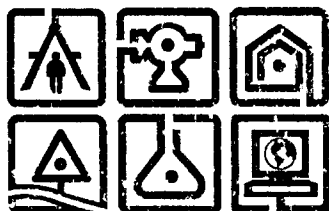


August 2005



Remedial Action for
Independent Leather Brownfield
Project
321-333 South Main Street
City of Gloversville
Fulton County, New York

Prepared for:

CITY OF GLOVERSVILLE
3 Frontage Road
Gloversville, New York 12078



Prepared by:

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SECTION 00020 - INVITATION TO BID

Sealed Bids will be received at the office of City of Gloversville, City Hall, 3 Frontage Road, Gloversville, New York 12078, until 2:00 PM local time on September 7, 2005, and then at said office publicly opened and read aloud for:

City of Gloversville
Independent Leather Remedial Action Project
321-333 South Main Street, Gloversville, New York

A Remedial Action is required at the Independent Leather Site by the New York State Department of Environmental Conservation (NYSDEC) under an Environmental Restoration Program Record of Decision dated February 2004. The Remedial Action work includes relocating, repairing and maintaining the existing gravel access road for construction traffic and removal as necessary to excavate petroleum impacted soil; removal and off-site disposal of the slab on grade concrete and foundation walls of the former tannery building to facilitate assessment of underlying soils for petroleum impacts; excavate and stage contaminated soils suspected beneath the building floor slab and in the area of a former 20,000 gallon underground fuel oil tank; load, transport and dispose non-hazardous contaminated soils at the Fulton County Landfill; load, transport and dispose hazardous contaminated soils, if encountered on the basis of waste characterization testing; backfill and grade the eastern portion of the site for placement of a soil barrier to contact; evaluate a suspect tank vent pipe and permanently close associated equipment if present by removal; and place a soil barrier to contact consisting of a minimum one foot thick layer of imported clean soil and underlying demarcation layer over the site on the east side of the Cayadutta Creek and on a localized portion of the site on the west side of the Cayadutta Creek.

The Work will be substantially completed on or before November 15, 2005, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions on or before May 15, 2006. Substantially complete is defined as all work except for hyroseeding. No work will be allowed between November 15, 2005 and April 1, 2006 unless otherwise directed by the Engineer.

Bids will be received on an itemized unit price basis.

Bids actually received by mail or by hand after the appointed time on the date specified shall be rejected, notwithstanding that such Bid may have been placed in a mail box or other mail receptacle regularly maintained by the United States Postal Service before such time, and ordinarily in sufficient time to have been delivered on time.

The successful Bidder will be required to furnish a performance bond and a payment bond, each in an amount equal to 100% of the contract price.

Bids should not include sales and compensating use taxes on materials incorporated into the work.

Drawings and Specifications may be examined on and after August 9, 2005 at C.T. MALE ASSOCIATES, 50 Century Hill Dr., P.O. Box 727, Latham, New York 12110-0727, tel. (518) 786-7400, from 7:45 AM to 4:15 PM Monday through Friday, and during normal business hours at City of Gloversville, City Hall, 3 Frontage Road, Gloversville, New York 12078-2897, Telephone (518) 773-4557. Documents may also be examined at Eastern Contractors Association, Inc., 6 Airline Dr., Albany, NY 12205, tel. (518) 869-0961, from 8 AM to 5 PM Monday through Friday; at F.W. Dodge, 6 Wembley Court, Albany, NY 12205, tel. (518) 869-5374, from 8:30 AM to 5 PM Monday through Friday; and at Reed Construction Data, 1275 Broadway, Albany, NY 12204, tel. (518) 487-3649, from 8:00 AM to 5:00 PM Monday through Friday.

Complete sets of Bidding and Contract Documents may be purchased from C.T. MALE ASSOCIATES, P.C. The deposit on the first set is fifty dollars \$50.00, to be refunded in full to all Formal Bidders provided that the complete set of Bidding and Contract Documents (Drawings and Project Manual) is returned to C. T. MALE ASSOCIATES, P.C., postage paid and in good condition within 30 days after the Bid Opening. Full refund will be made to non-bidders only if the complete set of Documents is returned to C. T. MALE ASSOCIATES, P.C., in good condition

within 7 days after the bid opening. Additional sets of Documents are available at non-refundable cost as listed in the Instructions to Bidders. If requested, Documents will be mailed first-class at additional non-refundable cost of \$5.00 per set for postage and handling.

Payment for Documents should be made either in cash or by check. Separate checks should be written for the first set, for any additional Documents, and for postage and handling. All checks should be made payable to C. T. MALE ASSOCIATES, P.C.

There will be a Pre-bid Conference on August 22, 2005 at 2:00 PM at the project site, 321-333 South Main Street, Gloversville, New York as described in the Instructions to Bidders.

Bidders on this work will be required to comply with mandatory contract provisions as included in all Municipal/Consultant-Construction-Service Contracts for work performed as part of an eligible Environmental Restoration Project (Brownfield). The requirements for Bidders and Contractors under these provisions are explained in the Bidding and Contract Documents.

City of Gloversville reserves the right to waive any informalities or irregularities in the Bids received, or to reject any or all Bids without explanation.

By Order of:
City of Gloversville
Ronald Ellis
Director of Public Works

END OF SECTION 00020

SECTION 00100 - INSTRUCTIONS TO BIDDERS

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SECTION 00100 - INSTRUCTIONS TO BIDDERS

(This document is based on EJCDC Document 1910-12, 1996 Edition, entitled "Guide to the Preparation of Instructions to Bidders".)

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:

- A. *Bidder*--The individual or entity who submits a Bid directly to OWNER.
- B. *Issuing Office*--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.
- C. *Successful Bidder*--The lowest responsible Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Issuing Office. The deposit, if any, will be refunded to each document holder of record who returns a complete set of Bidding Documents in good condition within 30 days after opening of Bids (for Bidders) or within seven (7) days after opening of Bids (for non-Bidders).
- 2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 ENGINEER in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.
- 2.04 Additional copies of the Bidding Documents may be purchased at the following non-refundable prices:

Additional complete set, per set \$50.00

Set of Drawings, per set \$10.00

Project Manual, per book \$40.00

Individual Pages of Manual, per page \$0.15 (\$5.00 min.)

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within five days of Owner's request written evidence, such as financial data, previous experience, present commitments, and other such data as may be called for below (or in the Supplementary Instructions). Some or all of this data may be requested as part of the Bid by inclusion of a Bidder's Qualification Statement in the Bid Forms that must be completed by all Bidders. Each Bid must contain evidence of Bidder's qualifications to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract (see Bidder's Qualifications Statement).

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 *Subsurface and Physical Conditions*

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.01.A will be made available by OWNER to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions has been identified and established in paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to OWNER and ENGINEER by owners of such Underground Facilities, including OWNER, or others.

4.03 *Hazardous Environmental Conditions*

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by OWNER to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.06 of the General Conditions has been identified and established in paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 4.06 of the General Conditions.

4.05 On request, OWNER will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

To gain access to the site, contact Mr. Ronald Ellis, Director of Public Works, City of Gloversville, City Hall, 3 Frontage Road, Gloversville, New York 12078. Phone (518) 773-4557.

4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by OWNER or others (such as utilities and other prime contractors) that relates to the Work for which a Bid is to be submitted. On request, OWNER will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. carefully study all reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;

E. obtain and carefully study (or assume responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. promptly give ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by ENGINEER is acceptable to Bidder; and

J. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by ENGINEER are acceptable to Bidder, and that the

Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A pre-Bid conference will be held at 2:00 PM on Monday, August 22, 2005 at the project site, 321-333 South Main Street, Gloversville, New York. Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. ENGINEER will transmit to all prospective Bidders of record such Addenda as ENGINEER considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by OWNER unless otherwise provided in the Bidding Documents.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted in writing to Engineer/Architect. Attention: Jeffrey A. Marx, PE. Generally, all such questions should be submitted in writing to the above noted party at the following address: C. T. MALE ASSOCIATES, P.C., 50 Century Hill Drive, P.O. Box 727, Latham, NY 12110-0727, tel. (518) 786-7400. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by ENGINEER as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by OWNER or ENGINEER.

ARTICLE 8 - BID SECURITY

8.01 Bid security is not required for this project.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) Substantially Completed and (b) also completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions and may be supplemented in the General Requirements.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to OWNER in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to OWNER a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by OWNER. If OWNER or ENGINEER, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, OWNER may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and OWNER may consider such price adjustment in evaluating Bids and making the contract award.

12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which OWNER or ENGINEER makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to OWNER and ENGINEER subject to revocation of such acceptance after the Effective Date of the Agreement as provided in paragraph 6.06 of the General Conditions.

12.03 CONTRACTOR shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom CONTRACTOR has reasonable objection.

12.04 Some or all of such identification of subcontractors and material and equipment suppliers may be requested as part of the Bid by inclusion of an appropriate form(s) in the Bid Forms that must be completed by all Bidders.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained as prescribed in the Bid Form.

13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter, such that it is reproducible by copy machine, and the Bid signed. A Bid price shall be indicated for each [section, Bid item, alternative, adjustment unit price item, and unit price item] listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered. Any quantities shown for unit price items are only an estimate and are in no way guaranteed as final quantities.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venture in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid form.

13.10 The address and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number for the state of the Project, if any, shall also be shown on the Bid form.

ARTICLE 14 - BASIS OF BID; EVALUATION OF BIDS

14.01 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

ARTICLE 15 - SUBMITTAL OF BID

15.01 Each prospective Bidder is furnished one copy of the Bidding Documents with an unbound copy each of the Bid form, and, if required, the Bid Bond. The unbound copy of the Bid form is to be completed and submitted with the Bid security and other documentation required as part of the Bidding Requirements.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." Bids sent through the postal service shall be by registered mail.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 72 hours after Bids are opened (or prior to award if less than 72 hours) any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is re-bid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened privately. An abstract of the Bids will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN OPEN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain open subject to acceptance for 45 days after the Bid Opening, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 - AWARD OF CONTRACT

19.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. OWNER further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. OWNER may also reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder. OWNER also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, OWNER will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, OWNER will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents. Owner reserves the right to reject the Bid of any Bidder who does not pass any such investigations to the Owner's satisfaction.

19.06 If the Contract is to be awarded, OWNER will award the Contract to the Bidder whose Bid is in the best interests of the Project.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNER's requirements as to performance and payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it must be accompanied by such Bonds. Certain bond information may be requested of all Bidders by inclusion of a Bond Information Form in the Bidding Documents.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When OWNER gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER. Within ten days thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 22 - SPECIAL LEGAL REQUIREMENTS

22.01 Detailed Description of Work: see Division 1 - General Requirements.

22.02 Insurance: see General Conditions, Section 00700; and Supplementary Conditions - Modifications, Section 00810.

22.03 Sales Tax Exemption: see Supplementary Conditions - Modifications, Section 00810, paragraph 6.10.B.

22.04 Non-Collusive Bidding Certification: see Bid Form, Section 00300; and Supplementary Conditions - Additional Articles, Section 00820 and Supplementary Conditions - New York State Agency Requirements (Appendix A), Section 00825.

22.05 Wage Rates: see Supplementary Conditions - Additional Articles, Section 00820, Article 21.

22.06 Cash Allowances: see General Conditions, Section 00700, paragraph 11.02; and Division 1 - General Requirements.

22.07 Retainage: see Agreement, Section 00500.

22.08 Standard Clauses for New York State Contracts (Appendix A), Section 00825.

22.09 NYSDEC Mandatory Contract Clauses, Section 00827.

END OF SECTION 00100

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SECTION 00220 - REPORTS OF EXPLORATIONS

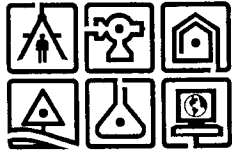
1. **BORING LOGS** (See Pages 00220 – 2 through 6)
2. **STORMWATER POLLUTION PREVENTION PLAN** (See Pages 00220 – 7 through 34)
3. **ERP INVESTIGATION ANALYTICAL TABLES FOR SOIL AND GROUNDWATER AND MAPS**
(See Pages 00220 – 35 through 51)
4. **RECORD OF DECISION ANALYTICAL TABLES AND MAP** (See Pages 00220 – 52 through 54)
5. **REMEDIAL DESIGN ANALYTICAL TABLE AND MAP** (See Pages 00220 – 55 through 56)
6. **HEALTH AND SAFETY PLAN MODULE FOR ARSENIC** (See Attached CD)
7. **HEALTH AND SAFETY PLAN MODULE FOR CHROMIUM** (See Attached CD)
8. **HEALTH AND SAFETY PLAN MODULE FOR PETROLEUM HYDROCARBONS** (See Attached CD)

If any bidder has problems viewing or printing Items #6, #7 or #8, contact the Engineer and hardcopies will be provided upon request.

END OF SECTION 00220
EXCEPT FOR ABOVE REFERENCED ITEMS WHICH FOLLOW
AND END ON PAGE 00220 – 56 AND PROVIDED
ELECTRONICALLY ON THE CD IN THE FOLLOWING POCKET

C.T. MALE ASSOCIATES, P.C.

SUBSURFACE EXPLORATION LOG



BORING NO.: MW-11

ELEV.: 90.94

DATUM: Assumed

START DATE: 4/25/02

FINISH DATE: 4/25/02

SHEET 1 OF 1

PROJECT: Independent Leather Tannery

CTM PROJECT NO.: 01.7293

LOCATION: 321-333 South Main Street, Gloversville, NY

CTM OBSERVER: J. Cross

DEPTH (FT.)	SAMPLE		BLOWS ON SAMPLER						RECOVERY	SAMPLE CLASSIFICATION	NOTES
	TYPE	NO.	0/6	6/12	12/18	18/24	N				
5		S-1	6	7					1.3	FILL: Brown to dk brown f to m SAND (Damp, Firm to Loose) Becomes Dk brown to black f to m SAND, Some Silt, trace gravel (Damp to Moist) At 5' Becomes Brown f SAND, little silt	6'
		S-2	8	6	10	7	17				
		S-3	1	1	5	8	11				
		S-4	2	2	2	2	3				
		S-5	1	1	2	2	4				
10		S-6	2	2					0.2	Olive-Brown SILT, Some f Sand (Wet, Loose) Grades to Brown f SAND, Some Silt Becomes Lt Gray	Roots noted at 7.5' ±
		S-7	42	47	2	2	4				
15		S-8	1	1	2	2	3		1.9	Becomes Lt Gray	
		S-6	2	2							
		S-7	42	47	5	7	7	0.7			
20		S-8	24	25					2.0	Becomes Yellow-Brown f to c SAND, little silt, trace gravel	12'
		S-7	42	47	39	40	86				
		S-8	24	25	27	50	52	1.4			
25									1.4	TILL: Brown f to m SAND, little silt & embedded gravel (Wet, Very Compact) At 15' Becomes Lt brown f SAND, little silt, trace embedded f gravel (Wet, Very Compact)	
30										Boring Terminated at 16'	
30										Installed a 2" diameter PVC monitoring well at a depth of 15'. See Monitor Well Construction Log for details.	

N = NO. OF BLOWS TO DRIVE 2" SAMPLER 12" WITH A 140 LB. WT. FALLING 30" PER BLOW
 DRILLING CONTRACTOR: Env. Drilling NY, Inc. DRILL RIG TYPE: Truck Mounted CME-55
 METHOD OF INVESTIGATION: 4.25" Hollow Stem Augers with 2" x 2" Split Spoon

GROUNDWATER LEVEL
READINGS

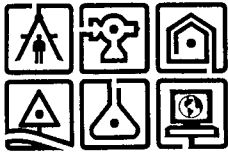
DATE	LEVEL	CASING	STABILIZATION TIME

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SAMPLE CLASSIFICATION BY:
J. Cross

C.T. MALE ASSOCIATES, P.C.

SUBSURFACE EXPLORATION LOG



BORING NO.: MW-12

ELEV.: 90.61

DATUM: Assumed

START DATE: 4/24/02

FINISH DATE: 4/24/02

SHEET 1 OF 1

PROJECT: Independent Leather Tannery

CTM PROJECT NO.: 01.7293

LOCATION: 321-333 South Main Street, Gloversville, NY

CTM OBSERVER: J. Cross

DEPTH (FT.)	SAMPLE		BLOWS ON SAMPLER						RECOVERY	SAMPLE CLASSIFICATION	NOTES
	TYPE	NO.	0/6	6/12	12/18	18/24	N				
5		S-1	6	6					0.9	FILL: Brown & black f to m SAND, little silt, trace gravel (Damp, Firm to Loose) Becomes brown f SAND, Some to little Silt At 5' Becomes Rust brown to olive f SAND, Some Silt (Damp to Wet, Loose) 6'	Piece of coal noted in S-2 S-3 initial recovery of 0.1', repounded spoon to obtain sample Wet at 5.5' ± Roots noted
		S-2	1	1	6	5	12	1.5			
		S-3	2	1					0.6		
		S-4	4	13	2	1	3	0.4			
		S-5	13	18	8	10	21	0.4			
10		S-6	21	28					1.6	TILL: Gray-brown SILT, Some embedded f to c Sand, little gravel (Moist, Very Compact) Becomes Gray 9'	
		S-7	67	100/.4	41	60	69	0.7			
		S-8	47	107	-	-	-	0.3			
15					100/.3	-	-	1.0	Boring Terminated at 15.3' (Refusal)		
20									Installed a 2" diameter PVC monitoring well at a depth of 14'. See Monitor Well Construction Log for details.		
25											
30											

N = NO. OF BLOWS TO DRIVE 2" SAMPLER 12" WITH A 140 LB. WT. FALLING 30" PER BLOW

DRILLING CONTRACTOR: Env. Drilling NY, Inc.

DRILL RIG TYPE: Truck Mounted CME-55

METHOD OF INVESTIGATION: 4.25" Hollow Stem Augers with 2" x 2' Split Spoon

GROUNDWATER LEVEL READINGS

DATE	LEVEL	CASING	STABILIZATION TIME

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SAMPLE CLASSIFICATION BY:

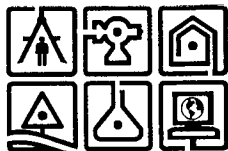
J. Cross

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER

REMEDIAL ACTION

GEOPROBE SUBSURFACE EXPLORATION LOG



BORING NO.: MW-13

ELEV.: 91.09

DATUM: Assumed

START DATE: 4/25/02 FINISH DATE: 4/25/02

SHEET 1 OF 1

PROJECT: Independent Leather Tannery

CTM PROJECT NO.: 01.7293

LOCATION: 321-333 South Main Street, Gloversville, NY

CTM OBSERVER: J. Cross

DEPTH (FT.)	SAMPLE			SAMPLE CLASSIFICATION	NOTES
	INTERVAL	NO.	RECOVERY (FT.)		
4		S-1	2.4	0.3' ± CONCRETE FILL: Brown/gray SILT, Some f-c Sand&Gravel (Damp to Moist) At 2' Becomes Brown SILT, trace v.f. sand At 3' Becomes Olive SILT, trace v.f. sand	A hole cut in concrete for curbox with starbit. Sweet petroleum-like odor 4' Brick noted
8		S-2	3.2	Olive-Brown f SAND, Some Silt, trace gravel (Wet) Becomes Some Gravel At 7.5' ± Becomes Gray f to c SAND, little silt & embedded gravel (Moist)	Wet at 4' ±
12		S-3	3.5		
16				Boring Terminated at 11.5' (Refusal) Installed a 1" diameter PVC monitoring well at a depth of 11'. See Monitor Well Construction Log for details.	
20					
24					
28					

DRILLING CONTRACTOR:

Env. Drilling NY, Inc. GEOPROBE TYPE: Track 54DT

METHOD OF SAMPLING:

Direct Push w/ Percussion Hammer with 2" x 4' Macrocore

GROUNDWATER LEVEL READINGS

DATE LEVEL REFERENCE MEASURING POINT

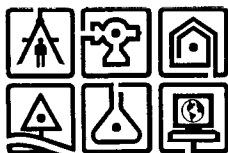
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SAMPLE CLASSIFICATION BY:

J. Cross

C.T. MALE ASSOCIATES, P.C.

SUBSURFACE EXPLORATION LOG



BORING NO.: MW-14

ELEV.: 100.31

DATUM: Assumed

START DATE: 4/24/02

FINISH DATE: 4/24/02

SHEET 1 OF 1

PROJECT: Independent Leather Tannery

CTM PROJECT NO.: 01.7293

LOCATION: 321-333 South Main Street, Gloversville, NY

CTM OBSERVER: J. Cross

DEPTH (FT.)	SAMPLE		BLOWS ON SAMPLER						RECOVERY	SAMPLE CLASSIFICATION	NOTES
	TYPE	NO.	0/6	6/12	12/18	18/24	N				
5		S-1	3	3						Brown & black f to m SAND, little silt, trace gravel (Damp, Loose to Firm) Becomes Orange-Brown f SAND, little silt At 5' Becomes Brown f SAND, little silt & gravel At 7.7' ± Becomes Brown f SAND, little silt (Moist, Compact) 10'	
		S-2	5	5	5	5	8	1.2			
					6	5	11	1.3			
		S-3	7	11							
		S-4	18	21	13	16	24	1.3			
10				20	32	41	1.3				
		S-5	16	20	23	25	43	1.5			
15		S-6	19	21	27	23	48	1.4	TILL: Brown f SAND, little silt, little embedded gravel (Moist, Compact to Very Compact)		
		S-7	40	42	69	83	111	1.0			
		S-8	21	23							
					24	27	47	1.6			
20									Boring Terminated at 16'		
									Installed a 2" diameter PVC monitoring well at a depth of 15'. See Monitor Well Construction Log for details.		
25											
30											

N = NO. OF BLOWS TO DRIVE 2" SAMPLER 12" WITH A 140 LB. WT. FALLING 30" PER BLOW

DRILLING CONTRACTOR: Env. Drilling NY, Inc.

DRILL RIG TYPE: Truck Mounted CME-55

METHOD OF INVESTIGATION: 4.25" Hollow Stem Augers with 2" x 2' Split Spoon

GROUNDWATER LEVEL READINGS

DATE	LEVEL	CASING	STABILIZATION TIME

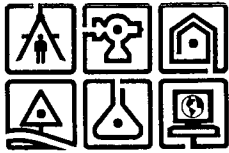
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SAMPLE CLASSIFICATION BY:

J. Cross

C.T. MALE ASSOCIATES, P.C.

GEOPROBE SUBSURFACE EXPLORATION LOG



BORING NO.: MW-15

ELEV.: 90.17

DATUM: Assumed

START DATE: 4/25/02 FINISH DATE: 4/25/02

SHEET 1 OF 1

PROJECT: Independent Leather Tannery

CTM PROJECT NO.: 01.7293

LOCATION: 321-333 South Main Street, Gloversville, NY

CTM OBSERVER: J. Cross

DEPTH (FT.)	SAMPLE			SAMPLE CLASSIFICATION	NOTES
	INTERVAL	NO.	RECOVERY (FT)		
4		S-1	1.6	0.2' ± CONCRETE	Concrete broken with starbit.
				POS FILL: Brown f to c SAND, Some Silt, little gravel (Wet)	Sweet petroleum-like odor
				At 3.5' ± Becomes Black f to c SAND, Some Silt, little gravel	
				Becomes Brown f SAND, little silt (Moist)	
8		S-2	2.7	At 5' ± Becomes Black f to c SAND, Some Gravel & Silt	Wood noted
				Grades to Gray f to c SAND, little silt, trace gravel (Wet)	Sweet petroleum-like odor
12		S-3	4.0	POSSIBLE TILL: Gray f to c SAND, little silt & embedded gravel (Wet)	
				Boring Terminated at 12'	
16				Installed a 1" diameter PVC monitoring well at a depth of 12'. See Monitor Well Construction Log for details.	
20					
24					
28					

DRILLING CONTRACTOR: Env. Drilling NY, Inc. GEOPROBE TYPE: Track 54DT
 METHOD OF SAMPLING: Direct Push w/ Percussion Hammer with 2" x 4' Macrocore

GROUNDWATER LEVEL READINGS

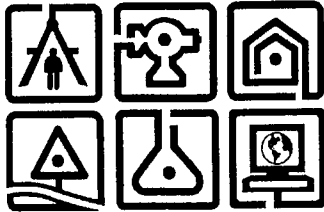
DATE	LEVEL	REFERENCE MEASURING POINT

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SAMPLE CLASSIFICATION BY:

J. Cross

December 2004



Stormwater Pollution Prevention Plan
(SWPPP) For
*"Independent Leather Tannery
Brownfield Site"*

City of Gloversville
Fulton County, New York

Prepared for:

City of Gloversville
3 Frontage Road
Gloversville, NY 12078

Prepared by:

C.T. MALE ASSOCIATES, P.C.
50 Century Hill Drive
P.O. Box 727
Latham, New York 12110
(518) 786-7400
FAX (518) 786-7299

*C.T. Male Project No: 01.7293
Related Drawing No: 04-0710*

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Subdivision 2 of the New York State
Education Law.

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C.T. MALE ASSOCIATES, P.C.

**STORMWATER POLLUTION PREVENTION PLAN (SWPPP)
FOR "INDEPENDENT LEATHER TANNERY" SITE**

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C.T. MALE ASSOCIATES, P.C.

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APPENDICES

- A NOI Application Form
- B Site Location Map
- C Erosion & Sediment Control Plans (ES-1 and ES-2)
- D Post-Developed Computations

1.0 NARRATIVE REPORT

The former Independent Leather Tannery site is located at 321-333 South Main Street in the City of Gloversville, County of Fulton, New York. The site lies within the northeast quadrant of the intersection of South Main Street and Hill Street. The site is identified on City of Gloversville tax maps as being Section 149.13, Block 2 and Parcel 9. The parcel is approximately 3.725± acres in size. The subject site has frontage on South Main Street and Hill Street and is accessible from Hill Street. The approximate latitude and longitude for the site is 43° 02' 22"N and 73° 21' 10" W. A Site Location Map is included as Appendix B.

The site is situated in the middle of a commercial/retail, light industrial area in the City of Gloversville. The site's property boundaries create an irregularly shaped parcel, as show in Appendix C. The site is bound to the west by South Main Street; to the east by a bike path and a gravel pit further east of the bike path; to the north by a car wash; and to the south by commercial/retail businesses and Hill Street. The Cayadutta Creek flows across the site from the north and continues in a southerly direction through the middle of the parcel. The site is occupied by a defunct tannery complex.

From April 2001 until December 2001, the United States Environmental Protection Agency (EPA), under an Emergency Removal Action Program packaged and removed hundreds of drums of chemicals and other wastes on-site and properly disposed of the materials. EPA demolished three buildings including the main tannery building, a smaller maintenance building on the west side of the creek, and the storage shed located on the east side of the creek. EPA also performed the following: final cleaning and demolition of the waste water treatment plant and concrete foundation walls, excavation and disposal of arsenic and chromium contaminated soil hot spots, disposal/recycling of remaining scrap steel and wood beams from the old bridges on-site, closure of an unknown 300 gallon underground storage tank found along West Main Street, closure of an abandoned 20,000 gallon underground storage tank and removal of associated petroleum contaminated soil, preparation of a report on the fate and transport (geochemical modeling) of chromium and arsenic contamination present on the site, reconstruction of damaged areas of creek banks, and excavation of exploratory trenches in designated areas where geophysical surveys identified anomalies. At the completion of the removal action, EPA installed a barrier soil fill one

to eight feet in depth covered with grass throughout the majority of the western portion of the site.

As of December 2004, one building remains on the eastern side of the site. The balance of the site is vegetated with grass and has limited gravel and concrete coverage.

All erosion & sediment control measures and pollution prevention measures employed in this project are in compliance with the "New York Guidelines for Urban Erosion and Sediment Control" and the "New York State Stormwater Management Design Manual".

1.1 Nature of Construction

The project consists of two phases of demolition and remediation as part of a state funded Environmental Restoration Project (ERP). Phase I will include the demolition of an approximately 13,000± square feet building located in the northeast corner of the site. Phase II will include excavation of the contaminated soil east of Cayadutta Creek and placement of backfill for construction of a soil barrier to contact.

Access to the site will be provided from Hill Street, approximately 100 feet east of the intersection with South Main Street. A gravel haul road will be constructed from Hill Street to the building to be demolished. The existing bridge across Cayadutta Creek will be reinforced and/or replaced.

Phase I of the project is expected to be completed in January/February of 2005. Phase II of the project is targeted for spring 2005.

1.2 Intended sequence of disturbance

The following is a sequential list of intended disturbances for Phase I:

1. Installation of erosion and sediment control measures.
2. Placement of gravel haul road and work area. Reinforce and/or replace existing bridge.
3. Abate asbestos materials and demolish buildings.
4. Load and transport building materials off site.

5. Repair gravel haul road, if needed
6. Leave concrete building slab in place after broom swept and leave gravel haul road in-place for subsequent use in Phase II.

Intended Disturbance for Phase II:

1. Repair existing and/or install new sediment control measures.
2. Construct staging and decontamination area(s) on-site, as necessary
3. Remove concrete building slab and dispose off-site.
4. Excavate contaminated soil and dispose off-site.
5. Place backfill and construct soil barrier.
6. Construct sand filter, perforated underdrain and swale along the retaining wall.
7. Perform final grading of the site and seed/mulch all disturbed areas.
8. Upon establishment of mature vegetation, remove temporary erosion and sediment control measures.

1.3 Area of Disturbance

The area of disturbance for Phase I is approximately 1.10 acres. The area of disturbance for Phase II is approximately 1.31 acres. Since the area of disturbance is greater than 1 acre, an application permit for stormwater discharge coverage is required and included in this report, refer to Appendix A, "NOI Application Form".

1.4 Estimated Post-Development Runoff Coefficient

The estimated post-developed runoff coefficient is 0.30.

1.5 Site Map

Refer to Appendix C, "Erosion and Sediment Control Plans".

2.0 STORMWATER MANAGEMENT OBJECTIVES

2.1 Purpose and Methodology

The purpose of the stormwater management plan is to maintain existing drainage patterns as much as possible and continue the conveyance of upland watershed runoff. Also, the plan mitigates potential stormwater quality impacts, and prevents soil erosion and sedimentation resulting from stormwater runoff.

The detention capability of the swales along the retaining wall was calculated using the methodology prescribed in the *United States Department of Agriculture (U.S.D.A.) Soil Conservation Service's (SCS) Technical Release No. 20 (TR-20)*. The software program "HydroCAD" was used to simulate stormwater runoff. The design storms are a 1, 10, and 100-year/24-hour Type II events having rainfall amounts of 2.39, 3.88, and 5.48 inches respectively.

2.2 Scope

The scope of work for the site will occur in two phases. During Phase I of the project, the existing building will be demolished, a gravel haul road will be constructed and the existing bridge will be removed and replaced. Runoff from the site will follow the natural topography of the site and flow towards the Cayadutta Creek. Sediment contained in this runoff will be controlled by silt fence. Phase II of the project includes excavating contaminated soil, placement of backfill for a soil barrier and re-grading the site to slope towards the retaining wall. Runoff from the site will follow the natural topography of the site and flow towards the Cayadutta Creek. Sediment contained in runoff will be contained in excavation areas of soil removal or controlled by silt fence. During both work phases the gravel haul road will be the only vehicular access way to the site. During Phase II there will be a decontamination area to rid vehicles leaving the site of the contaminated sediments. Once final surface treatments have been installed and the area is stabilized, runoff will be directed to the sand filter. The sand filter system is designed with an underdrain which will allow the system to drain between storm events. The water collected in the underdrains flows directly into Cayadutta Creek through two penetrations in the retaining wall.

3.0 EXISTING CONDITIONS

3.1 Stormwater Runoff

The runoff rates under existing conditions are higher than the expected runoff rates during post-construction. This is due to the fact that all of the impervious area on the site will be vegetated (i.e. grass). Peak flow calculations were deemed unnecessary as stormwater detention is not required for this project.

3.2 Topography & Land Cover

The site slopes downhill from east to west. The slope of the ground surface along the northern property line is approximately 10%. The slope across the rest of the site ranges from 1% to 5%. The runoff from the entire site drains directly into the Cayadutta Creek.

The land cover on the site is a grass and concrete floor slab of an abandoned building.

3.3 Soils and Groundwater Conditions

The USDA Soil Conservation Service's (SCS) Soil Survey of Fulton County, New York was reviewed. The soils in the area of the subject site are categorized as "Mosherville-Broadalbin". These soils are assigned to hydrologic group "C". Contaminated soils on-site will be removed to a pre-determined depth and filled with clean backfill. A conservative estimate for the runoff coefficient post-construction is hydrologic group "B".

3.4 Surface Waters and Floodplains

Examination of the applicable "New York State Department of Environmental Conservation Freshwater Wetlands Maps" did not reveal any existence of New York State regulated wetlands in the watershed studied. The "Flood Insurance Rate Map" for the City of Gloversville indicates that portions of this site lie within the 100-year floodplain for Cayadutta Creek.

4.0 POST-CONSTRUCTION CONDITIONS

4.1 Site Improvements

Post-developed conditions include demolition of the abandoned on-site tannery building and removal of the contaminated soil east of Cayadutta Creek. The amount of impervious area will be reduced from 12.5% to 0%. The runoff from the site post-construction will be reduced compared to the existing runoff condition. Since the total disturbance is greater than 1 acre, water quality measures must be employed on the site. Detention of the stormwater is not required as the peak flows post-development will be less than the existing peak flows. In order to satisfy the treatment requirements post-construction, a swale and sand filter system will be installed along the retaining wall. The site will be graded post-excavation to slope towards the swale. Underdrains will be installed below the sand filter to convey runoff directly into Cayadutta Creek. The swale is designed to detain flow during storm events, ensuring that runoff enters the sand filter. (Refer to **Appendix D**, "Post-Developed Computations.")

4.2 Environment

During construction, the runoff patterns on-site will not change. Sediment from the runoff will not enter the Creek, due to silt fence being placed along the back side of the retaining wall.

Regarding water quality, the runoff will be collected in a swale along the retaining wall and sent through a sand filter which drains into Cayadutta Creek.

4.3 Stormwater Run-off Simulation

The peak rate of runoff under post-developed conditions was also analyzed utilizing the *SCS TR-20 Methodology* to determine a peak run-off (Q) in cubic feet per second. Hydrological Group "B" soil curve numbers were utilized in this analysis to more accurately reflect the runoff from clean fill that will be imported to the site. (Refer to **Appendix D** - "Post-Developed Conditions Computations.")

The results of the post-developed condition analysis indicate that the swale is able to detain the 100-year storm event without overflow. The post-developed runoff

C.T. MALE ASSOCIATES, P.C.

conditions are less than the existing runoff conditions since all of the impervious area on site will be removed.

Based on a quantitative comparison of existing and post-developed conditions, the peak rate of runoff entering Cayadutta Creek is reduced, and the quality of the runoff will be improved. The runoff will be pre-treated by flowing across the grassed area, and then filtered through the sand filter before entering the Creek.

5.0 CONTROLS

5.1 Erosion and Sediment Controls

Stabilizing measures shall be initiated as soon as practical in portions of the site where construction activities have temporarily or permanently started, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

- (1) Where the initiation of stabilization measures, by the 14th day after construction activity temporary or permanently ceases, is precluded by snow cover, stabilization measures shall be initiated as soon as practical.
- (2) Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

5.2 Erosion and Sediment Controls - Structural Practices

The erosion control measures for this project are indicated and noted in the project site development plans, refer to Appendix C, "Erosion & Sediment Control Plans (ES-1 & ES-2)". The plans include use of silt fence and a gravel haul road.

5.3 Stormwater Management

The stormwater runoff from the site will be collected in a swale and sent through a sand filter system. The underdrains in the sand filter outlets directly into Cayadutta Creek.

The Contractor will be responsible for implementing appropriate measures to control litter, construction chemicals and construction debris from becoming a pollutant source in the stormwater discharges. This is especially important due to the contaminated nature of the underlying soil, whereby the contractor should prevent/limit disturbance to site soils. Contaminated sediments should not be generated by Phase I activities. Handling of contaminated sediments should be performed in accordance with site specific remedial plans.

5.4 Other Controls

Off-site tracking of sediments and the generation of dust shall be minimized by installing a stabilized construction entrance. Vehicle decontamination areas will also be utilized to prevent off-site tracking of sediments.

5.5 Approved Local or Regional Control Plans

The project is not subject to the "Site Plan" approval process administered by the City of Gloversville, as the city is the owner of the property.

5.6 Stormwater Management Conclusions

The results show that the runoff from the proposed conditions will be less than the existing runoff due to the demolition and removal of the defunct tannery buildings. After Phase II is complete, the site will be entirely covered with grass. A swale and sand filter will be installed along the retaining wall to treat stormwater runoff, prior to discharge in the creek.

It is our opinion that the proposed development, as designed, will not adversely impact downstream properties nor drainage systems if stormwater management facilities are constructed in accordance with this report.

6.0 MAINTENANCE

The erosion and sediment control measures will be installed and maintained by the Contractor until the final surface treatment is installed and the vegetated areas have been fully established. The property owner will assume responsibility for the erosion and sediment control system(s) thereafter. Refer to Appendix C, "Erosion & Sediment Control Plans (ES-1 & ES-2)" for notes pertaining to specific maintenance measures.

7.0 INSPECTIONS

7.1 Initial Observations

The following items should be noted during the on-site monitoring:

- Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.
- Erosion and sediment control measures shall be observed to ensure that they are operating correctly.
- Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

Following the commencement of construction, site inspections will be conducted at least every seven (7) calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater.

7.2 Revisions to SWPPP

Based on the inspections described above, the pollution prevention measures identified in this plan shall be revised as appropriate, but in no case later than seven (7) calendar days following the inspection. Such modifications shall provide for timely implementation of any changes to the plan within seven (7) calendar days following the inspection.

7.3 Inspection Reports

An inspection report summarizing the scope of the investigation, name(s), date and major observations relating to the implementation of the stormwater pollution prevention plan, and actions taken shall be made and retained as part of the plan for at least three (3) years from the date that the site is finally stabilized.

8.0 NON-STORMWATER DISCHARGES

At no time will the contractor discharge any non-stormwater from the site into Cayadutta Creek due to the contaminated nature of the site.

Phase II soil removal, depending on the depth of proposed excavations and the presence of groundwater, may require soil dewatering. Groundwater from dewatering activities will be collected in on-site tanks and will be treated prior to discharge.

Phase I demolition activities may include the use of water to mist the building materials to control dust. Excess water from misting is expected to be minimal. Sediments, if any, contained in the excess water will be controlled with the use of silt fences.

9.0 WINTER SHUTDOWN PLAN

The Contractor has prepared and will implement the following procedures in order to secure and stabilize the site against erosion during a period of winter shutdown. Upon enacting the winter shutdown, the contractor will use one (or a combination) of the following erosion control devices on all areas where vegetation has not been established:

- Jute / coconut fiber blankets;
- Geotextile;
- Tackifier;
- Hay/straw mulch; or
- Alternate method(s) acceptable to the Engineer and the NYSDEC.

Inspections of the site will be conducted on a minimum monthly basis, and will also be conducted after rainfalls in excess of one inch and after significant snow melt occurs. If these inspections reveal areas damaged by erosion, the contractor will provide repairs prior to the next scheduled inspection.

10.0 CONTRACTOR CERTIFICATION

All contractors and subcontractors involved with erosion and sediment control on the project site shall sign and date a copy of the following certification statement before undertaking any construction activity at the project site:

"I certify under penalty of law that I understand and agree to comply with the terms and conditions of the pollution prevention plan for the construction site identified in such plan as a condition of authorization to discharge storm water. I also understand that the operator must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards."

Contractor:

Company _____

Name/Title/Date _____

Subcontractor:

Company _____

Name/Title/Date _____

Appendix A
NOI Application Form



Notice of Intent ("NOI")

New York State Department of Environmental Conservation

Division of Water

625 Broadway, 4th Floor

Albany, New York 12233-3505

NOTICE OF INTENT for Stormwater Discharges Associated with Construction Activity UNDER SPDES GENERAL PERMIT #GP-02-01

NYR

(for DEC use only)

IMPORTANT: All sections must be completed unless otherwise noted. Failure to complete all items may result in this form being returned to you, thereby delaying your coverage under this general permit. Applicants must read and understand the conditions of the permit and prepare a Stormwater Pollution Prevention Plan (SWPPP) prior to completing and submitting this NOI. Applicants are responsible for identifying and obtaining other DEC permits that may be required.

Section I. Applicant/Activity Information

1. Owner/Operator Name: City of Gloversville

2a. Mailing Address:

3 Frontage Road

2b. City

Gloversville

2c. State

NY

2d. Zip

12078

3. Contact Person: 3a. First Name: Ronald

3b. Last Name: Ellis

3c. Phone:

518-773-4557

3d. E-mail:

4a. Site/Project Name: Independent Leather Tannery

4b. Existing use of the site: abandoned
tannery

5a. Street Address:

321-333 South Main Street

5b. City

Gloversville

State:

NY

5c. Zip

12078

6. County: Fulton

7. Site Location: 7a. X Coordinates 73 21' 10" W 7b. Y Coordinates: 43 02' 22"N

Section II. Disturbance Activity/Discharge Characteristics

8. Future use of the site: park

9. Duration of disturbance activity: from 9a: 1/1/2005 to 9b: 1/1/2006

10. Total site acreage: 3.725 (acres)

11. Total amount of disturbed area of overall plan of development or sale: 1.10 (acres)

12. Soil (Hydrologic Soil Group): B

13. What is the maximum slope of disturbed area: % 10%

14. What is the percentage of impervious area of the site?

14a. before commencement of the project % 12.5%

14b. after completion of the project % 0%

15. Will there be permanent stormwater management practices? ☒ yes ☐ no

16. Is this a phased project? ☒ yes ☐ no

Section III. Receiving System(s)

17. Does any part of the project lie within a regulated 100-year flood plain? ☒ yes ☐ no

18. Does the site/activity lie within the boundaries of the New York City watershed? ☐ yes ☒ no

19. Does runoff from site enter a storm sewer or ditch maintained by a local, Federal, or State government unit (MS4)? ☐ yes ☒ no
If the answer to 19 is no, skip to questions 20.

19a. Provide the name of the government owning the storm sewer system: _____

19b. Is the MS4 a "regulated MS4" as designed under 40 CFR Section 122.32? ☐ yes ☐ no ☐ don't know

19c. Does the MS4 have a SPDES permit for their storm sewer system? ☐ yes ☐ no ☐ don't know

19d. Is the runoff from the site tributary to a Combined Sewer Overflow (CSO)? ☐ yes ☐ no

20. What is the name of the nearest surface water body into which the runoff will enter? Cayadutta Creek

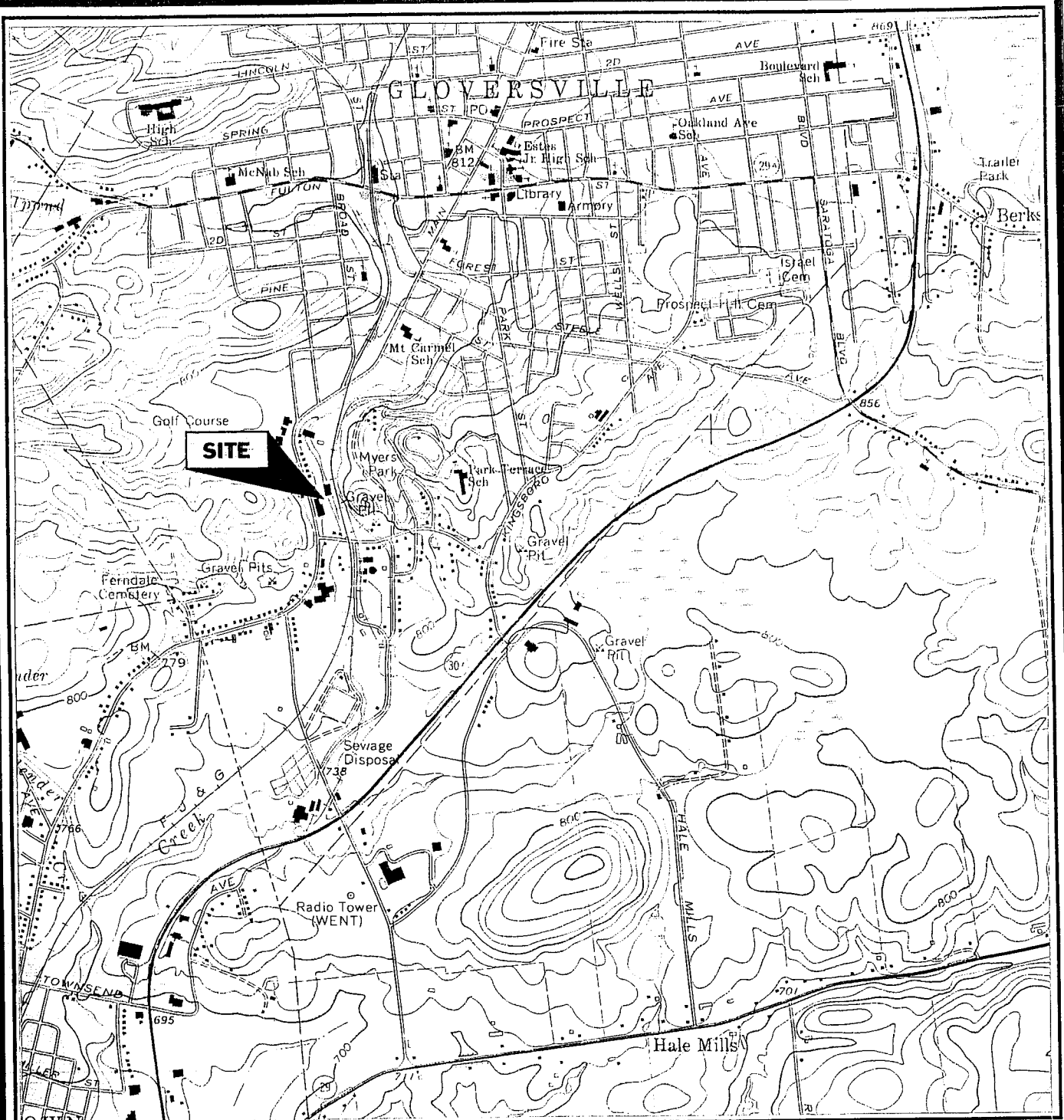
21. Does the runoff discharge to a receiving water identified as 303(d) listed segment ☐, or "TMDL" water ☐, or neither ☒?

Section IV. Stormwater Pollution Prevention Plan:

22. What components are required for the SWPPP? (Consult the SWPPP and Stormwater Permit Process flow chart and check all that apply): 22a. ☒ Erosion and Sediment Control Plan 22b. ☒ Water Quality and Quantity Controls

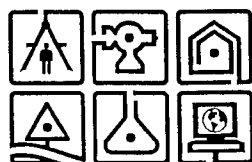
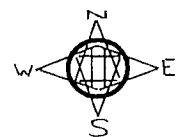
23. Is the Construction Sequence Schedule for the planned management practices prepared? ☒ yes ☐ no	
24. Will the Stormwater Pollution Prevention Plan be in conformance with:	
24a. local government requirements? ☒ yes ☐ no	24b. NYSDEC requirements? ☒ yes ☐ no
If the answer to 24b. is yes, skip to Section VI.	
Section V. Supplemental Information (only if you answered "no" to question 24b)	
25. Before submitting this NOI, you must have your SWPPP certified by a licensed Professional. This certification must state that the SWPPP has been developed in a manner which will ensure compliance with water quality standards and with the substantive intent of this permit (see general permit for additional information). Is your plan certified by a licensed Professional? ☒ yes ☐ no • Do not submit your SWPPP to DEC unless requested. • A copy of your SWPPP must be submitted to the local jurisdiction(s) as required under Part III, subsection B.2 (also see question #29 below). • State each division from the Department's Technical Standards, reasons supporting each deviation request and an analysis of the water quality impacts in your SWPPP. • Use Section VII below to summarize the justification statement in one paragraph. • Allow sixty (60) days from the receipt of your completed application for permit coverage to provide DEC an opportunity to review the application and supporting information.	
Section VI. Reviews and Approvals	
Has your SWPPP been reviewed by: 26a. ☐ local Soil and Water Conservation District 26b. ☒ Professional Engineer 26c. ☐ Certified Professional Erosion Control Specialist 26d. ☐ Licensed Landscape Architect 26e. ☐ None	
27. Are there other DEC permits required or already obtained for this project? ☐ yes ☒ no 28. If the answer to 27 is no, skip to question 29. 28a. If this NOI is submitted for the purpose of continuing previous coverage under the general permit for stormwater runoff from construction activities (GP-93-06), please indicate the SPDES reference number assigned under GP-93-06: NYR1 _____ 28b. If there is another SPDES permit, please indicate the permit number: NY _____ 28c. If there are other DEC permits, please provide one of the permit numbers: _____	
29. Has a copy of your SWPPP been submitted to the governing jurisdiction as required by the permit? ☒ yes ☐ no	
Section VII. Details (use this space, maximum 100 words or 600 characters, to further explain answers where necessary)	
Section VIII. Certification	
I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I also certify under penalty of law that this document and the corresponding documents were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person(s) who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgement that I will receive as a result of submitting this NOI and can be as long as sixty (60) days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.	
30a. Printed Name: Ronald Ellis	30b. Title/Position: Director of Public Works
30c. Phone: 518-773-4557	
Signature:	30d. E-mail:
	30e. Date:

Appendix B
Site Location Map



MAP REFERENCE

United States Geologic Survey
7.5 Minute Series Topographic Map
Quadrangle: Groversville, NY
Date: 1970



ENGINEERING
ENVIRONMENTAL SERVICES
SURVEYING
PHONE (518) 786-7400
FAX (518) 786-7299

C.T. MALE ASSOCIATES, P.C.
50 CENTURY HILL DRIVE, PO BOX 727, LATHAM, NY 12110

FIGURE 1 - SITE LOCATION MAP

INDEPENDENT LEATHER TANNERY

CITY OF GROVERSVILLE

FULTON COUNTY, NY

SCALE: 1"=2000'±

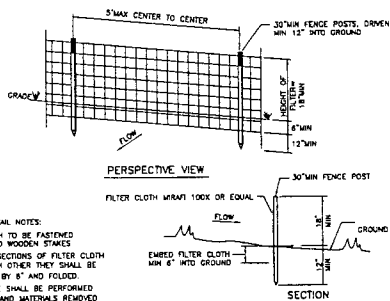
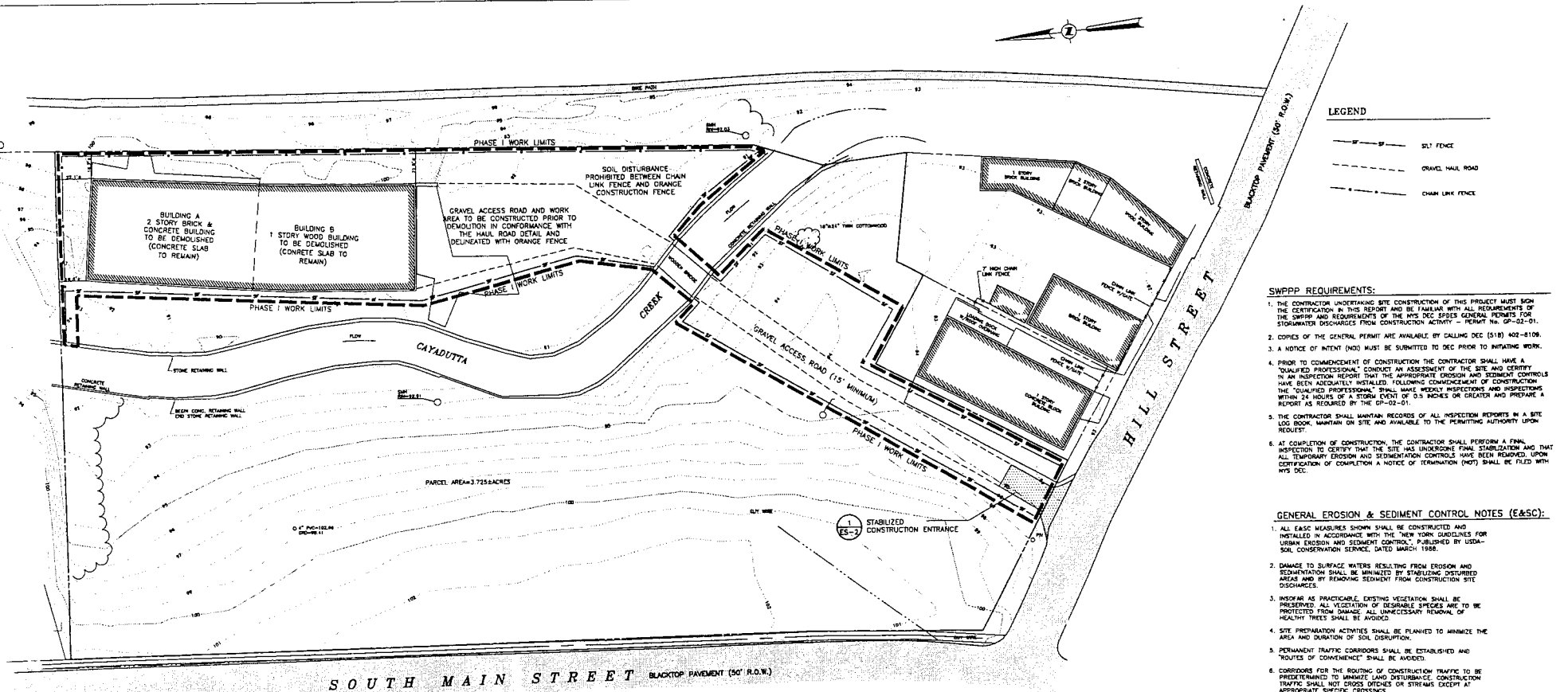
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PROJECT NO. 01.7293

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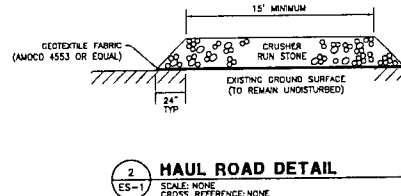
Appendix C

Erosion & Sediment Control Plans



- SILT FENCE DETAIL NOTES:**
1. FILTER CLOTH TO BE FASTENED SECURELY TO WOODEN STAKES
 2. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6" AND FOLDED
 3. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIALS REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE

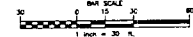
1 SILT FENCE DETAIL
ES-1 SCALE: NONE CROSS REFERENCE: NONE



- NOTE:**
1. THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.
- MAP REFERENCE:**
1. BOUNDARY SURVEY, FORMER INDEPENDENT LEATHER MFG. CORP., PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG NO. 02-448, DATED JANUARY 29, 2002, REVISED DWG NO. 04-662 OCTOBER 5, 2004.
 2. TOPOGRAPHIC SURVEY, LANDS NOW OR FORMERLY OF THE CITY OF GLOVERSVILLE, 321 SOUTH MAIN STREET, PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG NO. 04-662, DATED OCTOBER 25, 2004.

HAUL ROAD NOTES:

1. ANY OFF-SITE MATERIAL BROUGHT TO THE SITE FOR FILLING AND GRADING PURPOSES SHALL BE FROM AN ACCEPTABLE BORROW SOURCE FREE OF INDUSTRIAL AND/OR OTHER POTENTIAL SOURCES OF CHEMICAL OR PETROLEUM CONTAMINATION, AND SHALL BE DOCUMENTED IN WRITING FROM THE SUPPLIER.
2. COMPACT CRUSHER RUN STONE AS NECESSARY TO PROVIDE A STABLE BASE FOR CONSTRUCTION VEHICLE TRAFFIC. PROVIDE ADDITIONAL CRUSHER RUN STONE, WHERE NECESSARY, TO CONFORM TO THE HAUL ROAD REQUIREMENTS THROUGHOUT THE DURATION OF THE PROJECT.
3. HAUL ROAD TO REMAIN UPON COMPLETION OF THE PROJECT.



**PHASE I
EROSION AND SEDIMENT CONTROL PLAN**

INDEPENDENT LEATHER TANNERY

CITY OF GLOVERSVILLE

C.T. MALE ASSOCIATES, P.C.

50 CENTURY HILL DRIVE, P.O. BOX 727, LATHAM, NY 12110
518.765.7400 • FAX 518.738.7389

ARCHITECTURE & BUILDING SYSTEMS ENGINEERING • CIVIL ENGINEERING
ENVIRONMENTAL SERVICES • SURVEY & LAND INFORMATION SERVICES



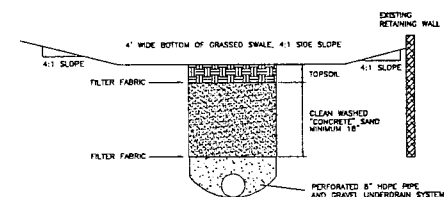
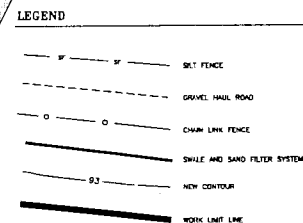
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SHEET 1 OF 2
DWG NO. 04-071

FULTON COUNTY, N.Y.

DATE	REVISIONS RECORD/DESCRIPTION	DRAFTER	CHECK	APPR.

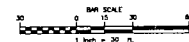
UNREGISTERED ATTENTION
IN ADDITION TO THIS DOCUMENT IS A
REVISION 1 OF THE NEW YORK
STATE EDUCATION LAW
© 2004
C.T. MALE ASSOCIATES, P.C.
DESIGNED: KLC
DRAFTED: KLC
CHECKED: TJH
PROJ. NO: 01-7293
SCALE: 1" = 30'
DATE: DEC. 2004

00220 - 31



SAND FILTER DETAIL NOTES:

1. SAND FILTER TO BE PROTECTED FROM SEDIMENT RUNOFF PRIOR TO STABILIZATION OF THE SITE.
2. SAND FILTER TO BE A MINIMUM WIDTH OF 18".
3. SAND FILTER TO BE A MINIMUM OF FIVE FEET FROM RETAINING WALL.
4. OUTLET OF 8" HOPE UNDERDRAINS SHALL PENETRATE THE EXISTING RETAINING WALL. THIS SHORT LENGTH OF PIPE SHALL BE SOLID THROUGH THE RETAINING WALL.



NOTE:

- 1.) THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.

MAP REFERENCE:

- 1.) BOUNDARY SURVEY, FORMER INDEPENDENT LEATHER WFG. CORP., PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG. NO. 02-448, DATED JANUARY 29, 2002, REVISED DWG. NO. 04-662 OCTOBER 5, 2004.
- 2.) TOPOGRAPHIC SURVEY, LANDS NOW OR FORMERLY OF THE CITY OF GLOVERSVILLE, 321 SOUTH MAIN STREET, PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG. NO. 04-662 DATED OCTOBER 23, 2004.

T. JAMES HOUSTON PE #3618	DATE	REVISIONS RECORD/DESCRIPTION	DRAFTER	CHECK	APPR.	UNAUTHORIZED ALTERATION OF DRAWING OR RECORD VIOLATION OF SECTION 2709 PENALTY \$1000 STATE EDUCATION LAW
	△					© 2004
	△					C.T. HALL ASSOCIATES, P.C.
	△					DESIGNED: KLC
	△					DRAFTED: KLC
	△					CHECKED: TJH
	△					PROJ. NO: 01.7293
	△					SCALE: 1"= 30'
	△					DATE: DEC. 2004

PHASE II EROSION AND SEDIMENT CONTROL PLAN	
INDEPENDENT LEATHER TANNERY	
CITY OF BLOKERSVILLE	FULTON CO.,
C.T. MALE ASSOCIATES, P.C. 30 CENTURY HILL DRIVE, P.O. BOX 727, LATHAM, NY 211 516/867400 • FAX 516/7867293	
ARCHITECTURE & BUILDING SYSTEMS ENGINEERING • CIVIL ENGINEERING ENVIRONMENTAL SERVICES • SURVEY & LAND INFORMATION SERVICES	
	ES-2
SHEET 2 OF 2	DWG. NO: 04-07

Appendix D

Post-Developed Computations

WATER QUALITY VOLUME CALCULATION

CTM PROJ # 1.7293

INDEPENDENT LEATHER TANNERY
CITY OF GLOVERSVILLE, NEW YORK

$$WQv = ((P) * (Rv) * (A)) / 12$$

WQv = water quality volume (acre-feet)

P = 90% rainfall event number

(See Fig 4.1 in NYS Stormwater Management Design Manual)

Rv = runoff volume = $0.05 + .009 (I)$, where I is the percent impervious cover

A = site area (acres)

$$Rv = 0.05 + 0.009 * \frac{I}{0} \quad \text{to a minimum of 0.17}$$

the site will be entirely covered in grass

$$WQv = \frac{P * Rv * A}{12} = \frac{1.00 * 0.17 * 1.000}{12}$$

$$WQv = 0.014 \text{ acre-feet}$$

$$WQv = \underline{617} \text{ CF}$$

$$10\% WQv = \underline{62} \text{ CF}$$

$$25\% WQv = \underline{154} \text{ CF}$$

$$50\% WQv = \underline{309} \text{ CF}$$

$$75\% WQv = \underline{463} \text{ CF}$$

Sand Filter Design

8" underdrain in gravel layer (pipe freezing requirement)
pretreatment of $\geq 25\%$ of WQV

grass filter strip between 15' and 18'
→ the entire site is grass $\therefore$ pretreatment is met

• silt must hold at least 75% WQV prior to filtration ✓

• filter bed area: $A_f = \frac{WQV \cdot d_f}{K \cdot (h_f + d_f) \cdot t_f}$

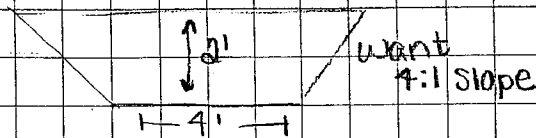
$$WQV = 617 \text{ cf}$$

$$d_f = \text{filter bed depth} = 18'' = 1.5' \text{ (Min)}$$

$$K = 3.5 \text{ ft/day (Sand)}$$

$$h_f = \text{height above filter} = \text{use height during 1-yr storm} = 2.1'$$

$$t_f = \text{drain time} = 1.67 \text{ days (Max)}$$

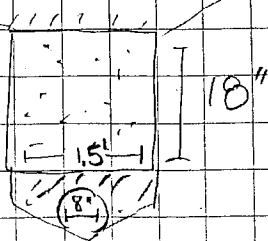


$$A_f = \frac{617 \cdot 1.5}{3.5 (1.5 + 2.1) \cdot 1.67} = 92.3 \text{ ft}^2$$

$$\text{length} = 460' \therefore \text{min width} = 2' 4''$$

✓ for gravel & underdrain

for design want filter 1.5' wide and 1.5' high



$$\text{filter volume} = 1.5 \times 1.5 \times 480 = 1080 \text{ cf} > WQV \checkmark$$

Draft Table 5.3.2-1 - Volatile Organic Compounds for Surface Soil
Independent Leather - Project #01.7293
Data Validated

Parameter	NTSDECTAGM 4046 Values ⁽²⁾ mg/kg	SS-6 DL mg/kg	SS-7 (0.25-0.75') mg/kg	SS-8 (1-1.5') mg/kg	SS-8 (1-1.5') RE mg/kg
Acetone	0.2	<29	<0.014 B	<0.012 B	<0.017 B
Benzene	0.06	<12	<0.006	<0.006	<0.006
Bromodichloromethane	NA	<12	<0.006	<0.006	<0.006
Bromoform	NA	<12	<0.006	<0.006	<0.006
Bromomethane	NA	<12	<0.006	<0.006	<0.006
2-Butanone	0.3	<12	<0.012	<0.012 B	<0.012 B
Carbon Disulfide	2.7	<12	<0.006	<0.006	<0.006
Carbon Tetrachloride	0.6	<12	<0.006	<0.006	<0.006
Chlorobenzene	1.7	<12	<0.006	<0.006	<0.006
Chloroethane	NA	<12	<0.006	<0.006	<0.006
Chloroform	0.3	<12	<0.006	<0.006	<0.006
Chloromethane	NA	<12	<0.006	<0.006	<0.006
Dibromochloromethane	NA	<12	<0.006	<0.006	<0.006
1,1-Dichloroethane	0.2	<12	<0.006	<0.006	<0.006
1,2-Dichloroethane	0.1	<12	<0.006	<0.006	<0.006
1,2-Dichloroethene (cis)	0.25	<12	<0.006	<0.006	<0.006
1,2-Dichloroethene (trans)	0.3	<12	<0.006	<0.006	<0.006
1,1-Dichloroethene	0.4	<12	<0.006	<0.006	<0.006
1,2-Dichloropropane	NA	<12	<0.006	<0.006	<0.006
1,3-Dichloropropene (cis)	NA	<12 J	<0.006	<0.006	<0.006
1,3-Dichloropropene (trans)	NA	<12	<0.006	<0.006	<0.006
Ethylbenzene	5.5	40	<0.006	<0.006	<0.006
2-Hexanone	NA	<12	<0.012	<0.012	<0.012
Methylene Chloride	0.1	<12	<0.006 B	<0.006	<0.006 B
4-Methyl-2-Pentanone	1.0	<12	<0.012	<0.012	<0.012
Styrene	NA	<12	<0.006	<0.006	<0.006
Tetrachloroethene	1.4	<12	<0.006	<0.006	<0.006
1,1,1-Trichloroethane	0.6	<12	<0.006	<0.006	<0.006
1,1,2-Trichloroethane	1.5	<12	<0.006	<0.006	<0.006
1,1,2,2-Tetrachloroethane	0.8	<12	<0.006	<0.006	<0.006 J
Toluene	NA	<12	<0.006	<0.006	<0.006
Trichloroethene	0.7	<12	<0.006	<0.006	<0.006
Vinyl Acetate	NA	<12	<0.006	<0.006	<0.006
Vinyl Chloride	NA	<12	<0.006	<0.006	<0.006
Xylenes (total)	1.2	33	<0.006	<0.006	<0.006
Total VOCs	10	73	ND	ND	ND

⁽¹⁾ NYSDEC Technical Guidance for Screening Contaminated Sediments, Human Health Bioaccumulation, November 22, 1993 (Reprinted with changes July 1994, March 1998, and January 1999).

⁽²⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995. VOCs analyzed using EPA Method 8260.

B indicates the analyte was detected in the blank as well as the sample.

J indicates an estimated value.

NA is Not Applicable.

ND is Not Detected.

DL indicates laboratory dilution applied.

Draft Table 5.3.3-1 - Semi-Volatile Organic Compounds for Surface Soil
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽²⁾ mg/kg	SS-6 DL mg/kg	SS-7 (0.25-0.75') mg/kg	SS-8 (1-1.5') mg/kg
Acenaphthene	50	<19	<0.41	0.019 J
Acenaphthylene	41	<19	<0.41	0.02 J
Anthracene	50	0.86 J	<0.41	0.059 J
Benzo(a)anthracene ¹	0.224 or MDL	2.0 J	<0.41	0.28 J
Benzo(a)pyrene ¹	0.061 or MDL	1.6 J	<0.41	0.28 J
Benzo(b)fluoranthene ¹	0.224 or MDL	<19 J	<0.41	0.32 J
Benzo(k)fluoranthene ¹	0.224 or MDL	<19 J	<0.41	0.29 J
Benzo(g,h,i)perylene	50	1.4 J	<0.41	0.33 J
Benzoic Acid	2.7	<93	<2.0	<1.9
Benzyl Alcohol	NA	<19	<0.41	<0.4
bis(2-Chloroethoxy)methane	NA	<19	<0.41	<0.4
bis(2-Chloroethyl)ether	NA	<19	<0.41	<0.4
bis(2-ethylhexyl)phthalate ¹	50	<19	<0.41	<0.4
4-Bromophenyl-phenylether	NA	<19	<0.41	<0.4
Butylbenzylphthalate	50	<19	<0.41	<0.4
Carbazole	NA	<19	<0.41	0.03 J
4-Chlorophenyl-phenylether	NA	<19	<0.41	<0.4
4-Chloroaniline ¹	0.220 or MDL	<19	<0.41	<0.4
4-Chloro-3-methylphenol	0.240 or MDL	<19	<0.41	<0.4
2-Chloronaphthalene	NA	<19	<0.41	<0.4
2-Chlorophenol	0.8	<19	<0.41	<0.4
Chrysene	0.4	2.0 J	<0.41	0.38 J
Dibenzofuran	6.2	<19	<0.41	0.028 J
Dibenzo(a,h)anthracene ¹	0.014 or MDL	<19 J	<0.41	0.092 J
1,2-Dichlorobenzene	NA	<19	<0.41	<0.4
1,3-Dichlorobenzene	NA	<19	<0.41	<0.4
1,4-Dichlorobenzene	NA	<19	<0.41	<0.4
3,3'-Dichlorobenzidine ¹	NA	<38	<0.81	<0.79
2,4-Dichlorophenol	0.4	<19	<0.41	<0.4
Diethylphthlate	7.1	<19	<0.41	<0.4
Dimethylphthlate	2.0	<19	<0.41	<0.4
2,4-Dimethylphenol	NA	<19	<0.41	<0.4
Di-n-butyl phthalate	8.1	<19	<0.41	<0.4
Di-n-octyl phthalate	50.0	<19 J	<0.41	<0.4
4,6-Dinitro-2-methylphenol	NA	<93	<2.0	<1.9
2,4-Dinitrophenol	0.200 or MDL	<93	<2.0	<1.9
2,4-Dinitrotoluene	NA	<19	<0.41	<0.4
2,6-Dinitrotoluene ¹	1.0	<19	<0.41	<0.4
Fluoranthene	50	3.5 J	<0.41	0.5
Fluorene	50	<19	<0.41	<0.4 M
Indeno(1,2,3-cd)pyrene	3.2	1.3 J	<0.41	0.25 J

Draft Table 5.3.3-1 - Semi-Volatile Organic Compounds for Surface Soil
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽²⁾ mg/kg	SS-6 DL mg/kg	SS-7 (0.25-0.75') mg/kg	SS-8 (1-1.5') mg/kg
Hexachlorobenzene ¹	0.41	<19	<0.41	<0.4
Hexachlorobutadiene	NA	<19	<0.41	<0.4
Hexachlorocyclopentadiene	NA	<19	<0.41	<0.4
Hexachloroethane	NA	<19	<0.41	<0.4
Isophorone ¹	4.4	<19	<0.41	<0.4
2-Methylnaphthalene	36.4	37	<0.41	0.064 J
2-Methylphenol	0.100 or MDL	<19	<0.41	<0.4
4-Methylphenol	NA	<19	<0.41	<0.4
Naphthalene	13	110	<0.41	0.12 J
Nitrobenzene	0.200 or MDL	<19	<0.41	<0.4
2-Nitroaniline	0.430 or MDL	<93	<2.0	<1.9
3-Nitroaniline	0.500 or MDL	<93	<2.0	<1.9
4-Nitroaniline	NA	<38	<0.81	<0.79
2-Nitrophenol	0.330 or MDL	<19	<0.41	<0.4
4-Nitrophenol	0.100 or MDL	<93	<2.0	<1.9
n-Nitroso-di-n-propylamine	NA	<19	<0.41	<0.4
n-Nitrosodiphenylamine	NA	<19	<0.41	<0.4
2,2'-oxybis(1-Chloropropane)	NA	<19	<0.41	<0.4
Pentachlorophenol ¹	1.0 or MDL	<93	<2.0	<1.9
Phenanthrene	50	2.5 J	<0.41	0.3 J
Phenol	0.03 or MDL	<19	<0.41	<0.4
Pyrene	50	3.7 J	<0.41	0.48
1,2,4-Trichlorobenzene	NA	<19	<0.41	<0.4
2,4,5-Trichlorophenol	0.1	<93	<2.0	<1.9
2,4,6-Trichlorophenol	NA	1.3 J	<0.41	<0.4
Total SVOCs	500	167.16	ND	3.842

⁽¹⁾ NYSDEC Technical Guidance for Screening Contaminated Sediments, Human Health Bioaccumulation, November 22, 1993 (Reprinted with changes July 1994, March 1998, and January 1999).

⁽²⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995. SVOCs analyzed using EPA Method 8270.

MDL is Method Detection Limit.

J indicates an estimated value.

M indicates a manually integrated compound.

NA is Not Applicable.

DL indicates laboratory dilution applied.

Draft Table 5.3.4-1 - Pesticides and Polychlorinated Biphenyl Compounds for Surface Soil
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽²⁾ mg/kg	SS-1 mg/kg	SS-2 mg/kg	SS-3 mg/kg	SS-4 mg/kg	SS-5 (0.5-1') mg/kg	SS-6 mg/kg	SS-7 (0.25-0.75') mg/kg	SS-8 (1-1.5') mg/kg
Aldrin	0.041	<0.0026	<0.0021	<0.0024	<0.0023	<0.0025	0.0047	<0.0024	<0.0024
alpha-BHC	0.11	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	0.0018 J	<0.0021	<0.002
beta-BHC	0.2	<0.0022	<0.0018	0.0055 J	<0.0019	<0.0021	<0.004	<0.0021	<0.002
delta-BHC	0.3	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	<0.004	<0.0021	<0.002
gamma-BHC (Lindane)	0.06	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	<0.004	<0.0021	<0.002
alpha-chlordane	NA	<0.0022	<0.0018	<0.0043	<0.0019	<0.0021	0.0072 J	<0.0021	<0.002
gamma-chlordane	0.54	<0.0022	<0.0018	0.0022 JN	<0.0019	<0.0021	0.007	<0.0021	<0.002
4,4'-DDD	2.9	0.0088 J	<0.0034	<0.0035	<0.0037	<0.0041	0.026 J	<0.004	<0.002
4,4'-DDE	2.1	<0.0044	<0.0034	<0.004	<0.0037	<0.0041	0.038	<0.004	<0.004
4,4'-DDT	2.1	0.016	<0.0034	<0.004	<0.0037	<0.0041	<0.0077	<0.004	<0.002
Dieldrin	0.044	<0.0044	<0.0034	0.0017 J	<0.0037	<0.0041	<0.0077	<0.004	<0.004
Endosulfan I	0.9	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	<0.004	<0.0021	<0.002
Endosulfan II	0.9	<0.0044	<0.0034	<0.004	<0.0037	<0.0041	<0.0077	<0.004	<0.002
Endosulfan Sulfate	1.0	<0.0044	<0.0034	<0.004	<0.0037	<0.0041	<0.0077	<0.004	<0.002
Endrin	0.1	<0.0066	<0.0052	<0.006	<0.0057	<0.0062	<0.012	<0.006	<0.006
Endrin aldehyde	NA	<0.005	<0.0034	<0.0048	<0.0037	<0.0041	<0.0077	<0.004	<0.004
Endrin keytone	NA	<0.0044	<0.0034	<0.004	<0.0037	<0.0041	0.0033 J	<0.004	<0.004
Heptachlor	0.1	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	<0.004	<0.0021	<0.002
Heptachlor epoxide	0.02	<0.0022	<0.0018	<0.0021	<0.0019	<0.0021	<0.004	<0.0021	<0.002
Methoxychlor	NA	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Toxaphene	NA	<0.11	<0.087	<0.1	<0.094	<0.1	<0.19	<0.1	<0.1
Total Pesticides	10	0.0248	ND	0.0094	ND	ND	0.0881	ND	ND
Polychlorinated Biphenyls									
Aroclor 1016	1.0	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Aroclor 1221	1.0	<0.044	<0.034	<0.04	<0.037	<0.041	<0.077	<0.04	<0.04
Aroclor 1232	1.0	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Aroclor 1242	1.0	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Aroclor 1248	1.0	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Aroclor 1254	1.0	<0.022	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Aroclor 1260	1.0	0.022 J	<0.018	<0.021	<0.019	<0.021	<0.04	<0.021	<0.02
Total PCBs	1.0	0.022	ND	ND	ND	ND	ND	ND	ND

⁽¹⁾ NYSDEC Technical Guidance for Screening Contaminated Sediments, Human Health Bioaccumulation, November 22, 1993 (Reprinted with changes July 1994, March 1998, and January 1999).

⁽²⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995. Pesticides and PCBs analyzed using EPA Method 8082.

J indicates an estimated value.

N indicates spike recovery exceeds the upper or lower control limits.

NA is Not Applicable.

ND is Not Detected.

Draft Table 5.3.5-1 - Metal Analytes for Surface Soil
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽²⁾ mg/kg	NYSDEC TAGM 4046 Eastern USA Background ⁽²⁾ mg/kg	SS-1 mg/kg	SS-2 mg/kg	SS-3 mg/kg	SS-4 mg/kg	SS-5 (0.5-1') mg/kg	SS-6 mg/kg	SS-7 (0.25-0.75') mg/kg	SS-8 (1-1.5') mg/kg
Aluminum	SB	33,000	-	-	-	-	-	11,200	4,590	6,740
Antimony	SB	NA	-	-	-	-	-	7.8 JB	<8.6 J	4.0 JB
Arsenic	7.5 or SB	3-12**	-	-	-	-	-	3,510	5.1 B	987
Barium	300 or SB	15-600	-	-	-	-	-	86.6	21.5	145
Beryllium	0.16 or SB	0-1.75	-	-	-	-	-	<4.2	<1.5	1.5 B
Cadmium	10	0.1-1	-	-	-	-	-	<6.3	<2.2	<3.1
Calcium	SB	130-35,000**	-	-	-	-	-	87,400	23,000	35,300
Chromium	50	1.5-40**	-	-	-	-	-	605	63.3	73.1
Cobalt	30 or SB	2.5-60**	-	-	-	-	-	15.5	2.5	5.7
Copper	25 or SB	1-50	-	-	-	-	-	123	20.6	25
Cyanide	NA	NA	<0.674 R	<0.514 R	<0.608 R	<0.571 R	<0.599 R	<1.16 R	<0.585 R	<0.591 R
Iron	2,000 or SB	2,000-550,000	-	-	-	-	-	30,400	8,110	17,800
Lead	***	***	-	-	-	-	-	123	45.6	89.1
Magnesium	SB	100-5,000	-	-	-	-	-	7,900	4,990	931
Manganese	SB	50-5,000	-	-	-	-	-	241	116	83.2
Mercury	0.1	0.001-0.2	-	-	-	-	-	3.1 BD	<0.099	0.31
Nickel	13 or SB	0.5-25	-	-	-	-	-	34.8	5.6	11.7
Potassium	SB	8,500-43,000**	-	-	-	-	-	1,360	940	622
Selenium	2 or SB	0.1-3.9	-	-	-	-	-	<33.4	<11.7	<16.8
Silver	SB	NA	-	-	-	-	-	<6.3	<2.2	<3.1
Sodium	SB	6,000-8,000	-	-	-	-	-	541	304	346
Thallium	SB	NA	-	-	-	-	-	<45.9	<16.1	<23
Vanadium	150 or SB	1-300	-	-	-	-	-	19.2	11.5	18.5
Zinc	20 or SB	9-50	-	-	-	-	-	255	90.2	56.3
% Solids	NA	NA	74.2	94.5	82.2	87.5	79.5	42.8	81.4	83

⁽¹⁾ NYSDEC Technical Guidance for Screening Contaminated Sediments, Human Health Bioaccumulation, November 22, 1993 (Reprinted with changes July 1994, March 1998, and January 1999).

⁽²⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995.

** New York State Background.

*** Background levels for lead vary widely. Average background levels in metropolitan areas near highways are much higher and typically range from 200-500 ppm. The USEPA's Interim Lead Hazard Guidance (7/14/94) establishes a residential screening level of 400 ppm.

Metals were analyzed using EPA Method 6010 and 7471 for Mercury.

SB is Site Background.

B indicates value was obtained from a reading less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).

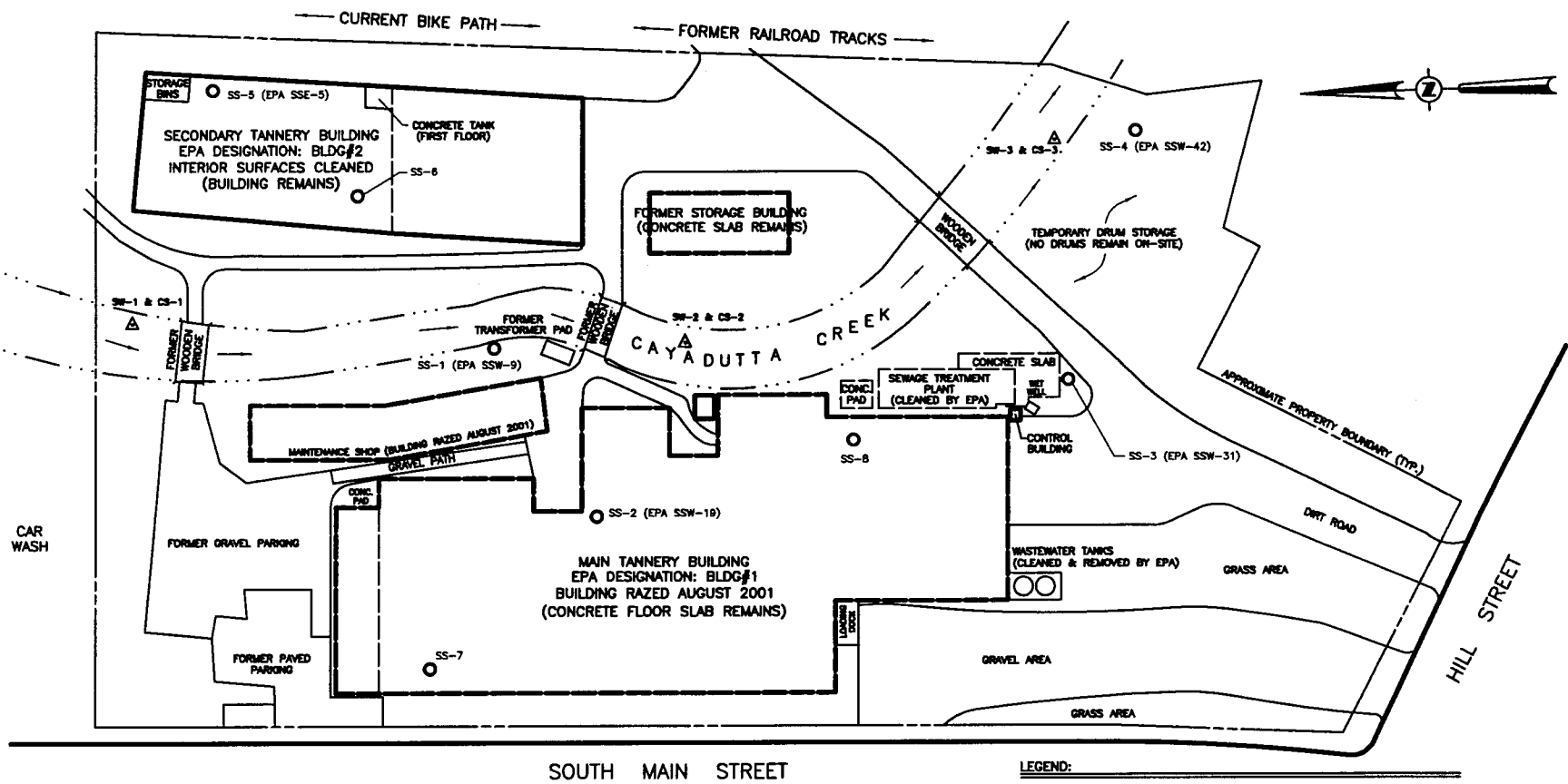
D indicates compound analyzed at a dilution.

J indicates an estimated value.

R indicates rejected; NA is Not Applicable.

00220 - 50

NO DIMS



LEGEND:

△ SW-3 & CS-3

SURFACE WATER AND SEDIMENT SAMPLING
LOCATION AND ID (TYP.).

○ SS-2 (EPA SSW-19)

SURFACE SOIL SAMPLING LOCATION AND ID
(TYP.). ANALYSES WAS LIMITED TO SUPPLEMENT
EPA ANALYTICAL DATA.

● SS-7

SURFACE SOIL SAMPLING LOCATION AND ID
(TYP.). THE LOCATION DOES NOT OVERLAP EPA
SAMPLING POINTS, THEREFORE, COMPLETE
PROJECT ANALYSES WAS PERFORMED.

FIGURE 1

SITE MAP SHOWING SURFACE SOIL, SURFACE WATER, AND SEDIMENT SAMPLE LOCATIONS

INDEPENDENT LEATHER TANNERY

CITY OF GLOVERSVILLE

FULTON COUNTY, NEW YORK

C.T. MALE ASSOCIATES, P.C.

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SHEET 3 OF 9

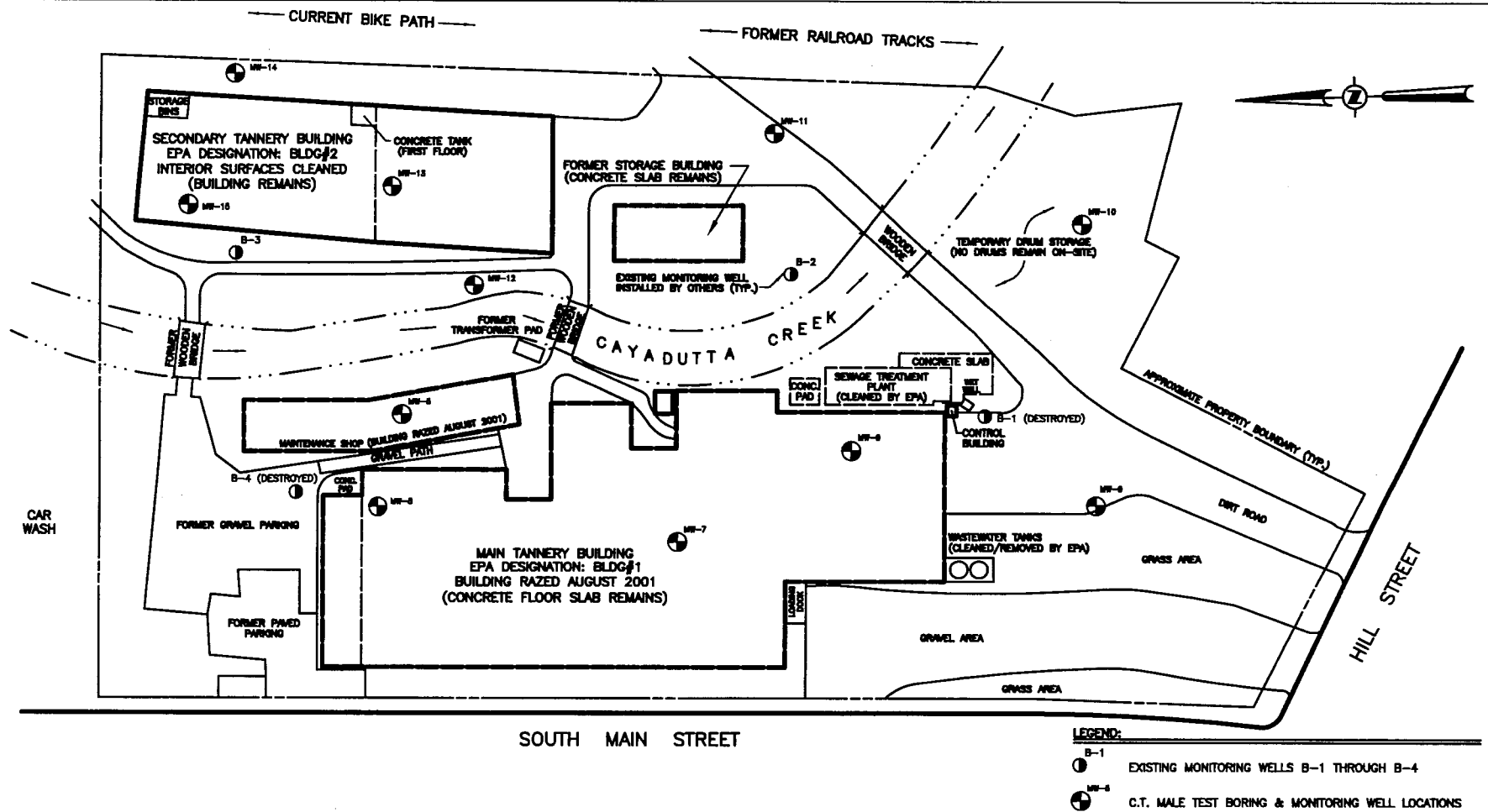
DWG. NO: 03-570

GENERAL NOTES:
THE LOCATIONS AND FEATURES
DEPICTED ON THIS MAP ARE
APPROXIMATE AND DO NOT REPRESENT
AN ACTUAL FIELD SURVEY.

2.) THE LOCATIONS OF EPA SAMPLING
POINTS WERE ELECTRONICALLY PROVIDED
BY EPA AND ARE APPROXIMATE.

DATE	REVISIONS RECORD/DESCRIPTION	DRAFTED	CHECK	APPR.	UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW. © 2003 C.T. MALE ASSOCIATES P.C.
	△				DESIGNED:
	△				DRAFTED : JAM
	△				CHECKED : KM
	△				PROJ. NO : 01.7293
	△				SCALE : NOT TO SCALE
	△				DATE : NOVEMBER 2003

CADD DWG. FILE NAME: SURF SOIL SW-3 & CS-3.DWG



GENERAL NOTES:

1.) THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.

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					PROJ. NO : 01.7293
					SCALE : NOT TO SCALE
					DATE : NOVEMBER 2003

FIGURE 2 SITE MAP SHOWING TEST BORING & MONITORING WELL LOCATIONS BY C. T. MALE

INDEPENDENT LEATHER TANNERY

CITY OF GLOVERSVILLE

FULTON COUNTY, NEW YORK

C.T. MALE ASSOCIATES, P.C.

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SHEET 4 OF 9
DWG. NO: 03-570

**INDEPENDENT LEATHER SITE
VALIDATED ANALYTICAL RESULTS
C.T. MALE PROJECT NUMBER: 01.7293**

Client ID	Lab Sample ID	Analysis Date	Compound	Result	Qualifier	MDL	RL	Units
ROD-SS1(0-2)	207049-009	7/15/2004	Arsenic	1.3	B*N J	1	6.8	mg/Kg
ROD-SS1(10-12)	207049-011	7/15/2004	Arsenic	7.2	B*N J	1.6	10.5	mg/Kg
ROD-SS2(0-2)	207049-015	7/15/2004	Arsenic	2.5	B*N J	1.5	10	mg/Kg
ROD-SS2(10-12)	207049-016	7/15/2004	Arsenic	8	B*N J	1.6	10.6	mg/Kg
ROD-SS3(0-2)	207049-017	7/15/2004	Arsenic	27.2	*N J	1.4	9.2	mg/Kg
ROD-SS3(10-12)	207049-018	7/15/2004	Arsenic	52.3	*N J	1.5	9.8	mg/Kg
ROD-SS3(18-20)	207268-001	8/5/2004	Arsenic	8.7	B*N J	1.4	8.9	mg/Kg
ROD-SS4(0-2)	207050-005	7/15/2004	Arsenic	9	B	1.7	11.1	mg/Kg
ROD-SS4(10-12)	207050-006	7/15/2004	Arsenic	1.6	B	1.4	9.4	mg/Kg
ROD-SS5(0-2)	207052-003	7/15/2004	Arsenic	5.6	B	1.6	10.7	mg/Kg
ROD-SS5(10-12)	207052-004	7/15/2004	Arsenic	2.8	B	1	6.7	mg/Kg
ROD-SS6(0-2)	207052-001	7/15/2004	Arsenic	3.5	B	1.4	9	mg/Kg
ROD-SS6(10-12)	207052-002	7/15/2004	Arsenic	1.2	U	1.2	8.1	mg/Kg
ROD-SS7(0-2)	207050-019	7/15/2004	Arsenic	14.9		1.3	8.8	mg/Kg
ROD-SS7(10-12)	207050-020	7/15/2004	Arsenic	13.2		1.7	11.2	mg/Kg
ROD-SS7(18-20)	207268-002	8/5/2004	Arsenic	9.7	B*N J	1.7	11.2	mg/Kg
ROD-SS8(0-2)	207050-017	7/15/2004	Arsenic	10.9		1.5	10	mg/Kg
ROD-SS8(10-12)	207050-018	7/15/2004	Arsenic	12.5		1.7	11.4	mg/Kg
ROD-SS9(0-2)	207050-015	7/15/2004	Arsenic	202		1.2	8.1	mg/Kg
ROD-SS9(10-12)	207050-016	7/15/2004	Arsenic	386		1.7	11.3	mg/Kg
ROD-SS9(18-20)	207268-003	8/5/2004	Arsenic	293	*N J	1.6	10.7	mg/Kg
ROD-SS10(0-2)	207050-013	7/15/2004	Arsenic	85.5		1.7	11.1	mg/Kg
ROD-SS10(10-12)	207050-014	7/15/2004	Arsenic	107		1.7	11.2	mg/Kg
ROD-SS10(18-20)	207268-004	8/5/2004	Arsenic	11.5	*N J	1.5	9.6	mg/Kg
ROD-SS11(0-2)	207050-011	7/15/2004	Arsenic	100		1.6	10.2	mg/Kg
ROD-SS11(10-12)	207050-012	7/15/2004	Arsenic	156		1.8	12	mg/Kg
ROD-SS11(18-20)	207268-005	8/5/2004	Arsenic	271	*N J	1.7	11	mg/Kg
ROD-SS12(0-2)	207050-008	7/15/2004	Arsenic	48.3		1.4	9.2	mg/Kg
ROD-SS12(10-12)	207050-009	7/15/2004	Arsenic	67.3		1.5	9.9	mg/Kg
ROD-SS12(18-20)	207268-006	8/5/2004	Arsenic	463	*N J	1.8	11.5	mg/Kg
ROD-SS13(0-2)	207050-003	7/15/2004	Arsenic	169		1.4	8.9	mg/Kg
ROD-SS13(10-12)	207050-004	7/15/2004	Arsenic	382		1.7	11	mg/Kg
ROD-SS13(18-20)	207268-007	8/5/2004	Arsenic	4910	*N J	1.7	11.4	mg/Kg

INDEPENDENT LEATHER SITE
VALIDATED ANALYTICAL RESULTS
C.T. MALE PROJECT NUMBER: 01.7293

Client ID	Lab Sample ID	Analysis Date	Compound	Result	Qualifier	MDL	RL	Units
ROD-SS14(0-2)	207049-019	7/15/2004	Arsenic	41.3	*N J	1.3	8.8	mg/Kg
ROD-SS14(10-12)	207049-020	7/15/2004	Arsenic	31.7	*N J	1.8	11.5	mg/Kg
ROD-SS14(18-20)	207268-008	8/5/2004	Arsenic	37.8	*N J	1.4	9.1	mg/Kg
ROD-SS15(0-2)	207050-001	7/15/2004	Arsenic	190		1.6	10.4	mg/Kg
ROD-SS15(10-12)	207050-002	7/15/2004	Arsenic	177		1.5	10	mg/Kg
ROD-SS15(18-20)	207268-009	8/5/2004	Arsenic	11.4	*N J	1.3	8.4	mg/Kg
ROD-SS16(0-2)	207049-013	7/15/2004	Arsenic	7.6	B*N J	1.7	11.1	mg/Kg
ROD-SS16(10-12)	207049-014	7/15/2004	Arsenic	258	*N J	1.5	9.7	mg/Kg
ROD-SS16(18-20)	207268-010	8/5/2004	Arsenic	173	*N J	1.4	9	mg/Kg
ROD EQ BLANK #1	207049-012	7/19/2004	Arsenic	3.9	U	3.9	40	ug/L
ROD EQ BLANK #2	207050-010	7/19/2004	Arsenic	3.9	U	3.9	40	ug/L
ROD-SS1 DUPLICATE#	207049-010	7/15/2004	Arsenic	8.5	*N	1.2	7.6	mg/Kg
ROD-SS12(DUPE#2)	207050-007	7/15/2004	Arsenic	72.1		1.5	10	mg/Kg

Qualifiers

"*" denotes duplicate analysis was not within control limits.

"B" denotes value was obtained from a reading less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).

"U" denotes the compound was analyzed for but not detected.

"N" denotes spiked recovery not within control limits.

"J" denotes an estimated value.

SECTION 00300n - NOTICE TO BIDDERS - BID FORMS

The complete Bid Forms are stapled together and inserted in the pocket which follows this page. These Bid Forms are to be completely filled in and submitted as the Formal Bid. The bound Project Manual book should not be submitted with the Bid Forms but should be returned to C.T. Male Associates, P.C. as described in the Invitation to Bid.

After Bid Opening and Contract Award, a copy of the successful Bidder's complete Bid Forms will be bound in this Project Manual immediately following this page.

END OF SECTION 00300n

2005 SEP -7 AM 9:59

FILED - CITY CLERK
GLOVERSVILLE, NY



THE ENVIRONMENTAL QUALITY COMPANY
EQ Northeast, Inc. 185 Industrial Road, P.O. Box 617, Wrentham, MA 02093

CITY OF Gloversville
CITY HALL
3 Frontage Road
Gloversville, NY 12078

Independent Leather Remedial Action Project
321-333 South Main Street, Gloversville, NY

Bid Due: September 7, 2005 @ 2:00 pm

SECTION 00300 - BID FORM

(This document is similar to Suggested Bid Form, EJCDC Document 1910-1996 Edition.)

FOR: Remedial Action for Independent Leather Brownfield Project

TO: **CITY OF GLOVERSVILLE**
City Hall
3 Frontage Road
Gloversville, New York 12078-2897

FROM: EQ Northeast, Inc. September 7, 2005
(Name of Bidder) (Date Bid Submitted)

1.01 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

2.01 Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for 45 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of OWNER.

3.01 In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

- A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>
<u>No. 1</u>	<u>August 12, 2005</u>
<u>No. 2</u>	<u>August 24, 2005</u>
<u>No. 3</u>	<u>August 30, 2005</u>

- B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) reports and drawings of a Hazardous Environmental Condition, if any, which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.
- E. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may

affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

- F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to Bidder.
- J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

4.01 Bidder further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

4.02 Non-Collusive Bidding Certification - As required by Section 103-d of New York State General Municipal Law, the Bidder must complete and submit with the Bid the certification on page 00480-1.

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

BID SCHEDULE

PROJECT: **INDEPENDENT LEATHER BROWNFIELD PROJECT
REMEDIAL ACTION**

Refer to Section 01025 - Measurement and Payment for scope of pay items.
Unit Prices have been computed in accordance with paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities provided, determined as provided in the Contract Documents.

Pay Item No.	Pay Item Description	Estimated Quantity	Unit	Unit Price	Total Price
I.	Mobilization and Demobilization: submittals, equipment delivery and general start-up tasks	1	LS	39,000	39,000
II.	<u>Site Preparation:</u>				
1.	Prepare and provide a site specific Health and Safety Plan prior to start of work	1	LS	4,000	4,000
2.	Repair existing and install new silt fence at the locations shown on Contract Drawings	1	LS	6,000	6,000
3.	Clearing and grubbing and off-site disposal of removed material	1	LS	5,000	5,000
4.	Construct decontamination pad of sufficient size to clean heavy equipment and contain wash fluids and sediments	1	LS	3,000	3,000
5.	Relocate, repair and maintain existing gravel access road for construction traffic and install new gravel access road for construction traffic	1	LS	7,000	7,000
6.	Break-up, excavate and temporary stockpile remaining building materials. This includes concrete slabs on grade, loading dock, above grade/below grade foundation walls and wood timbers	1	LS	20,000	20,000
7.	Load, transport and dispose building materials at the Fulton County Landfill	1,250	TON	60	75,000
8.	Monitoring well decommissioning (remove PVC pipe and fill with bentonite)	4	EA	700	2,800
9.	Terminate the inactive drain pipe located on the north side of the building per City requirements	1	LS	1,500	1,500

Pay Item No.	Pay Item Description	Estimated Quantity	Unit	Unit Price	Total Price
III	<u>Contaminated Soil Removal</u>				
C 1.	Excavate petroleum contaminated soil at the direction of the Owner's Representative; control dust generation; temporarily stage soil on the east side of the Cayadutta Creek, and protect soil piles from wind and precipitation erosion on a daily basis until off-site disposal	3,225	TON	7	22,575
C 2.	Coordinate, load, transport and dispose non-hazardous contaminated soil at Fulton County Landfill and control dust generation	2,725	TON	46	125,350
C 3.	Develop and implement personal air monitoring program for site workers for organic vapors and particulates for determining and upgrading personal protective equipment	60	DAY	200	12,000
C 4.	Coordinate, load, transport and dispose hazardous contaminated soil at a facility permitted to accept this type of material, and control dust generation, if required	500	TON	140	70,000
5.	Waste characterization sample collection and analysis (Full TCLP analysis) required by the disposal facility for acceptance of non-hazardous contaminated soil, with results available within 48 hours from sample collection	4	EA	1,200	4,800
6.	Waste characterization sample collection and analysis required by the disposal facility for acceptance of hazardous contaminated soil, with results available within 48 hours from sample collection, if required	1	EA	1,700	1,700
7.	Provide and place clean general backfill to increase site grades (to replace the petroleum contaminated soils removed)	2,150	CY	16	34,400
8.	Decontaminate heavy equipment and contain, wash fluids and sediments for subsequent disposal	1	LS	1,000	1,000
9.	Transfer decontamination wash fluids from decontamination pad to 55-gallon drums, characterize liquid and properly dispose at a facility permitted to accept this type of non-hazardous waste	2	DR	750	1,500
IV	<u>Suspect Vent Pipe Evaluation</u>				
1.	Exploratory excavation of the suspect vent pipe to determine if pipe is connected to an underground storage tank	1	LS	1,000	1,000

Pay Item No.	Pay Item Description	Estimated Quantity	Unit	Unit Price	Total Price
2.	Empty, excavate, remove, clean and dispose underground storage tank and associated piping, if located, assuming 275 to 1,499 gallons	1	LS	3,000	3,000
3.	Transport and dispose tank contents assuming No. 2 fuel oil, diesel or kerosene mixed with water at a facility permitted to accept this type of non-hazardous waste	275	GAL	20	5,500
4.	Transport and dispose tank bottom sludge in 55 gallon drum at a facility permitted to accept this type of non-hazardous waste	1	DR	600	600
V	<u>Soil Dewatering and Groundwater Treatment</u>				
1.	Mobilization and Demobilization: Construct, set-up and dismantle temporary groundwater treatment system; and cleaning of the temporary storage tank.	1	LS	9,000	9,000
C 2.	Soil dewatering and groundwater treatment including 20,000 gallon untreated water storage capacity, treatment with a minimum of 2-55 gallon granular activated carbon units plumbed in series, bag filter as necessary, installation of water meter, and sampling before and during treatment	10,000	GAL	1.50	15,000
3.	Laboratory analysis of groundwater treatment system samples by EPA Methods 8021 and 8270 (base neutrals only), and arsenic and chromium by standard methods within 24 hours	4	EA	700	2,800
4.	Supply 55-gallon virgin granular activated carbon (GAC) units and dispose of spent 55-gallon GAC unit	2	DR	800	1,600
VI.	<u>Placement of Soil Barrier to Contact</u>				
C 1.	Supply and place general fill, preliminary grade, and final grade soil barrier to contact	2,200	CY	20	44,000
2.	Supply and place 3" of clean topsoil to construct soil barrier to contact	57	MSF	400	22,800
3.	Supply and install a demarcation layer beneath clean imported fill and soil barrier to contact	57	MSF	250	14,250
4.	Collect and analyze soil samples from the source (i.e., borrow pit) of imported material used for backfill and topsoil for Target Compound List (TCL) volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide) analyses	6	EA	700	4,200

C.T. MALE ASSOCIATES, P.C.
AIA MasterSpec

INDEPENDENT LEATHER
REMEDIAL ACTION

Pay Item No.	Pay Item Description	Estimated Quantity	Unit	Unit Price	Total Price
5.	Apply hydroseed to the soil barrier to contact and protect until establishment of vegetative cover acceptable to the Engineer	57	MSF	120	6,840
Total Base Bid (Items I to VI)					567,215

6.01 Bidder agrees that the Work will be substantially completed and completed and ready for final payment in accordance with paragraph 14.07.B of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified above, which shall be stated in the Agreement.

7.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid Security, in the form of a certified check, bank check, or a Bid Bond in accordance with the Instructions to Bidders.

B. Required Bidder's Qualification Statement, with supporting data.

C. Subcontractor Listing.

D. Non-Collusive Bidding Certification.

E. Performance Bond Information Form.

8.01 The terms used in this Bid with initial capital letters have the meanings indicated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

9.01 Communication covering this Bid shall be addressed to the Bidder as indicated on the following signature page.

SUBMITTED on September 7, 2005.

EMPLOYER's Tax ID No. 04-2619121.

State Contractor License No. _____ (If applicable)

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

Business address: _____

Phone No.: _____ FAX No.: _____

C.T. MALE ASSOCIATES, P.C.
AIA MasterSpec

INDEPENDENT LEATHER
REMEDIAL ACTION

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Business address: _____

Phone No.: _____ FAX No.: _____

A Corporation

Corporation Name: EQ Northeast, Inc. (SEAL)

State of Incorporation: Massachusetts

Type (General Business, Professional, Service, Limited Liability): General Business

By: Kevin T. Franklin
(Signature -- attach evidence of authority to sign)

Name (typed or printed): Kevin T. Franklin

Title: Vice President

Attest: [Signature] (CORPORATE SEAL)
(Signature of Corporate Secretary)

Business address: 185 Industrial Road
Wrentham, MA 02093

Phone No.: 508-384-6151 FAX No.: 508-384-5139

Date of Qualification to do business is 1977

SECTION 00420 - BIDDER'S QUALIFICATION STATEMENT

The undersigned Bidder guarantees the accuracy of all statements made herein. Please print in ink or type in the spaces provided. Attach additional sheets if necessary.

This statement of Bidder's qualifications is required of all Bidders as part of their Bid and is in partial fulfillment of requirements in Article 3 of the Instructions to Bidders. Additional data on Bidder's qualifications may be requested from selected Bidders after the Bid Opening in accordance with Article 3.

1. List equipment that you plan to rent or purchase for this work and specify whether rent or purchase. If none, so state.

None

2. List equipment that you own that is available for this work.

See attached equipment list.

3. How many years has your firm been in business as a contractor? 28 years

4. Is your firm qualified to do business in the state where the project is located? YES X NO If NO, by signing this Qualification Statement at the end you are agreeing to obtain such qualification prior to award of contract within fourteen days of Owner's request.

5. List up to three (3) projects that are of the same or related nature to the one now being bid that you have completed in the last ten (10) years. For each project, list the name, address, and telephone number of the Owner and/or the Engineer/Architect, the original bid price, the completion date, and the completed contract price.

United Plating, Schenectady, NY, NYS DEC, Jeff Trad

(518)402-9804, Completed 5/05, \$750,000

Holyoke Tar Holder/Separator, Holyoke Gas & Electric

Tim Shannon (413)536-9392, Completed 11/04, \$975,000

United Illuminating, Soil Remediation, United Illuminating

Barry Girons (860)368-5340, Completed 2/05, \$1,000,000

Doxsee Site, State of Delaware, Department of Environmental Protection,

Shiva Kumar (302)283-2211, Completed 8/05, \$350,000

6. List projects presently under construction by your firm, the dollar volume of the contract, the percentage complete of the contract, and the name and telephone number of the Owner and/or the Engineer/Architect.

See Attached

7. Have you ever failed to complete a contract awarded to you? YES ____ NO X If YES, state where and why.

8. Give the name, address, and telephone number of an individual who represents each of the following and whom the Owner may contact to investigate your financial responsibility: a surety, a bank, and a major material supplier.

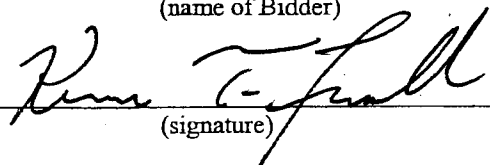
- Comerica Bank, Ron Ruks, VP, 35405 Grand River, Farmington, MI 48335, (248)442-9708
- Mass Compliance, Beth Comeau, 7 Old Silver Lane, West Falmouth, MA 02574 (978)857-9552
- The Insurance Company of the State of Pennsylvania, Mary Laginess, 70 Pine Street,
New York, NY 10270, (248)735-7252

Upon request, I agree to expand the foregoing statements.

EQ Northeast, Inc.

(name of Bidder)

By:



(signature)

Kevin T. Franklin, Vice President
(individual's name & title)

END OF SECTION 00420

SECTION 00430 - SUBCONTRACTOR LISTING

Do you plan to subcontract any part of the Work?

YES _____ NO X If YES, list the name and address of all Subcontractors that you propose to use on this Contract and the Work assigned to each. Please print in ink or type in the spaces provided. Attach additional sheets if necessary.

This identification of subcontractors is required of all Bidders as part of their Bid and is in partial fulfillment of requirements in Article 12 of the Instructions to Bidders. Additional data on proposed Subcontractors may be requested from selected Bidders after the Bid Opening in accordance with Article 12.

END OF SECTION 00430

SECTION 00480 - NON-COLLUSIVE BIDDING CERTIFICATION

(Required by Section 103-d of the New York State General Municipal Law.)

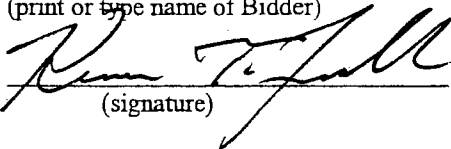
By submission of this Bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to the opening, directly or indirectly, to any other bidder or to any competitor; and
3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

EQ Northeast, Inc.

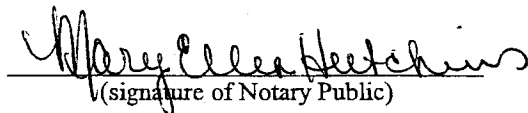
(print or type name of Bidder)

By:


(signature)Kevin T. Franklin, Vice President

(individual's name & title)

Subscribed and sworn to before me

this 6th day of SEPTEMBER, 20 05.
(signature of Notary Public)

(Notary Stamp)

END OF SECTION 00480

SECTION 00485 - PERFORMANCE BOND INFORMATION FORM

(To be completed and submitted with Bid Forms by all Bidders.)

Project Grant No. _____

Project Location Independent Leather, 321-333 South Main Street, Gloversville, NYConstruction Contract Number CT Male Project No. 01.7293Name of Contract Remedial action for Independent Leather Brownfield ProjectName of Contractor EQ Northeast, Inc.Address 185 Industrial RoadWrentham, MA 02093Bonding Company or Person Issuing Security Bond The Insurance Company of the State of PennsylvaniaAddress 70 Pine Street, New York, NY 10270Bonding Company Agent Willis of MichiganMary LaginessAddress 431 55 Main Street, Suite 2200B, Novi, MI 48375Amount of Bond* \$Contract Price As AwardedDuration of Bond* One Year After Date of Final Payment

Identification Number of Bond Assigned When Bond is Furnished

* Amount and duration of bond are in accordance with Paragraph 5.01 of the General Conditions and any applicable Supplementary Conditions.

END OF SECTION 00485



THE ENVIRONMENTAL QUALITY COMPANY

EQ Northeast, Inc. 185 Industrial Road, P.O. Box 617, Wrentham, MA 02093
Telephone: (508) 384-6151 • Facsimile: (508) 384-6028 • Internet: www.eqonline.com

BOARD RESOLUTION

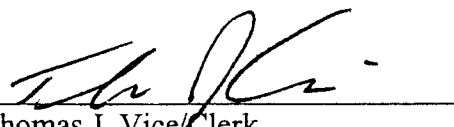
At a duly authorized meeting of the Board of Directors of EQ Northeast, Inc.

held on Monday, April 21, 2003 and attended by:

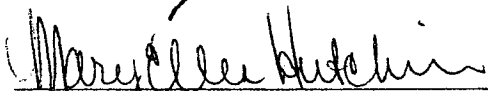
David M. Lusk, President
Thomas Schuck, Treasurer
Thomas J. Vine, Vice President/Clerk

It was hereby voted that Thomas J. Vine, Vice President/Clerk and Kevin T. Franklin,
Vice President, is authorized to execute documents and matters related to
contracts and proposals on behalf of EQ Northeast, Inc.

This authorization is duly signed and sealed below.


Thomas J. Vice/Clerk

4/21/2003


Notary Public

4/21/2003

EXPERIENCE REFERENCES: LIST THE CONSTRUCTION PROJECTS YOUR ORGANIZATION HAS UNDER WAY ON THIS DATE

CONTRACT AMOUNT	CLASS OF WORK	PERCENT COMPLETE	PERCENT SUBLET	EXEPTED DATE OF COMPLETION	FIRM NAME	CITY STATE ZIP	CONTACT PERSON	TELEPHONE NUMBER
33,000,000	Haz Waste Construction Remediation	65%	0%	8/09	Maywood Superfund Site	Maywood, NJ	Andrew Mills	201-226-6601
3,000,000	Construction Demolition Remediation	50%	0%	8/07	IMTT	Bayonne, NJ	George Bress	201-437-2200
5,000,000	Remediation Haz Waste Demolition	35%	0%	Indefinite	Equiva Waste Services	New England	Diana Henk	713-241-4006
15,000,000	Haz Waste Construction Demolition	90%	0%	9/05	Ford Motor Company	Edison, NJ	Bill Robb	732-287-3214
	Haz Waste Construction Remediation	5%	0%		Charter Oak			
10,000,000	On Site Thermal Treatment	5%	35%	7/06	EBCO Spanish Fork, UT	UT	Mark Franson	860-423-2670

EQ Northeast, Inc.

Haz - Mat Division Equipment

F.E.S. #	YEAR	MAKE	MODEL	DESCRIPTION	USE	V.I.N.	PLATE #	ST	EXPIRES
301	1991	TRAIL KING	TK8U	BOBCAT TRLR	HGWY	1TKU01421MM107956	522708	MA	11/30/2004
304	1988	WELLS CARGO	TW122	RESPONSE TRLR	HGWY	1WC200E23J1040438	811193	MA	11/31/04
307	1996	EZ LOADER	B1250	BOAT TRAILER	HGWY	1ZE1RCV16TN035224	636146	MA	11/30/2004
326	1995	ROGERS	CR35PL86	LOWBED	HGWY	1RBH4220XSAR22122	6727	MA	12/31/2005
373	1997	HUDSON	HTD 18A	FLAT-PINTLE	HGWY	1OHHTD1A2W1000003	TL781	MA	11/30/2004
378	2000	SHADOW MAST	SM820STE	RESPONSE TRLR	HGWY	4U01S2025YA002332	317980	MA	11/30/04
412	2000	FREIGHTLINER	FLD120	TRACTOR	HGWY	1FV7F0Y93YLG94247	55709	MA	06/30/2004
452	1981	MACK	RD886	DUMP TRUCK	HGWY	1M2P137Y0BA009010	57239	MA	06/30/2004

EQ Northeast, Inc. Haz Mat Division Off Road Equipment

F.E.S. #	YEAR	MAKE	MODEL	DESCRIPTION	COLOR	V.I.N.	OWNED BY
303	1985	ATLAS	HT45DYS	AIR COMP	RED	925011	
306	1988	HYDRA TECH	S4THL	PUMP	RED	44367	
379	2000	CARSON	PR9932	DE-WATERING TRAIL	BLACK	4DEUS2024YS001786	
507	1996	STARCRAFT	16' SKIFF	FIBREGLASS BOAT	WHITE	STRB97TEE696	
526A	1994	NPK	6XA	HDY.DEMO TOOL	BLACK	719381	
529	1988	JOHN DEERE	710	BACKHOE	YELLOW	T0710BJ750847	
530	1988	JOHN DEERE	644E	LOADER	YELLOW	DW644EB519090	
531	1990	MELROE	843B	BOBCAT LOADER	YELLOW	60155	
532	1994	CATERPILLAR	311	EXCAVATOR	YELLOW	9LJ00211	
534	1995	JOHN DEERE	790E	EXCAVATOR	YELLOW	FF790EX015151	
535	1995	JOHN DEERE	644G	LOADER	YELLOW	DW644GB550981	
537	1998	JOHN DEERE	410E	4X4 BACKHOE	YELLOW	T0410EX846357	
538	1996	JOHN DEERE	650G	DOZER	YELLOW	TO650GW824137	
TOTAL	13						

EQ Northeast, Inc.

Haz - Mat Division Equipment

F.E.S. #	YEAR	MAKE	MODEL	DESCRIPTION	USE	V.I.N.	PLATE #	ST	EXPIRES
254	1992	FORD	F350	CREW CAB	HGWY	2FTJW35M8NCA70572	J35078	MA	12/31/2004
258	1993	CHEV	ASTRO	VAN	HGWY	1GNDM19Z7PB225177	J57272	MA	12/31/2005
259	1995	FORD	F800	RACK BODY TRUCK	HGWY	1FDNF80C7SVA64003	30400	MA	6/30/2004
260	1997	FORD	F350	PICK UP	CREW	3FTHF36F2VMA23976	E36577	MA	12/31/2004
261	1996	DODGE	RAM 3500	PICK UP	HGWY	3B7MC33C2TM138365	F14694	MA	12/31/2004
262	1999	FORD	F450	CREW CAB	CREW	1FDXW46F5XEC48267	C19279	MA	12/31/2004
263	1999	FORD	F450	CREW CAB	CREW	1FDXW46F3XEC48266	C19282	MA	12/31/2004
264	1999	FORD	F450	CREW CAB	CREW	1FDXW46F9XEC48269	F71373	MA	12/31/2004
265	1999	FORD	F350	CREW CAB	CREW	1FTSX31F9XEC42453	J57270	MA	12/31/2004
266	1999	FORD	F450	RACK BODY TRUCK	HGWY	1FDXF46F9XEC56369	J60914	MA	12/31/04
267	1999	FORD	F150	PICK UP	SPEC	1FTZF1727XNA32413	J57271	MA	12/31/2004
268	1999	FORD	F150	PICK UP	HGWY	1FTZF1728XNA63265	J12785	MA	12/31/04
270	1999	FORD	EXP.	SUV	PERS	1FMZU34X8XZB42070	G29125	MA	12/31/2004
271	1999	FORD	EXP.	SUV	PERS	1FMZU34X1XZB42069	G29124	MA	12/31/2004
272	1999	FORD	F150	PICK UP	CREW	1FTZF1726XNC15995	J60901	MA	12/31/04
276	2001	CHEVROLET	W43500	RACK BODY	HGWY	18BB4B15117011950	K36084	MA	12/31/2004

EQ Northeast, Inc.
Transportation Equipment

<u>EQNE#</u>	<u>YEAR</u>	<u>MAKE</u>	<u>MODEL</u>	<u>DESCRIPTION</u>	<u>COLOR</u>	<u>PLATE #</u>	<u>ST</u>	<u>EXPIRES</u>	<u>V.I.N.</u>
409	2000	FREIGHTLINE	FL70	VAN	WHITE	52393	MA	06/30/2004	1FV6HJBA6YHB95816
410	2000	FREIGHTLINE	FL70	TANK TRUCK	WHITE	52392	MA	06/30/2004	1FV6HJBA8YHB99561
411	2001	FREIGHTLINE	FL70	TANK TRUCK	WHITE	55642	MA	06/30/2004	1FVABTAK01HJ37477
414	2002	FREIGHTLINE	FL70-MEDC	TANK TRUCK	WHITE	56975	MA	06/30/2004	1FVABTAK12HK93982
440	2004	KENWORTH	T800	TRACTOR	WHITE	61610	MA	06/30/2004	1XKDDB9XX4J064648
441	2004	KENWORTH	T800	TRACTOR	WHITE	61609	MA	06/30/2004	1XKDDB9X14J064649
442	2004	KENWORTH	T800	TRACTOR	WHITE	61608	MA	06/30/2004	1XKDDB9X84J064650
443	2004	KENWORTH	T800	TRACTOR	WHITE	61607	MA	06/30/2004	1XKDDB9XX4J064651
444	2004	KENWORTH	T800	TRACTOR	WHITE	61605	MA	06/30/2004	1XKDDB9X14J064652
445	2004	KENWORTH	T800	TRACTOR	WHITE	61604	MA	06/30/2004	1XKDDB9X34J064653
446	2004	KENWORTH	T800	TRACTOR	WHITE	61603	MA	06/30/2004	1XKDDB9X54J064654
447	2004	KENWORTH	T800	TRACTOR	WHITE	61602	MA	06/30/2004	1XKDDB9X74J064655
448	2004	KENWORTH	T800	TRACTOR	WHITE	61601	MA	06/30/2004	1XKDDB9X94J064656
451	1988	MACK	RW713	ROLL OFF TR	RED	56927	MA	06/30/2004	1M2AY10Y7JM002925
462	1991	MACK	RW613	TANK TRUCK	WHITE	21919	MA	06/30/2004	1M2AY74Y1MM006504
463	1992	MACK	CH613	TRACTOR	WHITE	56587	MA	06/30/2004	1M2AA14YXNW015113
464	1988	MACK	DM609S	ROLL OFF TR	RED	56086	MA	06/30/2004	1M2B197C6JM004165

TOTAL 17

EQ Northeast, Inc.
Transportation Equipment

<u>EQNE#</u>	<u>YEAR</u>	<u>MAKE</u>	<u>MODEL</u>	<u>DESCRIPTION</u>	<u>COLOR</u>	<u>PLATE #</u>	<u>ST</u>	<u>EXPIRES</u>	<u>V.I.N.</u>
309	1981	PRESVAC	307/312	TANK TRLR	S/S	33432	MA	12/31/2004	PVST500006812018
320	1987	BRENNER	307/312	TANK TRLR	S/S	SM24376	MA	12/31/2006	10BGS621XHF008682
322	1988	BRENNER	307/312	TANK TRLR	S/S	38082	MA	12/31/2007	10BGT6213JFOA1006
323	1988	ATLAS	TR075-35BR	ROLL OFF TR	BLACK	33415	MA	12/31/2007	2C9014139JA068035
327	1990	STRICK	45-96LG	BOX VAN L/G	WHITE	33401	MA	12/31/2004	1S12E8458LD330734
335	1989	BRENNER	307/312	TANK TRLR	S/S	SM33403	MA	12/31/2008	10BGU6211KF0A1455
337	1989	ATLAS	TR075-35BR	ROLL OFF TR	BLACK	SM33405	MA	12/31/2008	2C9014032KAD68016
339	1990	BRENNER	307/312	TANK TRLR	S/S	SM33357	MA	12/31/2008	10BGU6217LFOA1851
340	1990	BRENNER	307/312	TANK TRLR	S/S	SM33358	MA	12/31/2008	10BGU6219LFOA1852
343	1981	FRUEHAUF	42FT	FLAT BED	BLACK	38092	MA	12/31/2007	1H4P04220BF079625
344	1972	GENERAL	44/33FT	DROP DECK	BLACK	38237	MA	12/31/2007	60BDH7202S
345	1993	GALBREATH	ADOR-416	ROLL OFF TR	BLACK	37879	MA	12/31/2007	1B9K13922PB128631
346	1993	GALBREATH	ADOR-416	ROLL OFF TR	BLACK	37878	MA	12/31/2007	1B9K13926PB128633
347	1993	GALBREATH	ADOR-416	ROLL OFF TR	BLACK	37877	MA	12/31/2007	1B9K13924PB128677
359	1994	GALBREATH	ADOR-416	ROLL OFF TR	BLACK	SM33416	MA	12/31/2008	1G9F13926RA157140
360	1994	GALBREATH	ADOR-416	ROLL OFF TR	BLACK	SM63434	MA	12/31/2008	1G9F13923RA157256
364	1994	COMPTANK	E-9166	TANK TRLR	WHITE	SM62219	MA	12/31/2008	2C9LTA2B9RB075075

EQ Northeast, Inc.
Transportation Equipment

<u>EQNE#</u>	<u>YEAR</u>	<u>MAKE</u>	<u>MODEL</u>	<u>DESCRIPTION</u>	<u>COLOR</u>	<u>PLATE #</u>	<u>ST</u>	<u>EXPIRES</u>	<u>V.I.N.</u>
396	1997	STRICK	1S1	BOX VAN 48X	WHITE	T145904	TN	PERM	1S12E9486VD422752
397	1997	STRICK	1S1	BOX VAN 48X	WHITE	T146000	TN	PERM	1S12E9484VD422748
398	1997	STRICK	1S1	BOX VAN 48X	WHITE	T145905	TN	PERM	1S12E9488VD422753
399	1997	STRICK	1S1	BOX VAN 48X	WHITE	T145906	TN	PERM	1S12E948XVD422754
600	1998	HYUNDAI	48x102	BOX VAN-LG	WHITE	A535533	ME	02/28/04	3H3V482C1WT091018
601	1999	HYUNDAI	48x102	BOX VAN-LG	WHITE	HR94506	OR	PERM	3H3V482C7XT044643
602	1999	HYUNDAI	48x102	BOX VAN-LG	WHITE	HR57695	OR	PERM	3H3V482C3XT019027
603	2000	MONNON	MA3;28x102	BOX VAN PUP	WHITE	T405529	TN	PERM	1NNVA2814YM338552

TOTAL 25

Owner-Operator Equipment

[illegible]

SECTION 00500 - AGREEMENT

(This document is similar to Standard Form of Agreement Between Owner and contractor on the basis of a stipulated price, EJCDC Document 1910-8-A-1-FA, 1997 Edition.)

THIS AGREEMENT is by and between CITY OF GLOVERSVILLE

(hereinafter called OWNER) and EQ NORTHEAST, INC.

(hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 - WORK

1.01 CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Independent Leather
Remedial Action Project
321-333 South Main Street, Gloversville, New York

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

A Remedial Action is required at the Independent Leather Site by the New York State Department of Environmental Conservation (NYSDEC) under an Environmental Restoration Program Record of Decision dated February 2004. The Remedial Action work includes the relocating, repairing and maintaining the existing gravel access road for construction traffic and removal as necessary to excavate petroleum impacted soil; removal and off-site disposal of the slab on grade concrete and foundation walls of the former tannery building to facilitate assessment of underlying soils for petroleum impacts; excavate and stage contaminated soils suspected beneath the building floor slab and in the area of a former 20,000 gallon underground fuel oil tank; load, transport and dispose non-hazardous contaminated soils at the Fulton County Landfill; load, transport and dispose hazardous contaminated soils, if encountered on the basis of waste characterization testing; backfill and grade the eastern portion of the site for placement of a soil barrier to contact; evaluate a suspect tank vent pipe and permanently close associated equipment if present by removal; and place a soil barrier to contact consisting of a minimum one foot thick layer of imported clean soil and underlying demarcation layer over the site on the east side of the Cayadutta Creek and on a localized portion of the site on the west side of the Cayadutta Creek.

ARTICLE 3 - ENGINEER

The Project has been designed by C.T. Male Associates, P.C., 50 Century Hill Dr., P.O. Box 727, Latham, NY 12110-0727, tel. (518) 786-7400, who is hereinafter called ENGINEER/ARCHITECT and who will assume all duties and responsibilities and will have the rights and authority assigned to ENGINEER and ENGINEER/ARCHITECT in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Dates for Substantial Completion and Final Payment*

A. The Work will be substantially completed on or before November 15, 2005, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions on or before May 15, 2006. Substantially complete is defined as all work except for hyroseeding. No work will be allowed between November 15, 2005 and April 1, 2006 unless otherwise directed by the Engineer.

4.03 *Liquidated Damages*

A. CONTRACTOR and OWNER recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding, the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER \$500.00 for each day that expires after the time specified in paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER \$1,000.00 for each day that expires after the time specified in paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

5.01 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to paragraphs 5.01.A, 5.01.B, and 5.01.C below:

The total estimated amount of the Contract is _____ dollars (\$ 567,215.00) based on the estimated quantities set forth in the Bid Form and the unit prices contained therein.

As provided in paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by ENGINEER as provided in paragraph 9.08 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. OWNER shall process progress payments monthly on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment and make progress payments within 10 days after receipt of State funds during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established in paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

As required by Section 106-b of New York State General Municipal Law, when an acceptable Performance Bond and Labor and Materials Payment Bond have been furnished in accordance with paragraph 5.01 of the General Conditions:

1. Prior to Substantial Completion progress payments will be in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER/ARCHITECT shall determine, or OWNER may withhold, in accordance with paragraph 14.02 of the General Conditions (including any amounts necessary to satisfy any claims, liens, or judgments against CONTRACTOR which have not been suitably discharged):

95% of the Work completed (resulting from a 5% retainage), and

95% of materials and equipment not incorporated in the Work (resulting from a 5% retainage), but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in paragraph 14.02 of the General Conditions.

2. Upon Substantial Completion, in an amount sufficient to increase total payments to CONTRACTOR to 100% of the Contract Price (resulting from 0% retainage), less such amounts as ENGINEER/ARCHITECT shall determine, or OWNER may withhold, in accordance with paragraph 14.02.B.5 of the General Conditions and less such amounts as follows:

- a. Two times the value of any uncompleted items of Work.
- b. An amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not been suitably discharged.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.07 within 10 days after receipt of State Funds.

ARTICLE 7 - INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the maximum rate allowed by law at the place of the project.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce OWNER to enter into this Agreement CONTRACTOR makes the following representations:

A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. CONTRACTOR has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. CONTRACTOR has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions.

E. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, including applying the specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and programs incident thereto.

F. CONTRACTOR does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the Site that relates to the Work as indicated in the Contract Documents.

H. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

I. CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents, and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement, Section 00500 (pages 1 to 8, inclusive).
2. Exhibits to this Agreement (None).
3. Bonds and Certificates.
 - a. Performance Bond, Section 00610 (pages 1 to 1, inclusive including attachments).
 - b. Labor and Materials Payment Bond, Section 00620 (pages 1 to 1, inclusive, including attachments).
 - c. The Bonds.

- d. Supplements to Bond Forms, Section 00630 (pages 1 to 9, inclusive).
- e. Certificates of Insurance, Section 00650 (pages 1 to 1, inclusive, including attachments).
- 4. Notice of Award (not attached hereto).
- 5. Standard General Conditions of the Construction Contract, Section 00700 (pages 1 to 44, inclusive).
- 6. Supplementary Conditions
 - a. Modifications to General Conditions, Section 00810 (pages 1 to 9, inclusive).
 - b. Additional Articles, Section 00820 (pages 1 to 60, inclusive).
 - c. Standard Clauses for New York State Contracts (Appendix A), Section 00825 (pages 1 to 4, inclusive).
 - d. NYSDEC Mandatory Contract Clauses, Section 00827 (pages 1-7, inclusive)
- 7. Specifications bearing the title:

Remedial Action for Independent Leather Brownfield Project

C.T. Male Associates, P.C., 50 Century Hill Drive, Latham, New York
and consisting of 3 divisions and 323 pages, as listed in the table of contents thereof.

- 8. Drawings (not attached hereto) consisting of 2 sheets as listed in the Drawings Index, Section 00851, with each sheet bearing the following general title:

Topographic Survey

Remedial Action Implementation Plan

- 9. Addenda and Modifications (numbers 1 to 3, inclusive) as included in Section 00900.
- 10. Contractors Bid
 - a. Bid Form, Section 00300 (pages 1 to 9, inclusive).
 - b. Supplements to Bid Form
 - 1) Bidder's Qualification Statement, Section 00420 (pages 1 to 12, inclusive).
 - 2) Subcontractor Listing, Section 00430 (pages 1 to 1, inclusive).
 - 3) Non-Collusive Bidding Certification, Section 00480 (page 1 to 1, inclusive).
 - 4) Performance Bond Information Form, Section 00485 (page 1 to 1, inclusive).
- 11. Documentation submitted by CONTRACTOR prior to Notice of Award (pages ____ to ____, inclusive).
- 12. The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying, or supplementing the Contract Documents pursuant to paragraph 3.04 of the General Conditions. These may include such items as Field Orders, Change Orders, Work Directive Changes, Approved Shop Drawings, etc.

B. The documents listed in paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in paragraph 3.04 of the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 *Terms*

A. Terms used in this Agreement will have the meanings indicated in the General Conditions.

10.02 *Assignment of Contract*

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

A. OWNER and CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Other Provisions*

A. None.

C.T. MALE ASSOCIATES, P.C.
CTMSPEC

INDEPENDENT LEATHER
REMEDIAL ACTION

IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR and ENGINEER. All portions of the Contract Documents have been signed, initialed or identified by OWNER and CONTRACTOR or identified by ENGINEER on their behalf.

This Agreement will be effective on September 29, 2005 (which is the Effective Date of the Agreement). (This Agreement shall not be effective unless and until concurred in by AGENCY's designated representative.)

OWNER: **CITY OF GLOVERSVILLE**

By: Frank A. Porta

[CORPORATE SEAL]

Attest Gary Marguth

Address for giving notices:

If OWNER is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of OWNER-CONTRACTOR Agreement.)

Designated Representative:

Name: _____

Title: _____

Address: _____

Phone: _____

Facsimile: _____

AGENCY Concurrence

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the AGENCY hereby concurs in the form, content, and execution of this Agreement.

By: _____
AGENCY Official

Date: _____

CONTRACTOR: **EQ NORTHEAST, INC.**

By: T. R. McEay

[CORPORATE SEAL]

Attest Michael McEay

Address for giving notices:

185 Industrial Rd.
Wrentham MA 02093

License No. _____
(Where applicable)

Agent for service of process: _____

(If CONTRACTOR is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:

Name: Thomas J. Vine

Title: Vice President / clerk

Address: 185 Industrial Rd.
Wrentham MA 02093

Phone: 508-384-6151

Facsimile: 508-384-5139

END OF SECTION 00500

ATTACH TO PAGE 00610 - 1 - PERFORMANCE BOND FORM

BOND NUMBER: _____

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____,
(Individual, Partnership, Corporation, Joint Venture)
hereinafter called PRINCIPAL, and

(Name of Surety)

(Address of Surety)

a corporation created and existing under the laws of the State of _____,
hereinafter called SURETY, are
held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____

_____ Dollars (\$ _____),
in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves,
our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract
with the OWNER, dated the _____ day of _____, 20_____, a copy of which is hereto
attached and made a part hereof for the construction of:

(continued on page 00630 - 1)

END OF FORM

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

SECTION 00610 - PERFORMANCE BOND

Attach bond here.

END OF SECTION 00610

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

ATTACH TO PAGE 00510 - 1 - PERFORMANCE BOND FORM

BOND NUMBER: ESD 731 6699

KNOW ALL MEN BY THESE PRESENTS: that

EQ Northeast Inc.

(Name of Contractor)

185 Industrial Rd

Wrentham, MA 02093

a Corporation

(Address of Contractor)

(Individual, Partnership, Corporation, Joint Venture)

hereinafter called PRINCIPAL, and

The Insurance Company of the State of Pennsylvania

(Name of Surety)

175 Water St., New York, NY 10038

(Address of Surety)

a corporation created and existing under the laws of the State of Pennsylvania
hereinafter called SURETY, are
held and firmly bound unto

City of Gloversville

(Name of Owner)

3 Frontage Rd., Gloversville, NY 12078

(Address of Owner)

hereinafter called OWNER, in the penal sum of Five Hundred Sixty Seven Thousand Two Hundred
Fifteen and 00/100

Dollars (\$ 567,215.00),

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves,
our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract
with the OWNER, dated the 29th day of September, 20 05, a copy of which is hereto
attached and made a part hereof for the construction of:

(continued on page 00630 - 1)

END OF FORM

ATTACH TO PAGE 00620 - 1 - LABOR AND MATERIALS PAYMENT BOND FORM

BOND NUMBER: _____

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____,
(Individual, Partnership, Corporation, Joint Venture)
hereinafter called PRINCIPAL, and

(Name of Surety)

(Address of Surety)

a corporation created and existing under the laws of the State of _____,
hereinafter called SURETY, are held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called OWNER, and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the penal sum of

_____ Dollars (\$ _____),
in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract with the OWNER, dated the _____ day of _____, 20_____, a copy of which is hereto attached and made a part hereof for the construction of:

(continued on page 00630 - 1)

END OF FORM

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

SECTION 00620 - LABOR AND MATERIALS PAYMENT BOND

Attach bond here.

END OF SECTION 00620

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

ATTACH TO PAGE 00620 - 1 - LABOR AND MATERIALS PAYMENT BOND FORM

BOND NUMBER: ESD 731 6699

KNOW ALL MEN BY THESE PRESENTS: that

EQ Northeast Inc.

(Name of Contractor)

185 Industrial Rd.

Wrentham, MA

02093

(Address of Contractor)

a Corporation

(Individual, Partnership, Corporation, Joint Venture)

hereinafter called PRINCIPAL, and

The Insurance Company of the State of Pennsylvania

(Name of Surety)

175 Water St., New York, NY 10038

(Address of Surety)

a corporation created and existing under the laws of the State of Pennsylvania
hereinafter called SURETY, are held and firmly bound unto

City of Gloversville

(Name of Owner)

3 Frontage Rd., Gloversville, NY 12078

(Address of Owner)

hereinafter called OWNER, and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the penal sum of

Five Hundred Sixty Seven Thousand

Two Hundred Fifteen and 00/100

Dollars (\$ 567,215.00),

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain contract with the OWNER, dated the 29th day of September, 20 05, a copy of which is hereto attached and made a part hereof for the construction of:

(continued on page 00630 - 1)

END OF FORM

SECTION 00630 - SUPPLEMENTS TO BOND FORMS

NOW, THEREFORE, THE CONDITIONS OF THE ABOVE OBLIGATIONS ARE SUCH THAT, if the Contractor, hereinafter referred to as the Principal, and his/her successors or assigns, or any or either of them, shall:

1. Well and truly and in good, sufficient and workmanlike manner, perform and cause to be performed said contract, and any amendment or extension of , or addition thereto, and each and every of the covenants, promises, agreements, and provisions therein, stipulated and contained to be performed by said Principal, and complete the same within the period therein mentioned, and in each and every respect, comply with the conditions therein mentioned to be complied with by said Principal, and fully indemnify and save harmless the Oblige from all costs and damages which it may suffer by reason of failure so to do and fully reimburse and repay an Oblige all outlay and expense which it may incur in making good any such default; and,
2. also pay or cause to be paid the wages and compensation for labor performed and services rendered of all persons engaged in the prosecution of the work provided for therein, whether such persons be agents, servants, or employees of the Principal and of his successors or assigns, as listed in (1) above, or of any subcontractor or any assignee of laborers or of mechanics regardless of any contractual relationship between the Principal, or successors, or assigns, or any subcontractor, or any assignee thereof, and such laborers or mechanics, but not including office employees not regularly stationed at the site(s) of the work, and further, shall pay or cause to be paid all lawful claims of subcontractors and of materialmen and other third persons arising out of, or in connection with, said contract and the work, labor, services, supplies, and materials, furnished in and about the performance and completion thereof, then these obligations shall be null and void, otherwise they shall remain in full force and effect.

Provided, however, that these bonds are subject to the following additional conditions and limitations:

1. All persons who have performed labor or rendered services, as aforesaid, all subcontractors, and all persons, firms, corporations, including workmen and third persons, as aforesaid, furnishing work, labor, services, supplies, and material under or in connection with said contract or in or about the performance and completion thereof, shall have a direct right of action (subject to the prior right of the Oblige under any claim which it may assert against the Principal and his/her successors and assigns, and/or the Surety and its successors and assigns) against the Principal and his/her successors and assigns, and/or the Surety and its successors and assigns, on the Bond, which right of action shall be asserted in proceedings instituted in the State in which such work, labor, services, supplies, or material, was performed, rendered, or furnished, as aforesaid, and if in more than one State, then in any such State.

Insofar as permitted by the laws of such State, said right of action shall be asserted in a proceeding instituted in the name of the Oblige to the use and benefit of the individual, firm, or corporation instituting such actions and of all other individuals, firms, or corporations having claims hereunder, and any other individual, firm, or corporation having a claim hereunder, shall have the right to be made a party of such proceedings, (but not later than one (1) year after the performance of said contract and final settlement thereof), and to have such claim adjudicated in such action and judgment rendered thereon. Prior to the institution of such a proceeding by individual, firm, or corporation, in the name of the Oblige, as aforesaid, such individual firm, or corporation shall furnish the Oblige with a bond of indemnity for costs, which bond shall be in an amount satisfactory to the Oblige.

2. The Surety, or its successors and assigns, shall not be liable thereunder for any damages or compensation recoverable under any Workmen's Compensation or Employer's Liability Statute.
3. In no event shall the Surety, or its successors and assigns, be liable for a greater sum than the penalty of the bond, or subject to any suit, action, or proceeding hereon that is instituted by any individual, firm, or corporation under the provisions of section (1) above later than one (1) year after the completion of said contract and final settlement thereof.

The Principal, and his/her successors and assigns, and the Surety, for itself and its successors and assigns, do hereby expressly waive any objection that might be interposed as to the right of the Oblige to require a bond containing the

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

foregoing provision, and they do hereby further expressly waive any defense which they or either of them might interpose to an action brought thereon by any individual, firm, or corporation, including subcontractors, materialmen, and third persons, for work, labor, services, supplies, or material performed, rendered or furnished as aforesaid, upon the grounds that there is no law authorizing the said Oblige to require the foregoing provision to be placed in the bond.

And the Surety, for value received for itself and its successors and assigns, hereby stipulates and agrees that the obligations of the said Surety and of its successors and assigns, and these bonds shall in no way be impaired or affected by any extension of time, modification, omission, addition, or change in or to the said contract, or the work to be performed thereof, or by an assignment, subletting, or other transfer thereof, or any part thereof, or of any work to be performed, or of any money due or to become due thereunder; and the said Surety, for itself and its successors and assigns, does hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts, and transfers, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to executors, administrators, successors, assignees, subcontractors, and other transferees, shall have the same effect as to the said Surety and its successors and assigns, as though done or omitted to be done by and in relation to said Principal.

END OF SECTION 00630

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

IN WITNESS WHEREOF, this instrument is executed in a number of counterparts equal to the number of executed Agreements, each counterpart of which shall be deemed an original, and dated as of the _____ day of _____ in the year 20_____.
(must be same or later than date of Agreement).

PRINCIPAL: _____
(print or type company name)

By: _____
(signature) (print individual's name & title)

Attest (witness):

(signature)

(name & title)

(Corporate Seal)

Address of Principal: _____

If Contractor (PRINCIPAL) is a partnership, all partners must sign.

If Contractor (PRINCIPAL) is a corporation, a duly authorized officer, agent, or attorney-in-fact must sign.

If Contractor (PRINCIPAL) is a joint venture, each joint venturer must sign.

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

SURETY: The Insurance Company of the State of Pennsylvania
(print or type company name)

By: (signature) Mary Laginess Attorney-in-Fact
(print individual's name & title)

Attest (witness):

Robin Ochalek
(signature)

Robin Ochalek

(name & title)

(Corporate Seal)

Address of Surety: 175 Water St., New York, NY 10038

Surety Company must be licensed to conduct business in the State where the Project is located, and must appear on the Treasury Department's most current list (Circular 570 as amended), all in accordance with Article 5 of the General Conditions.

Each executed bond shall be accompanied by the following:

1. Appropriate acknowledgments of the respective parties (see next several pages).
2. Surety Company data as listed on the last page of this section, and to be attached thereto.

CERTIFICATE OF ACKNOWLEDGMENT - CONTRACTOR

INDIVIDUAL

State of _____

SS:

County of _____

On this _____ day of _____, 20____, before

me personally appears _____, to
me known, who being duly sworn by me, deposes and says that he (she) is the person described in and who executed
the foregoing instrument, and acknowledges to me that he (she) executed the same.

(signature of Notary Public)

(Notary Stamp)

CERTIFICATE OF ACKNOWLEDGMENT - CONTRACTOR

PARTNERSHIP

State of _____

SS:

County of _____

On this _____ day of _____, 20____, before

me personally appears _____, to
me known, who being duly sworn by me, deposes and says that he
(she) is a member of the Partnership of _____

that he (she) is the person described in and who executed the foregoing instrument, and acknowledges to me that he
(she) executed the same on behalf of said Partnership.

(signature of Notary Public)

(Notary Stamp)

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

CERTIFICATE OF ACKNOWLEDGMENT - CONTRACTOR

CORPORATION

State of _____

SS:

County of _____

On this _____ day of _____, 20____, before

me personally appears _____, to
me known, who being duly sworn by me, deposes and says that he

(she) resides in

(City/Town/Village, County, State)

that he (she) is the _____ of

_____, the
Corporation described in and which executed the foregoing instrument; that he (she) knows the seal of said
Corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the
Board of Directors of said Corporation; and that he (she) executed the said instrument on behalf of said Corporation
by like order.

(signature of Notary Public)

(Notary Stamp)

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

CERTIFICATE OF ACKNOWLEDGMENT - CONTRACTOR

JOINT VENTURE

State of _____

SS:

County of _____

On this _____ day of _____, 20____, before
me personally appears the following:

(name)

(residing in City/Town/Village, County, State)

to me known, who being duly sworn by me, depose and say that they reside at the locations indicated above; that
they are the

parties to the Joint Venture of _____

_____;
that they are the parties described in and who executed the foregoing instrument, and acknowledge to me that they
executed the same on behalf of said Joint Venture.

(signature of Notary Public)

(Notary Stamp)

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

CERTIFICATE OF ACKNOWLEDGMENT - SURETY COMPANY

State of Michigan
County of Oakland

SS:

On this 29th day of September, 20 05, before
me personally appears Mary Laginess, to
me known, who being duly sworn by me, deposes and says that he (she) resides in
Novi, MI Oakland County;
(City/Town/Village, County, State)

that he (she) is the Attorney-in-Fact of

The Insurance Company of the State of Pennsylvania, the

Company described in and which executed the foregoing instrument; that he (she) knows the seal of said Company;
that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors
of said Company; and that he (she) executed the said instrument on behalf of said Company by virtue of a certain
power of Attorney executed by said
Company and dated _____,
which said power has never been revoked, and is still in force and effect; and that the said Company has received
from the

(title of official)

of the State of _____ a certificate of
solvency and of its sufficiency as surety or guarantor under the laws of said State, and that such certificate has not
been revoked.

Elise C. Kearns
(signature of Notary Public)

(Notary Stamp)

Elise C. Kearns
Notary Public - Oakland County
My Commission Expires January 22, 2012

SURETY COMPANY DATA

Attach here the following:

1. POWER OF ATTORNEY - duly certified copy of power of attorney or other certificate of authority when bond is executed by agent, officer, or other representative of Surety.
2. POWER OF ATTORNEY AUTHORIZATION - duly certified extract from by-laws or resolutions of Surety under which power of attorney or other certificate of authority of its agent, officer, or other representative was issued.
3. FINANCIAL STATEMENT - certified copy of latest published financial statement of assets and liabilities of Surety.

END OF SECTION 00630

American International Companies
The Insurance Company of the State of Pennsylvania
175 Water Street
New York, NY 10038

PERFORMANCE BOND RIDER

**Exclusions From The Scope Of The Surety's Duties, Obligations and liabilities under Bond
Attachment A**

WHEREAS, this Rider is executed concurrently with Bond No. ESD 731 6699 in the amount of \$567,215.00 for work under the Remedial Action for Independent Leather Brownfield Project contract (hereinafter "the Bond") and is intended to form a part thereof; and

WHEREAS, the parties, consisting of City of Gloversville as Oblige, EQ Northeast Inc. as Contractor and Principal on the Bond, and The Insurance Company of The State of Pennsylvania as Surety, wish to amend the Bond to make certain exclusions from the scope of the Sureties duties, obligations and liabilities under the Bond.

NOW THEREFORE, and notwithstanding anything in the contract to the contrary, the parties agree to amend the bond as follows:

1. The Bond is not intended by the parties to be, nor shall it be construed to be, an insurance policy, primary or excess, or in any other way be considered to satisfy the requirements for any type of insurance set forth in the contract documents between the Principal and the Oblige and /or Owner (hereinafter "the Contract"). The existence and maintenance of any and all insurance required by the Contract through the completion of any guaranty period provided therein shall be both a condition precedent and a condition subsequent to the Sureties duties, obligations and liabilities under the Bond.
2. Any rights of action under the Bond shall accrue to, and be for the exclusive use of, the Oblige. The bond is not intended by the parties to, nor shall it be construed to, create or extend any third party beneficiary rights.
3. No suit or action shall be commenced against the Principal or Surety for any default in performance or for labor performed or materials supplied after the earlier of (1) the contract duration period as set forth in the Contract at the time of execution plus any agreed extensions; or (2) one year after substantial completion of work under the Contract (3) one year after termination of the Contract in accordance with its terms and conditions. In no event shall the Surety be liable under any warranty provision in the Contract after one year from the date of substantial completion of under the Contract.
4. In the event of default, the Surety's liability under the Bond is limited to providing funds for the cost of completion of the Contract work in accordance with the plans and specifications, less the balance of funds remaining to be paid under the Contract. Under no circumstances is the Surety obligated to tender another contractor to complete the work, enter into a takeover agreement with the Owner and/or Oblige for the Completion of the work, finance completion of the work by the Principal or in any way assume responsibility, directly or indirectly, for the work required to be performed. Under no circumstances shall the liability of the Surety exceed the penal Sum of the Bond.
5. Upon Notice of default, the Surety will have a reasonable amount of time to honor it's obligations, if any, under the bond.

6. The Surety shall in no event be liable to indemnify or compensate the Obligee for loss or liability arising from personal injury or property damage whether or not caused by breach of the bonded Contract. Under no circumstances shall the Surety be liable to indemnify or compensate the Obligee for any consequential damages.

7. The Surety shall in no event be liable to any person for injuries, costs, damages, expenses, or other liability which results from any release or threatened release of a hazardous substance or pollutant or contaminant, even if such release or threatened release is caused by the conduct of the Principal or Obligee which is negligent, or which constitutes intentional misconduct.

8. The Bond is not intended to be, nor shall it be construed to be a contract, agreement or other instrument arranging for disposal or treatment, or arranging with a transporter for transport for disposal or treatment of hazardous substances.

9. Notwithstanding any provision of the Contract or the Bond to the contrary, extension of the Contract completion date and modification or changes to the Contract require actual written receipt of notice by the Surety and authorization by the Surety in order for the Surety to be bound by such extensions, modifications or changes.

10. The Bond is issued subject to the above express conditions which shall survive the release and discharge of the Surety from any further liability of its Bond obligations, and those conditions are accepted by the Obligee notwithstanding any obligation to the contrary in the Contract.

11. It is not the intent of this bond to accept any design or professional responsibility within the terms of this contract. Further, this bond in no way provides a guarantee of the adequacy or efficiency of equipment selected or supplied, nor does this bond guarantee the achievement of any remedial limits resulting from design specifications. Accordingly, it is agreed by all parties that this bond shall only cover the actual physical construction work contained within the contract, all other work is specifically excluded from the scope of this bond as if it were individually stated herein.

Signed, Sealed and dated this September 29, 2005.

Witness:

Principal: **EQ Northeast Inc.**

By: _____

By: _____

Surety: The Insurance Company of the State of Pennsylvania

By: _____

Mary Laginess

, Attorney-In-Fact

The Insurance Company of the State of Pennsylvania

Executive Offices
70 Pine Street
New York, NY 10270

STATUTORY FINANCIAL STATEMENT

as of DECEMBER 31, 2003

ASSETS

Bonds.....	\$ 492,697,185
Stocks.....	855,276,094
Collateral Loans.....	-
Cash & Short-Term Investments.....	20,441,825
Agents' Balances or Uncollected Premiums...	49,420,058
Funds Held by Ceding Reinsurers	164,189,519
Reinsurance Recoverable on Loss Payments.	165,821,528
Equities & Deposits in Pools & Associations.	54,581,443
Other Admitted Assets	717,347,868

TOTAL ASSETS \$ 2,519,775,320

LIABILITIES

Reserve for Losses and Loss Expense \$	912,331,733
Reserve for Unearned Premiums.....	450,888,758
Reserve for Expenses, Taxes,	
Licenses and Fees.....	12,909,379
Provision for Reinsurance	49,617,518
Funds Held Under Reinsurance	
Treaties	183,951,774
Other Liabilities.....	85,853,634
Capital Stock.....	5,005,500
Surplus	819,217,024

TOTAL POLICYHOLDERS'
SURPLUS 824,222,524

TOTAL LIABILITIES AND
POLICYHOLDERS' SURPLUS \$ 2,519,775,320

Bonds and stocks are valued in accordance with the basis adopted by the National Association of Insurance Commissioners. Securities carried at \$ 104,545,469 in the above statement are deposited as required by law or otherwise pledged.

CERTIFICATE

Kristian P. Moor, President, and Robert J. Beier, Comptroller, of The Insurance Company of the State of Pennsylvania being duly sworn, each for himself deposes and says that they are the above described officers of the said Company and that on the 31st day of December, 2003, the Company actually possessed the assets set forth in the foregoing statement and that such assets were available for the payment of losses and claims and held for the protection of its policyholders and creditors, except as hereinbefore indicated, and that the foregoing statement is a correct exhibit of such assets and liabilities of said Company on the 31st day of December, 2003, according to the best of their information, knowledge and belief respectively.



President



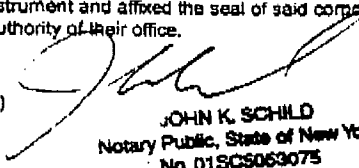
Comptroller

STATE OF NEW YORK
COUNTY OF NEW YORK

} ss.:

On this 17 day of March, 2004, before me came the above named officers of The Insurance Company of the State of Pennsylvania to me known to be the individuals and officers described herein, and acknowledged that they executed the foregoing instrument and affixed the seal of said corporation thereto by authority of their office.

31077 (3/03)


JOHN K. SCHILD
Notary Public, State of New York
No. 01SC063075
Qualified in Kings County
Commission Expires Dec. 11, 2005



KNOW ALL MEN BY THESE PRESENTS:

That The Insurance Company of the State of Pennsylvania, a Pennsylvania corporation, does hereby appoint

--John Barry, Mary Laginess: of Novi, Michigan--

its true and lawful Attorney(s)-in-Fact, with full authority to execute on its behalf bonds, undertakings, recognizances and other contracts of indemnity and writings obligatory in the nature thereof, issued in the course of its business, and to bind the company thereby.

IN WITNESS WHEREOF, The Insurance Company of the State of Pennsylvania has executed these presents



this 20th day of April, 2005.

Vincent P. Forte, Vice President

STATE OF NEW YORK }
COUNTY OF NEW YORK}ss.

On this 20th day of April, 2005 before me came the above named officer of The Insurance Company of the State of Pennsylvania, to me personally known to be the individual and officer described herein, and acknowledged that he executed the foregoing instrument and affixed the seal of said corporation thereto by authority of his office.

STEPHEN LEACH
Notary Public, State of New York
No. 01-LE4816242
Qualified in Westchester County
Commission Expires July 31, 2006

CERTIFICATE

Excerpts of Resolution adopted by the Board of Directors of The Insurance Company of the State of Pennsylvania, on May 18, 1976:

"RESOLVED, that the Chairman of the Board, the President, or any Vice President be, and hereby is, authorized to appoint Attorneys-in-Fact to represent and act for and on behalf of the Company to execute bonds, undertakings, recognizances and other contracts of indemnity and writings obligatory in the nature thereof, and to attach thereto the corporate seal of the Company, in the transaction of its surety business;

"RESOLVED, that the signatures and attestations of such officers and the seal of the Company may be affixed to any such Power of Attorney or to any certificate relating thereto by facsimile, and any such Power of Attorney or certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the Company when so affixed with respect to any bond, undertaking, recognizance or other contract of indemnity or writing obligatory in the nature thereof;

"RESOLVED, that any such Attorney-in-Fact delivering a secretarial certification that the foregoing resolutions still be in effect may insert in such certification the date thereof, said date to be not later than the date of delivery thereof by such Attorney-in-Fact."

I, Elizabeth M. Tuck, Secretary of The Insurance Company of the State of Pennsylvania, do hereby certify that the foregoing excerpts of Resolution adopted by the Board of Directors of this corporation, and the Power of Attorney issued pursuant thereto, are true and correct, and that both the Resolution and the Power of Attorney are in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the facsimile seal of the corporation



this 29th day of September 2005

Elizabeth M. Tuck, Secretary

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

SECTION 00650 - CERTIFICATES OF INSURANCE

Attach insurance certificates here.

END OF SECTION 00650

ACORDTM CERTIFICATE OF LIABILITY INSURANCE

Page 1 of 3

DATE
09/21/2005

PRODUCER

877-945-7378

Willis North America, Inc.
26 Century Blvd.
P. O. Box 305191
Nashville, TN 37230-5191

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE

NAIC#

INSURED

EQ Northeast, Inc.
185 Industrial Road
Wrentham, MA 02093

INSURER A: Commerce and Industry Insurance Company	19410-006
INSURER B: New Hampshire Insurance Company	23841-002
INSURER C: American International Specialty Lines In	26883-002
INSURER D: Insurance Company of the State of Pennsylv	19429-002
INSURER E: American International Specialty Lines In	26883-007

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR ADD'L LTR INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS
A	GENERAL LIABILITY ☒ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☒ OCCUR ☒ XCU Included GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☒ PRO-JECT ☒ LOC	GL4177902	8/1/2005	8/1/2006	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000 MED EXP (Any one person) \$ 25,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000
B	AUTOMOBILE LIABILITY ☒ ANY AUTO ☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☒ HIRED AUTOS ☒ NON-OWNED AUTOS	CA1955437 CA7557770	8/1/2005 8/1/2005	8/1/2006 8/1/2006	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$
	GARAGE LIABILITY ☐ ANY AUTO				AUTO ONLY - EA ACCIDENT \$ OTHER THAN EA ACC \$ AUTO ONLY: AGG \$
C	EXCESS LIABILITY ☒ OCCUR ☐ CLAIMS MADE DEDUCTIBLE ☒ RETENTION \$ 10,000	UMB8086095	8/1/2005	8/1/2006	EACH OCCURRENCE \$ 10,000,000 AGGREGATE \$ 10,000,000 \$ \$ \$
D	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? If yes, describe under SPECIAL PROVISIONS below	WC9683944 WC9683943	1/1/2005 1/1/2005	1/1/2006 1/1/2006	☒ WC STATU-TORY LIMITS ☐ OTH-ER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY LIMIT \$ 1,000,000
E	OTHER Pollution Legal Liability	PLS2673560	8/1/2005	8/1/2008	\$24,000,000 Each Claim \$28,000,000 Aggregate

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS
See Attached.

CERTIFICATE HOLDER

City of Gloversville
3 Frontage Road
Gloversville, NY 12078

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

Willis**CERTIFICATE OF LIABILITY INSURANCE**

Page 2 of 3

DATE
09/21/2005

PRODUCER 877-945-7378 Willis North America, Inc. 26 Century Blvd. P. O. Box 305191 Nashville, TN 37230-5191	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.	
INSURED EQ Northeast, Inc. 185 Industrial Road Wrentham, MA 02093	INSURERS AFFORDING COVERAGE	NAIC#
	INSURER A: Commerce and Industry Insurance Company	19410-006
	INSURER B: New Hampshire Insurance Company	23841-002
	INSURER C: American International Specialty Lines In	26883-002
	INSURER D: Insurance Company of the State of Pennsylv	19429-002
	INSURER E: American International Specialty Lines In	26883-007

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

Cargo Coverage Policy No. QT6608039B186 8/1/05 to 8/1/06
Issuing Carrier: Travelers Property Casualty Co.
Limits:
\$250,000 Any One Truck
\$250,000 Catastrophe Limit

Excess Liability
Carrier: Lexington Insurance Co.
Policy No.: 6500924
Policy Period: 8/1/05 to 8/1/06
Limits:
\$15,000,000 Occurrence
\$15,000,000 Aggregate

Errors & Omissions and Pollution Liability COPS1449340 8/1/05 - 8/01/06
American International Specialty Lines Insurance
\$5,000,000 Each Claim
\$10,000,000 Aggregate
(Pollution Liability: Occurrence Form
Errors and Omissions: Claims Made Form)

Contractors Equipment 6639631 8-01-05/8-01-06
Lexington Insurance Company
"All Risk" subject to policy conditions
\$13,093,362 Scheduled Limit
\$500,000 Leased/Rented Limit Per Item

IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

The Certificate of Insurance on the reverse side of this form does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – ENGINEERS, ARCHITECTS OR SURVEYORS

This endorsement modifies insurance provided under the following:

OWNERS AND CONTRACTORS PROTECTIVE LIABILITY COVERAGE PART

- A. Section II – Who Is An Insured** is amended to include as an additional insured any architect, engineer or surveyor engaged by you, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by your acts or omissions or the acts or omissions of those acting on your behalf:
1. In connection with your premises; or
 2. In the performance of your ongoing operations.
- B.** With respect to the insurance afforded to these additional insureds, the following additional exclusion applies:
- This insurance does not apply to "bodily injury" or "property damage" arising out of the rendering of or the failure to render any professional services by or for you, including:
1. The preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or
 2. Supervisory, inspection, architectural or engineering activities.

ACORD™ CERTIFICATE OF LIABILITY INSURANCE Page 1 of 2DATE
10/04/2005

PRODUCER Willis North America, Inc. 26 Century Blvd. P. O. Box 305191 Nashville, TN 37230-5191	877-945-7378	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.
INSURERS AFFORDING COVERAGE		
INSURED City of Gloversville Department of Public Works 3 Frontage Road Gloversville, NY 12078		INSURER A: Commerce and Industry Insurance Company 19410-001
		INSURER B:
		INSURER C:
		INSURER D:
		INSURER E:

COVERAGES

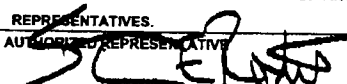
THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR ADD'L LTR INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS
A	GENERAL LIABILITY ☐ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☒ OCCUR ☒ Owners Contractors ☒ Protective GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐ PRO-JECT ☐ LOC	GL7567988	9/29/2005	9/29/2006	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ 1,000,000 PRODUCTS - COMP/OP AGG \$
	AUTOMOBILE LIABILITY ☐ ANY AUTO ☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☐ HIRED AUTOS ☐ NON-OWNED AUTOS				COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$
	GARAGE LIABILITY ☐ ANY AUTO				AUTO ONLY - EA ACCIDENT \$ OTHER THAN EA ACC \$ AUTO ONLY: AGG \$
	EXCESS LIABILITY ☐ OCCUR ☐ CLAIMS MADE ☐ DEDUCTIBLE RETENTION \$				EACH OCCURRENCE \$ AGGREGATE \$ \$ \$ \$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? If yes, describe under SPECIAL PROVISIONS below				WC STATUTORY LIMITS ☐ OTH-ER ☐ E.L. EACH ACCIDENT \$ E.L. DISEASE - EA EMPLOYEE \$ E.L. DISEASE - POLICY LIMIT \$
	OTHER				

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

C T Male Associates, P.C. and The New York State Department of Environmental Conservation are Additional Insureds under this policy

CERTIFICATE HOLDER**CANCELLATION**

City of Gloversville Department of Public Works 3 Frontage Road Gloversville, NY 12078	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES. AUTHORIZED REPRESENTATIVE 

IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

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ACORD CERTIFICATE OF LIABILITY INSURANCE

Page 1 of 2

DATE
09/30/2005

PRODUCER Willis North America, Inc. 26 Century Blvd. P. O. Box 305191 Nashville, TN 37230-5191		877-945-7378		THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.	
INSURED City of Gloversville 36255 Michigan Ave Wayne, MI 48184		INSURERS AFFORDING COVERAGE		NAIC#	
		INSURER A: Commerce and Industry Insurance Company		19410-001	
		INSURER B:			
		INSURER C:			
		INSURER D:			
		INSURER E:			

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR ADD'L LTR	INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS
A		GENERAL LIABILITY ☐ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☒ OCCUR ☒ Owners Contractors ☒ Protective GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐ PRO-JECT ☐ LOC	GL7567988	9/29/2005	9/29/2006	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ 1,000,000 PRODUCTS - COMP/OP AGG \$
		AUTOMOBILE LIABILITY ☐ ANY AUTO ☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☐ HIRED AUTOS ☐ NON-OWNED AUTOS				COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$
		GARAGE LIABILITY ☐ ANY AUTO				AUTO ONLY - EA ACCIDENT \$ OTHER THAN EA ACC \$ AUTO ONLY: AGG \$
		EXCESS LIABILITY ☐ OCCUR ☐ CLAIMS MADE ☐ DEDUCTIBLE RETENTION \$				EACH OCCURRENCE \$ AGGREGATE \$ \$ \$ \$
		WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? If yes, describe under SPECIAL PROVISIONS below				☐ WC STATU-TORY LIMITS ☐ OTH-ER E.L. EACH ACCIDENT \$ E.L. DISEASE - EA EMPLOYEE \$ E.L. DISEASE - POLICY LIMIT \$
		OTHER				

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

C T Male Associates, P.C. and The New York State Department of Environmental Conversation are Additional Insureds under this policy

CERTIFICATE HOLDER

CANCELLATION

City of Gloversville Department of Public Works 3 Frontage Road Gloversville, NY 12078	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES. AUTHORIZED REPRESENTATIVE

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This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the Controlling Law.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



AMERICAN CONSULTING
ENGINEERS COUNCIL



**National Society of
Professional Engineers**
Professional Engineers in Private Practice



AMERICAN SOCIETY OF
CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN CONSULTING ENGINEERS COUNCIL

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General [seal] Contractors of America

Construction Specifications Institute

[seal]

These General Conditions have been prepared for use with the Owner-Contractor Agreements (No. 1910-8-A-1 or 1910-8-A-2) (1996 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC User's Guide (No. 1910-50). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. 1910-17) (1996 Edition).

In these General Conditions these are cross references to Supplementary Conditions and Division 1 - General Requirements to aid in general recognition. Provision of these General Conditions may be amended or supplemented for this Project by these other documents

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National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314

American Consulting Engineers Council
1015 15th Street N.W., Washington, DC 20005

American Society of Civil Engineers
345 East 47th Street, New York, NY 10017

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

Defined Terms 1.01

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *Addenda*--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

3. *Application for Payment*--The form acceptable to ENGINEER which is to be used by CONTRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *ENGINEER*--The individual or entity named as such in the Agreement.

20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

21. *Field Order*--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated biphenyls.

33. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

35. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. *Site*--Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

41. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

42. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

43. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

44. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

45. *Supplier*--A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

46. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults,

tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

47. *Unit Price Work*--Work to be paid for on the basis of unit prices.

48. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

50. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

1.02 Terminology

A. Intent of Certain Terms or Adjectives

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project

as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

1. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials,

or equipment in a context clearly requiring an obligation of CONTRACTOR, "provide" is implied.

E. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 *Delivery of Bonds*

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 *Copies of Documents*

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work* 2.04 *Starting the Work* 2.04 *Starting the Work*

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy

which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and

3. a preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

C. *Evidence of Insurance:* Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.

2.06 *Preconstruction Conference*

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other

submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The progress schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.

2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be

provided whether or not specifically called for at no additional cost to OWNER.

C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

Reference Standards

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the

methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 *Reuse of Documents*

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on

extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and
2. those drawings of physical conditions in or relating to existing surface or subsurface struc-

tures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 Differing Subsurface or Physical Conditions

4.03 Differing Subsurface or Physical Conditions 4.03 Differing Subsurface or Physical Conditions

A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *ENGINEER's Review:* After receipt of written notice as required by paragraph 4.03.A, ENGINEER will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for

CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price of Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 *Reference Points*

A. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate

replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site 4.06 Hazardous Environmental Condition at Site 4.06 Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR

shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.

F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or

by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain. OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.

5.04 *CONTRACTOR's Liability Insurance*

A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

5.05 *OWNER's Liability Insurance* 5.05 *OWNER's Liability Insurance* 5.05 *OWNER's Liability Insurance*

A. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, OWNER, at OWNER's option, may purchase and maintain at OWNER's expense OWNER's own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of

them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;

5. allow for partial utilization of the Work by OWNER;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will

not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.

D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.

5.07 *Waiver of Rights* 5.07 *Waiver of Rights* 5.07
Waiver of Rights

A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other

individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER's property or the Work caused by, arising out of, or resulting from fire or other peril whether or not insured by OWNER; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on

account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.

5.09 Acceptance of Bonds and Insurance; Option to Replace 5.09 Acceptance of Bonds and Insurance; Option to Replace 5.09 Acceptance of Bonds and Insurance; Option to Replace

A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 Partial Utilization, Acknowledgment of Property Insurer

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall

consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.

6.02 Labor; Working Hours

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using

the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below.

1. *"Or-Equal" Items:* If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items*

a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by

ENGINEER from anyone other than CONTRACTOR.

c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the

substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. *Special Guarantee:* OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

E. *ENGINEER's Cost Reimbursement:* ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

F. *CONTRACTOR's Expense:* CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date

prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor

or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 *Patent Fees and Royalties*

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist

CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 *Laws and Regulations*

A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10 *Taxes*

A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all

property not designated for alteration by the Contract Documents.

D. *Loading Structures:* CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to ENGINEER for OWNER.

6.13 *Safety and Protection*

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;
2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or

loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. CONTRACTOR shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples* 6.17 *Shop Drawings and Samples*

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRACTOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. *ENGINEER's Review*

1. ENGINEER will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *Resubmittal Procedures*

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.18 *Continuing the Work*

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 *CONTRACTOR's General Warranty and Guarantee*

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or
2. normal wear and tear under normal usage.

B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

1. observations by ENGINEER;
2. recommendation by ENGINEER or payment by OWNER of any progress or final payment;
3. the issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;
4. use or occupancy of the Work or any part thereof by OWNER;
5. any acceptance by OWNER or any failure to do so;
6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER;
7. any inspection, test, or approval by others; or
8. any correction of defective Work by OWNER.

6.20 *Indemnification* 6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:

1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and
2. is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Sub-

contractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

B. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

ARTICLE 7 - OTHER WORK

7.01 *Related Work at Site* 7.01 *Related Work at Site* 7.01 *Related Work at Site*

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination* 7.02 *Coordination* 7.02 *Coordination*

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the

activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 *Replacement of ENGINEER* 8.02 *Replacement of ENGINEER*

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 *Furnish Data* 8.03 *Furnish Data*

A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

8.04 *Pay Promptly When Due*

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

8.06 *Insurance*

A. OWNER's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders* 8.07 *Change Orders*

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 *Limitations on OWNER's Responsibilities*

A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *OWNER'S Representative*

A. ENGINEER will be OWNER's representative during the construction period. The duties and responsi-

bilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ENGINEER.

9.02 *Visits to Site* 9.02 *Visits to Site* 9.02 *Visits to Site*

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Clarifications and Interpretations*

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 *Authorized Variations in Work* 9.05 *Authorized Variations in Work* 9.05 *Authorized Variations in Work*

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 *Rejecting Defective Work*

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.07 *Shop Drawings, Change Orders and Payments*

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER's authority as to Applications for Payment, see Article 14.

9.08 *Determinations for Unit Price Work*

A. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER's written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of paragraph 10.05.

9.09 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 *Limitations on ENGINEER's Authority and Responsibilities*

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by

ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change

Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 *Execution of Change Orders*

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 *Notification to Surety*

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 *Claims and Disputes*

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs

of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER, who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of

transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and

insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.

3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

4. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 11.01.A and 11.01.B.

C. *CONTRACTOR's Fee:* When all the Work is performed on the basis of cost-plus, CONTRACTOR's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and

maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

11.02 *Cash Allowances*

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01)

plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. *CONTRACTOR's Fee:* The CONTRACTOR's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;
 - b. for costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. the amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times* 12.02 *Change of Contract Times*
12.02 *Change of Contract Times*

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 *Delays Beyond CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 *Delays Within CONTRACTOR's Control*

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 *Delays Beyond OWNER's and CONTRACTOR's Control*

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 *Delay Damages* 12.06 *Delay Damages* 12.06
Delay Damages

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work* 13.02 *Access to Work* 13.02 *Access to Work*

A. OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections,

tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGI-

NEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

13.05 *OWNER May Stop the Work*

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and

replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work 13.08*

Acceptance of Defective Work 13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

13.09 *OWNER May Correct Defective Work*

A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In

connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ENGINEER and ENGINEER's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CONTRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The schedule of values established as provided in paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to pro-gress payments will be as stipulated in the Agreement.

B. *Review of Applications*

1. ENGINEER will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's observations on the Site of the executed Work as an experienced and qualified design professional and on ENGINEER's

review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER's responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER's review of CONTRACTOR's Work for the purposes of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine

that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Written Amendment or Change Orders;

c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR.

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

a. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;

c. there are other items entitling OWNER to a set-off against the amount recommended; or

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 *CONTRACTOR's Warranty of Title*

A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after

considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work.

CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment* 14.07 *Final Payment* 14.07 *Final Payment*

A. *Application for Payment*

1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. *Review of Application and Acceptance*

1. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due*

1. Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 *Final Completion Delayed*

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND
TERMINATION

15.01 *OWNER May Suspend Work*

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05.

15.02 *OWNER May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of

the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 *OWNER May Terminate For Convenience*

A. Upon seven days written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *CONTRACTOR May Stop Work or Terminate*

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A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, seven days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.04 are not intended to preclude CONTRACTOR from making a Claim under paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping the Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 *Giving Notice* 17.01 *Giving Notice* 17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

END OF SECTION 00700

SECTION 00810 - SUPPLEMENTARY CONDITIONS
MODIFICATIONS TO GENERAL CONDITIONS

(This document is based on EJCDC Document 1910-17, 1996 Edition, entitled "Guide to the Preparation of Supplementary Conditions".)

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC Document 1910-8, 1996 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so modified remain in full force and effect.

Articles and paragraphs herein bear numbers corresponding to those parts of the General Conditions that are being modified. Each modification to the General Conditions made herein is noted at the part of the General Conditions being modified by means of a symbol keyed to a footnote cross reference to these Supplementary Conditions. Also, if text is deleted by these modifications, it is crossed out in the General Conditions.

1.01 DEFINED TERMS

The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (EJCDC Document 1910-8, 1996 Edition) have the meanings assigned to them in the General Conditions.

In addition, the following definitions apply:

DIRECTED, REQUIRED, APPROVED, ACCEPTABLE - Whenever these terms or words of like import are used to refer to the Work or its performance, they shall mean direction by, or approval by, or equivalent action of or by the ENGINEER/ARCHITECT. Such direction or approval is subject to the limitations described in paragraph 9.10 of the General Conditions.

ENGINEER/ARCHITECT - The person, firm, or corporation named as such in the Agreement, or the duly appointed assistants and representatives of the named ENGINEER/ARCHITECT.

2.03 COMMENCEMENT OF CONTRACT TIMES; NOTICE TO PROCEED

Delete paragraph 2.03.A. in its entirety and insert the following in its place:

- A. The Contract Times will commence to run on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within {30} days after the Effective Date of the Agreement. ***In no event will the Contract Time commence to run later than the 100th day after the day of Bid opening or the 30th day after the Effective Date of the Agreement, whichever date is earlier.***

2.03.1 SEQUENCE OF EVENTS

Add a new paragraph immediately after paragraph 2.03 of the General Conditions as follows:

The sequence or chronology of events from the date of Bid opening to the date when the Contract Time starts to run as described by these Contract Documents is summarized as follows:

Bid Opening

Within 45 days OWNER to give CONTRACTOR Notice of Award accompanied by Contract Documents to execute.

Within 15 subsequent days (Up to Day 60 after Bid Opening) CONTRACTOR to deliver to OWNER executed Contract Documents.

Within 10 subsequent days (Up to Day 70 after Bid Opening) OWNER to deliver fully signed Contract Documents to CONTRACTOR, which date equals the latest effective date of the Agreement.

Within 30 subsequent days (Up to Day 100 after Bid Opening) OWNER to give CONTRACTOR Notice to Proceed, which starts the Contract Time.

2.05.C EVIDENCE OF INSURANCE

Add the following sentence to the end of paragraph 2.05C of the General Conditions:

When CONTRACTOR delivers the executed Agreement to OWNER, CONTRACTOR shall furnish all his required insurance certificates by attaching them to page 00650 - 1 near the end of the Contract Forms part of the Project Manual.

4.02 SUBSURFACE AND PHYSICAL CONDITIONS

Add the following new paragraphs immediately after paragraph 4.02.B as follows:

- C. In the preparation of Drawings and Specifications, ENGINEER or ENGINEER's Consultants relied upon the following reports of exploration and tests of subsurface conditions at the Site:
 - a. Remedial Design Work Plan for Independent Leather, dated May 2005, prepared by C.T. Male Associates, P.C.
 - b. Boring Logs completed April 2002, prepared by C.T. Male Associates, P.C.
- D. The Contractor shall be responsible for locating and protecting subsurface utilities, etc.

4.02.B.4 OWNER'S DISCLAIMER - REPORTS OF EXPLORATIONS

Add a new paragraph immediately after paragraph 4.02.B.3 of the General Conditions as follows:

The subsurface soils information which is being made available reports water levels and conditions as recorded on the dates given and may vary according to the prevailing climate, rainfall, and other factors. It contains no technical data upon which the CONTRACTOR may rely.

The OWNER and the ENGINEER/ARCHITECT assume no responsibility or liability for the accuracy of information on soils or materials or on other conditions, nor on the exact location of borings shown.

This information was intended for Bid cost purposes only, and is made available to bidders only that they may have access to identical information available. It is presented in good faith, but is not intended as a substitute for personal investigations, interpretations, or judgment of the CONTRACTOR. This information is not guaranteed and does not form part of the Contract Documents.

4.02.B.5 OWNER'S DISCLAIMER - DRAWINGS OF PHYSICAL CONDITIONS

Add a new paragraph after paragraph 4.02.B.3 of the General Conditions as follows:

The drawings which are being made available contain no technical data upon which the CONTRACTOR may rely.

The OWNER and the ENGINEER/ARCHITECT assume no responsibility or liability for the accuracy of information on existing structures.

This information was intended for Bid cost purposes only, and is made available to bidders only that they may have access to identical information available. It is presented in good faith, but is not intended as a substitute for personal investigations, interpretations, or judgment of the CONTRACTOR. This information is not guaranteed and does not form part of the Contract Documents.

4.06 HAZARDOUS ENVIRONMENTAL CONDITIONS AT THE SITE

Add the following new paragraphs immediately after paragraph 4.06.A as follows:

1. In the preparation of Drawings and Specifications, ENGINEER or ENGINEER's Consultants relied upon the following reports of Hazardous Environmental Conditions at the Site:
 - a. Record of Decision for Independent Leather, February 2004, prepared by NYS Department of Environmental Conservation.
2. The site is the subject of the NYS Environmental Restoration Program. Contaminated soil and groundwater have been identified at the site.

5.01 PERFORMANCE, PAYMENT AND OTHER BONDS

Add the following new paragraph at the beginning of Section 5.01:

A performance bond and a labor and materials payment bond are required by these Contract Documents. This bond shall remain in effect until at least one year after the date of final payment. No other bonds are required.

5.04 CONTRACTOR'S LIABILITY INSURANCE

Add the following new paragraphs immediately after paragraph 5.04.B:

- C. The limits of liability for the insurance required by paragraph 5.04.B of the General Conditions shall provide coverages for not less than the following amounts, or greater where required by Laws or Regulations:
 1. Workers' Compensation, and related coverages,, under paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:

a.	State:	Statutory
b.	Applicable Federal (e.g., Longshoreman's)	Statutory
c.	Employers' Liability:	\$ <u>100,000.00</u>
 2. Contractor's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

a.	General Aggregate	\$ <u>2,000,000</u>
b.	Products - Completed Operations Aggregate	\$ <u>2,000,000</u>
c.	Personal and Advertising Injury	\$ <u>1,000,000</u>
d.	Each Occurrence (Bodily Injury and Property Damage)	\$ <u>1,000,000</u>
e.	Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.	
f.	Excess or Umbrella Liability	
	1) General Aggregate	\$ <u>5,000,000</u>
	2) Each Occurrence	\$ <u>5,000,000</u>
 3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

a.	Bodily Injury:	
	Each Person	\$ <u>1,000,000</u>
	Each Accident	\$ <u>1,000,000</u>
b.	Property Damage:	
	Each Accident	\$ <u>1,000,000</u>
c.	Combined Single Limit of	\$ <u>1,000,000</u>
 4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall be provided by the CONTRACTOR as part of the CONTRACTOR's General Liability coverage.

In the paragraph after 5.04.B.5. of the General Conditions, amend the first sentence to read as follows, and as so amended, the paragraph remains in effect:

Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice, by certified mail, has been given to OWNER and ENGINEER/ARCHITECT.

5.04.B.8 ADDITIONAL CONTRACTOR'S INSURANCE

Add a new paragraph immediately after paragraph 5.04.B.7 of the General Conditions as follows:

- a. Contractor's Protective Liability (protection against claims arising out of the operations performed for the Contractor by his/her subcontractors while they are on the Project):
 - 1. Bodily Injury:
\$ 1,000,000 Each Accident
 - 2. Property Damage:
\$ 1,000,000 Each Accident
\$ 1,000,000 Annual Aggregate

5.05 OWNER'S LIABILITY INSURANCE

Add a new paragraph 5.05.A.1 immediately after paragraph 5.05.A of the General Conditions as follows:

CONTRACTOR shall provide additional liability insurance for OWNER and ENGINEER/ARCHITECT by:

- a. Having his/her insurance carrier issue a separate Protective Liability Policy covering OWNER and ENGINEER/ARCHITECT in the following amounts:
 - 1. Bodily Injury:
\$ 1,000,000 Each Occurrence
 - 2. Property Damage:
\$ 1,000,000 Each Occurrence
- b. The separate Protective Liability Policy shall specifically name as the insured the following parties:
 - 1. The OWNER, specifically City of Gloversville
 - 2. The ENGINEER/ARCHITECT, specifically C. T. Male Associates, P.C.
 - 3. The New York State Department of Environmental Conservation
- c. The separate Protective Liability Policy shall contain a provision that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice has been given to OWNER and ENGINEER/ARCHITECT.

5.06 PROPERTY INSURANCE

Property insurance is not applicable to this Project and will not be provided by the OWNER.

5.09 ACCEPTANCE OF BONDS AND INSURANCE; OPTION TO REPLACE

Add the following sentence to the beginning of paragraph 5.09 of the General Conditions.

All insurance shall be issued by such insurance companies as are authorized to transact business in the State where the Project is located.

6.02. WORK DURING INCLEMENT WEATHER

Add a new paragraph 6.02.C immediately after paragraph 6.02.B of the General Conditions as follows:

During inclement, stormy, or freezing weather, no work shall be done, except as may be performed in a manner satisfactory to secure first-class construction and by permission of the ENGINEER/ARCHITECT. During freezing weather, approved precautions shall be taken to remove ice and frost from materials used and to prevent completed portions of the work from freezing by heating the water, sand, gravel, broken stone, bricks, or other materials and by covering and heating the completed portions of the work. The cost of such precautions shall be borne by the CONTRACTOR. If, in the opinion of the ENGINEER/ARCHITECT, any work or materials shall have been damaged or injured by reason of failure on the part of the CONTRACTOR or any Subcontractor to so protect his work, such work and materials shall be removed and replaced at the expense of the CONTRACTOR.

6.05 SUBSTITUTES AND/OR EQUALS

Amend paragraph 6.05.C by making two subparagraphs under the title C. Engineer's Evaluation. The paragraph text is retitled, 6.05.C.2 After Effective Date of Agreement. A new paragraph is added before this paragraph to read as follows:

1. During Bidding, the Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 6.05 of the General Conditions, or those substitute or materials and equipment approved by the ENGINEER and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function, and quality to be met by any proposed substitute or "or-equal" item. Request for ENGINEER's clarification of materials and equipment considered "or-equal" prior to the Effective Date of the Agreement must be received by the ENGINEER at least 5 days prior to the date for receipt of Bids. No item of material or equipment will be considered by ENGINEER as a substitute unless written request for approval has been submitted by Bidder and has been received by ENGINEER at least 15 days prior to the date for receipt of Bids. Each request shall conform to the requirements of paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon the Bidder. ENGINEER's decision of approval or disapproval of a proposed item will be final. If ENGINEER approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

6.06.B.1 IDENTITY OF SUBCONTRACTORS AND OTHERS

Add a new paragraph immediately after paragraph 6.06.B of the General Conditions as follows:

As described in paragraph 12.01 of the Instructions to Bidders, the CONTRACTOR, as apparent successful bidder, and any other bidder so required, shall submit in writing to OWNER, after Bid opening and prior to Notice of Award, the identity of certain Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment). Such identification shall be required for the following specific types of Work, materials, and equipment.

1. Earthwork Subcontractor
2. Trucking or Transportation Subcontractor.
3. Non-Hazardous Waste Disposal Facility.
4. Hazardous Waste Disposal Facility.

6.06.C.1 INFORMATION ON SUBCONTRACTORS AND OTHERS

Add a new paragraph immediately after 6.06.C of the General Conditions as follows:

OWNER or ENGINEER/ARCHITECT may furnish to any such Subcontractor, Supplier or other individual or entity, to the extent practicable, information about amounts paid to CONTRACTOR in accordance with CONTRACTOR's Applications for Payment.

6.08 PERMITS**6.08.B PERMITS BY OWNER**

Add a new paragraph immediately after paragraph 6.08.A of the General Conditions as follows:

- A. The OWNER shall obtain and pay for the following specific permits and licenses:
NONE
- B. All other permits required shall be obtained by the CONTRACTOR.

6.10.B SALES TAX EXEMPTION

Add a new paragraph immediately after paragraph 6.10.A of the General Conditions as follows:

All Bid prices shall include all New York State and local taxes required to be paid by the CONTRACTOR except those sales and compensating use taxes exempted by the following provisions.

- A. The OWNER is exempt from payment of sales and compensating use taxes of the State of New York, and of cities, counties, and other subdivisions of the State, hereinafter referred to as subdivisions of the State, pursuant to the provisions of this Contract. These taxes are not to be included in the Bids. This exemption shall apply to:
 - 1. materials permanently incorporated in the Project;
 - 2. supplies which are permanently incorporated in the Project; and
 - 3. materials and furnishings for the Project which are incorporated therein, such as chairs, desks, drapes, and moveable personal property.
- B. This exemption does not, however, apply to tools, machinery, equipment, or other property purchased by, leased by or to the CONTRACTOR or Subcontractor, or to supplies or materials not incorporated into the completed Project. The CONTRACTOR and his Subcontractors shall be responsible for and shall pay any and all applicable taxes, including sales and compensating use taxes, on such tools, machinery, equipment, or other property, or such unincorporated supplies and materials.

6.17 SHOP DRAWINGS AND SAMPLES

Add a new paragraph 6.17.E.4 immediately after paragraph 6.17.E.3 of the General Conditions as follows:

ENGINEER/ARCHITECT's "review and approval" of submittals is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections and comments made on the shop drawings during this review do not relieve CONTRACTOR from compliance with requirements of the drawings and specifications. The CONTRACTOR is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

9. ENGINEER'S STATUS DURING CONSTRUCTION**9.03.B PROJECT REPRESENTATIVE (BY ENGINEER/ARCHITECT)**

Add a new paragraph 9.03.B immediately after paragraph 9.03.A of the General Conditions as follows:

In accordance with an agreement with the OWNER, the ENGINEER/ARCHITECT will furnish a full-time Resident Project Representative at the site to assist ENGINEER/ARCHITECT in observing the performance of the Work. The duties, responsibilities, and limitations of authority of such Representative and assistants will be as follows:

1. Observe the work for conformance with the contract documents requirements.
2. Perform soil vapor screening and visual observation for determining the horizontal and vertical extent of soil removal.
3. Perform area air monitoring for organic vapors.
4. Perform area dust monitoring during site intrusive activities and backfilling.

9.03.C PROJECT REPRESENTATION (BY OWNER)

Add a new paragraph 9.03.C immediately after paragraph 9.03.B of the General Conditions as follows:

OWNER will not furnish a Resident Project Representative.

9.08 DETERMINATIONS FOR UNIT PRICE WORK

Delete Paragraph 9.08.A of the General Conditions in its entirety and insert the following in its place:

ENGINEER/ARCHITECT will have authority to determine the actual quantities and classifications of items of Unit Price Work performed by CONTRACTOR, and the written decisions of ENGINEER/ARCHITECT on such matters will be final, binding on OWNER and CONTRACTOR, and not subject to appeal (except as modified by ENGINEER/ARCHITECT to reflect changed factual conditions or more accurate data).

11.01.A.5.a SUPPLEMENTAL LABOR COSTS

Delete Article 11.01.A.5.a of the General Conditions and insert nothing in its place.

11.01.A.5.b SUPPLEMENTAL EQUIPMENT COSTS

Delete the word "equipment" from the first sentence of paragraph 11.01.A.5.b of the General Conditions and insert the following language after the first sentence:

Allowance will be made for the cost of construction equipment that is approved for use in the Work by the ENGINEER/ARCHITECT. The rate on self-owned equipment used for periods of under one week will be the Associated Equipment Distributor's published monthly rate divided by 22 days to establish a daily rate and divided again by eight hours to establish an hourly rate. Equipment used for periods of 5 days or more will be billed at a rate equal to 45% of this base hourly rate. Self-owned equipment is defined to include equipment rented from controlled or affiliated companies. In the alternative, the ENGINEER/ARCHITECT may approve for reimbursement a rate representing the allocable costs of ownership. When, in the opinion of the CONTRACTOR, and as approved by the ENGINEER/ARCHITECT, suitable equipment is not available on the site, the moving of said equipment to and from the site will be paid for at actual cost.

Add the following sentence at the end of paragraph 11.01.A.5.b of the General Conditions:

Gasoline, oil, and grease required for operation and maintenance of construction equipment will be paid for at actual cost.

11.01.A.5.c RENTAL OF CONSTRUCTION EQUIPMENT

Amend the first part of the first sentence of paragraph 11.01.A.5.c of the General Conditions to read as follows, and as so amended the paragraph remains in effect:

Rentals of all construction equipment at actual cost, and machinery and parts thereof, only when rented from others not controlled by or affiliated with CONTRACTOR in accordance with rental agreements approved by OWNER with the advice of ENGINEER/ARCHITECT,...

11.03.C ADJUSTMENT OF UNIT PRICES

Delete Paragraph 11.03.C of the General Conditions in its entirety and insert the following in its place:

- C. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. if the total cost of a particular item of Unit Price Work amounts to 15% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and
 2. if there is no corresponding adjustment with respect to any other item of Work; and
 3. if CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof; or if OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, either OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

12.01.C.2.a CONTRACTOR'S FEE

Delete paragraph 12.01.C.2.a of the General Conditions in its entirety and insert the following in its place:

For costs incurred under paragraph 11.01.A.1 (labor) and 11.01.A.2 (materials and equipment), the CONTRACTOR's Fee shall be 10% for overhead plus 10% for profit, subject to the following exclusions:

1. No overhead and profit shall be allowed on the premium portion of overtime pay.
2. No overhead and profit shall be applied to payroll taxes. Payroll taxes include FICA, unemployment insurance, disability insurance, workman's compensation, and personal liability and property damage insurance.

12.01.C.2.b CONTRACTOR'S FEE FOR SUBCONTRACTOR WORK

Delete paragraph 12.01.C.2.b of the General Conditions in its entirety and insert the following in its place:

For costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be 10% for combined overhead and profit; and if a subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to the Subcontractor as a fee shall be 5% for overhead plus 10% for profit.

13.03 TESTS AND INSPECTIONS

Add a sentence to the end of paragraph 13.03.D of the General Conditions to read as follows, and as so amended the paragraph remains in effect:

The cost of all other inspections, tests, and approvals required by the Contract Documents shall be paid by CONTRACTOR (not OWNER), in accordance with Division 1, Section 01400 - Quality Control.

13.07 CORRECTION PERIOD

Amend the first part of the first sentence of paragraph 13.07.A of the General Conditions to read as follows, and as so amended the paragraph remains in effect:

If within one year after the date of Final Payment and Acceptance (not Substantial Completion) or such longer period of time as may be prescribed by law...

Amend the first part of the last sentence of paragraph 13.07.A of the General Conditions to read as follows, and as so amended the paragraph remains in effect:

If CONTRACTOR does not comply after seven days with the terms of such instructions,...

14.02.A.1 PAYMENT FOR MATERIALS

Delete the second sentence of paragraph 14.02.A.1 of the General Conditions and insert the following:

No payment will be made for materials and equipment not incorporated into completed work.

14.02.A.4 PAYMENT FOR COMPLETED WORK

Add a new paragraph immediately after paragraph 14.02.A.3 of the General Conditions to read as follows:

Completed Work shall be defined as Work completed, tested, and accepted. Payment for completed Work will be made to the CONTRACTOR based on a payment estimate prepared by the CONTRACTOR and duly certified and approved by the ENGINEER/ARCHITECT. No payment for any part of any Work not completed, tested, and accepted in the preceding calendar month shall be made, except at the discretion of the ENGINEER/ARCHITECT with the approval of the OWNER.

- A. For work performed on lump sum items as described by the Specifications in percentages as determined by the ENGINEER/ARCHITECT as a measure of actual progress made, in accordance, when realistic, with the CONTRACTOR's progress schedule required to be submitted by paragraph 2.07 of the General Conditions, and with his breakdown of his bid prices for lump sum items required to be submitted as a schedule of values by paragraph 14.01 of the General Conditions.
- B. For work performed on all other items as described in the Specifications not covered in (A) and (B) above, in the quantities actually performed in an acceptable manner as determined by the ENGINEER/ARCHITECT - 100% payment less retainage.

14.03 CONTRACTOR'S WARRANTY OF TITLE

Add the following sentence at the end of paragraph 14.03 of the General Conditions:

If requested by the OWNER, the CONTRACTOR shall furnish to the OWNER confirmatory bills of sale and other instruments as may be required by the OWNER, properly executed, confirming to the OWNER, title to such materials free of encumbrances.

14.07.A.2 FINAL APPLICATION FOR PAYMENT

Add a sentence to the end of Paragraph 14.07.A.2 of the General Conditions to read as follows, and as so amended the paragraph remains in effect:

The final Application for Payment shall also be accompanied by such other data and schedules as ENGINEER/ARCHITECT may reasonably require.

14.07.B.2 ADDITIONAL REASONS TO WITHHOLD PAYMENTS

Add a new paragraph immediately after paragraph 14.07.B.1 of the General Conditions to read as follows:

Reasons ENGINEER/ARCHITECT may refuse to recommend the whole or any part of any payment, or nullify any such payment previously recommended, are to protect OWNER from loss because:

- A. of injury to persons, or damage to the work or property of other contractors, subcontractors, or others caused by the act or neglect of the CONTRACTOR or any of his/her Subcontractors; or
- B. of defective Work and Work not remedied; or
- C. of CONTRACTOR's failure to make payment to Subcontractors or Suppliers, or for labor; or
- D. Liability for liquidated damages has been incurred by CONTRACTOR (when the Agreement includes such liquidated damage provisions).

The OWNER shall have the right, as an agent for the CONTRACTOR, to apply any such amounts so withheld in such a manner as the OWNER may deem proper to satisfy such claims or to secure protection. Such application of such money shall be deemed payment to the account of the CONTRACTOR.

END OF SECTION 00810

SECTION 00820 - SUPPLEMENTARY CONDITIONS - ADDITIONAL ARTICLES

These Supplementary Conditions add new topics to the Standard General Conditions of the Construction Contract (EJCDC Document 1910-8, 1996 Edition) and other provisions of the Contract Documents.

Articles and paragraphs herein are numbered as a continuation of the General Conditions. Some numbers in sequence may not appear because those numbered Articles and paragraphs are not applicable to this Project and have been deleted when transferring this Section from the office master document.

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SECTION 00820

SUPPLEMENTARY CONDITIONS - ADDITIONAL ARTICLES

18. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

- 18.1 Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall read and be enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

19. NEW YORK STATE NONDISCRIMINATION CLAUSES

During the performance of this contract, the Contractor agrees as follows:

- 19.1 The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and will take affirmative action to insure that they are afforded equal employment opportunities without discrimination because of race, creed, color or national origin. Such action shall be taken with reference but not limited to: recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of pay, other forms of compensation, and selection for training or retraining, including apprenticeship and on-the-job training.
- 19.2 The Contractor will send to each labor union or representative of workers with which he/she has or is bound by a collective bargaining or other agreement or understanding, a notice, to be provided by the State Commission for Human Rights, advising such labor union or representative of the Contractor's agreement under clauses (19.1) through (19.8) hereinafter called "nondiscrimination clauses". If the Contractor was directed to do so by the contracting agency as part of the bid or negotiation of this contract, the Contractor shall request the labor union or representative to furnish him/her with a written statement that such labor union or representative will not discriminate because of race, creed, color or national origin and that such labor union or representative either will affirmatively cooperate within the limits of its legal and contractual authority in the implementation of the policy and provisions of these nondiscrimination clauses, or that it consents and agrees that recruitment, employment, and the terms and conditions of employment under this contract shall be in accordance with the purposes and provisions of these nondiscrimination clauses. If such labor union or representative fails or refuses to comply with such a request that it furnish such a statement, the Contractor shall promptly notify the State Commission for Human Rights of such failure or refusal.
- 19.3 The Contractor will post and keep posted in conspicuous places, available to employees and applicants for employment, notices to be provided by the State Commission for Human Rights setting forth the substance of the provisions of clauses (19.1) through (19.2) and such provisions of the State's Laws against discrimination as the State Commission for Human Rights shall determine.
- 19.4 The Contractor will state, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color or national origin.
- 19.5 The Contractor will comply with the provisions of the Executive Law, Human Rights Law, Article 15, and will furnish all information and reports deemed necessary by the State Commission for Human Rights under these nondiscrimination clauses and such sections of the Executive Law, and will permit access to his books, records and accounts by the State Commission for Human Rights, the Attorney General, District Commissioner of Housing and Community Renewal and the Industrial Commission for purposes of investigation to ascertain compliance with these nondiscrimination clauses of the Executive Law, Human Rights Law, Article 15.
- 19.6 This Contract may be forthwith canceled, terminated or suspended, in whole or in part by the contracting agency upon the basis of a finding made by the State Commission for Human Rights that the Contractor has

not complied with these nondiscrimination clauses, and the Contractor may be declared ineligible for future contracts made by or on behalf of the State or a public authority or agency of the State or housing authority, or an urban renewal agency, or contract requiring the approval of the Commissioner of Housing and Community Renewal, until he/she has satisfied the State Commission for Human Rights after conciliation efforts by the Commission have failed to achieve compliance with these nondiscrimination clauses and after a verified complaint has been filed with the Commission, notice thereof has been afforded him/her to be heard publicly before three members of the Commission. Such sanctions may be imposed and remedies invoked independently of or in addition to sanctions and remedies otherwise provided by law.

- 19.7 If this contract is canceled or terminated under clause (19.6), in addition to other rights of the contracting agency provided in this Contract upon its breach by the Contractor, the Contractor will hold the contracting agency harmless against any additional expenses or costs incurred by the contracting agency in completing the work or in purchasing the services, materials, equipment or supplies contemplated by the contract, and the contracting agency may withhold payments from the Contractor in an amount sufficient for this purpose and recourse may be had against the surety on the performance bond if necessary.
- 19.8 The Contractor will include the provisions of clauses (19.1) through (19.7) in every subcontract or purchase order altered only to reflect the proper identity of the parties in such manner that such provisions will be binding upon each subcontractor or vendor as to operations to be performed within the State of New York. The Contractor will take such actions in enforcing such provisions of such subcontract or purchase order as the contracting agency may direct, including sanctions or remedies for non-compliance. If the Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by the contracting agency the Contractor shall promptly so notify the Attorney General, requesting him to intervene and to protect the interests of the State of New York.

20. NEW YORK STATE NON-COLLUSIVE BIDDING CERTIFICATION

- 20.1 In addition to the other provisions herein contained to be done or performed by the Contractor as part of this Contract, the said Contractor certifies, pursuant to the provisions of Section 103-d of the New York State General Municipal Law that:

By submission of this bid, each bidder and such person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his/her knowledge and belief:

- A. The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition, as to any competitor; and
- B. unless otherwise required by law, the prices which have been quoted in this bid have not knowingly been disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
- C. no attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

- 20.2 A bid shall not be considered for award nor shall any award be made where A, B, and C, above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefore. Where A and C above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, has determined that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (1) has published price lists, rates, or tariffs covering items being procured, (2) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (3) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph (A).

Any bid hereafter made to any political subdivision of state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certification referred to in subdivision (A) of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of the corporation.

21. WAGE RATES

21.1 New York State

- A. New York State minimum wage rate schedules are bound at the end of these Supplementary Conditions.
- B. The labor on this contract shall be performed in all respects in full accordance with the Labor Law of the State of New York. In accordance with Section 220, Subdivision 3, and Section 220-D, of the Labor Law, the Industrial Commissioner has designated as the minimum hourly rates to be paid to employees on this work the rates shown on the attached schedules which shall be posted in a prominent and convenient place for the inspection of the Contractor's employees. Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, provides, among other things, that it shall be the duty of the fiscal officer to make a determination of the schedule of wages and supplements to be paid to all laborers, workmen and mechanics employed on public works projects. The amount of supplements listed on the enclosed schedule does not necessarily include all types of prevailing supplements.
- C. The Contractor shall make provision for disability benefits, workmen's compensation, unemployment insurance and social security, as required by law.

22. PROTECTION OF EXISTING FACILITIES

- 22.1 The Contractor shall conduct his/her operations and take all special temporary and permanent precautions necessary to insure a stable and secure job, and as may be required by the contract documents, the Engineer/Architect, the Owner, and the public utilities, to protect and sustain in normal service all existing structures, equipment, utility lines, roadways, and subsurface, submerged and overhead facilities which are to remain in place and undisturbed by his/her operations under this contract completely at his/her own expense, unless otherwise provided for in the contract documents. The Contractor shall be held accountable for damage resulting from failure to exercise proper judgment in the progress of the work.
- 22.2 When power poles, light poles, pipes, or portions of any other existing structures, or utilities, either visible or underground, constitute an unavoidable interference to his/her operations, the Contractor shall consult with the owner of such facility prior to performing any work at or near the same. If permitted by the owner of the facility, the Contractor shall relocate or temporarily remove, and later restore, the interfering portion of the facility, as directed by said owner and the project Owner, through the Engineer/Architect. If the owner of the facility so elects, he will perform such work with his own forces. Under either arrangement, the work shall be done at the Contractor's expense unless stated otherwise in the contract documents.
- 22.3 The Contractor shall immediately notify the Engineer/Architect and the owner of any facilities which are disturbed, damaged or injured as a result of the Contractor's operations. The Contractor shall consult with the owner of such facility as to the proper method of replacing, repairing, or restoring the affected facilities to the conditions which existed prior to the Contractor's operations. If permitted by the owner of the facility, the Contractor shall, at his/her own expense, replace, repair, or restore the affected facilities to their original condition, to the satisfaction of said owner.
- 22.4 In the event that the owner of the facility desires to use his/her own forces to perform the replacement, repairing or restoring of affected facilities, the Contractor shall reimburse the owner of said facilities for such expenses as said owner may accrue in performing such work. The Contractor shall not be entitled to receive additional compensation under this contract for such work.

- 22.5 Upon learning of the existence and location of any utility omitted from or shown incorrectly on the contract drawings the Contractor shall notify the utility owner and the Engineer/Architect and assume full responsibility for that utility's protection or relocation as described above.

23. MATERIALS FOUND AT THE SITE

- 23.1 All timber, fences, buildings, stone, sand, utility lines, pipes, and any other appurtenances, materials, or articles of value found on lands or in excavations within the contract limits shall be brought to the attention of the Engineer/Architect.
- 23.2 If such items are found in or upon lands of the Owner, they shall remain the property of the Owner. Such materials may, therefore be used by the Contractor in the work at the discretion of the Engineer/Architect or the Owner, for purposes for which they are acceptable. If not otherwise claimed by the Owner or his/her representatives, such items shall be considered waste and shall be disposed of by the Contractor as stipulated hereafter.
- 23.3 If such items are found in or upon lands or easements being used in the project but being owned by parties other than the Owner, they shall remain the property of such other owners. If claimed by these owners, the items shall be turned over to these owners at the site of the work as the Engineer/Architect directs. If such items are not claimed by these owners, they may similarly be used in the work as stipulated in the preceding paragraph, or be considered waste and be disposed of by the Contractor as stipulated hereafter.
- 23.4 Disposal of waste materials shall be the Contractor's responsibility as an integral part of the contract and shall be done without special payment from the Owner. The decision as to whether disposal takes place inside or outside of the project limits shall be subject to control by the Engineer/Architect. If disposal takes place within the project limits, it shall be done by the Contractor subject to the direction and satisfaction of the Engineer/Architect. Waste material shall not be sold to parties within the project limits. If disposal takes place outside the project limits, it shall be done by the Contractor exclusively at his discretion and be solely his/her responsibility. The Contractor will be required to show the Engineer/Architect how he/she plans to dispose of the waste (i.e., unsuitable backfill, rock, etc.) in an environmentally acceptable manner. The Engineer/Architect will require copies of release forms from property owners who have agreed with Contractor to accept spoil materials.

24. BLASTING

Blasting Shall Not Be Allowed.

25. OPERATION OF VALVES AND HYDRANTS

- 25.1 Operation of all valves and hydrants under pressure shall be done by representatives of the Water Department or owner of the water utility of the locality where the work is performed, or under their direct supervision and with their approval.
- 25.2 The Contractor shall give sufficient notice to the Engineer/Architect when and where he desires operation of valves and hydrants so that the Water District representatives can be contacted and be present. The Contractor shall notify customers served by the main in adequate time before the closing of a section to permit them to draw water for their use while the main is shut down.

26. USE AND PROTECTION OF WATERS IN NEW YORK STATE

- 26.1 The Contractor is advised that any work or operations which in any way disturb or affect the streambed or banks of any stream, wetlands or other waters of the United States which are classified or regulated by the New York State Department of Environmental Conservation, the United States Army Corps of Engineers, or other local agency falls under the control and supervision of the Department of Environmental Conservation, the United States Army Corps of Engineers, and other local agency. In compliance with the law, the Contractor will be required to contact the Local Permit Agent of NYSDEC, the USACOE, and/or other local agency and advise him/her of his/her intent to impact said stream, the United States Army Corps of Engineers,

and other local agency. They will then advise the Contractor of the procedures and conditions to be followed, if any, in making the stream crossings and/or working on the banks of the stream.

27. SANITARY SEWER AND WATER MAIN SEPARATION

27.1 Horizontal Separation

Sewer pipe and water mains shall be separated by a minimum 10 foot horizontal distance. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the appropriate reviewing agency may allow deviation on a case-by-case basis, if supported by data from the design Engineer/Architect. Such deviation may allow installation at less than the ten foot horizontal separation provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer.

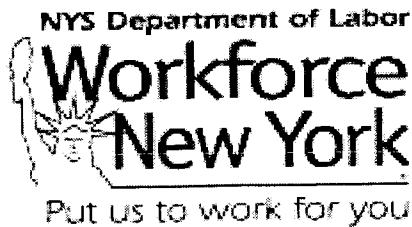
27.2 Crossings

At crossings of sewers and water mains, a minimum vertical distance of 18 inches shall be provided between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. At crossings of sewers and water mains, the pipe undermined during construction shall receive adequate structural support to prevent damage.

27.3 Special Conditions

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe, and shall be pressure tested to assure watertightness prior to backfilling.

END OF SECTION 00820
EXCEPT FOR WAGE RATE SCHEDULES WHICH FOLLOW
AND END ON PAGE 00820 - 78



George E. Pataki, Governor

Linda Angello, Commissioner

City of Gloversville
Jeff Marx, P.E.
City of Gloversville
C.T. Male Associates
50 Century Hill Drive
PO Box 727
Latham NY 12110

Schedule Year 2005
Date Requested 07/21/2005
PRC# 2005005300

Location Eastern half
Project ID#
Project Type Remediation of soil eastern half of site.

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2005 through June 2006. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.state.ny.us. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____
Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission; a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12240; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.state.ny.us.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.state.ny.us.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.state.ny.us.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. Payrolls must be maintained for at least three (3) years from the project's date of completion. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provide, and Daily and weekly number of hours worked in each classification.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall receive and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, by are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed \$100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds \$25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12240 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 and Article 9 of the Labor Law) constitute a misdemeanor punishable by fine or imprisonment, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of \$50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract

(NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

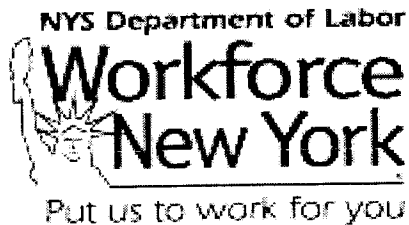
If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.



George E. Pataki, Governor

Linda Angello, Commissioner

City of Gloversville
Jeff Marx, P.E.
City of Gloversville
C.T. Male Associates
50 Century Hill Drive
PO Box 727
Latham NY 12110

Schedule Year 2005
Date Requested 07/21/2005
PRC# 2005005300

Location Eastern half
Project ID#
Project Type Remediation of soil eastern half of site.

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information

All information must be supplied

Federal Employer Identification Number: _____		
Name: _____		
Address: _____ _____		
City: _____	State: _____	Zip: _____
Amount of Contract: \$ _____	Contract Type:	
Approximate Starting Date: ____/____/____	☐ (01) General Construction	
Approximate Completion Date: ____/____/____	☐ (02) Heating/Ventilation	
	☐ (03) Electrical	
	☐ (04) Plumbing	
	☐ (05) Other : _____	

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is for each hour worked, some classifications require the payment or provision of supplements for each hour paid (including paid holidays on which no work is performed) and/or may require supplements to be paid or provided at a premium rate for premium hours worked.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.state.ny.us) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
boilermaker	1:1,1:4
Mason	1:1,1:4
Carpenter	1:1,1:4
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:4
Iron Worker	1:1,1:6
Laborer	1:1,1:3
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3

Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12240

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - New York City	212-352-6088	212-352-6580
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

Fulton County General Construction

Asbestos Worker

07/01/2005

JOB DESCRIPTION Asbestos Worker

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Essex, Franklin, Fulton, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Warren, Washington

WAGES

Per hour

07/01/2005

Asbestos Worker

Removal & hazardous
abatement Only

\$ 19.58

Only for the removal of insulation materials from mechanical systems which are not going to be scrapped. For ALL other removal work, please refer to the appropriate Building Laborer category.

SUPPLEMENTAL BENEFITS

Per hr. paid

Journeyman

\$ 12.55

OVERTIME PAY

See (B, E, *Q, **T, V) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (2, 4, 6, 25) on HOLIDAY PAGE

*Code Q applies to 4,6,25.

**Code T applies to 2.

1-201North

Asbestos Worker

07/01/2005

JOB DESCRIPTION Asbestos Worker

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Delaware, Essex, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Sullivan, Ulster, Warren, Washington

WAGES

Per Hour

07/01/2005

05/01/2006

Asbestos Worker

\$ 23.82

\$ 25.24

Insulator

\$ 23.82

\$ 25.24

Firestopping Worker*

\$ 17.07

\$ 18.21

* On Mechanical Systems only.

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman

\$ 13.47

\$ 14.28

OVERTIME PAY

See (B, D1, O*) on OVERTIME PAGE.

* Triple time on Labor Day.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

one year terms at the following percentage of Journeyman's wage.

1st	2nd	3rd	4th
60 %	70 %	80 %	90 %

Supplemental Benefits per hour worked:

Apprentices	\$ 13.47	\$ 14.28

1-40

Boilermaker

07/01/2005

JOB DESCRIPTION Boilermaker

DISTRICT 1

ENTIRE COUNTIES

Albany, Broome, Chenango, Columbia, Delaware, Essex, Fulton, Greene, Hamilton, Herkimer, Montgomery, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Tioga, Warren, Washington

WAGES

Per hour

07/01/2005	10/01/2005 Additional

Boilermaker	\$ 25.62	\$ 1.00

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 8.71 Plus 36.6% of Gross Wages Paid	\$ 8.71 Plus 36.6% of Gross Wages Paid

OVERTIME PAY

See (B, E, *Q) on OVERTIME PAGE

* DOUBLE TIME AFTER TEN HOURS ON MON.-SAT.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 10, 11, 15) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

(1/2) year terms at the following percentage of Journeyman's wage.

1st	2nd	3rd	4th	5th	6th	7th	8th
65%	65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits per hour worked & paid

Same as Journeyman

1-197

Carpenter - Building

07/01/2005

JOB DESCRIPTION Carpenter - Building

DISTRICT 1

ENTIRE COUNTIES

Albany, Fulton, Montgomery, Rensselaer, Schenectady, Schoharie

WAGES

Per hour

07/01/2005

Carpenter	\$ 23.55
Floor Coverer	23.55
Carpet Layer	23.55
Dry-Wall Applicator	23.55
Lather	23.55
Piledriver	24.05
Diver-Wet Day	55.00
Diver -Dry Day	25.00
Diver Tender	25.00

Welder 23.55

Hazardous site pay, requiring protective gear shall be an additional \$1.50
PER HOUR.

Millwright \$ 24.05

Millwright Welder &
Hazardous Waste Work 25.30*

* For work that belongs to the Millwrights only.

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman Carpenter \$10.235

Journeyman Millwright 10.235

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

Indentured BEFORE 5/31/02

One Half Year terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Indentured AFTER 5/31/02:

1 year terms at the following percentage of Journeyman's wage:

1st	2nd	3rd	4th
50%	60%	70%	80%

Supplemental Benefits per hour worked

Carpenter
1st year term \$ 4.445
2nd year term 7.34
3rd year term 10.235
4th year term 10.235

Millwright
1st year term \$ 4.445
2nd year term 7.34
All others 10.235

1-370

Carpenter - Heavy&Highway

07/01/2005

JOB DESCRIPTION Carpenter - Heavy&Highway

DISTRICT 1

ENTIRE COUNTIES

Albany, Fulton, Montgomery, Rensselaer, Schenectady, Schoharie

WAGES

Per hour	07/01/2005	07/01/2006 Additional
Carpenter	\$ 24.49	\$ 1.45
Millwrights	24.49	1.45
Piledriver	24.49	1.45
Welder & Hazardous Work	25.59	1.45
Diver - Wet Day	55.00	56.25*
Diver - Dry Day	25.49	1.45
Tender	25.49	1.45

* RATE, NOT AN ADDITIONAL AMOUNT

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 10.235	\$ 10.235

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (2, 17) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

Indentured BEFORE 5/31/02

One Half Year terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Indentured AFTER 5/31/02

1 year terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th
50%	60%	70%	80%

Supplemental Benefits per hour worked

1st year terms	\$ 4.445	\$ 4.445
2nd year terms	7.34	7.34
3rd year terms	10.235	10.235
4th year terms	10.235	10.235

1-370H/H

Electrician

07/01/2005

JOB DESCRIPTION Electrician

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Fulton, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

PARTIAL COUNTIES

Greene: All of the city of Catskill and that portion of the county that lies north of Route 23A.

Otsego: Only the Towns of Decatur and Worcester

WAGES

Per hour

	07/01/2005	06/01/2006
Electrician	\$ 27.00	Additional \$ 1.55
Audio/Sound	27.00	1.55
Certified Welder	29.65	1.55

An additional 5% above rate for work over 30' above floor when working on ooth picks, structural steel, temp. platforms, swing scaffolds & boatswain chairs.

An additional 10% above rate on towers & smoke stacks over 100' high.

An additional 20% above rate in shafts over 25' deep & tunnels over 50' lg under const.

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 13.58	\$ 13.58
	+ 3% of	+ 3% of
	Gross Wages	Gross Wages

OVERTIME PAY

See (B, *E, Q) on OVERTIME PAGE

* DOUBLE TIME AFTER 10 HOURS ON SATURDAY

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1000 hour terms at the following percentage of Journeyman's wage.

6mo	1yr
40%	45%

1500 hour terms at the following percentage of Journeyman's wage.

2nd yr	3rd yr	4th yr	5th yr
50%	60%	70%	80%

Supplemental Benefits per hour worked

1st term	\$ 7.30	\$ 7.30
2nd term	7.30	7.30
All others	13.58	13.58
	+ 3% of	+ 3% of
	Gross Wages	Gross Wages

1-236

Electrician Lineman

07/01/2005

JOB DESCRIPTION Electrician Lineman

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES

Per hour:

Includes Teledata Work within Ten feet of High Voltage Transmission Lines

	07/01/2005	04/30/2006
Lineman/Tech./Welder	\$ 36.60	\$ 38.00
Cable splicer	36.60	38.00
Digging Machine Operator	32.94	34.20
Tractor Trailer Driver	31.11	32.30
Truck Driver/Groundman	29.28	30.40
Mechanic 1st Class	29.28	30.40
Flagman	21.96	22.80

Additional 1.00 per hr. for entire crew when a helicopter is used.

Above rates applicable on all overhead Transmission line work & Fiber Optic Cable where other construction trades are or have been involved. This applies to transmission line work only, not other construction.

Lineman/Technician/Welder	\$ 35.37	\$ 36.78
Digging Machine Operator	31.83	33.10
Tractor Trailer Driver	30.06	31.26
Truck Driver/Groundman	28.30	29.42
Mech. 1st Class	28.30	29.42
Flagman	21.22	22.07
Certified Welder Pipe Type Cable	37.14	38.62
Cable Splicer	38.91	40.46

Additional 1.00 per hour for entire crew when a helicopter job.

Above rates apply on Switching Structures, Maintenance projects, Railroad Catenary install/maint, Third rail installation, Bonding of Rails and pipe type cable and installation of Fiber Optic Cable.

Lineman /Techician	\$ 34.08	\$ 35.48
Welder/Cable Splicer	34.08	35.48
Digging Machine Operator	30.67	31.93
Tractor Trailer Driver	28.97	30.16
Truck Driver/Groundman	27.26	28.38

Mechanic 1st Class	27.26	28.38
Flagman	20.45	21.29

Additional 1.00 per.hr.for entire crew when a helicopter is used.

Above rates applicable on all overhead and underground distribution and maintenance work, and all overhead and underground transmission line work and the installation of Fiber Optic Cable where no other construction trades are or have been involved.

Lineman/Technician	\$ 34.08	\$ 35.48
Cable Ssplicer	37.49	39.03
Certified Welder	35.78	37.25
Digging Machine Operato	30.67	31.93
Tractor Trailer Driver	28.97	30.16
Mechanic 1st Class	27.26	28.38
Truck Driver/Groundman	27.26	28.38
Flagman	20.45	21.29

Additional \$ 1.00 per hour for entire crew when a helicopter is used.

Above rates applicable on all electrical sub-stations, switching structures, fiber optic cable and all other work not defined as "Utility outside electrical work"

SUPPLEMENTAL BENEFITS

Per hour worked including holidays listed below:

The following SUPPLEMENTAL benefits apply to all classification categories of CONSTRUCTION, TRANSMISSION and DISTRIBUTION.

\$ 10.50	\$ 11.50
plus	plus
7% of wage	7% of wage

OVERTIME PAY

See (B, E, Q,) on OVERTIME PAGE. Double time for all emergency work designated by the Dept. of Jurisdiction.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1st shift	8:00 AM to 4:30 PM REGULAR RATE
2nd shift	4:30 PM to 1:00 AM REGULAR RATE PLUS 17.3 %
3rd shift	12:30 AM to 9:00 AM REGULAR RATE PLUS 31.4 %

HOLIDAY

Paid	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Gov. Election Day.
Overtime	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Gov. Election Day.

SUPPLEMENTS for holidays paid at straight time

REGISTERED APPRENTICES

(1000) hr terms at the following percentage of Journeyman's wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

Supplemental Benefits per hour worked:

The following SUPPLEMENTAL benefits apply to all classification categories of CONSTRUCTION, TRANSMISSION and DISTRIBUTION.

\$ 10.50	\$ 11.50
plus	plus
7% of wage	7% of wage

6-1249a

Electrician Lineman - Teledata

07/01/2005

JOB DESCRIPTION Electrician Lineman - Teledata

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour:

For work outside building property lines****

**** EXCLUDES Teledata work within ten feet of High Voltage transmission lines. For this work please see LINEMAN.

	07/01/2005	01/02/2006	01/01/2007
Cable Splicer	\$ 23.65	\$ 24.24	\$ 24.85
Installer/Repairman	22.46	23.02	23.60
Teledata Lineman	22.46	23.02	23.60
Technician/Equip oper	22.46	23.02	23.60

Groundman	11.90	12.20	12.51

SUPPLEMENTAL BENEFITS

Per hour worked:

\$ 3.43	3.93	4.43
plus 3%	plus 3%	plus 3%
of wage	of wage	of wage

OVERTIME PAY

See (B, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

Electrician Lineman - Traffic Signal Lighting

07/01/2005

JOB DESCRIPTION Electrician Lineman - Traffic Signal Lighting

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

WAGES

Per hour:

	07/01/2005	04/30/2006
Certified Welder	\$ 32.78	34.26
Lineman/Technician	31.22	32.63
Digging Mach	28.10	29.37
Tractor trailer driver	26.54	27.74
Truck Driver/groundman	24.98	26.10
Mechanic 1st Class	24.98	26.10
Flagman	18.73	19.58

Above rates applicable on ALL Lighting and Traffic Signal Systems with the installation, testing, operation, maintenance and repair of all traffic control and illumination projects, traffic monitoring systems, road weather information systems and the installation of Fiber Optic Cable.

SUPPLEMENTAL BENEFITS

Per hour worked including above listed holidays:

The following APPRENTICE Rates and the following SUPPLEMENTAL BENEFITS apply to all classifications.

\$ 10.50	\$ 11.50
plus	plus
6.5% of wage	6.5% of wage

NOTE: Additional \$1.00 per hr. for entire crew when a helicopter is used.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

NOTE* Double time for all emergency work designated by the Dept. of Jurisdiction.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM	REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM	REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM	REGULAR RATE PLUS 31.4%

HOLIDAY

Paid See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Gov Election Day.
Overtime See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Gov Election Day.

Supplements paid at STRAIGHT TIME rate for holidays.

REGISTERED APPRENTICES

(1000) hour terms at the following percentage of Journey's wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

6-1249a-LT

Electrician Lineman - Tree Trimmer

07/01/2005

JOB DESCRIPTION Electrician Lineman - Tree Trimmer

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES

Putnam: Entire county except Brewster Township.

WAGES

Per hour:

Applies to line clearance, tree work and right-of-way preparation on all new or existing overhead electrical, telephone and CATV lines.

WAGES: (per hour)

07/01/2005

Tree Trimmer

Treeman	\$ 19.73
" Equip. Operator	17.47
" Mechanic	17.47
" Truck Driver	14.84
" Inexperienced Grdsman	12.28
" Flagman	8.88

SUPPLEMENTAL BENEFITS

Per hour worked including above listed holidays:

\$ 4.15
plus 3%
of wage

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 10, 15, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 10, 15, 16) on HOLIDAY PAGE

Supplements paid at STRAIGHT TIME rate for holidays.

6-1249TT

Elevator Constructor

07/01/2005

JOB DESCRIPTION Elevator Constructor

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Montgomery, Oneida, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

PARTIAL COUNTIES

Columbia: Only the Townships of Stuyvesant, Kinderhook, Chatham, Canaan, Stockport, Ghent, Austerlitz, Greenport, Claverack, Hillsdale and New Lebanon.

Greene: Towns of Durham, Greenville, New Baltimore, Cosacki, Ciro, & Athens

WAGES

Per hour	07/01/2005	01/01/2006	01/01/2007
Mechanic	\$ 30.99	\$ 32.99	\$ 34.99
Helper	21.69	23.69	25.69

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 12.115	\$ 12.115	\$ 12.115
+8 %		+8 %	+8 %
of wage		of wage	of wage
Helper	\$ 12.115	\$ 12.115	\$ 12.115
+6 %		+6 %	+6 %
of wage		of wage	of wage

OVERTIME PAY

See (D, O) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 15, 16) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1st 6mo	2nd 6mo	2nd yr	3rd yr	4th yr
50 %	55 %	65 %	70 %	80 %

Supplemental Benefits per hour worked

Apprentices	\$ 12.115	\$ 12.115	\$ 12.115

1-35

Glazier

07/01/2005

JOB DESCRIPTION Glazier

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

WAGES

Per hour	07/01/2005	05/01/2006 Additional	05/01/2007 Additional	05/01/2008 Additional
Glazier	\$ 22.15	\$ 1.10	\$ 1.10	\$ 1.10
High Rate*	24.75	1.10	1.10	1.10

*When working on Swing Stage or Lift 100 feet or more in height, measured from the ground level up.

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 9.11	\$ 9.11	\$9.11	\$9.11
Journeyman				
High Rate	15.66	15.66	15.66	15.66

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

One Half Year (900 hr) terms at the following percentage of Journeyman's wage or High Rate as applicable.

1st	2nd	3rd	4th	5th	6th	7th	8th
35%	45%	55%	65%	75%	85%	90%	95%

Supplemental Benefits per hour worked

Apprentice	\$ 9.11	\$ 9.11	\$ 9.11	\$ 9.11
Apprentice				
High Rate	15.66	15.66	15.66	15.66

1-155

Ironworker

07/01/2005

JOB DESCRIPTION Ironworker

DISTRICT 7

ENTIRE COUNTIES

Franklin, Herkimer, Lewis, Oneida, St. Lawrence

PARTIAL COUNTIES

Chenango: Only the Townships of Columbus, New Berlin, North Norwich, Plymouth, Sherburne and Smyrna.

Fulton: Only the Townships of Caroga, Ephratah, Oppenheim, Strafford.

Hamilton: Only the Townships of Arietta, Indian Lake, Lake Pleasant, Long Lake and Morehouse.

Jefferson: Only the Townships of Antwerp, Champion, Philadelphia and Wilna.

Madison: Only the Townships of Brookfield, Eaton, Hamilton, Lebanon, Madison, Oneida and Stockbridge.

Montgomery: Only the Townships of Canajoharie, Minden, Palatine and St. Johnsville.

Otsego: Only the Townships of Burlington, Cherry Valley, Decatur, Edmeston, Exeter, Hartwick, Middlefield, New Lisbon, Otsego, Pittsfield, Plainfield, Richfield, Roseboom, Springfield and Westford.

WAGES

Per hour 07/01/2005

Structural/Reinforcing	\$ 22.00
Mach. Mover/Ornamental	22.00
Stone Derrickman	22.00
Chain Link Fence	22.00
Sheeter Bucker-Up	22.00
Sheeter Ironworker	22.00
Pre-engineered Buildings	22.00
Window Erector	22.00
Precast Erector	22.00
Welder	22.00

SUPPLEMENTAL BENEFITS

Per hour worked: 07/01/2005

Journeyman \$ 16.09

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour

(Hour) terms at the following percentage of Journeyman's wage.

	to 1500	to 3000	to 4500	to 6000
07/01/2005	\$ 13.80	\$ 16.10	\$ 18.40	\$ 20.70

Supplemental Benefits per hour worked:

	to 1500	to 3000	to 4500	to 6000
07/01/2005	\$ 8.00	\$ 11.93	\$ 12.49	\$ 13.05

7-440

Ironworker

07/01/2005

JOB DESCRIPTION Ironworker

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Columbia, Delaware, Essex, Greene, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

PARTIAL COUNTIES

Fulton: Only the Townships of Broadalbin, Mayfield, Northampton, Bleeker and Johnstown.
Hamilton: Only the Townships of Hope, Benson and Wells.
Montgomery: Only the Townships of Florida, Amsterdam, Charleston, Glen, Mohawk and Root.
Otsego: Only the Townships of Unadilla, Butternut, Morris, Otego, Oneonta, Laurens, Millford, Maryland and Worchester.

WAGES

Per hour 07/01/2005

Ornamental	\$ 23.75
Reinforcing	23.75
Rodman	23.75
Sheeter Bucker-up	23.875
Structural & Precast	23.75
Mover/Rigger	23.75
Fence Erector	23.75
Stone Derrickman	23.75
Sheeter	24.00
Curtain Wall Installer	23.75
Metal Window Installer	23.75

SUPPLEMENTAL BENEFITS

Per hour worked

JOURNEYMAN \$ 16.66

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

One YEAR TERMS AT THE FOLLOWING WAGE RATES:

1st yr	\$ 13.80
2nd yr	16.10
3rd yr	18.40
4th yr	20.70

Supplemental Benefits per hour worked

1st year	\$ 8.00
2nd year	14.46
3rd year	15.38
4th year	16.31

1-12

Laborer - Building

07/01/2005

JOB DESCRIPTION Laborer - Building

DISTRICT 7

ENTIRE COUNTIES

Hamilton, Herkimer, Madison, Oneida

PARTIAL COUNTIES

Fulton: Only the Townships of Stratford, Caroga, Oppenheim and Ephrata.
Montgomery: Only the Townships of Minden, Palantine, Canajoharie, Root and St. Johnsville.

WAGES

GROUP #2: Pipe Layer, Mortar Mixer, Walk behind Mortar Buggy and Power Lift.

GROUP #3: Wagon Drill

GROUP #4: Blaster, Formsetter, Riding Mortar Buggy.

GROUP #5: Hazardous Waste Removal

GROUP #6: Asbestos and Lead Removal.

WAGES per hour: 07/01/2005

Building Laborer:

Group # 1	\$ 18.20
Group # 2	18.35
Group # 3	18.60
Group # 4	18.70

Group # 5 20.20
Group # 6 19.70

SUPPLEMENTAL BENEFITS

Per hour worked:

All groups \$ 8.34

OVERTIME PAY

OVERTIME: See (B,E,E2*,Q) on OVERTIME PAGE.

*When an employee has worked between 16 and 32 hours.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(Hour) terms at the following percentage of Journeyman's wage.

to 1000	to 2000	to 3000	to 4000
60%	70%	80%	90%

Supplements per hour worked:

All terms \$ 8.34

7-35

Laborer - Building

07/01/2005

JOB DESCRIPTION Laborer - Building

DISTRICT 1

ENTIRE COUNTIES

Schenectady, Schoharie

PARTIAL COUNTIES

Fulton: Only the Townships of Bleeker, Mayfield, Northampton, Johnstown, Broadalbin and Perth.

Montgomery: Only the Townships of Mohawk, Glen, Charleston, Amsterdam and Florida.

Saratoga: Only the Townships of Day, Hadley, Edinburg, Corinth, Moreau, South Glens Falls, Providence, Greenfield, Wilton, Galaway, Northumberland, Milton, Saratoga Springs, Charlton, Ballston, Malta and Clifton Park.

WAGES

Per hour

	07/01/2005	10/01/2005

Group #1:

All Classifications
except as noted in

Groups 2 & 3

\$ 19.83	\$ 21.43

Group #2:

Blaster, Wagon Drill Operator,
Formsetter, Well Pointing &
Laser Operator

\$ 20.33	\$ 21.93

Group #3:

Handling of Asbestos
or Toxic Materials

\$ 21.28	\$ 22.88

SUPPLEMENTAL BENEFITS

Supplemental Benefits per hour worked

Journeyman	\$ 10.45	\$ 10.45

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1000 Hour terms at the following percentage of Journeyman's wage.

1st	2nd	3rd	4th
65 %	70 %	80 %	80 %

Supplemental Benefits per hour worked

Apprentices	\$ 10.45	\$ 10.45	1-157

Laborer - Heavy&Highway

07/01/2005

JOB DESCRIPTION Laborer - Heavy&Highway

DISTRICT 7

ENTIRE COUNTIES

Hamilton, Herkimer, Madison, Oneida

PARTIAL COUNTIES

Fulton: Only the Townships of Stratford, Caroga, Oppenheim and Ephrata.
Montgomery: Only the Townships of Minden, Palantine, Canajoharie, Root and St. Johnsville.

WAGES

GROUP # A: Basic, Drill Helper, Flagman, Outboard and Hand Boats.

GROUP # B: Bull Float, Chain Saw, Concrete Aggregate Bin, Concrete Bootmen, Gin Buggy, Hand or Machine Vibrator, Jack Hammer, Mason Tender, Mortar Mixer, Pavement Breaker, Handlers of all SteelMash, Small Generators for Laborers' Tools, Installation of Bridge Drainage Pipe, Pipe Layers, Vibrator Type Rollers, Tamper, Drill Doctor, Tail or Screw Operator on Asphalt Paver, Water Pump Operators (1-1/2" and Single Diaphragm), Nozzle (Asphalt, Gunite, Seeding, and Sand Blasting), Laborers on Chain Link Fence Erection, Rock Splitter and Power Unit, Pusher Type Concrete Saw and all other Gas, Electric, Oil and Air Tool Operators, Wrecking Laborer.

GROUP # C: All Rock or Drilling Machine Operators (Except Quarry Master and Similar Type), Acetylene Torch Operators, Asphalt Raker and Powderman.

GROUP # D: Blasters, Form Setters, Stone or Granite Curb Setters.

Per hour:	07/01/2005	07/01/2006 Additional	07/01/2007 Additional
Heavy/Highway Laborer:			
GROUP # A	\$ 21.20	\$ 1.50	\$ 1.50
GROUP # B	21.40	1.50	1.50
GROUP # C	21.60	1.50	1.50
GROUP # D	21.80	1.50	1.50

An additional \$2.00 to hourly rate when required to use or wear protective equipment on a Federal or State designated hazardous site.
Governmental mandated night work, (single irregular shift): Additional \$1.50/hr.

SUPPLEMENTAL BENEFITS

Per hour worked: \$ 10.99

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

(Hour) terms at the following percentage of Journeyman's wage.

to 1000	to 2000	to 4000
65%	70%	80%

Supplements per hour worked:

All terms	\$ 10.99	7-35/2h

Laborer - Heavy&Highway

07/01/2005

JOB DESCRIPTION Laborer - Heavy&Highway

DISTRICT 1

ENTIRE COUNTIES

Schenectady, Schoharie

PARTIAL COUNTIES

Fulton: Only the Townships of Bleeker, Mayfield, Northampton, Johnstown, Broadalbin and Perth.
Montgomery: Only the Townships of Mohawk, Glen, Charleston, Amsterdam and Florida.

Saratoga: Only the Townships of Day, Hadley, Edinburg, Corinth, Moreau, South Glens Falls, Providence, Greenfield, Wilton, Galaway, Northumberland, Milton, Saratoga Springs, Charlton, Ballston, Malta and Clifton Park

WAGES

GROUP # A:

Basic, Drill Helper, Flagman, Outboard and Hand Boats.

GROUP # B:

Bull Float, Chain Saw, Concrete Aggregate Bin, Concrete Bootmen, Gin Buggy, Hand or Machine Vibrator, Jack Hammer, Mason Tender, Mortar Mixer, Pavement Breaker, Handlers of all Steel Mash, Small Generators for Laborers, Tools Installation of Bridge Drainage Pipe, Pipe Layers, Vibrator Type Rollers, Tamper, Drill Doctor, Tail or Screw Operator on Asphalt Paver, Water Pump Operators (1-1/2" and Single Diaphragm), Nozzle (Asphalt, Gunite, Seeding, and Sand Blasting), Laborers on Chain Link Fence, Rock Splitter and Power Unit, Pusher Type Concrete Saw and all other Gas, Electric, Oil and Air Tool Operators, Wrecking Laborer.

GROUP # C:

All Rock or Drilling Machine Operators (Except Quarry Master and Similar Type), Acetylene Torch Operators, Asphalt Paver/Raker and Powderman.

GROUP # D:

Blasters, Form Setters, Stone or Granite Curb Setters.

WAGES per hour 07/01/2005

Group # A	\$ 21.79
Group # B	21.99
Group # C	22.19
Group # D	22.39

Additional \$2.00 per hr. over base rate for work on a State or Federally designated waste site & where relevant State or Federal regulations require employees to use or wear forms of personal protection. Workers on a single irregular work shift starting anytime from 5:00 pm to 1:00 am due to governmental mandated night work shall be paid an additional \$1.50 per hour. Effective on jobs bid after January 1, 2001.

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman \$ 10.40

OVERTIME PAY

See (Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1000 HOUR TERMS AT THE FOLLOWING PERCENTAGE OF JOURNEYMAN'S WAGE

1ST	2ND	3RD	4TH
65 %	70 %	80 %	80 %

Supplemental Benefits per hour worked

Apprentices \$ 10.40

1-157h/h

Mason - Building

07/01/2005

JOB DESCRIPTION Mason - Building

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

WAGES

Per hour 07/01/2005

Marble, Tile, Slate
& Terrazzo
Setter

\$ 22.70

Finisher 20.00

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman Setter \$ 12.15
Journeyman Finisher 10.25

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

Hour terms at the following percentage of Journeyman's wage

Setter:
1st term 500 hours 60%
2nd term 1000 hours 80%
3rd term 500 hours 90%

Finisher:
1st term 500 hours 70%
2nd term 1000 hours 80%
3rd term 500 hours 90%

Supplemental Benefits per hour worked

Setter:
1st term \$ 6.90
All others 12.15

Finishers:
1st term \$ 6.55
All others 10.25

1-2TS.1

Mason - Building

07/01/2005

JOB DESCRIPTION Mason - Building

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Washington

PARTIAL COUNTIES

Warren: Only the Townships of Bolton, Lake George, Lake Luzerne, Queensbury, Stony Creek, Thurman & Warrensburg.

WAGES

Per hour

	07/01/2005	05/01/2006 Additional	05/01/2007 Additional
Bricklayer	\$ 24.30	\$ 1.50	\$ 1.55
Cement Mason(Bldg)	24.30	1.50	1.55
Plasterer/Fireproofing*	24.30	1.50	1.55
Pointer/Caulker/Cleaner	24.30	1.50	1.55
Stone Mason	24.30	1.50	1.55

*Fireproofing of Structural only.

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman \$ 12.73 \$ 12.73 \$ 12.73

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

750 hour terms at the following percentage of Journey's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
55%	60%	65%	70%	75%	80%	85%	90%

Supplemental Benefits per hour worked

1st term	\$ 7.13	\$ 7.13	\$ 7.13
All others	12.73	12.73	12.73

1-2b.1

Mason - Heavy&Highway

07/01/2005

JOB DESCRIPTION Mason - Heavy&Highway

DISTRICT 1

ENTIRE COUNTIES

Albany, Cayuga, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Jefferson, Lewis, Madison, Montgomery, Oneida, Oswego, Rensselaer, Saratoga, Schenectady, Schoharie, St. Lawrence, Warren, Washington

PARTIAL COUNTIES

Onondaga: All classifications except Cement Masons.

WAGES

Per hour

	07/01/2005	01/01/2006	07/01/2006 Additional	07/01/2007 Additional
Mason & Bricklayer	\$24.21	\$ 25.21	\$ 1.50	\$ 1.50

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman	\$ 11.84	\$ 11.84	\$ 11.84	\$ 11.84

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

750 HR TERMS at the following percent of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
55%	60%	65%	70%	75%	80%	85%	90%

Supplemental Benefits per hour worked

1st term	\$ 6.84	\$ 6.84	\$ 6.84	\$ 6.84
All others	11.84	11.84	11.84	11.84

1-2hh.1

Operating Engineer - Building

07/01/2005

JOB DESCRIPTION Operating Engineer - Building

DISTRICT 1

ENTIRE COUNTIES

Albany, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

PARTIAL COUNTIES

Dutchess: North of a West/East line through Dutchess County starting at the Northern Boundary of the City of Poughkeepsie.
Herkimer: East of a North/South line through the Railroad Station at Little Falls.

WAGES

CLASS A1:

Crane, Hydraulic Cranes, Tower Crane, Locomotive Crane, Piledriver, Cableway, Derricks, Whirlies, Dragline, Boom truck over 5 ton.

CLASS A:

Maintenance Engineer, Self-Contained Crawler Drill, Hydraulic Rock drill, shovel, All Excavators including rubber tire & full swing.

Backhoe(except tractor mtd. rubber tired), Gradalls, Power road grader, all CMI equipment, Front-end rubber tire loader, Tractor-mounted drill (quarry master), Mucking machine, Concrete central mix plant, Concrete pump, Belcrete system, Automated asphalt concrete plant, Tractor road paver, Boom Trucks 5 ton & under.

CLASS B:
Backhoe(rubber tired backhoe/loader combination), Bulldozer, Push cat, Tractor, Traxcavator, Scraper, LeTourneau grader, Form fine Grader, Road Roller, Blacktop Roller, Blacktop Spreader, Power Brooms, Sweepers, Trenching Machine, Barber Greene loader, Side booms, Hydro hammer, Concrete spreader, Concrete finishing machine, One Drum Hoist, Power Hoisting(single drum), hoist-two drum or more, 3 Drum Eng., power hoisting (2 drum & over) 2 & 3 Drum & Swing Engine, Hod Hoist, A-L Frame Winchs, Core & Well Drillers(one drum), Post Hole Digger, CHB Vibro Tamp or Similar Mach. Batch Pin & Plant Oper., Dinky Locom., Skid Steer loader, Track excav. 5/8 cu yd or under.

CLASS C:
Forklift, High Lift, Lull, Oiler, Fireman and Heavy-duty Greaser, Boilers, Steam Generators, Vibrator, Mortar Mixer, Air Compressor, Dust Collector, Welding Machine, Well Point, Mechanical Heater, Generators, Temporary Light Plants, Concrete Pumps, Electric Submersible Pump 4" and over, Murphy type diesel generator, Conveyor, Elevators, Concrete Mixer and Belcrete power pack (Belcrete system), Seeding & Mulching Machines, Pumps.

In the event that equipment listed above is operated by robotic control, the classification covering the operation will be the same as if manually operated.

WAGES per hour	07/01/2005
Class # A1	\$ 30.07
Class # A	29.63
Class # B	28.72
Class # C	26.15

Cranes: over 150 ft add .50 per hr, Cranes: over 200 ft add 1.00 per hr, tower Cranes add .50 per hr over class A1 rate.

Additional \$ 2.50 per hr. for hazardous or toxic waste work.
Additional \$ 2.00 per hr over B rate for Nuclear Leader work.
Additional \$.40 per hr for tunnel or excavation of shaft 40' or more deep.

SUPPLEMENTAL BENEFITS

Per hour paid

Journeyman \$ 14.00

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1000 hours terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th
60% of	65% of	70% of	75% of
Class C	Class B	Class A	Class A1

Supplemental Benefits per hour paid

All classes \$ 14.00

1-106b

Operating Engineer - Building - Survey

07/01/2005

JOB DESCRIPTION Operating Engineer - Building - Survey

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Chautauqua, Chemung, Chenango, Clinton, Columbia, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Livingston, Monroe, Montgomery, Niagara, Ontario, Orleans, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Steuben, Tioga, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES

Dutchess: Northern part of Dutchess county (to the Northern Boundary Line of the City of Poughkeepsie), east of a North/South line through the railroad station at Little Falls.

WAGES

SURVEY CLASSIFICATIONS: Party Chief- One who directs a survey party. Instrumentman- One who runs the instrument and assists the Party Chief. Rodman-One who holds the rods and in general, assists the survey party.

Survey Rates-Building:

Party Chief

Instrument/Rodperson

07/01/2005

\$ 28.00

25.50

Additional \$3.00 per hour for work in a tunnel.

Additional \$2.50 per hour for work in hazardous waste area.

SUPPLEMENTAL BENEFITS

Per hour worked:

Journeyman

\$ 13.60

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid:

See (5, 6) on HOLIDAY PAGE

Overtime:

See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1000) hour terms at the following wage rates.

	1st	2nd	3rd
07/01/2005	\$ 15.30	\$ 17.85	\$ 20.40

Supplemental Benefits per hour worked:

Apprentices

\$ 13.60

6-545 DBS

Operating Engineer - Heavy&Highway

07/01/2005

JOB DESCRIPTION Operating Engineer - Heavy&Highway

DISTRICT 4

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per Hour:

DIPPER, CLAMSHELL DREDGES

07/01/2005

10/01/2005

CLASS A

Operator

\$ 28.97

\$ 29.62

CLASS B

Operator II

\$ 23.94

\$ 24.59

Engineer

25.37

26.02

Boat Master

24.14

24.79

CLASS C

Maintenance Engineer

\$ 24.49

\$ 25.15

Mate

22.89

23.54

Drag Barge Operator

22.89

23.54

Welder

24.12

24.77

Boat Captain

23.05

23.70

Chief of Party

22.89

23.54

CLASS D

Oiler

\$ 19.29

\$ 20.34

Scowman

18.78

19.43

Rodman

18.78

19.43

Deckhand

18.83

19.48

HYDRAULIC DREDGES	07/01/2005	10/01/2005
CLASS A		
Leverman	\$ 28.97	\$ 29.62
CLASS B		
Leverman II	\$ 23.94	\$ 24.59
Engineer	24.82	25.47
Derrick Operator	25.07	25.72
Chief Mate	24.72	25.37
Chief Welder	25.38	26.03
Electrician	24.33	24.98
Fill Placer	24.72	25.37
Boat Master	24.13	24.78
CLASS C		
Maintenance Engineer	\$ 24.49	\$ 25.14
Mate	22.89	23.54
Drag Barge Operator	22.89	23.54
Welder (Dredge)	24.11	24.76
Spider Barge Operator	23.91	24.56
Boat Captain	23.05	23.70
Chief of Party	22.89	23.54
CLASS D		
Oiler	\$ 19.29	\$ 19.94
Shoreman	18.80	19.45
Rodman	18.80	19.45
Deckhand	19.23	19.88

SUPPLEMENTAL BENEFITS

Per Hour:

THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

	07/01/2005	10/01/2005
All Classes A & B	\$ 7.55 plus	\$ 7.90 plus
(overtime hours add)	7% of Wage	7% of Wage
	\$ 1.25	\$ 1.25
All Class C	\$ 6.95 plus	\$ 7.30 plus
(overtime hours add)	7% of Wage	7% of Wage
	\$ 0.95	\$ 0.95
All Class D	\$ 6.35 plus	\$ 6.70 plus
(overtime hours add)	7% of Wage	7% of Wage
	\$ 0.65	\$ 0.65

OVERTIME PAY

See (B, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarConst

Operating Engineer - Heavy&Highway

07/01/2005

JOB DESCRIPTION Operating Engineer - Heavy&Highway

DISTRICT 1

ENTIRE COUNTIES

Albany, Broome, Chenango, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Tioga, Warren, Washington

PARTIAL COUNTIES

Dutchess: North of a West/East line through Dutchess County starting at the Northern Boundary of the City of Poughkeepsie.
Herkimer: East of a North/South line through the Railroad Station at Little Falls.

Wages per hour

1000 hours terms at the following percentage of Journeyman's wage Class B

1st	2nd	3rd	4th
60%	70%	80%	90%

Supplemental Benefits per hour paid

All Terms	\$ 11.55	\$ 12.00	\$ 12.45	1-106h

Operating Engineer - Heavy&Highway - Survey Crew

07/01/2005

JOB DESCRIPTION Operating Engineer - Heavy&Highway - Survey Crew

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES

Dutchess: the northern portion of the county from the northern boundary line of the City of Poughkeepsie north to the Dutchess County line.

WAGES

Per hour:

SURVEY CLASSIFICATIONS: Party Chief- One who directs a survey party. Instrumentman- One who runs the instrument and assists the Party Chief. Rodman- One who holds the rods and in general, assists the survey party.

07/01/2005

Survey Rates:

Party Chief	\$ 28.00
Instrument/Rodperson	25.50

Additional 3.00 per hr. for work in a Tunnel.

Additional 2.50 per hr. for EPA or DEC certified toxic or hazardous waste work

SUPPLEMENTAL BENEFITS

Journeyman	\$ 13.60

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid:	See (5, 6) on HOLIDAY PAGE
Overtime:	See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1 yr. or 1000 hrs.) terms at the following wage rates.

	1st	2nd	3rd
6/01/2005	15.30	17.85	20.40

Supplemental Benefits:

Apprentices	\$ 13.60

6-545 D.H.H.

Operating Engineer - Survey Crew - Consulting Engineer

07/01/2005

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES

Dutchess: From the Northern boundary line of the City of Poughkeepsie North.

WAGES

Per hour:

Feasibility and preliminary design surveying, line and grade surveying for inspection or supervision of construction when performed under a consulting

ENGINEER AGREEMENT SURVEY CLASSIFICATIONS: Party Chief- One who directs a survey party. Instrumentman- One who runs the instrument and assists the Party Chief. Rodman- One who holds the rods and in general, assists the survey party.

07/01/2005

Survey Rates:

Party Chief \$28.00

Instrument/Rodperson 25.50

Additional 3.00 per hr. for work in a Tunnel.

Additional 2.50 per hr. for EPA or DEC certified toxic or hazardous waste work

SUPPLEMENTAL BENEFITS

Per hour worked:

\$ 13.60

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

6-545 DCE

Painter

07/01/2005

JOB DESCRIPTION Painter

DISTRICT 1

ENTIRE COUNTIES

Albany, Fulton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie

WAGES

Per hour

07/01/2005

05/01/2006

Brush,Roller,Spray	\$ 21.94	\$ 22.34
Dry Wall Taper	21.94	22.34
Paper Hanger	21.94	22.34
Epoxy, Scaffold	21.94	22.34
Sandblasting	21.94	22.34
Lead Abatement	22.94	23.34
Structural Steel*	22.94	23.34

*Also includes tanks over 100,000 gallons or over 20 feet high or under 55 feet wall height, towers, smoke stacks, flag poles.

Bridge Painter:

See Bridge Painter rates for the following work.

All Elevated Tanks and Shell Tanks over 55 feet wall height will be performed at the Bridge rate.

For Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman \$ 5.60 \$ 6.10

OVERTIME PAY

See (B, H) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

900 hour terms at the following percentage of Journeyman's base wage

1st	2nd	3rd	4th	5th	6th
45%	50%	60%	70%	80%	90%

Supplemental Benefits per hour worked

All Terms	\$ 5.60	\$ 6.10

1-466-Z1

Painter - Building / Heavy&Highway

07/01/2005

JOB DESCRIPTION Painter - Building / Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

7/01/05

Metal Polisher	\$ 21.98

All workers shall be paid a premium in an amount equal to twenty (20%) percent of their basic straight time rate of pay for all time worked on hanging scaffolds and on standing scaffolds while working more than 28 feet off the ground, such premium to be paid on top of their straight time or overtime, whichever is applicable.

SUPPLEMENTAL BENEFITS

(% of Total Wages)	
Journeyman & Apprentice -	55% of Wages

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid:	See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

55% of Basic Polisher Rate (*)

9-8A/28A-MP

Painter - Heavy&Highway

07/01/2005

JOB DESCRIPTION Painter - Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Ulster, Warren, Washington, Westchester

WAGES

07/01/2005

STEEL:	
" **Bridge	\$ 42.00
" Spray	48.00
" Sandblasting	48.00
" Power Tool	48.00

**For Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SUPPLEMENTAL BENEFITS

(per hour)	\$ 24.77

OVERTIME PAY

See (*A, **F, ***R) on OVERTIME PAGE

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (*4, **6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following percentage of Journeyman's wage.

1st	2nd	3rd
40%	60%	80%

Supplemental Benefits:

1st term	19.77
2nd term	24.77
3rd term	24.77

9-DC-9/806-BrSS

Painter - Heavy&Highway

07/01/2005

JOB DESCRIPTION Painter - Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES

Painter (Striping-Highway): 07/01/05

Striping-Machine Operator	\$23.64
Linerman Thermoplastic	28.49

SUPPLEMENTAL BENEFITS

(per hour paid)

Journeyman..	7.14 +
	7% of wage

OVERTIME PAY

See (B, E, P, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 8, 11, 12, 15, 16, 17, 20) on HOLIDAY PAGE

Overtime: See (5, 8, 11, 12, 15, 16, 17, 20, 21, 22) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following wage.

1st term	\$ 14.24
2nd term	17.09
3th term	19.94
4th term	21.36

9-8a/28a (230)-HWSt

Plumber

07/01/2005

JOB DESCRIPTION Plumber

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Fulton, Greene, Montgomery, Rensselaer, Schenectady, Schoharie

PARTIAL COUNTIES

Hamilton: Only the Townships of Arietta, Benson, Hope, Indian Lake, Lake Pleasant, Morehouse and Wells.
Saratoga: Only the Townships of Charlton, Clifton Park, Galway, Halfmoon, Milton, Stillwater and Waterford.

WAGES

Per hour 07/01/2005

Plumber, Pipefitter,	\$ 28.17
Steamfitter	\$ 28.17

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman	\$ 13.38

OVERTIME PAY

Overtime Pay See (B,E*,Q,) on OVERTIME PAGE.

*Double time after 8 hrs. on Saturday.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

One year terms at the following percentage of Journeyman's wage.

1st	2nd	3rd	4th	5th
40 %	50 %	60 %	70 %	85 %

Supplemental Benefits per hour worked

Apprentices \$ 13.38

1-7-SF

Roofer**07/01/2005****JOB DESCRIPTION** Roofer**DISTRICT 1****ENTIRE COUNTIES**

Albany, Clinton, Columbia, Essex, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Warren, Washington

WAGES

Per hour

07/01/2005

Roofer/Waterproofers \$ 20.65

Pitch & Asbestos 21.65

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman \$ 9.17

OVERTIME PAY

See (B, E*Note, Q) on OVERTIME PAGE.

* Saturday may be used as a make up day at straight time if employee misses 8 hrs or more during that week due to inclement weather.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

(1/2) year terms at the following wage rates.

1st yr 1st half	\$ 9.29
1st yr 2nd half	9.29
2nd yr 1st half	10.33
2nd yr 2nd half	11.77
3rd yr 1st half	13.22
3rd yr 2nd half	14.87
4th yr 1st half	16.52
4th yr 2nd half	17.97

Supplemental Benefits per hour worked

1st yr 1st half	\$ 5.42
1st yr 2nd half	5.42
2nd yr 1st half	7.75
2nd yr 2nd half	7.94
3rd yr 1st half	8.14
3rd yr 2nd half	8.37
4th yr 1st half	8.60
4th yr 2nd half	8.80

Sheetmetal Worker**07/01/2005****JOB DESCRIPTION** Sheetmetal Worker**DISTRICT 1****ENTIRE COUNTIES**

Albany, Clinton, Columbia, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington

WAGES

Per hour

07/01/2005

06/01/2006
Additional

Sheetmetal Worker

\$ 24.45

\$ 2.35

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman

14.97

14.97

OVERTIME PAY

See (B,E*,Q,) on OVERTIME PAGE

* Double time after 8 hours on Saturdays.

HOLIDAY

Paid:

See (1) on HOLIDAY PAGE

Overtime:

See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

1st term	\$ 10.89	\$ 10.89
2nd term	11.67	11.67
3rd term	12.45	12.45
4th term	12.97	12.97
5th term	13.45	13.45
6th term	14.67	14.67
7th term	15.89	15.89
8th term	17.12	17.12
9th term	18.34	18.34
10th term	19.56	19.56

Supplemental Benefits per hour worked

1st term	\$ 10.01	\$ 10.01
2nd term	10.19	10.19
3rd term	10.37	10.37
4th term	10.49	10.49
5th term	12.29	12.29
6th term	12.60	12.60
7th term	12.89	12.89
8th term	13.19	13.19
9th term	13.49	13.49
10th term	13.78	13.78

1-83

Sprinkler Fitter**07/01/2005****JOB DESCRIPTION** Sprinkler Fitter**DISTRICT 1****ENTIRE COUNTIES**

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

WAGES

Per hour

07/01/2005

Sprinkler Fitter

\$ 25.15

00820 -- 40

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman \$ 12.70

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour

One Half Year terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
45%	50%	55%	60%	65%	70%	75%	80%	85%	90%

Supplemental Benefits per hour worked

1st & 2nd terms	\$ 5.61
3rd & 4th terms	8.95
All others	12.70

1-669

Teamster - Building

07/01/2005

JOB DESCRIPTION Teamster - Building

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Fulton, Greene, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Washington

PARTIAL COUNTIES

Warren: Only the Townships of Bolton, Warrensburg, Thurman, Stony Creek, Lake George, Lake Luzerne and Queensbury.

WAGES

GROUP # A:

Straight trucks, winch, transit mix on the site, road oilers,
dump trucks, pick-ups, panel, water trucks, fuel trucks on the site
(including nozzle).

GROUP # B:

Low boy or Low boy trailer, Euclids or similar equipment.

WAGES per hour	07/01/2005	10/01/2005
Group # A	\$ 20.72	\$ 21.72
Group # B	\$ 21.02	\$ 22.02

SUPPLEMENTAL BENEFITS

Per hour worked

Journeyman	\$ 8.32	\$ 8.89

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

1-294

Teamster - Heavy&Highway

07/01/2005

JOB DESCRIPTION Teamster - Heavy&Highway

DISTRICT 1

ENTIRE COUNTIES

Albany, Columbia, Fulton, Greene, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Washington

PARTIAL COUNTIES

Warren: Only the Townships of Bolton, Warrensburg, Thurman, Stony Creek, Lake George, Lake Luzerne and Queensbury.

WAGES

GROUP #1:

Warehousemen, Yardmen, Truck Helpers, Pickups, Panel Trucks, Flatboy Material Trucks(straight jobs), Single Axel Dump Trucks, Dumpsters, Material Checkers and Receivers, Greasers, Truck Tiremen, Mechanics Helpers and Parts Chasers.

GROUP #2:

Tandems and Batch Trucks, Mechanics, Dispatcher.

GROUP #3:

Semi-Trailers, Low-boy Trucks, Asphalt Distributor Trucks, and Agitator, Mixer Trucks and dumpcrete type vehicles, Truck Mechanic, Fuel Trucks.

GROUP #4:

Specialized Earth Moving Equipment, Euclid type, or similar off-highway,where not self-loading, Straddle (Ross) Carrier, and self-contained concrete mobile truck.

GROUP #5:

Off-highway Tandem Back-Dump, Twin Engine Equipment and Double-Hitched Equipment where not self-loading.

WAGES per hour	07/01/2005	07/01/2006	07/01/2007
Group #1	\$ 22.17	\$ 22.92	\$ 23.67
Group #2	22.22	22.97	23.72
Group #3	22.27	23.02	23.77
Group #4	22.42	23.17	23.92
Group #5	22.57	23.32	24.07

Hazardous waste projects that require a Level C or greater protection shall be paid an additional \$ 1.50 per hour. All employees who work a single irregular work shift starting between 5pm and 1 am on governmental mandated night shifts shall be paid an additional 1.50 per hour. For work bid on or after April 1, 1995, there shall be a 12 month carryover of the negotiated rate in effect at the time of the bid.

SUPPLEMENTAL BENEFITS

Per hour paid:

\$ 10.75	\$ 11.50	\$ 12.25

OVERTIME PAY

See (Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

1-294h/h

Welder

07/01/2005

JOB DESCRIPTION Welder

DISTRICT 1

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour

Welder (To be paid the same rate of the mechanic performing the work)

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

- (A) Time and one half of the hourly rate after 7 hours per day
- (AA) Time and one half of the hourly rate after 7 and one half hours per day
- (B) Time and one half of the hourly rate after 8 hours per day
- (B1) Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday.
Double the hourly rate for all additional hours
- (C) Double the hourly rate after 7 hours per day
- (C1) Double the hourly rate after 7 and one half hours per day
- (D) Double the hourly rate after 8 hours per day
- (D1) Double the hourly rate after 9 hours per day
- (E) Time and one half of the hourly rate on Saturday
- (E1) Time and one half 1st 4 hours on Saturday Double the hourly rate all additional Saturday hours
- (E2) Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (E3) Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
- (E4) Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (F) Time and one half of the hourly rate on Saturday and Sunday
- (G) Time and one half of the hourly rate on Saturday and Holidays
- (H) Time and one half of the hourly rate on Saturday, Sunday, and Holidays
- (I) Time and one half of the hourly rate on Sunday
- (J) Time and one half of the hourly rate on Sunday and Holidays
- (K) Time and one half of the hourly rate on Holidays
- (L) Double the hourly rate on Saturday
- (M) Double the hourly rate on Saturday and Sunday
- (N) Double the hourly rate on Saturday and Holidays
- (O) Double the hourly rate on Saturday, Sunday, and Holidays
- (P) Double the hourly rate on Sunday
- (Q) Double the hourly rate on Sunday and Holidays
- (R) Double the hourly rate on Holidays
- (S) Two and one half times the hourly rate for Holidays, if worked
- (S1) Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
- (T) Triple the hourly rate for Holidays, if worked
- (U) Four times the hourly rate for Holidays, if worked

(V) Including benefits at SAME PREMIUM as shown for overtime

(W) Time and one half for benefits on all overtime hours.

NOTE: BENEFITS are PER HOUR WORKED, for each hour worked, unless otherwise noted

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

- (1) None
- (2) Labor Day
- (3) Memorial Day and Labor Day
- (4) Memorial Day and July 4th
- (5) Memorial Day, July 4th, and Labor Day
- (6) New Year's, Thanksgiving, and Christmas
- (7) Lincoln's Birthday, Washington's Birthday, and Veterans Day
- (8) Good Friday
- (9) Lincoln's Birthday
- (10) Washington's Birthday
- (11) Columbus Day
- (12) Election Day
- (13) Presidential Election Day
- (14) 1/2 Day on Presidential Election Day
- (15) Veterans Day
- (16) Day after Thanksgiving
- (17) July 4th
- (18) 1/2 Day before Christmas
- (19) 1/2 Day before New Years
- (20) Thanksgiving
- (21) New Year's Day
- (22) Christmas
- (23) Day before Christmas
- (24) Day before New Year's
- (25) Presidents' Day
- (26) Martin Luther King, Jr. Day

To all State Departments, Agency Heads and Public Benefit Corporations

IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

Chapter 511 of the Laws of 1995, as amended by Chapter 376 of the Laws of 2003, establishes the Public Work Enforcement Fund (PWEF) which is utilized by the Department of Labor (DOL) for the purposes of Labor Law enforcement.

This fund is supported by transfers and deposits based on assessments of public work contracts entered into by state agencies and public benefit corporations for construction, reconstruction, renovation, repair, maintenance or other improvement, as defined in Subdivision 2 of Section 220-6f of the Labor Law. The amount required to be provided to this fund, as stipulated in Chapter 376 of the Laws of 2003, is .07 of one-percent of the total cost of such contract.

The monthly assessment charge will be calculated for public work construction and reconstruction contracts which are approved by OSC and entered into their system. Based on this information, the NYSDOL will bill the state agencies and public benefit corporation on a monthly basis. If there are any increases to the original amount of the contract, state agencies and public benefit corporations are required to notify DOL and remit payment or a journal voucher for the additional PWEF assessment charge.

Payment by check or journal voucher is due to DOL within thirty (30) days from the date of the billing. DOL will verify the amounts and forward payment to the Office of the State Comptroller for processing to the fund.

For those contracts which are not approved or administered by the Office of the State Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the NYSDOL - Administrative Finance Bureau within thirty (30) days of the end of each month. Monthly reports should contain the following information:

- Name and billing address of State Agency or Public Benefit Corporation
- State Agency or Public Benefit Corporation contact and phone number
- Name and address of contractor receiving the award
- Contract number, amount and effective dates
- Brief description of the work to be performed

Checks should be made payable to the New York State Department of Labor.. Checks and Journal Vouchers should be sent to:

NYS Department of Labor
Administrative Finance Bureau - PWEF Unit
State Office Building Campus
Bldg. 12 - Rm. 464
Albany, NY 12240

Any questions regarding billing should be directed to DOL's Administrative Finance Bureau - PWEF Unit at (518) 457-3624 and any questions regarding Public Work contracts should be directed to the Bureau of Public Work at (518) 457-5589.

DEPARTMENT OF LABOR - BUREAU OF PUBLIC WORK

Under Article 8 of the NYS Labor Law, when two final determinations have been rendered against a contractor, sub-contractor and/or its successor within any consecutive six-year period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements, or when one final determination involves falsification of payroll records or the kickback of wages and/or supplements, said contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work contract/sub-contract with the state, any municipal corporation or public body for a period of five years from the date of debarment. NOTE: Where the Fiscal Officer is denoted "NYC", the information has been provided by the New York City Comptroller's Office, the agency issuing the determination.

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
385 Services LLC	2657 State Highway 28	Portlandville	NY	13834

FEIN:	Barred Until	Fiscal Officer Notes:
16-1466399	01/08/2009	DOL Multiple willful violations

Company Name	Address	City	State	Zip Code
A & R Paterno Construction Inc	287 Rockaway Turnpike	Lawrence	NY	11559

FEIN:	Barred Until	Fiscal Officer Notes:
	10/30/2005	NYC Falsified payrolls

Company Name	Address	City	State	Zip Code
A & T General Construction Inc	3 Alan Shephard Place	Yonkers	NY	10705

FEIN:	Barred Until	Fiscal Officer Notes:
13-3927478	01/31/2006	DOL Falsified payrolls

Company Name	Address	City	State	Zip Code
A A General Contractors Inc	1765 Mt Read Boulevard	Rochester	NY	14606

FEIN:	Barred Until	Fiscal Officer Notes:
16-1319254	10/18/2009	DOL And W.J. Grinder Roofing as a substantially affiliated employer and Dominic Antonucci as an individual. Multiple willful violations

Company Name	Address	City	State	Zip Code
A Castricone Concrete Inc	P O Box 203	Athol Springs	NY	14010

FEIN:	Barred Until	Fiscal Officer Notes:
16-1582253	03/03/2008	DOL and Crazy Horse Tonawanda Inc

Company Name	Address	City	State	Zip Code
A G Plumbing Inc	54 Knickerbocker Avenue	Brooklyn	NY	11237

FEIN:	Barred Until	Fiscal Officer Notes:
13-3276217	07/22/2006	NYC Multiple willful violations

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
A R DiGima	1331 Belle Avenue	Utica	NY	13501

FEIN:	Barred Until	Fiscal Officer Notes:
16-0996110		Successor to LBS of Frankfort Inc and/or Clean Air Asbestos Removal Inc

Company Name	Address	City	State	Zip Code
Aegean General Contracting Inc	57-16 157th Street	Flushing	NY	11355

FEIN:	Barred Until	Fiscal Officer Notes:
11-3451267	03/11/2008	Settlement agreement with A.G.'s Office - falsified payrolls - Also Aegean Marble Co., Aegean Marble Contracting Co., and George Begakis individually

Company Name	Address	City	State	Zip Code
Aegean Marble Co.				

FEIN:	Barred Until	Fiscal Officer Notes:
11-3451267	03/11/2008	See Aegean General Contracting Inc

Company Name	Address	City	State	Zip Code
Aegean Marble Contracting Co.				

FEIN:	Barred Until	Fiscal Officer Notes:
11-3451267	03/11/2008	See Aegean General Contracting Inc

Company Name	Address	City	State	Zip Code
Albany Pipe Insulators Inc	P O Box 332 - Foundry Rd	Voorheesville	NY	12186

FEIN:	Barred Until	Fiscal Officer Notes:
14-1617890	02/18/2008	DOL

Company Name	Address	City	State	Zip Code
American General Construction Corp	54 Knickerbocker Avenue	Brooklyn	NY	11237

FEIN:	Barred Until	Fiscal Officer Notes:
13-3276217	07/22/2006	NYC Multiple willful violations

Company Name	Address	City	State	Zip Code
American Weathertite Inc	P O Box 208	Clifton	NJ	07110

FEIN:	Barred Until	Fiscal Officer Notes:
65-0465918	03/28/2010	DOL

Company Name	Address	City	State	Zip Code
ANS Welding Corp	111 Dale Street	West Babylon	NY	11704

FEIN:	Barred Until	Fiscal Officer Notes:
11-1867262	06/09/2009	DOL Debarment period extended after additional willful violations

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
AP Painting & Improvement Inc	575 Hempstead Turnpike	West Hempstead	NY	11552
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2683637	04/09/2007	DOL Falsified payrolls		

Company Name	Address	City	State	Zip Code
APC Painting				
FEIN:	Barred Until	Fiscal Officer Notes:		
	05/13/2007	See Apollo Construction Services Corp		

Company Name	Address	City	State	Zip Code
Apollo Construction Services Corp	157 Tibbets Road	Yonkers	NY	10705
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3983219	05/13/2007	DOL dba Apollo Painting Corp. - multiple willful violations		

Company Name	Address	City	State	Zip Code
Apolo Painting Company				
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3863295	05/13/2007	aka APC Painting - see Apollo Construction Services Corp		

Company Name	Address	City	State	Zip Code
Apolo Painting Corp				
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3863295	05/13/2007	See Apollo Construction Services Corp		

Company Name	Address	City	State	Zip Code
Asbestos Systems Inc	1771 Foote Avenue	Jamestown	NY	14701
FEIN:	Barred Until	Fiscal Officer Notes:		
25-1742587	05/20/2007	DOL Gregory McCoy T/A GM Enterprises dba Asbestos Systems Inc		

Company Name	Address	City	State	Zip Code
Azam Ali Chaudhry				
FEIN:	Barred Until	Fiscal Officer Notes:		
	12/10/2007	See Republic Reconstruction & Management Inc		

Company Name	Address	City	State	Zip Code
B & Z Development Inc	19 West Street	Spring Valley	NY	10977
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3713559	02/22/2010	DOL dba Ben-Zvy Enterprises Inc and Erez Ben-Zvy as an individual.		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Bat-Jac Construction Inc	62 Neulist Avenue	Port Washington	NY	11050
FEIN: 11-3391498	Barred Until 07/17/2009	Fiscal Officer Notes: DOL aka Bat-Jac Contracting Inc. a/k/a Bat-Jac Inc. and Kenneth Merz, president and one of its five largest shareholders and Steve Menzer, vice president and one of its five largest shareholders, as individuals. Falsified payrolls.		

Company Name	Address	City	State	Zip Code
Bat-Jac Contracting Inc				
FEIN: 11-3133524	Barred Until 07/17/2009	Fiscal Officer Notes: See Bat-Jac Construction Inc		

Company Name	Address	City	State	Zip Code
Bat-Jac Inc				
FEIN:	Barred Until 07/17/2009	Fiscal Officer Notes: See Bat-Jac Construction aka Bat-Jac Contracting		

Company Name	Address	City	State	Zip Code
Ben-Zvy Enterprises Inc	19 West Street	Spring Valley	NY	10977
FEIN: 13-3713559	Barred Until 02/22/2010	Fiscal Officer Notes: See B & Z Development Inc.		

Company Name	Address	City	State	Zip Code
Betty Holl Inc				
FEIN: 16-1089599	Barred Until	Fiscal Officer Notes: see B H Refrigeration as its successor		

Company Name	Address	City	State	Zip Code
Betty Jones' Services	P O Box 58	Utica	NY	13503
FEIN: 16-1247154	Barred Until 12/31/2006	Fiscal Officer Notes: DOL dba D&B J's Services and Betty Jones as President and Individually		

Company Name	Address	City	State	Zip Code
Betty Jones (as President and Individually				
FEIN:	Barred Until 12/31/2006	Fiscal Officer Notes: See Betty Jones' Services		

Company Name	Address	City	State	Zip Code
BH Mechanical Services				
FEIN: 16-1089599	Barred Until	Fiscal Officer Notes: Aka B H Refrigeration Inc		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Boguslaw Bozek				

FEIN: **Barred Until** **Fiscal Officer Notes:**
 05/14/2008 As an individual - see Goldhand Construction LLC

Company Name	Address	City	State	Zip Code
C B E Contracting Corp	310 McGuiness Blvd	Greenpoint	NY	11222

FEIN: **Barred Until** **Fiscal Officer Notes:**
 10/21/2007 DOL And Muhammad A Beig as an individual. Falsified payrolls

Company Name	Address	City	State	Zip Code
Calvin S Robinson Electrical Inc	2117 Egret Drive	Clearwater	FL	33764

FEIN: **Barred Until** **Fiscal Officer Notes:**
 14-1657781 04/12/2007 DOL Falsified payrolls

Company Name	Address	City	State	Zip Code
Carl Babb				

FEIN: **Barred Until** **Fiscal Officer Notes:**
 07/21/2008 As an individual - See Olympic Window Installers Inc

Company Name	Address	City	State	Zip Code
Causeway Construction Corp	110-30 15th Avenue	College Point	NY	11356

FEIN: **Barred Until** **Fiscal Officer Notes:**
 13-3065561 09/27/2007 NYC Multiple willful violations

Company Name	Address	City	State	Zip Code
Cavalier Constr Corp c/o Clayman & Rosenbe	305 Madison Avenue	New York	NY	10165

FEIN: **Barred Until** **Fiscal Officer Notes:**
 02/19/2008 NYC Falsified records - plea agreement. Also Kingston Trucking & Rigging Corp., Manbru Construction Corp., Port Ewen Trucking Corp. and Super Structure Builders, Inc. as substantially owned-affiliated entities and/or successors of Cavalier.

Company Name	Address	City	State	Zip Code
Centurian Management of New York Inc	P O Box 961	Port Jefferson Sta	NY	11776

FEIN: **Barred Until** **Fiscal Officer Notes:**
 11-3230587 05/03/2006 DOL Aka Centurian Protection of New York State-falsified records - debarment period extended

Company Name	Address	City	State	Zip Code
Centurian Protection of New York				

FEIN: **Barred Until** **Fiscal Officer Notes:**
 11-3230587 See Centurian Management of New York State Inc - debarred until 05/03/2006

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Charles J Pardee	261 Ball Road	Hastings	NY	13076
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/16/2009	DOL As an individual. See Dalton Steel Inc.		
Company Name	Address	City	State	Zip Code
Charles Saliba				
FEIN:	Barred Until	Fiscal Officer Notes:		
	07/26/2005	See Monarch Construction Corporation (owner)		
Company Name	Address	City	State	Zip Code
Classic Electric Inc	29-01 21st Avenue	Astoria	NY	11105
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2811549	11/27/2005	NYC Multiple violations		
Company Name	Address	City	State	Zip Code
Columbus General Construction Inc	914 Newkirk Avenue	Brooklyn	NY	11230
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3357344	12/16/2009	AG And Mohammed A Rashid as an individual. Falsified business records. Plea agreement.		
Company Name	Address	City	State	Zip Code
Commercial Building Maintenance Corp	40 Oak Drive	Syosset	NY	11791
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2945732	01/23/2008	Plea agreement with D.A.'s Office - willful violation and falsification of payroll records		
Company Name	Address	City	State	Zip Code
Commercial Painting Co	4872 West Seneca Turnpike	Syracuse	NY	13215
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1513909	05/01/2008	DOL James Stanton dba Commercial Painting Co - falsified payroll records		
Company Name	Address	City	State	Zip Code
Commercial Steel Inc	65 Corporate Park Drive	Central Square	NY	13036
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1557064	03/16/2009	DOL As a successor and/or substantially-owned affiliated entity with Dalton Steel Inc dba Pardee Construction - multiple willful violations		
Company Name	Address	City	State	Zip Code
Commtech Communications Inc	649 Warwick Road	North Tonawanda	NY	14120
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1335983	11/22/2007	DOL See also Commtech Electrical Construction Corp and Michael R Palmer - multiple violations		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Commtech Electrical Construction	649 Warwick Road	North Tonawanda	NY	14120
FEIN: 16-1407836	Barred Until 11/22/2007	Fiscal Officer Notes: DOL See also Commtech Communications and Michael R Palmer- multiple violations		

Company Name	Address	City	State	Zip Code
Converse Construction Corp	1597 Route 112	Port Jefferson Sta	NY	11776
FEIN: 11-3262576	Barred Until 03/21/2007	Fiscal Officer Notes: DOL Falsified payrolls		

Company Name	Address	City	State	Zip Code
Crazy Horse Tonawanda Inc	P O Box 203	Athol Springs	NY	14010
FEIN: 16-1528124	Barred Until 03/03/2008	Fiscal Officer Notes: DOL and A Castricone Concrete Inc		

Company Name	Address	City	State	Zip Code
D & D Mason Contractors Inc	P O Box 140625	Jamaica	NY	11414
FEIN: 11-3219453	Barred Until 04/07/2010	Fiscal Officer Notes: NYC And Thomas DeMartino as an individual. Falsified payrolls - plea agreement. Debarment period extended after additional willful violation		

Company Name	Address	City	State	Zip Code
D&B J's Services				
FEIN: 16-1247154	Barred Until 12/31/2006	Fiscal Officer Notes: See Betty Jones' Services Inc		

Company Name	Address	City	State	Zip Code
Dalton Steel Inc	197 U S Route 11	Central Square	NY	13036
FEIN: 16-1557064	Barred Until 03/12/2009	Fiscal Officer Notes: DOL dba Pardee Construction and Shirley Pardee as an individual - multiple willful violations. Also Charles J Pardee as an individual.		

Company Name	Address	City	State	Zip Code
Darby General Contracting Inc	565 Oak Street	Copliague	NY	11726
FEIN: 11-3420817	Barred Until 08/04/2008	Fiscal Officer Notes: DOL dba Darby Glass Co - multiple willful violations		

Company Name	Address	City	State	Zip Code
Darby Glass Co				
FEIN: 11-3081390	Barred Until	Fiscal Officer Notes: See Darby General Contracting Inc		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Debcon Construction Corporation	77 Weyman Avenue	New Rochelle	NY	10805
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3157140	06/11/2006	DOL Multiple willfuls - Debcon Construction Corporation and Deborah Rago individually - falsified payrolls - debarment period extended		

Company Name	Address	City	State	Zip Code
Deborah Rago, individually				
FEIN:	Barred Until	Fiscal Officer Notes:		
	06/11/2006	See Debcon Construction Corp		

Company Name	Address	City	State	Zip Code
Dellapenna Associates Inc	86 Olive Street	Johnson City	NY	13790
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1465989	02/18/2008	DOL Substantially owned-affiliated entity and/or successor of Dellapenna Brothers Inc - debarment period extended after additional violations		

Company Name	Address	City	State	Zip Code
Dellapenna Brothers Inc	86 Olive Street	Johnson City	NY	13790
FEIN:	Barred Until	Fiscal Officer Notes:		
16-0964223	08/04/2008	DOL multiple willfuls - debarment period extended after additional violations		

Company Name	Address	City	State	Zip Code
Dennis Lounsbury Builders Inc	P O Box 220	Bulville	NY	10915
FEIN:	Barred Until	Fiscal Officer Notes:		
14-1538702	05/27/2009	DOL aka Lounsbury Erectors Inc.		

Company Name	Address	City	State	Zip Code
DePoalo and Son Building Contractors Inc	296 Morris Road	Schenectady	NY	12303
FEIN:	Barred Until	Fiscal Officer Notes:		
14-1507523	07/12/2009	DOL Multiple willful violations		

Company Name	Address	City	State	Zip Code
Diracon Commercial Contractors	310 Maple Avenue	New Hampton	NY	10958
FEIN:	Barred Until	Fiscal Officer Notes:		
08-1681415	05/18/2009	DOL and Rebecca Gatto-Wood as an individual. Falsified payarolls.		

Company Name	Address	City	State	Zip Code
Dominic Antonucci	1939 Town Line Road	Hilton	NY	14468
FEIN:	Barred Until	Fiscal Officer Notes:		
	10/18/2009	DOL As an individual. See A A General Contractors Inc and W J Grinder Roofing Company.		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Drywall Systems Unlimited Inc	182 West Main Street	Middletown	NY	10940
FEIN:	Barred Until	Fiscal Officer Notes:		
06-1405921	10/02/2007	DOL		

Company Name	Address	City	State	Zip Code
Drywall Wizard				
FEIN:	Barred Until	Fiscal Officer Notes:		
05-1684878	10/16/2006	See Stephen Potter		

Company Name	Address	City	State	Zip Code
E Green Restoration & Roofing Inc	117 Hawley Street	Binghamton	NY	13901
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1561693	06/21/2009	DOL		

Company Name	Address	City	State	Zip Code
Eliyhu Benyamin	303 Ten Eyck Street	Brooklyn	NY	11206
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/05/2010	As an individual. See W & B Mechanical Corp.		

Company Name	Address	City	State	Zip Code
Elizabeth A. Carr	P O Box 82	Valatie	NY	12184
FEIN:	Barred Until	Fiscal Officer Notes:		
	10/14/2008	dba Everlasting Slate - as an individual		

Company Name	Address	City	State	Zip Code
Emes Heating & Plumbing & Heating Contr	5 Emes Lane	Monsey	NY	10952
FEIN:	Barred Until	Fiscal Officer Notes:		
13-2590780		DOL and Julius and Gita Behrend, as individuals. Parties entered into a voluntary agreement to be permanently debarred		

Company Name	Address	City	State	Zip Code
Empire State Renovation Corp	15 Division Place	Brooklyn	NY	11222
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3170331	05/22/2007	NYC Falsified payrolls - plea agreement		

Company Name	Address	City	State	Zip Code
Enjem's Incorporated	111 South Main Street	Herkimer	NY	13350
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1038008	03/04/2009	DOL and Francis Enjem as an individual. Falsification of records.		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Enviroclean Services LLC	4245 Union Rd- Suite 210	Buffalo	NY	14225
FEIN:	Barred Until	Fiscal Officer Notes:		
26-0045677	09/07/2009	DOL		
Company Name	Address	City	State	Zip Code
Erez Ben-Zvy	19 West Street	Spring Valley	NY	10977
FEIN:	Barred Until	Fiscal Officer Notes:		
	02/22/2010	As an individual. See B & Z Development Inc		
Company Name	Address	City	State	Zip Code
Euro Craft Restoration, Inc.	41-12 Ditmars Blvd	Long Island City	NY	11105
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3769924	10/14/2008	DOL and Savvas A. Savva (as an individual) Falsification of records and kickback of wages. Plea agreement with A.G.'s Office		
Company Name	Address	City	State	Zip Code
Everlasting Slate	P O Box 82	Valatie	NY	12184
FEIN:	Barred Until	Fiscal Officer Notes:		
22-3397381	10/14/2008	DOL And Elizabeth A. Carr and Sean Campion as individuals. Falsification of records		
Company Name	Address	City	State	Zip Code
Flower City Asbestos Inc	850 St Paul Street	Rochester	NY	14605
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1292474	08/18/2009	DOL Multiple willful violations		
Company Name	Address	City	State	Zip Code
Flower City Insulation Sales & Contractors	137 Yorkton Street	Webster	NY	14580
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1157832	08/03/2009	DOL Multiple willful violations		
Company Name	Address	City	State	Zip Code
Foundation Construction Consultants Inc	294 20th Street	Brooklyn	NY	11215
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2761496	05/20/2008	NYC Multiple willfuls and falsification of payroll records		
Company Name	Address	City	State	Zip Code
Francis Enjem	111 South Main Street	Herkimer	NY	13350
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/04/2009	As an individual. See Enjem's Incorporated.		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Franco Paints Inc	159 92nd Street	Brooklyn	NY	11209
FEIN:	Barred Until	Fiscal Officer Notes:		
	08/07/2008	NYC and Mida Painting Ltd, Nicholas Kallergis and Stamatia Kallergis, as individuals. Assurance of Discontinuance/Settlement Agreement		

Company Name	Address	City	State	Zip Code
Frank J. Labriola				
FEIN:	Barred Until	Fiscal Officer Notes:		
		See State of the Art Construction Co Inc		

Company Name	Address	City	State	Zip Code
Gem Building & Equipment Inc	2332 Route 9W	Saugerties	NY	12477
FEIN:	Barred Until	Fiscal Officer Notes:		
14-1793970	06/28/2007	DOL		

Company Name	Address	City	State	Zip Code
George Begakis				
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/11/2008	As an individual - see Aegean General Contracting Inc		

Company Name	Address	City	State	Zip Code
George Bush	19 Hoffman Drive	Latham	NY	12118
FEIN:	Barred Until	Fiscal Officer Notes:		
	01/14/2009	DOL Falsification of payroll records		

Company Name	Address	City	State	Zip Code
George Forakis	P O Box 8808	Baltimore	MD	21224
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/07/2007	DOL Falsified payrolls - Paint City Contractors Inc and George Forakis individually		

Company Name	Address	City	State	Zip Code
George J Leva Sr.				
FEIN:	Barred Until	Fiscal Officer Notes:		
	02/06/2008	As an individual dba Ontario Flooring Company. Debarment period extended after additional violation		

Company Name	Address	City	State	Zip Code
George Lucey,Manual Tobio(see note)	150 Kings Street	Brooklyn	NY	11231
FEIN:	Barred Until	Fiscal Officer Notes:		
		NYC Manuel P Tobio and Lake Constr and Development Corp (individually and as a whole) grand larceny,falsified records,debarred permanently		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
GM Enterprises				

FEIN: 16-1509833 Barred Until 05/20/2007 Fiscal Officer Notes: See Asbestos Systems Inc

Company Name	Address	City	State	Zip Code
Goldhand Construction LLC	116 East Saddle River Rd	Saddle River	NJ	07458

FEIN: 22-3765123 Barred Until 05/14/2008 Fiscal Officer Notes: DOL Falsified of payroll records

Company Name	Address	City	State	Zip Code
Gregory McCoy				

FEIN: Barred Until 05/20/2007 Fiscal Officer Notes: As an individual. See GM Enterprises dba Asbestos Systems Inc

Company Name	Address	City	State	Zip Code
Gregory Kloepfer	248 Lein Road	West Seneca	NY	14224

FEIN: Barred Until 10/06/2009 Fiscal Officer Notes: DOL As an individual. See Kloepfer's Floor Covering

Company Name	Address	City	State	Zip Code
Hamax Construction Corporation	540 Commerce St - Ste 6	Thornwood	NY	10594

FEIN: 06-1482076 Barred Until 09/11/2008 Fiscal Officer Notes: DOL Also Thomas Hanlon and William Valentine as individuals. Multiple willfuls and falsification of records. Debarment period extended after other willful violations

Company Name	Address	City	State	Zip Code
Harrison Jarvis	132 W 129th St-Ste 4W	New York	NY	10027

FEIN: Barred Until 08/12/2009 Fiscal Officer Notes: AG As an individual and Two By Four Carpentry and Construction Inc. Plea agreement with A.G.'s Office.

Company Name	Address	City	State	Zip Code
HDA Construction	942 Havemeyer Avenue	Bronx	NY	10473

FEIN: 06-1613022 Barred Until 12/10/2007 Fiscal Officer Notes: DOL Falsified records

Company Name	Address	City	State	Zip Code
Hector Colon	3643 Bruckner Blvd	Bronx	NY	10464

FEIN: Barred Until 04/17/2007 Fiscal Officer Notes: DOL Conducting business as M & H Climate and Energy Management Ltd. Falsified payrolls

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Hi Tech Insulation	P O Box 12861	Rochester	NY	14612
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1487213	12/09/2007	DOL Kevin C. Marlowe dba Hi Tech Insulation - multiple violations		

Company Name	Address	City	State	Zip Code
Hi-Amp Electrical Construction Corp	265-12 Hillside Avenue	Floral Park	NY	11004
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3520080	04/30/2007	DOL and Ivan Torres individually. Falsified payrolls		

Company Name	Address	City	State	Zip Code
Howard K Enterprise Inc	219-02 Northern Boulevard	Flushing	NY	11361
FEIN:	Barred Until	Fiscal Officer Notes:		
22-3791841	04/14/2010	AG and Howard Kim a/k/a un Hak Kim as an individual - Plea agreement. Additional addresses: 703 Atlantic Avenue, Rochester, NY 14609 and 121 Hemingway Drive, Rochester, NY 14620		

Company Name	Address	City	State	Zip Code
Howard Kim	75 West Edsall Boulevard	Palisades Park	NJ	
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/14/2010	AG a/k/a un Hak Kim, as an individual. See Howard K Enterprise Inc		

Company Name	Address	City	State	Zip Code
I C Construction Company Inc	120 South Broadway	Red Hook	NY	12571
FEIN:	Barred Until	Fiscal Officer Notes:		
14-1789216	08/21/2007	DOL Multiple willfuls - Debarment period extended after additional violations		

Company Name	Address	City	State	Zip Code
IES Environmental Inc	1655 Elmwood Avenue	Cranston	RI	02910
FEIN:	Barred Until	Fiscal Officer Notes:		
	10/05/2009	DOL And International Environmental Services Inc and James J Ney Jr as an individual. Falsification of payroll records		

Company Name	Address	City	State	Zip Code
Intercounty Roofing Systems Inc	20 Jerusalem Avenue	Hicksville	NY	11801
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3550866	05/09/2006	DOL Falsified payrolls		

Company Name	Address	City	State	Zip Code
Interior Decorating Floor Covering Co Inc	2229 Clifford Avenue	Rochester	NY	14609
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1337838	07/29/2007	DOL Falsification of records		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
International Environmental Resources				
FEIN:	Barred Until	Fiscal Officer Notes:		
05-0448266	08/09/2007	See International Environmental Services Inc		
Company Name	Address	City	State	Zip Code
International Environmental Services Inc	2 Stafford Court	Cranston	RI	02920
FEIN:	Barred Until	Fiscal Officer Notes:		
05-0448266	10/05/2009	DOL dba International Environmental Resources - Falsified payrolls - Debarment period extended after additional violation. Also IES Environmental Inc and James J Ney Jr as an individual		
Company Name	Address	City	State	Zip Code
Ismael Cisneros				
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/14/2008	As an individual - See Izi Plumbing & Heating Ltd		
Company Name	Address	City	State	Zip Code
Ivan Torres	265-12 Hillside Avenue	Floral Park	NY	11004
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/30/2007	DOL Individually and Hi-Amp Electrical Construction Corp. Falsified payrolls		
Company Name	Address	City	State	Zip Code
Izi Plumbing & Heating Ltd	291 Metropolitan Avenue	Brooklyn	NY	11211
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3157717	04/14/2008	DOL and Ismael Cisneros, Individually - falsified payrolls		
Company Name	Address	City	State	Zip Code
J B C Contracting Co Inc	346 Prospect Ave - 1st Fl	Brooklyn	NY	11215
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3550663	03/23/2010	AG And/or 509 McDonald Avenue, Brooklyn NY 11218. And Mohammed H Kabir as an individual and J B C Contracting Company. Settlement agreement with A.G.'s Office		
Company Name	Address	City	State	Zip Code
J B C Contracting Company	346 Prospect Ave - 1st Fl	Brooklyn	NY	11215
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3330280	03/23/2010	AG And/or 509 McDonald Avenue, Brooklyn NY 11218. And Mohammed H Kabir as an individual and JBC Contracting Co Inc. Settlement Agreement with A.G's Office		
Company Name	Address	City	State	Zip Code
J Barr Construction Corp	119-51 Metropolitan Ave	Jamaica	NY	11415
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3344003	12/14/2009	DOL and Steve J Nictas as an individual. Multiple willful violations		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
J Mangone Contracting Inc	53 13th Avenue	Mincola	NY	11501

FEIN:	Barred Until	Fiscal Officer Notes:
11-2802563	11/07/2006	DOL Falsified payrolls and kickbacks of wages and supplements

Company Name	Address	City	State	Zip Code
J T Painting Corp	P O Box 337	Burlingham	NY	12722

FEIN:	Barred Until	Fiscal Officer Notes:
06-1260246	02/26/2009	DOL Falsification of records

Company Name	Address	City	State	Zip Code
James Avallone				

FEIN:	Barred Until	Fiscal Officer Notes:
	08/07/2008	As an individual - see James Avallone Tile & Marble - debarment period extended

Company Name	Address	City	State	Zip Code
James Avallone Tile & Marble	217 Christie Street	Ridgefield Park	NJ	07660

FEIN:	Barred Until	Fiscal Officer Notes:
07-5336752	08/07/2008	DOL Multiple willful violations - debarment period extended

Company Name	Address	City	State	Zip Code
James J Ney Jr	1655 Elmwood Avenue	Cranston	RI	02910

FEIN:	Barred Until	Fiscal Officer Notes:
	10/05/2009	DOL As an individual. See International Environmental Services Inc and IES Environmental Inc

Company Name	Address	City	State	Zip Code
JBC Industries of Parish Inc	P O Box 728 - CR 44	Mexico	NY	13114

FEIN:	Barred Until	Fiscal Officer Notes:
16-1470149	07/24/2007	DOL Multiple willful violations

Company Name	Address	City	State	Zip Code
John Bradford	6614 Furnace Road	Ontario	NY	14519

FEIN:	Barred Until	Fiscal Officer Notes:
	12/22/2009	As an individual. See Rusmar Environmental Services Corp.

Company Name	Address	City	State	Zip Code
John Varelakis	2063 Maple Street	Wantagh	NY	11793

FEIN:	Barred Until	Fiscal Officer Notes:
	02/20/2007	As an individual - See Sprucewood Painting Corp

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code

JRC Aris Electric Contractors

FEIN:	Barred Until	Fiscal Officer Notes:
	09/13/2009	See JRC Electric Control Service Inc

Company Name	Address	City	State	Zip Code

JRC Electric Control Service Inc

516 East 51st Street

Brooklyn

NY

11236

FEIN:	Barred Until	Fiscal Officer Notes:
11-3199418	09/13/2009	NYC a/k/a JRC Aris Electric Contractors - multiple willful violations

Company Name	Address	City	State	Zip Code

Julius and Gita Behrend

5 Emes Lane

Monsey

NY

10952

FEIN:	Barred Until	Fiscal Officer Notes:
		See Emes Heating & Plumbing Contractor, Inc

Company Name	Address	City	State	Zip Code

K M R Enterprises Inc

10 Stuffle Street

Cropseyville

NY

12052

FEIN:	Barred Until	Fiscal Officer Notes:
14-1749993	05/03/2010	DOL Multiple willful violations.

Company Name	Address	City	State	Zip Code

Keith Grimes Inc

Fairlawn Dr - P O Box 964

Montauk

NY

11954

FEIN:	Barred Until	Fiscal Officer Notes:
11-2938037	03/21/2006	DOL Falsified records

Company Name	Address	City	State	Zip Code

Kenneth Merz

62 Neulist Avenue

Port Washington

NY

11050

FEIN:	Barred Until	Fiscal Officer Notes:
	07/17/2009	As an individual. See Bat-Jac Construction

Company Name	Address	City	State	Zip Code

Kevin C Marlowe

FEIN:	Barred Until	Fiscal Officer Notes:
		See Hi Tech Insulation

Company Name	Address	City	State	Zip Code

Keystone Construction Corp

9945 Fort Hamilton Pkwy

Brooklyn

NY

11209

FEIN:	Barred Until	Fiscal Officer Notes:
16-1402500	08/20/2008	DOL And Nicholas Margaritis as an individual

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
King Machine	11365 Center Road	Sheridan	NY	14135
FEIN: 16-1293494	Barred Until 04/04/2010	Fiscal Officer Notes: DOL See Robert Metzgar		

Company Name	Address	City	State	Zip Code
Kingston Trucking & Rigging Corp	99 St Nicholas Avenue	Brooklyn	NY	11237
FEIN: 11-3540715	Barred Until 02/19/2008	Fiscal Officer Notes: DOL As a substantially owned-affiliated entity and/or successor of Cavalier Construction Corp. Falsification of records		

Company Name	Address	City	State	Zip Code
Kloepfer's Floor Covering	248 Lein Road	West Seneca	NY	14224
FEIN: 16-1234359	Barred Until 10/06/2009	Fiscal Officer Notes: DOL And Gregory Kloepfer as an individual. Multiple willful violations		

Company Name	Address	City	State	Zip Code
Kornas Construction Corporation	162 85th Street	Brooklyn	NY	11209
FEIN: 11-2691706	Barred Until 01/09/2006	Fiscal Officer Notes: NYC Falsified payrolls		

Company Name	Address	City	State	Zip Code
L & T Plumbing Corp	367 Veterans Memorial Hwy	Commack	NY	11725
FEIN: 11-3223496	Barred Until 01/11/2010	Fiscal Officer Notes: DOL And Robert DeMonte as an individual.		

Company Name	Address	City	State	Zip Code
Labar Enterprises of Rochester Inc	2121 Empire Boulevard	Webster	NY	14580
FEIN: 16-1605462	Barred Until 04/18/2010	Fiscal Officer Notes: DOL dba Labar Excavating Inc. Multiple willful violations		

Company Name	Address	City	State	Zip Code
Labar Excavating Inc				
FEIN:	Barred Until 04/18/2010	Fiscal Officer Notes: See Labar Enterprises of Rochester Inc.		

Company Name	Address	City	State	Zip Code
Lake Construction and Development Corp				
FEIN: 11-2678816	Barred Until	Fiscal Officer Notes: See George Lucey		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Linda Williams c/o MJAB Construction Inc	183 Washington Avenue	New Rochelle	NY	10801

FEIN: **Barred Until** **Fiscal Officer Notes:**
 04/22/2009 DOL As an individual. See MJAB Construction Inc

Company Name	Address	City	State	Zip Code
Lorenzo DeVardo	1850 Steinway Street	Long Island City	NY	11105

FEIN: **Barred Until** **Fiscal Officer Notes:**
 01/08/2009 DOL As an individual. See Vardo Construction Corp

Company Name	Address	City	State	Zip Code
Lounsbury Erectors Inc				

FEIN: **Barred Until** **Fiscal Officer Notes:**
 05/27/2009 See Dennis Lounsbury Builders Inc

Company Name	Address	City	State	Zip Code
LTS Construction	24 Miller Street	Rochester	NY	

FEIN: **Barred Until** **Fiscal Officer Notes:**
 16-1463105 06/30/2009 See Thomas L. Smalls

Company Name	Address	City	State	Zip Code
M & H Climate and Energy Management Ltd				

FEIN: **Barred Until** **Fiscal Officer Notes:**
 58-2152185 04/17/2007 See Hector Colon

Company Name	Address	City	State	Zip Code
M & S Pipeline Excavation Company Inc	784 Conklin Road	Binghamton	NY	13903

FEIN: **Barred Until** **Fiscal Officer Notes:**
 16-0926714 05/06/2009 DOL Multiple willful violations

Company Name	Address	City	State	Zip Code
Mac Stringer Painting	250 Lake Avenue	Rochester	NY	14608

FEIN: **Barred Until** **Fiscal Officer Notes:**
 16-1008740 12/18/2006 DOL Falsification of records

Company Name	Address	City	State	Zip Code
Manbru Construction Corp	1439 Wood Road	Bronx	NY	10462

FEIN: **Barred Until** **Fiscal Officer Notes:**
 02/19/2008 DOL Also at 201-203 E 22nd Street, New York 10010. As a substantially owned-affiliated entity and/or successor of Cavalier Construction Corp. Falsification of records.

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Manuel P. Tobio				
FEIN:	Barred Until	Fiscal Officer Notes:		
		See George Lucey		

Company Name	Address	City	State	Zip Code
Manuel Tobio				
FEIN:	Barred Until	Fiscal Officer Notes:		
		See George Lucey		

Company Name	Address	City	State	Zip Code
Mary Newsom	1537 Union Street	Schenectady	NY	12309
FEIN:	Barred Until	Fiscal Officer Notes:		
	05/24/2009	DOL As an individual. See Pachyderm Enterprises, Inc		

Company Name	Address	City	State	Zip Code
Mas-Ann Mechanical Inc	35 Regency Oaks Blvd	Rochester	NY	14624
FEIN:	Barred Until	Fiscal Officer Notes:		
	16-1357694 01/04/2010	DOL Debarment period extended after additional willful violations		

Company Name	Address	City	State	Zip Code
Masciarelli Construction Co	784 Conklin Road	Binghamton	NY	13903
FEIN:	Barred Until	Fiscal Officer Notes:		
	16-0902053 05/06/2009	DOL Multiple willful violations		

Company Name	Address	City	State	Zip Code
Merchants I & S Corp Inc	7732 Victor Mendon Road	Victor	NY	14564
FEIN:	Barred Until	Fiscal Officer Notes:		
	16-1405450 11/22/2007	DOL Debarment extended after additional violation		

Company Name	Address	City	State	Zip Code
Merit Fence Co Inc	130 Old Route 6	Carmel	NY	10512
FEIN:	Barred Until	Fiscal Officer Notes:		
	06-1350241 08/06/2008	DOL Multiple willful violations		

Company Name	Address	City	State	Zip Code
MGC Restoration Services Inc	64-58 218th Street	Bayside	NY	11364
FEIN:	Barred Until	Fiscal Officer Notes:		
	11-3031515 01/01/2010	AG And Michael Capous individually. Plea agreement		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Michael Capous	64-58 218th Street	Bayside	NY	11364
FEIN:	Barred Until	Fiscal Officer Notes:		
	01/01/2010	AG	As an individual. Se MGC Restoration Services Inc.	

Company Name	Address	City	State	Zip Code
Michael Falgiano Jr.				
FEIN:	Barred Until	Fiscal Officer Notes:		
		Principal officer-partner and/or shareholder - See M Falgiano Construction Co Inc		

Company Name	Address	City	State	Zip Code
Michael Falgiano Sr				
FEIN:	Barred Until	Fiscal Officer Notes:		
		Principal officer-partner and/or shareholder - see M Falgiano Construction Co Inc		

Company Name	Address	City	State	Zip Code
Michael R Palmer				
FEIN:	Barred Until	Fiscal Officer Notes:		
	11/22/2007	As an individual - See Commtech Communications Inc and Commtech Electrical Construction Corp		

Company Name	Address	City	State	Zip Code
Mida Painting Ltd	159 92nd Street	Brooklyn	NY	11209
FEIN:	Barred Until	Fiscal Officer	Notes:	
	08/07/2008	NYC	and Franco Paints, Inc. and Nicholas Kallergis and Stamatia Kallergis, as individuals. Assurance of Discontinuance/Settlement Agreement	

Company Name	Address	City	State	Zip Code
MJAB Construction Inc	183 Washington Avenue	New Rochelle	NY	10801
FEIN: 58-2620937	Barred Until 04/22/2009	Fiscal Officer Notes: DOL and Linda Williams as an individual. Falsification of payroll records		

Company Name	Address	City	State	Zip Code
Mohammed A Rashid	914 Newkirk Avenue	Brooklyn	NY	11230
FEIN:	Barred Until	Fiscal Officer Notes:		
	12/16/2009	As an individual. See Columbus General Construction Inc		

Company Name		Address	City	State	Zip Code
Mohammed H Kabir		200 East 77th Street	Brooklyn	NY	11218
FEIN:	Barred Until	Fiscal Officer Notes:			
	03/23/2010	AG	As an individual. See J B C Contracting Co Inc and J B C Contracting Company - Settlement Agreement with A.G.'s Office		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Monarch Construction Corporation	1057 Jackson Avenue	Long Island City	NY	11101
FEIN: 13-2808501	Barred Until 07/26/2005	Fiscal Officer Notes: NYC And Charles Saliba - falsified payrolls		

Company Name	Address	City	State	Zip Code
Muhammad A Beig	142 East Market Street	Long Beach	NY	11561
FEIN:	Barred Until 10/21/2007	Fiscal Officer Notes: DOL As an individual - See C B E Contracting Corporation. falsified payrolls		

Company Name	Address	City	State	Zip Code
Musa Pacuku				
FEIN:	Barred Until 04/14/2008	Fiscal Officer Notes: As an individual - See Victory Roofing & Contracting Co Inc		

Company Name	Address	City	State	Zip Code
Navarro Special Cleaning Services Inc	85-12 Sixty-Seventh Ave	Queens	NY	11374
FEIN: 11-2946101	Barred Until 04/16/2006	Fiscal Officer Notes: NYC Falsified payrolls		

Company Name	Address	City	State	Zip Code
Neptune Construction Co				
FEIN: 11-2779916	Barred Until	Fiscal Officer Notes: See Wayne Vitale Inc		

Company Name	Address	City	State	Zip Code
Nicholas Kallergis	159 92nd Street	Brooklyn	NY	11209
FEIN:	Barred Until 08/07/2008	Fiscal Officer Notes: As an individual. See Franco Paints, Inc. and Mida Painting Ltd		

Company Name	Address	City	State	Zip Code
Nicholas Margaritis				
FEIN:	Barred Until 08/20/2008	Fiscal Officer Notes: See Keystone Construction Corp.		

Company Name	Address	City	State	Zip Code
Nikolaos D. Varellakis	94 Cleveland Avenue	Massepequa	NY	11758
FEIN:	Barred Until 02/20/2007	Fiscal Officer Notes: As an individual - See Sprucewood Painting Corp		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Nu-Look Painting & Wallpapering Inc	151-60 7th Avenue	Whitestone	NY	11357
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3389457	08/04/2009	AG and TF Painting Corp. and Tarcisio Ferreira, individually. Plea agreement with the A.G.'s Office.		

Company Name	Address	City	State	Zip Code
Olib Construction Company Inc	120 South Broadway	Red Hook	NY	12571
FEIN:	Barred Until	Fiscal Officer Notes:		
22-3200661	11/14/2006	DOL		

Company Name	Address	City	State	Zip Code
Olympic Associates Inc	2843 U.S. Route 11	Lafayette	NY	13084
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1444097	01/08/2007	DOL Multiple willful violations		

Company Name	Address	City	State	Zip Code
Olympic Window Installers Inc	174 Lincoln Avenue	Hawthorne	NJ	07506
FEIN:	Barred Until	Fiscal Officer Notes:		
22-3034903	07/21/2008	DOL and Carl and Russell Babb as individuals		

Company Name	Address	City	State	Zip Code
Ontario Flooring Company	296 Rogers Parkway	Rochester	NY	14617
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1554554	02/06/2008	DOL See George J Leva Sr. Debarment period extended after additional violation		

Company Name	Address	City	State	Zip Code
Oswego Trucking & Leasing	258 Washington Blvd	Oswego	NY	12801
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1371814	07/21/2008	DOL Falsified records		

Company Name	Address	City	State	Zip Code
P & H Supply Company Inc	241-A Harrison Avenue	Harrison	NY	10528
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3868727	05/25/2009	DOL Multiple willful violations - debarment period extended after additional willful violations		

Company Name	Address	City	State	Zip Code
Pachyderm Enterprises Inc	1537 Union Street	Schenectady	NY	12309
FEIN:	Barred Until	Fiscal Officer Notes:		
00-1386527	05/24/2009	DOL And Willie Jones and Mary Newsom as individuals - Multiple willful violations		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Paint City Contractors Inc	P O Box 8808	Baltimore	MD	21224
FEIN:	Barred Until	Fiscal Officer Notes:		
52-1764775	03/07/2007	DOL Falsified payrolls		

Company Name	Address	City	State	Zip Code
Pardee Construction				
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1557064	03/12/2009	See Dalton Steel Inc.		

Company Name	Address	City	State	Zip Code
Paul M Maintenance Inc	7 Gatewood Drive	Hauppague	NY	11788
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3287638	07/02/2007	DOL Falsified payrolls		

Company Name	Address	City	State	Zip Code
Perry Jacobs	736 Sherman Dr-Box 8015	Utica	NY	13505
FEIN:	Barred Until	Fiscal Officer Notes:		
	05/18/2010	As an individual. See Precision Site Work Inc.		

Company Name	Address	City	State	Zip Code
Pete Forakis	P O Box 8808	Baltimore	MD	21224
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/07/2007	DOL Multiple willfuls - Paint City Contractors Inc and Panagiotis Forakis dba Pete Forakis		

Company Name	Address	City	State	Zip Code
Pettit & Pettit Inc	7 Schulyer Street	Belmont	NY	14813
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1576164	03/21/2010	DOL Multiple villful violations		

Company Name	Address	City	State	Zip Code
Pilos Contracting Corp	271 58th Street	Brooklyn	NY	11220
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2540761	08/10/2005	DOL one willful with NYC and one willful with DOL		

Company Name	Address	City	State	Zip Code
Pipejackers Inc	15 East Bartlett Road	Middle Island	NY	11953
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2209596	06/26/2007	DOL		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Port Ewen Trucking Corp	2013 Flatbush Avenue	Brooklyn	NY	11234

FEIN:	Barred Until	Fiscal Officer Notes:
11-3484639	02/19/2008	DOL Also at 99 St. Nicholas Avenue, Brooklyn, NY 11237. As a substantially owned-affiliated entity and/or successor of Cavalier Construction Corp. Falsification of records

Company Name	Address	City	State	Zip Code
Precision Site Work Inc	736 Sherman Dr - Box 8015	Utica	NY	13505

FEIN:	Barred Until	Fiscal Officer Notes:
16-1609167	05/18/2010	DOL And its president, Perry Jacobs, as an individual. Falsification of payroll records.

Company Name	Address	City	State	Zip Code
Rainbow Mechanical Systems Inc	42-49 Colder St - Suite 3	Flushing	NY	11355

FEIN:	Barred Until	Fiscal Officer Notes:
	01/28/2007	NYC Plea agreement

Company Name	Address	City	State	Zip Code
Rapid Demolition Co Inc	2550 West 13th Street	Brooklyn	NY	11223

FEIN:	Barred Until	Fiscal Officer Notes:
11-2869485	11/18/2007	NYC And successors

Company Name	Address	City	State	Zip Code
Rebecca Gatto-Wood				

FEIN:	Barred Until	Fiscal Officer Notes:
	05/18/2009	As an individual. See Diracon Commercial Contractors.

Company Name	Address	City	State	Zip Code
Republic Construction & Management Inc	8111 7th Avenue	Brooklyn	NY	11228

FEIN:	Barred Until	Fiscal Officer Notes:
11-3178177	12/10/2007	NYC and Azam Ali Chaudhry - falsified payrolls - plea agreement

Company Name	Address	City	State	Zip Code
Robbye Bissesar	89-51 Springfield Blvd	Queens Village	NY	11427

FEIN:	Barred Until	Fiscal Officer Notes:
		As an individual. See Star International Inc

Company Name	Address	City	State	Zip Code
Robert Amendola	1084 Sunrise Highway	Amityville	NY	11701

FEIN:	Barred Until	Fiscal Officer Notes:
	03/19/2008	As an individual. See Westwood Fence Corp.

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Robert DeMonte	367 Veterans Memorial Hwy	Commack	NY	11725
FEIN:	Barred Until	Fiscal Officer Notes:		
	01/10/2010	As an individual. See L & T Plumbing Corp.		

Company Name	Address	City	State	Zip Code
Robert W Metzgar	11365 Center Road	Sheridan	NY	14135
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/04/2010	DOL dba King Machine - Also as an individual.		

Company Name	Address	City	State	Zip Code
Rusmar Environmental Services Corp	703 Atlantic Avenue	Rochester	NY	14609
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1492326	12/22/2009	AG And John Bradford as an individual. Falsified payrolls. Plea agreement.		

Company Name	Address	City	State	Zip Code
Russell Babb				
FEIN:	Barred Until	Fiscal Officer Notes:		
	07/21/2008	As an individual - See Olympic Window Installers Inc		

Company Name	Address	City	State	Zip Code
S & B Construction & Contracting Ltd	78 Wohseepee Road	Brightwaters	NY	11718
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2987611	04/15/2007	DOL		

Company Name	Address	City	State	Zip Code
Savoya Construction Corp	13-15 37th Avenue	Long Island City	NY	11101
FEIN:	Barred Until	Fiscal Officer Notes:		
06-1421004	09/21/2006	DOL a Joint Venture with United Painting and Contracting Inc. - falsified payrolls - debarment period extended		

Company Name	Address	City	State	Zip Code
Savvas A. Savva				
FEIN:	Barred Until	Fiscal Officer Notes:		
	10/14/2008	See Euro Craft Restoration Inc		

Company Name	Address	City	State	Zip Code
Scott Bendersky	78 Wohseepee Road	Brightwaters	NY	11718
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/15/2007	DOL Individually and as Officer and/or Shareholder of S & B Construction and Contracting Ltd		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Sean Campion	P O Box 82	Valatie	NY	12184

FEIN:	Barred Until	Fiscal Officer Notes:
	10/14/2008	dba Everlasting Slate - as an individual

Company Name	Address	City	State	Zip Code
Shirley J Pardee	197 U S Route 11	Central Square	NY	13036

FEIN:	Barred Until	Fiscal Officer Notes:
	03/12/2009	As an individual. See Dalton Steel Inc dba Pardee Construction.

Company Name	Address	City	State	Zip Code
Southwestern General Contracting Inc	1586 Gowans Road	Angola	NY	14006

FEIN:	Barred Until	Fiscal Officer Notes:
16-1569822	10/08/2009	DOL Falsification of records

Company Name	Address	City	State	Zip Code
Spider Construction and Waterproofing Inc	806 53rd Street	Brooklyn	NY	11220

FEIN:	Barred Until	Fiscal Officer Notes:
	11/19/2006	NYC Falsified payroll records

Company Name	Address	City	State	Zip Code
Sprucewood Painting Corp	94 Cleveland Avenue	Massapequa	NY	11758

FEIN:	Barred Until	Fiscal Officer Notes:
11-2949533	02/20/2007	NYC and Nikolaos D. Varelakis, Susan E. Varelakis and John Varelakis, as individuals. Multiple willful violations and falsified payroll records. Assurance of Discontinuance/Settlement Agreement.

Company Name	Address	City	State	Zip Code
Stamatia Kallergis	159 92nd Street	Brooklyn	NY	11209

FEIN:	Barred Until	Fiscal Officer Notes:
	08/07/2008	As an individual. See Franco Paints, Inc. and Mida Painting Ltd

Company Name	Address	City	State	Zip Code
Star International Inc	89-51 Springfield Blvd	Queens Village	NY	11427

FEIN:	Barred Until	Fiscal Officer Notes:
00-1613496		DOL Also Robbye Bissesar. Falsified payroll - permanently debarred

Company Name	Address	City	State	Zip Code
State Environmental Services Inc	1801 Stillwell Avenue	Brooklyn	NY	11223

FEIN:	Barred Until	Fiscal Officer Notes:
11-3164259	02/25/2008	NYC Plea agreement

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
State of the Art Construction	140 Marine Street	Farmingdale	NY	11735

FEIN: 11-2653210	Barred Until 10/06/2005	Fiscal Officer Notes: DOL Multiple willful violations

Company Name	Address	City	State	Zip Code
Stephen Potter	112 Summerville Drive	Rochester	NY	14617

FEIN:	Barred Until 10/16/2006	Fiscal Officer Notes: DOL dba Drywall Wizard

Company Name	Address	City	State	Zip Code
Steve J Nictas c/o J Barr Constr	119-51 Metropolitan Ave	Jamaica	NY	11415

FEIN:	Barred Until 12/14/2009	Fiscal Officer Notes: DOL As an individual - See J Barr Construction Corp.

Company Name	Address	City	State	Zip Code
Steve Menzer	62 Neulist Avenue	Port Washington	NY	11050

FEIN:	Barred Until 07/17/2009	Fiscal Officer Notes: As an individual. See Bat-Jac Construction

Company Name	Address	City	State	Zip Code
Super Structure Builders Inc	99 St Nicholas Avenue	Brooklyn	NY	11237

FEIN: 11-3487355	Barred Until 02/19/2008	Fiscal Officer Notes: DOL Also at 2013 Flatbush Avenue, Brooklyn, NY 11234. As a substantially owned-affiliated entity and/or successor of Cavalier Construction Corp. Falsification of records

Company Name	Address	City	State	Zip Code
Superior Jamestown Corporation	55 Jones-Gifford Avenue	Jamestown	NY	14701

FEIN: 16-1381131	Barred Until 03/17/2008	Fiscal Officer Notes: NYC Falsified payroll records

Company Name	Address	City	State	Zip Code
Susan E. Varelakis	94 Cleveland Avenue	Massepequa	NY	11758

FEIN:	Barred Until 02/20/2007	Fiscal Officer Notes: As an individual - See Sprucewood Painting Corp

Company Name	Address	City	State	Zip Code
T J Wilson Electric Inc	263 Waverly Avenue	Mamaroneck	NY	10543

FEIN: 13-3615112	Barred Until 02/10/2007	Fiscal Officer Notes: NYC Falsified payrolls

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Tarcisio Ferreira	151-60 7th Avenue	Whitestone	NY	11357

FEIN:	Barred Until	Fiscal Officer Notes:
	08/04/2009	AG and Nu-Look Painting & Wallpapering Inc and TF Painting Corp. Plea agreement with A.G.'s Office.

Company Name	Address	City	State	Zip Code
TF Painting Corp	151-60 7th Avenue	Whitestone	NY	11357

FEIN:	Barred Until	Fiscal Officer Notes:
	08/04/2009	AG and Nu-Look Painting & Wallpapering Inc. and Tarcisio Ferreira, individually. Plea agreement with A.G.'s Office.

Company Name	Address	City	State	Zip Code
TGR Corporation	22 Troy Lane	Lincoln Park	NJ	07035

FEIN:	Barred Until	Fiscal Officer Notes:
22-2671011	07/31/2006	DOL Multiple violations

Company Name	Address	City	State	Zip Code
Thomas DeMartino	P O Box 140625	Jamaica	NY	11414

FEIN:	Barred Until	Fiscal Officer Notes:
	04/07/2010	As an individual. See D & D Mason Contractors Inc

Company Name	Address	City	State	Zip Code
Thomas Hanlon				

FEIN:	Barred Until	Fiscal Officer Notes:
	09/11/2008	As an individual. See Hamax Construction Corp

Company Name	Address	City	State	Zip Code
Thomas K Falgiano				

FEIN:	Barred Until	Fiscal Officer Notes:
		Principal officer-partner and/or shareholder - see M Falgiano Construction Co Inc

Company Name	Address	City	State	Zip Code
Thomas L Smalls	24 Miller Street	Rochester	NY	14605

FEIN:	Barred Until	Fiscal Officer Notes:
	06/30/2009	DOL dba LTS Construction - also as an individual. Falsified payrolls.

Company Name	Address	City	State	Zip Code
Thomas Masonry & Concrete Inc	803 West Avenue, Ste 207	Rochester	NY	14611

FEIN:	Barred Until	Fiscal Officer Notes:
16-1535306	08/18/2009	DOL Multiple willful violations

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Thomas Masonry Enterprise Inc	955 Buffalo Road	Rochester	NY	14624
FEIN:	Barred Until	Fiscal Officer Notes:		
73-3103284	08/18/2009	DOL	Multiple willful violations	

Company Name	Address	City	State	Zip Code
Topo-Metrics Inc	432 Park Avenue South	New York	NY	10016
FEIN:	Barred Until	Fiscal Officer Notes:		
11-2465550	04/22/2009	DOL	Falsification of payroll records	

Company Name	Address	City	State	Zip Code
Topor Contracting Inc	153 Fillmore Avenue	Buffalo	NY	14210
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1590680	04/27/2009	DOL	Falsified payrolls	

Company Name	Address	City	State	Zip Code
Tower Building Maintenance and Mgmt	347 Kingsland Avenue	Brooklyn	NY	11222
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3042307	11/24/2008	DOL	Additional willful violations - debarment period extended	

Company Name	Address	City	State	Zip Code
Tri-State Building Contractors Inc	108 Sparrow Ridge Road	Carmel	NY	10512
FEIN:	Barred Until	Fiscal Officer Notes:		
14-1765905	05/24/2009	DOL	Falsified payroll records	

Company Name	Address	City	State	Zip Code
Two By Four Carpentry and Constr Inc	132 W 129th St-Ste 4W	New York	NY	10027
FEIN:	Barred Until	Fiscal Officer Notes:		
	08/12/2009	AG	dba of Harrison Jarvis. Plea agreement with A.G.'s Office.	

Company Name	Address	City	State	Zip Code
Uhlein Property Services and Contracting	209 Paddock Street	Watertown	NY	13601
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1372913	08/10/2005	DOL	John C. Uhlein III dba Uhlein Property Services and Contracting - consent by stipulation	

Company Name	Address	City	State	Zip Code
un Hak Kim				
FEIN:	Barred Until	Fiscal Officer Notes:		
	04/14/2010	AG	As an individual. See Howard K Enterprise Inc and Howard Kim	

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
United Painting and Contracting Inc	13-15 37th Avenue	Long Island City	NY	11101

FEIN:	Barred Until	Fiscal Officer Notes:
	09/21/2006	DOL a Joint Venture with Savoya Construction Corp. - falsified payrolls - debarment period extended

Company Name	Address	City	State	Zip Code
Vardo Construction Corporation	1850 Steinway Street	Long Island City	NY	11105

FEIN:	Barred Until	Fiscal Officer Notes:
11-2694892	01/08/2009	DOL And Lorenzo DeVardo as an individual. Falsified payrolls

Company Name	Address	City	State	Zip Code
VICO Mechanicals Systems Inc	c/o S.Zeitlin 50 Court St	Brooklyn	NY	11201

FEIN:	Barred Until	Fiscal Officer Notes:
	01/28/2007	NYC Plea agreement

Company Name	Address	City	State	Zip Code
Victory Roofing & Contracting Co Inc	265 Victory Boulevard	Staten Island	NY	10301

FEIN:	Barred Until	Fiscal Officer Notes:
38-0100331	04/14/2008	DOL and Musa Pacuku as in individual. Falsification of records

Company Name	Address	City	State	Zip Code
W & B Mechanical Corp	303 Ten Eyck Street	Brooklyn	NY	11206

FEIN:	Barred Until	Fiscal Officer Notes:
11-1340725	03/05/2010	DOL aka White and Blue Sheet Metal Inc and Eliyhu Benyamin as an individual. Falsification of records.

Company Name	Address	City	State	Zip Code
W J Grinder Roofing Company	1765 Mt Read Boulevard	Rochester	NY	14606

FEIN:	Barred Until	Fiscal Officer Notes:
16-0846854	10/18/2009	DOL As a substantially affiliated employer. See A A General Contractors, Inc. Multiple violations

Company Name	Address	City	State	Zip Code
W Property Resources Inc	123 West 126th Street	New York	NY	10027

FEIN:	Barred Until	Fiscal Officer Notes:
13-3462866	08/16/2006	NYC Multiple willfuls

Company Name	Address	City	State	Zip Code
Wayne Vitale Inc	P O Box 325	Port Jefferson	NY	11777

FEIN:	Barred Until	Fiscal Officer Notes:
11-2779916	11/08/2005	DOL DbA Neptune Construction Co

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
West Electric Inc	P O Box 83	Blossvale	NY	13308
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1496979	07/19/2006	DOL Multiple willful violations		

Company Name	Address	City	State	Zip Code
Westchester Iron Works Corporation	65 Plain Avenue	New Rochelle	NY	10801
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3459763	03/02/2006	NYC Voluntary debarment		

Company Name	Address	City	State	Zip Code
Westwood Fence Corp	1084 Sunrise Highway	Amityville	NY	11701
FEIN:	Barred Until	Fiscal Officer Notes:		
11-3084236	03/19/2008	And Robert Amendola as an individual. Falsified payrolls. Plea agreement entered into with Suffolk County D.A.'s Office.		

Company Name	Address	City	State	Zip Code
White and Blue Sheet Metal Inc	303 Ten Eyck Street	Brooklyn	NY	11206
FEIN:	Barred Until	Fiscal Officer Notes:		
	03/05/2010	See W & B Mechanical Inc.		

Company Name	Address	City	State	Zip Code
Wiley Development Co Inc	235 Northampton Street	Buffalo	NY	14208
FEIN:	Barred Until	Fiscal Officer Notes:		
16-1363561	08/11/2009	DOL Falsified payroll records		

Company Name	Address	City	State	Zip Code
William M Stringer				
FEIN:	Barred Until	Fiscal Officer Notes:		
	12/18/2006	See Mac Stringer Painting		

Company Name	Address	City	State	Zip Code
William Valentine				
FEIN:	Barred Until	Fiscal Officer Notes:		
	09/11/2008	As an individual. See Hamax Construction Corp		

Company Name	Address	City	State	Zip Code
Willie Jones	1537 Union Street	Schenectady	NY	12309
FEIN:	Barred Until	Fiscal Officer Notes:		
	05/24/2009	DOL As an individual. See Pachyderm Enterprises Inc		

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Company Name	Address	City	State	Zip Code
Wilson Tank Builders Inc	646 North Broad Street	Grove City	PA	16127
FEIN:	Barred Until	Fiscal Officer Notes:		
25-1773019	05/08/2006	DOL Falsified records		

Company Name	Address	City	State	Zip Code
Wintech Contracting Inc	1950 E Main St - Ste 205A	Mohegan Lake	NY	10547
FEIN:	Barred Until	Fiscal Officer Notes:		
13-3139312	07/22/2009	DOL Falsified payroll records		

STANDARD CLAUSES FOR NEW YORK STATE CONTRACTS

APPENDIX A

The parties to the attached contract, license, lease, amendment or other agreement of any kind (hereinafter, "the contract" or "this contract") agree to be bound by the following clauses which are hereby made a part of the contract (the work "Contractor" herein refers to any party other than the State, whether a contractor, licensor, licensee, lessor, lessee or any other party):

1. **EXECUTORY CLAUSE.** In accordance with Section 41 of the State Finance Law, the State shall have no liability under this contract to the Contractor or to anyone else beyond funds appropriated and available for this contract.

2. **NON-ASSIGNMENT CLAUSE.** In accordance with Section 138 of the State Finance Law, this contract may not be assigned by the Contractor or its right, title or interest therein assigned, transferred, conveyed, sublet or otherwise disposed of without the previous consent, in writing, of the State and any attempts to assign the contract without the State's written consent are null and void. The Contractor may, however, assign its right to receive payment without the State's prior written consent unless this contract concerns Certificates of Participation pursuant to Article 5-A of the State Finance Law.

3. **COMPTROLLER'S APPROVAL.** In accordance with Section 112 of the State Finance Law (or, if this contract is with the State University or City University of New York, Section 355 or Section 6218 of the Education Law), if this contract exceeds \$10,000 (or the minimum thresholds agreed to by the Office of the State Comptroller for certain S.U.N.Y. and C.U.N.Y. contracts), or if this is an amendment for any amount to a contract which, as so amended, exceeds said statutory amount, or if, by this contract, the State agrees to give something other than money when the value or reasonably estimated value of such consideration exceeds \$10,000, it shall not be valid, effective or binding upon the State until it has been approved by the State Comptroller and filed in his office.

4. **WORKERS' COMPENSATION BENEFITS.** In accordance with Section 142 of the State Finance Law, this contract shall be void and of no force and effect unless the Contractor shall provide and maintain coverage during the life of this contract for the benefit of such employees as are required to be covered by the provisions of the Workers' Compensation Law.

5. **NON-DISCRIMINATION REQUIREMENTS.** In accordance with Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, national origin, age, disability or marital status. Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or

for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, disability, sex, or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in Section 230 of the Labor Law, then, in accordance with Section 239 thereof, Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. Contractor is subject to fines of \$50.00 per person per day for any violation of Section 220-e or Section 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation.

6. **WAGE AND HOURS PROVISIONS.** If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither Contractor's employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law.

7. **NON-COLLUSIVE BIDDING CERTIFICATION.** In accordance with Section 139-d of the State Finance Law, if this contract was awarded based upon the submission of bids, Contractor warrants, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. Contractor further warrants that, at the time Contractor submitted its bid, an authorized and responsible person executed and delivered to the State a non-collusive bidding certification on Contractor's behalf.

8. **INTERNATIONAL BOYCOTT PROHIBITION.** In accordance with Section 220-f of the Labor Law and Section 139-h of the State Finance Law, if this contract exceeds \$5,000, the Contractor agrees, as a material condition of the contract, that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating, or shall participate in an international boycott in violation of the federal Export Administration Act of 1979 (50 USC

STANDARD CLAUSES FOR NEW YORK STATE CONTRACTS

APPENDIX A

App. Sections 2401 et seq.) or regulations thereunder. If such Contractor, or any of the aforesaid affiliates of Contractor, is convicted or is otherwise found to have violated said laws or regulations upon the final determination of the United States Commerce Department or any other appropriate agency of the United States subsequent to the contract's execution, such contract, amendment or modification thereto shall be rendered forfeit and void. The Contractor shall so notify the State Comptroller within five (5) business days of such conviction, determination or disposition of appeal (2NYCRR 105.4).

9. **SET-OFF RIGHTS.** The State shall have all of its common law, equitable and statutory rights of set-off. These rights shall include, but not be limited to, the State's option to withhold for the purposes of set-off any moneys due to the Contractor under this contract up to any amounts due and owing to the State with regard to this contract, any other contract with any State department or agency, including any contract for a term commencing prior to the term of this contract, plus any amounts due and owing to the State for any other reason including, without limitation, tax delinquencies, fee delinquencies or monetary penalties relative thereto. The State shall exercise its set-off rights in accordance with normal State practices including, in cases of set-off pursuant to an audit, the finalization of such audit by the State agency, its representatives, or the State Comptroller.

10. **RECORDS.** The Contractor shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under this contract (hereinafter, collectively, "the Records"). The Records must be kept for the balance of the calendar year in which they were made and for six (6) additional years thereafter. The State Comptroller, the Attorney General and any other person or entity authorized to conduct an examination, as well as the agency or agencies involved in this contract shall have access to the Records during normal business hours at an office of the Contractor within the State of New York, or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the Term specified above for the purposes of inspection, auditing and copying. The State shall take reasonable steps to protect from public disclosure any of the Records which are exempt from disclosure under Section 87 of the Public Officers Law (the "Statute") provided that: (i) the Contractor shall timely inform an appropriate State official, in writing, that said records should not be disclosed; and (ii) said records shall be sufficiently identified; and (iii) designation of said records as exempt under the Statute is reasonable. Nothing contained herein shall diminish, or in any way adversely affect, the State's right to discovery in any pending or future litigation.

11. **IDENTIFYING INFORMATION AND PRIVACY NOTIFICATION.**

(a) **FEDERAL EMPLOYER IDENTIFICATION NUMBER and/or FEDERAL SOCIAL SECURITY NUMBER.** All invoices or New York State standard vouchers submitted for payment for the sale of goods or services or the lease of real or personal property to a New York State agency must include the payee's identification number, i.e., the seller's or lessor's identification number. The number is either the payee's Federal employer identification number or Federal social security number, or both such numbers when the payee has both such numbers. Failure to include this number or numbers may delay payment. Where the payee does not have such number or numbers, the payee, on its invoice or New York State standard voucher, must give the reason or reasons why the payee does not have such number or numbers.

(b) **PRIVACY NOTIFICATION.** (1) The authority to request the above personal information from a seller of goods or services or a lessor of real or personal property, and the authority to maintain such information, is found in Section 5 of the State Tax Law. Disclosure of this information by the seller or lessor to the State is mandatory. The principal purpose for which the information is collected is to enable the State to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liabilities and to generally identify persons affected by the taxes administered by the Commissioner of Taxation and Finance. The information will be used for tax administration purposes and for any other property authorized by law.

(2) The personal information is requested by the purchasing unit of the agency contracting to purchase the goods or services or lease the real or personal property covered by this contract or lease. The information is maintained in New York State's Central Accounting System by the Director of State Accounts, Office of the State Comptroller, AESOB, Albany, New York 12236.

12. **EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITIES AND WOMEN.**

In accordance with Section 312 of the Executive Law, if this contract is: (i) a written agreement or purchase order instrument, providing for a total expenditure in excess of \$25,000.00, whereby a contracting agency is committed to expend or does expend funds in return for labor, services, supplies, equipment, materials or any combination of the foregoing, to be performed for, or rendered or furnished to the contracting agency; or (ii) a written agreement in excess of \$100,000.00 whereby a contracting agency is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon; or (iii) a written agreement in excess of \$100,000.00 whereby the owner of a State assisted housing project is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon for such project, then:

STANDARD CLAUSES FOR NEW YORK STATE CONTRACTS

APPENDIX A

(a) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal employment opportunities without discrimination. Affirmative action shall mean recruitment, employment, job assignment, promotion, upgradings, demotion, transfer, layoff, or termination and rates of pay or other forms of compensation;

(b) at the request of the contracting agency, the Contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will affirmatively cooperate in the implementation of the contractor's obligations herein; and

(c) the Contractor shall state, in all solicitations or advertisements for employees, that, in the performance of the State contract, all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.

Contractor will include the provisions of "a", "b", and "c" above, in every subcontract over \$25,000.00 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon (the "Work") except where the Work is for the beneficial use of the Contractor. Section 312 does not apply to: (i) work, goods or services unrelated to this contract; or (ii) employment outside New York State; or (iii) banking services, insurance policies or the sale of securities. The State shall consider compliance by a contractor or subcontractor with the requirements of any federal law concerning equal employment opportunity which effectuates the purpose of this section. The contracting agency shall determine whether the imposition of the requirements of the provisions hereof duplicate or conflict with any such federal law and if such duplication or conflict exists, the contracting agency shall waive the applicability of Section 312 to the extent of such duplication or conflict. Contractor will comply with all duly promulgated and lawful rules and regulations of the Governor's Office of Minority and Women's Business Development pertaining herein.

13. **CONFLICTING TERMS.** In the event of a conflict between the terms of the contract (including any and all attachments thereto and amendments thereof) and the terms of this Appendix A, the terms of this Appendix A shall control.

14. **GOVERNING LAW.** This contract shall be governed by the laws of the State of New York except where the Federal supremacy clause requires otherwise.

15. **LATE PAYMENT.** Timeliness of payment and any interest to be paid to Contractor for late payment shall be governed by Article XI-A of the State Finance Law to the extent required by law.

16. **NO ARBITRATION.** Disputes involving this contract, including the breach or alleged breach thereof, may not be submitted to binding arbitration (except where statutorily authorized), but must, instead, be heard in a court of competent jurisdiction of the State of New York.

17. **SERVICE OF PROCESS.** In addition to the methods of service allowed by the State Civil Practice Law & Rules ("CPLR"), Contractor hereby consents to service of process upon it by registered or certified mail, return receipt requested. Service hereunder shall be complete upon Contractor's actual receipt of process or upon the State's receipt of the return thereof by the United States Postal Service as refused or undeliverable. Contractor must promptly notify the State, in writing, of each and every change of address to which service of process can be made. Service by the State to the last known address shall be sufficient. Contractor will have thirty (30) calendar days after service hereunder is complete in which to respond.

18. **PROHIBITION ON PURCHASE OF TROPICAL HARDWOODS.** The Contractor certifies and warrants that all wood products to be used under this contract award will be in accordance with, but not limited to, the specifications and provisions of State Finance Law §165, (Use of Tropical Hardwoods) which prohibits purchase and use of tropical hardwoods, unless specifically exempted, by the State or any governmental agency or political subdivision or public benefit corporation. Qualification for an exemption under this law will be the responsibility of the contractor to establish to meet with the approval of the State.

In addition, when any portion of this contract involving the use of woods, whether supply or installation, is to be performed by any subcontractor, the prime Contractor will indicate and certify in the submitted bid proposal that the subcontractor has been informed and is in compliance with specifications and provisions regarding use of tropical hardwoods as detailed in §165 State Finance Law. Any such use must meet with the approval of the State; otherwise, the bid may not be considered responsive. Under bidder certifications, proof of qualification for exemption will be the responsibility of the Contractor to meet with the approval of the State.

19. **MACBRIDE FAIR EMPLOYMENT PRINCIPLES.** In accordance with the MacBride Fair Employment Principles (Chapter 807 of the Laws of 1992), the Contractor hereby stipulates that the Contractor either

STANDARD CLAUSES FOR NEW YORK STATE CONTRACTS

APPENDIX A

(a) has no business operations in Northern Ireland, or (b) shall take lawful steps in good faith to conduct any business operations in Northern Ireland in accordance with the MacBride Fair Employment Principles (as described in Section 165 of the New York State Finance Law), and shall permit independent monitoring of compliance with such principles.

20. **OMNIBUS PROCUREMENT ACT OF 1992.** It is the policy of New York State to maximize opportunities for the participation of New York State business enterprises, including minority and women-owned business enterprises as bidders, subcontractors and suppliers on its procurement contracts.

Information on the availability of New York State subcontractors and suppliers as well as a directory of minority and women-owned business enterprises is available from:

NYS Empire State Development
Minority & Women Owned Business Division
One Commerce Plaza
Albany, New York 12245

The Omnibus Procurement Act of 1992 requires that by signing this bid proposal or contract, as applicable, Contractors certify that whenever the total bid amount is greater than \$1 million:

(a) The Contractor has made reasonable efforts to encourage the participation of New York State Business Enterprises as suppliers and subcontractors, including certified minority and women-owned business enterprises, on this project, and has retained the documentation of these efforts to be provided upon request to the State;

(b) The Contractor has complied with the Federal Equal Opportunity Act of 1972 (P.L. 92-261), as amended;

(c) The Contractor agrees to make reasonable efforts to provide notification to New York State residents of employment opportunities on this project through listing any such positions with the Job Service Division of the New York State Department of Labor, or providing such notification in such manner as is consistent with existing collective bargaining contracts or agreements. The Contractor agrees to document these efforts and to provide said documentation to the State upon requests; and

(d) The Contractor acknowledges notice that the State may seek to obtain offset credits from foreign countries as a result of this contract and agrees to cooperate with the State in these efforts.

21. **RECIPROCITY AND SANCTIONS PROVISIONS.** Bidders are hereby notified that if their principal place of business is located in a state that penalizes New York State vendors, and if the goods or

services they offer will be substantially produced or performed outside New York State, the Omnibus Procurement Act 1994 amendments (Chapter 684, Laws of 1994) require that they be denied contracts which they would otherwise obtain. NOTE: South Carolina, Alaska, West Virginia, Montana, Wyoming, Louisiana and Hawaii were the states subject to this provision as of October, 1998. Contact NYS Empire State Development for a current list of states subject to this provision.

SECTION 00827 - SUPPLEMENTARY CONDITIONS -- NYSDEC MANDATORY CONTRACT CLAUSES

These Supplementary Conditions add new topics to the Standard General Conditions of the Construction Contract (EJCDC Document 1910-8, 1996 Edition) and other provisions of the Contract Documents.

Articles and paragraphs herein are numbered independently of the General Conditions.

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SECTION 00827 - SUPPLEMENTARY CONDITIONS - NYSDEC MANDATORY CONTRACT CLAUSES

The following are mandatory contract provisions to be included in all Municipal/Consultant-Construction-Service contracts for work performed as part of an eligible Environmental Restoration Project (ERP). Any changes to these provisions by the municipality should be approved by the New York State Department of Environmental Conservation (NYSDEC) prior to execution of the contract. Failure to comply with these requirements may jeopardize the eligibility of your ERP.

Mandatory Provisions

NON-DISCRIMINATION REQUIREMENTS

1. In accordance with Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, national origin, age, disability or marital status.

To the extent that such work is to be provided pursuant to the contract, the following paragraph is required:

Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, the Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, disability, sex or national origin: a) discriminate in hiring or promotion of any individual who is qualified and available to perform the work; or b) discriminate against or intimidate any employee hired for the performance of work under this contract.

WAGE AND HOUR PROVISIONS

2. If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither the Contractor's employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, the Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law.

RECORD-KEEPING REQUIREMENT

3. The Contractor shall maintain all books, documents, papers, and other evidence directly pertinent to the performance of work under this Contract in accordance with generally acceptable accounting principles and practices consistently applied, and 40 CFR Part 30 in effect during the term of this Contract. The Municipality, the Department of Environmental Conservation, the State Comptroller, the State Attorney General, the State Department of Labor, and, in the event of federal funding, the USEPA, the Comptroller General of the United States, the United States Department of Labor or any of their authorized representatives shall have access to all such books, records, documents and other evidence for the purpose of inspection, audit and copying for a period of six years following final payment or the termination of this Contract whichever is later, and any extensions thereto. These books, records, documents and other evidence shall be accessible within the State of New York to the agencies identified above for the time period stated above. "Termination of this contract," as used in this clause, shall mean the later of completion of the work of the contract or the end date of the term stated in the contract.

CONFLICT OF INTEREST

4. To the best of the Contractor's knowledge and belief, the Contractor warrants that there are no relevant facts or circumstances which could give rise to an organizational conflict of interest, as herein defined, or that the Contractor has disclosed all such relevant information to the Municipality.

An organizational conflict of interest exists when the nature of the work to be performed under this Contract may, without some restriction on future activities, either result in an unfair competitive advantage to the Contractor or impair the Contractor's objectivity in performing the work for the Municipality.

The Contractor agrees that if an actual, apparent or potential organizational conflict of interest is discovered at any time after award, whether before or during performance, the Contractor will immediately make a full disclosure in writing to the Municipality and the State Department of Environmental Conservation. This disclosure shall include a description of actions which the Contractor has taken or proposes to take, after consultation with the Municipality, to avoid, mitigate, or minimize the actual or potential conflict.

Remedies - The Municipality may terminate this contract in whole or in part, if it deems such termination necessary to avoid an organizational or personal conflict of interest, or an unauthorized disclosure of information. If the Contractor was aware of a potential conflict of interest prior to award, or discovered an actual or potential conflict after award and did not disclose or misrepresent relevant information to the Municipality, the Municipality may terminate the contract, or pursue such other remedies as may be permitted by law or this contract. The terms of other applicable contract provisions regarding termination shall apply to termination by the Municipality pursuant to this clause.

The Contractor further agrees to insert in any subcontract hereunder, provisions which shall conform to the language of this clause.

- (a) In addition to the requirements of the above clauses with respect to "Organizational Conflicts of Interest," the following provision with regard to employee personnel performing under this contract shall apply until the earlier of the termination date of the affected employee(s) or the duration of the contract.

The Contractor agrees to notify the Department and the Municipality immediately of any actual, apparent or potential personal conflict of interest with regard to any employee, subcontractor employee, or consultant working on or having access to information regarding this contract, as soon as the Contractor becomes aware of such conflict. A personal conflict of interest is defined as a relationship of an employee, subcontractor employee, or consultant with an entity that may impair or appear to impair the objectivity of the employee, subcontractor employee, or consultant in performing the contract work. The Municipality will notify the Contractor of the appropriate action to be taken.

- (b) To the extent that the work under this contract requires access to proprietary or confidential business or financial data of other companies, and as long as such data remains proprietary or confidential, the Contractor shall protect such data from unauthorized use and disclosure and agrees not to use it to compete with such companies.
- (c) The Contractor shall certify annually that, to the best of the Contractor's knowledge and belief, all actual, apparent or potential conflicts of interest, both personal and organizational, have been reported to the Department and the Municipality. Such certification must be signed by a senior executive of the Contractor and submitted in accordance with instructions provided by the Municipality. Along with the annual certification, the Contractor shall also submit an update of any changes in the conflict of interest plan submitted with its proposal for this contract. The initial certification shall cover the one-year period from the date of contract award, and all subsequent certifications shall cover successive annual periods thereafter. The certification is to be submitted no later than 45 days after the close of the previous certification period covered.

- (d) The Contractor recognizes that employees in performing this contract may have access to data, either provided by the Department or the Municipality or first generated during contract performance, of a sensitive nature which should not be released without Department/Municipality approval. Therefore, the Contractor agrees to obtain confidentiality agreements from all such employees working on requirements under this contract including subcontractors and consultants. Such agreements shall contain provisions which stipulate that each employee agrees that the employee will not disclose, either in whole or in part, to any entity external to the Department, Department of Health or the New York State Department of Law, any information or data provided by the Department or first generated by the Contractor under this contract, any site-specific cost information, or any enforcement strategy without first obtaining the written permission of the Municipality. If a Contractor, through an employee or otherwise, is subpoenaed to testify or produce documents, which could result in such disclosure, the contractor must provide immediate advance notification to the Municipality/Department so that the Department can authorize such disclosure or have the opportunity to take action to prevent such disclosure. Such agreements shall be effective for the life of the contract and for a period of five (5) years after completion of the contract.
- (e) The Contractor agrees to insert in each subcontract or consultant agreement placed hereunder (except for subcontracts or consultant agreements for well drilling, fence erecting, plumbing, utility hookups, security guard services, or electrical services) provisions which shall conform substantially to the language of this clause, including this paragraph (e), unless otherwise authorized by the Municipality.

If this is a contract for work related to action at an inactive hazardous waste site, the following paragraph shall apply:

- (f) Due to the scope and nature of this contract, the Contractor shall observe the following restrictions on future hazardous waste site contracting for the duration of the contract.
- (1) The Contractor will be ineligible to enter into a contract for remedial action projects for which the Contractor has developed the statement of work or the solicitation package.
 - (2) The Contractor, during the life of the work assignment and for a period of five (5) years after the completion of the work assignment, agrees not to enter into a contract with or to represent any party with respect to any work relating to remedial activities or work pertaining to a site where the Contractor previously performed work for the Department and/or Municipality under this contract without the prior written approval of the Department.
 - (3) The Contractor agrees in advance that if any bids/proposals are submitted for any work for a third party that would require written approval of the Municipality/Department prior to entering into a contract because of the restrictions of this clause, then the bids/proposals are submitted at the Contractor's own risk, and no claim shall be made against the Municipality/Department to recover bid/proposal costs as a direct cost whether the request for authorization to enter into the contract is denied or approved.

AFFIRMATIVE ACTION

5. (a) The Contractor agrees to be bound by the provisions of New York State Executive Law Article 15-A, Sections 312, 313 and 316 and the regulations promulgated thereunder.

As provided thereunder, the Contractor is required to make good faith efforts to solicit the meaningful participation of minority and women owned business enterprises identified in the Directory of Certified Businesses provided by the New York State Department of Economic Development's Division of Minority and Women's Business Development.

- (b) The Contractor agrees to include the requirements set forth in paragraph (a) above and paragraphs (c), (d), and (e) and (f) below in every subcontract in such a manner that the provisions will be binding upon each subcontractor as to work in connection with such contract. For the purpose of this paragraph, a "subcontract" shall mean an agreement providing for a total expenditure in excess of \$25,000 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon in which a portion of Contractor's obligation under a State contract is undertaken or assumed.
- (c) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal employment opportunities without discrimination. For purposes of this article, affirmative action shall mean recruitment, employment, job assignment, promotion, upgradings, demotion, transfer, layoff, or termination and rates of pay or other forms of compensation.
- (d) At the request of the contracting agency, the contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will affirmatively cooperate in the implementation of the contractor's obligations herein.
- (e) The Contractor shall state, in all solicitations or advertisements for employees, that, in the performance of the contract, all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.
- (f) The Contractor also agrees to incorporate into any contract with subcontractors, contractual provisions applicable to record keeping, reporting, notice requirements and actions determined to be necessary by the Department to implement the requirements of the Minority/Women Business Enterprise - Equal Employment (M/WBE-EEO) utilization plan, and of Executive Law Article IS-A, regulations promulgated thereunder, and other applicable law and regulations.

END OF SECTION 00827

SECTION 00851 - DRAWINGS INDEX

Title: Independent Leather Tannery, 321-333 South Main Street
Date: August 2005
Dwg. Nos.: 04-0662 & 05-0388
By: C.T. Male Associates, P.C.

SHEET NO.	DESCRIPTION
1 of 1	Topographic Survey
1 of 1	Remedial Action Implementation Plan

END OF SECTION 00851

SECTION 00900 - ADDENDA AND MODIFICATIONS

NOTICE TO BIDDERS

Any addenda and modifications may be inserted in the pocket at the end of this Project Manual book.

After Bid Opening and Contract Award, any addenda and modifications will be bound in this Project Manual immediately following this page.

END OF SECTION 00900

(Following to be completed after Bidding.)

___ NO ADDENDA AND MODIFICATIONS

___ EXCEPT FOR ADDENDA AND MODIFICATIONS
WHICH FOLLOW AND END ON PAGE 00900 - ____

C.T. MALE ASSOCIATES, P.C.

ADDENDUM NO. 1
REMEDIAL ACTION
INDEPENDENT LEATHER BROWNFIELD PROJECT

AUGUST 12, 2004

This addendum consists of one page and two attachments. The first attachment is Sheet ENV2 - Finished Grading Plans. The second attachment is Sheet ENV3 - Sections and Detail. The following additions, deletions and modifications are made to the Bidding Contract Documents for the project.

SPECIFICATIONS

- A. For clarification, C.T. Male will be providing surveying services to locate the demarcation layer just before or just after its placement and to locate the soil barrier to contact after final grading to document their "as-built" horizontal and vertical position. It is the Contractor's responsibility to provide it's own survey control as necessary to determine grading cuts and fills in the field for conformance to the Finished Grading Plans provided as part of this addendum.

PLANS

- A. Drawings ENV2 and ENV3 were prepared to provide further information on the installation of the soil barrier to contact. Please understand that the intent of the grading plans is to show that a minimum 12-inches of the soil barrier to contact is required within the limits shown on these drawings. These drawings are attached to this addendum and are hereby made part of the Bidding Documents.

This Addendum is hereby part of the Contract and Bidding Documents. The Contractor is reminded to note receipt of the Addendum on Page 00300-1. Failure to do so may result in disqualification of the bid.

C.T. MALE ASSOCIATES, P.C.

By: Jeffrey A Marx, PE
Project Engineer



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ADDENDUM NO. 2
REMEDIAL ACTION
INDEPENDENT LEATHER BROWNFIELD PROJECT

AUGUST 24, 2005

This addendum consists of one page and two attachments. The first attachment is the August 22, 2005 Pre-Bid Meeting Agenda that was distributed to pre-bid meeting attendees. The second attachment is Pre-Bid Questions, Answers Provided and Other Information resulting from the August 22, 2005 pre-bid meeting. The third attachment is Sections 00420, 00430, 00480 and 00485. The following additions, deletions and modifications are made to the Bidding Contract Documents for the project.

SPECIFICATIONS

- A. A pre-bid meeting was held on August 22, 2005. The Pre-bid meeting agenda is provided as the first attachment to this addendum. Pre-bid meeting questions and answers, and other information are provided as the second attachment to this addendum.
- B. The Date on Addendum No. 1 was incorrectly listed as August 12, 2004. The date should be revised to August 12, 2005.
- C. Section 00220 - Reports of Exploration: The Stormwater Pollution Prevention Plan (SWPPP) is provided as Item #2. The SWPPP includes Erosion and Sediment Control Plans in Appendix C (Sheets ES-1 and ES-2). Sheet ES-1 was utilized for a previous phase of work on this project. The SWPPP Requirements and General Erosion & Sediment Control Notes are the only items on Sheet ES-1 that apply to this project. The locations of the SWPPP required silt fence are shown on Sheet ENV1. Sheet ES-2 should not be utilized for grading the site and the Contractor is not going to be required to install the sand filter shown on Sheet ES-2. Finished grading plans provided as Addendum No. 1 shall be used for grading the site.
- D. Section 00300 - Pay Item III.4: Providing a unit price for this pay item should be based on disposal of a hazardous soil on the basis of TCLP testing for metals. This does not relieve the Contractor from performing other analyses for waste characterization as required by the disposal facility.
- E. Heavy equipment will be allowed to cross the bridge over the Cayadutta Creek provided planking or other means are placed to protect the bridge decking from damage.
- F. Please be advised that some of the Project Manuals distributed may not have had Sections 00420, 00430, 00480 and 00485 stapled to the Bid Form Section 00300. Please note that all of these forms must be completed and returned as part of the bid. Extra loose copies of these sections are provided as the third attachment to this addendum for use in bid preparation.
- G. Section 01025 - Part 1.3B: Delete Item #5 in its entirety and replace with "The method of measurement for imported fill materials used to backfill excavations will be on the basis of surveying data and computer calculations completed by the Engineer."
- H. For clarification, the Contractor is responsible for payment of disposal facility tipping fees for concrete, contaminated soil and other materials removed from the site.

C.T. MALE ASSOCIATES, P.C.

- I. Section 00820: The Director of Public Works for the City of Gloversville wanted to remind Contractors that as part of prevailing wage requirements, certified payroll and employment utilization reports will be required to be submitted by the Contractor.

PLANS

- A. No changes are made to the plans.

This Addendum is hereby part of the Contract and Bidding Documents. The Contractor is reminded to note receipt of the Addendum on Page 00300-1. Failure to do so may result in disqualification of the bid.

C.T. MALE ASSOCIATES, P.C.

By: Jeffrey A. Marx, PE
Project Engineer



AUGUST 22, 2005 PRE-BID MEETING AGENDA

Independent Leather Brownfield Site

Remedial Action

City of Gloversville, New York

C.T. Male Project No.: 01.7293

Introductions

1. Site is the subject of a NYS Department of Environmental Conservation (DEC) Environmental Restoration Program (ERP) whereby the City of Gloversville (the Property Owner) has investigated the site and already remediated the majority of the western portion of the site. The work being bid is part of the overall Remedial Action required by NYSDEC under a February 2004 Record of Decision. The site is known to have soil and groundwater impacts from metals (primarily arsenic and chromium), and to a lesser degree from use of petroleum products.
2. Introductions of those at the meeting:
Owner City of Gloversville, Contact: Ronald Ellis
Engineer C.T. Male Associate of Latham, NY, Contacts: Jeffrey Marx, PE and Dave Roecker, PE
State NYSDEC, Region 5 Office of Ray Brook, NY, Contact: Mike McLean, PE
3. A reduced version (11 by 17) of ENV1, one of the contract drawings, is attached to this agenda for reference.

Scope of Work Overview

1. Site Preparation
 - Health and Safety (prepare site specific HASP within 14 days of Notice to Proceed, Contractor required daily air monitoring during earthwork for determining personnel protective equipment)
 - Site Control (existing chain-link, orange construction fence & silt fence)
 - Haul Road (for construction traffic, existing grade not to be disturbed, relocate as necessary, maintain thickness and width during completion)
 - Clearing and Grubbing (clear where soil barrier is being placed, no burning or burying debris on-site)
 - Building Demolition (drain pipe termination, concrete slab and foundation walls removal and disposal at Fulton County Landfill, debris not to be considered clean fill and will not be allowed to be buried on-site)
 - Monitoring Well Decommissioning (leave wells in-place or remove PVC pipe and fill with bentonite, as necessary)
2. Use of Bridge (be aware of AASHTO HS-20 vehicular loading for hauling contaminated soil)
3. Contaminated Soil Excavation
 - Remove and dispose at the direction of the Engineer.
 - Transport to Fulton County Landfill unless waste characterization sampling by Contractor identifies hazardous levels.

C.T. MALE ASSOCIATES, P.C.

- Backfill with imported soils that are proven clean through analytical sampling.
- Recognize coordination with C.T. Male for pre and post surveying to determine quantities of imported fill for payment.
- 4. Suspect Vent Pipe Evaluation
 - One pipe protrudes concrete pad.
 - Excavate pipe to find its endpoint.
 - Permanently close tank by removal, if present.
- 5. Soil Dewatering and Treatment
 - Separate mobilization to allow for treatment system construction only if needed.
 - Contractor required to install, maintain, monitor, sample and assure discharge limits are being met.
- 6. Install Soil Barrier to Contact
 - Minimum 12-inches of clean imported soil.
 - Demarcation layer between existing soils and clean soil.
 - Key into existing soils at boundaries and along creek to match adjoining property grades.
 - Analytical sampling required for documenting imported soil is free of contamination.
 - Hydroseed soil barrier to contact and establish growth (note contract time limitations).
- 7. Site Restoration (chain-link fence to remain, bridge and access road to remain, establish vegetation on soil barrier).

Additional Items

1. Addendum No. 1 already distributed on August 12, 2005. It included clarification on C.T. Male's surveying role and finished grading plans for placement of the minimum 12-inch soil barrier to contact.
2. Addendum No. 2 forthcoming. It will include confirmation on the need/absence for post water quality treatment (i.e., sand filter) reference in the SWPPP.
3. The Engineer will be performing perimeter electronic dust and organic vapor monitoring during soil disturbance including backfilling operations in accordance with Environmental Restoration Program. If levels exceed action levels for community air monitoring, work will be stopped and the Contractor will have to alter work methods to meet action levels.
4. Source of water for dust control and requirements for water use must be coordinated through City of Gloversville Department of Public Works (such as meter, backflow prevention device, etc.).
5. Bike path will not be allowed for site access.
6. Contractor will be entering an agreement directly with the City of Gloversville. Payment terms for this project are within 10 days from the City's receipt of State funds. Experience with the State reimbursement process has shown that is not unusual for payment to take 90 to 120 days.

C.T. MALE ASSOCIATES, P.C.

Closing Items

1. Reminder that the bids will be received at the City of Gloversville City Hall until 2:00 pm on September 7, 2005.
2. Make sure attendees complete the sign-in sheet for distribution of pre-bid meeting sign-in sheet.
3. Pre-bid meeting questions and answers will be distributed by facsimile and/or may be made part of Addendum No. 2.
4. Remember to mark receipt of addendums on Section 00300 Bid Form.

K:\Projects\017293\Admin\After ROD\Soil Barrier\Pre-Bid mtg agenda.doc

*INDEPENDENT LEATHER BROWNFIELD PROJECT
REMEDIAL ACTION
PRE-BID QUES. RAISED, ANSWERS PROVIDED AND OTHER INFORMATION
AUGUST 22, 2005 PRE-BID MEETING
C.T. MALE PROJECT NO.: 01.7293*

Ques.: What compaction requirements are there for the soil barrier to contact and topsoil?

Ans.: It is stated in the Contract Documents, but I believe it is 90%. The method of compaction is not specified and this compaction was kept low so that traversing with heavy equipment may be able to achieve this compaction. Our goal with the compaction requirements is to provide a stable surface and reduce the erosion potential of the soil barrier to contact.

Ques.: Can we get heavy equipment across the bridge?

Ans.: The bridge was installed for this project and is rated for AASHTO HS-20 vehicular loading. It will be up the Contractor to determine if the equipment they propose to use is less than the rating of the bridge.

Ques.: What is the 20,000 gallon groundwater treatment requirement?

Ans.: The groundwater treatment would be for when soil dewatering is necessary to facilitate contaminated soil excavation.

Ques.: How thick is the concrete slab?

Ans.: We completed a few borings within the floor slab and at those locations it was observed to be less than 6 inches. This does not include the loading dock and walls.

Ques.: What size are the wells to be removed?

Ans.: Two-inch and one inch diameter.

Ques.: For the well decommissioning, are the wells required to be overdrilled?

Ans.: No.

Ques.: Is there hazardous materials and how are you supposed to quote for disposal?

Ans.: There are no hazardous materials identified at the site but the potential exists for soil to be deemed hazardous on the basis of TCLP testing required for disposal of non-hazardous soil at Fulton County Landfill. We didn't realize it would cause confusion for bidding and we will take a closer look at it and will address it in Addendum No. 2.

C.T. MALE ASSOCIATES, P.C.

Independent Leather Brownfield Project

Remedial Action

Pre-Bid Questions Raised, Answers Provided and Other Information

Page - 2

Ques.: Any thought to estimating the cost for dewatering? If it is not required it would affect the project cost and has there been consideration for taking it out of the bid?

Ans.: Yes, on the bid form there is a separate mobilization and demobilization bid item under soil dewatering and groundwater treatment so that the system would only be installed if excavation soil dewatering is required.

Ques.: Any other special insurance requirements?

Ans.: Insurance requires additional insured for the City, State and C.T. Male. Refer to specification Section 00810 for details on insurance requirements.

Ques.: What is the method of payment for imported clean soil fill and contaminated soil? Is it going to be paid for on the basis of weight tickets?

Ans.: Imported clean soil brought to the site for general backfill or the soil barrier to contact will be paid for on the basis of in-place volume calculated from surveying information obtained from C.T. Male pre and post placement of fill. Contaminated soil will be paid for on the basis of weight tickets (certified scales) and other supporting information provided by Fulton County Landfill.

Additional information from C.T. Male

- Contractors must recognize that the City has MBW/WBE requirements to fulfill as part of their contract with the State, which translates to the requirement of the Contractor. Good faith efforts must be made on the Contractor's part to use and involve MBE/WBE wherever possible in accordance with the specifications. Documentation of these efforts will be required.
- The City will require Certified Payroll documentation with Payment Application(s) prior to approval.

SECTION 00420 - BIDDER'S QUALIFICATION STATEMENT

The undersigned Bidder guarantees the accuracy of all statements made herein. Please print in ink or type in the spaces provided. Attach additional sheets if necessary.

This statement of Bidder's qualifications is required of all Bidders as part of their Bid and is in partial fulfillment of requirements in Article 3 of the Instructions to Bidders. Additional data on Bidder's qualifications may be requested from selected Bidders after the Bid Opening in accordance with Article 3.

1. List equipment that you plan to rent or purchase for this work and specify whether rent or purchase. If none, so state.

2. List equipment that you own that is available for this work.

3. How many years has your firm been in business as a contractor? _____ years

4. Is your firm qualified to do business in the state where the project is located? YES _____ NO _____ If NO, by signing this Qualification Statement at the end you are agreeing to obtain such qualification prior to award of contract within fourteen days of Owner's request.

5. List up to three (3) projects that are of the same or related nature to the one now being bid that you have completed in the last ten (10) years. For each project, list the name, address, and telephone number of the Owner and/or the Engineer/Architect, the original bid price, the completion date, and the completed contract price.

6. List projects presently under construction by your firm, the dollar volume of the contract, the percentage complete of the contract, and the name and telephone number of the Owner and/or the Engineer/Architect.

7. Have you ever failed to complete a contract awarded to you? YES____ NO____ If YES, state where and why.

8. Give the name, address, and telephone number of an individual who represents each of the following and whom the Owner may contact to investigate your financial responsibility: a surety, a bank, and a major material supplier.

Upon request, I agree to expand the foregoing statements.

(name of Bidder)

By: _____
(signature)

(individual's name & title)

END OF SECTION 00420

Do you plan to subcontract any part of the Work?

This identification of subcontractors is required of all Bidders as part of their Bid and is in partial fulfillment of requirements in Article 12 of the Instructions to Bidders. Additional data on proposed Subcontractors may be requested from selected Bidders after the Bid Opening in accordance with Article 12.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

01.7293

SECTION 00480 - NON-COLLUSIVE BIDDING CERTIFICATION

(Required by Section 103-d of the New York State General Municipal Law.)

By submission of this Bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to the opening, directly or indirectly, to any other bidder or to any competitor; and
3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(print or type name of Bidder)

By:

(signature)

(individual's name & title)

Subscribed and sworn to before me

this _____ day of _____, 20_____.

(signature of Notary Public)

(Notary Stamp)

END OF SECTION 00480

SECTION 00485 - PERFORMANCE BOND INFORMATION FORM

(To be completed and submitted with Bid Forms by all Bidders.)

Project Grant No. _____

Project Location _____

Construction Contract Number _____

Name of Contract _____

Name of Contractor _____

Address _____

Bonding Company or Person Issuing Security Bond _____

Address _____

Bonding Company Agent _____

Address _____

Amount of Bond* \$Contract Price As Awarded

Duration of Bond* One Year After Date of Final Payment

Identification Number of Bond Assigned When Bond is Furnished

* Amount and duration of bond are in accordance with Paragraph 5.01 of the General Conditions and any applicable Supplementary Conditions.

END OF SECTION 00485

C.T. MALE ASSOCIATES, P.C.

ADDENDUM NO. 3
REMEDIAL ACTION
INDEPENDENT LEATHER BROWNFIELD PROJECT

AUGUST 30, 2005

This addendum consists of one page and one attachment. The attachment is Sheet ENV4. The following additions, deletions and modifications are made to the Bidding Contract Documents for the project.

SPECIFICATIONS

- A. Based on recent meetings with NYSDEC, arsenic contaminated soils in the area depicted on Sheet ENV4 require additional remedial action. This work will be required to be performed in accordance with Contract Documents and the following clarifications are provided:
- The Contractor will be required to excavate 12 inches of surface soil from the area shown on Sheet ENV4, temporarily stage soil on the east side of Cayadutta Creek, and protect soil piles from wind and precipitation erosion on a daily basis until off-site disposal. The Contractor will be paid for this work task under Pay Item No. III, Item 1.
 - The Contractor will be required to coordinate, load, transport and dispose arsenic contaminated soil at Fulton County Landfill and control dust generation. The Contractor will be paid for this work task under Pay Item No. III, Item 2. Payment for tipping fees will be the responsibility of the Contractor under this pay item.
 - The Contractor will be required to provide and place general backfill to increase site grades (to replace the 12 inches of arsenic contaminated soils removed). The Contractor will be paid for this work task under Pay Item No. III, Item 7.
 - The Contractor will be required to place a minimum 12 inch thick soil barrier to contact over the general backfill described in the previous bullet. Payment for placement of the soil barrier to contact will be made on the basis of the unit prices under Pay Item VI.
- B. The estimated quantities in Section 00300 - Bid Form shall remain the same.

PLANS

- A. Drawing ENV4 was prepared to provide further information on the area of the site that will require excavation of arsenic contaminated soil. Please understand that additional excavation of petroleum and/or arsenic contaminated soil may be required at the direction of the Engineer. The drawing is attached to this addendum and is hereby made part of the Bidding Documents.

This Addendum is hereby part of the Contract and Bidding Documents. The Contractor is reminded to note receipt of the Addendum on Page 00300-1. Failure to do so may result in disqualification of the bid.

C.T. MALE ASSOCIATES, P.C.

By: Jeffrey A. Marx, PE
Project Engineer



SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 - Specification Sections, apply to this Section.

1.2 PROJECT DESCRIPTION

- A. The work covered by the Contract Documents consists of furnishing all labor, materials, machines, equipment, tools, testing and notifications and associated fees to perform work at the work area described generally within this section, otherwise known as the Independent Leather Site.
- B. The Contractor shall perform the following work under the Bid:
 - 1. Mobilization/Demobilization: Includes, but is not limited to, general project set-up tasks, bonds and insurance, submissions and coordination, cleanup and project close-out.
 - 2. Site Preparation: Prepare and provide site specific health and safety plan and air monitoring program; repair and install new silt fence; clear and grub vegetation and trees as necessary to install the soil barrier to contact; construct decontamination pad to clean equipment that comes into contact with site soils; relocate, repair and maintain access road to facilitate construction traffic and access to contaminated soil; break-up, excavate, and temporarily stockpile remaining building materials; dispose building materials at the Fulton County Landfill; and terminate the inactive drain pipe penetrating the north building wall.
 - 3. The existing gravel access road on the west side of the Cayadutta Creek must remain in its entirety on the west side of the Cayadutta Creek from Hill Street to the bridge during and upon completion of the project. A portion of the existing gravel road on the east side of the Cayadutta Creek must remain during construction to allow for construction vehicle traffic to safely transition from the bridge to the eastern side of the site and shall remain upon completion of the project. The access road thickness and width shall be maintained (in accordance with Contract Drawings) to allow for construction vehicle traffic and to prevent disturbance of site soils on the western side of the site.
 - 4. The building materials consist of the remains from the demolition of the former secondary tannery building on the east side of the Cayadutta Creek. The materials to be removed and disposed include the slab on grade floor slab, above grade foundation walls, below grade foundation walls at the direction of the Engineer, the loading dock, and the concrete apron south of the building footprint. All demolition debris generated from this activity must be disposed off-site at the Fulton County Landfill.
 - 5. Contaminated Soil Removal: Excavate petroleum contaminated soil at the direction of the Engineer; control dust generation during excavation activities; temporarily stage soil on the east side of the Cayadutta Creek; conduct personal air monitoring for organic vapors and particulates; characterize staged soil by completing required testing by the disposal facility; protect soil piles from wind and precipitation erosion at the end of each work day; coordinate, load, transport and dispose contaminated soil at Fulton County Landfill; provide and place clean backfill, decontaminate heavy equipment that comes into contact with site soils; and properly dispose decontamination wash fluids and sediments.
 - 6. Suspect Vent Pipe Evaluation: Perform exploratory excavation of a suspect vent pipe located along the western edge of the former building to determine if it is connected to an underground storage tank. If a tank is not present as determined by the Engineer no further work is required. If a tank is present, properly close the tank by removing the contents, cleaning the interior and proper off-site disposal of the tank and its contents. The Contractor shall assist the Engineer in soil sample collection from the open excavation, as necessary, for the Engineer to determine if petroleum impacts are present and require removal. If contaminated soils are identified, the

- Contractor shall remove contaminated soil at the direction of the Engineer, and stage, load, transport and dispose contaminated soil at Fulton County Landfill.
7. Demarcation Layer: Install a demarcation layer across the entire east side of the Cayadutta Creek and in an isolated area on the west side of the Cayadutta Creek prior to placement of the clean imported soil fill. The demarcation layer shall consist of Amoco Propex 4545 or equal and shall be placed with a minimum one foot overlap on the edges.
 8. Soil Barrier to Contact: Complete preliminary and final grading of the site to prepare for the placement of a demarcation layer and soil barrier to contact to promote positive drainage; place clean soil backfill across the entire east side of the Cayadutta Creek and in an isolated area on the west side of the Cayadutta Creek at a minimum thickness of one foot; and apply hydroseed across the surface of the soil barrier to contact after final grading.
 9. All of the existing monitoring wells located on the east side of the Cayadutta Creek may be properly abandoned if their location impedes excavation or grading activities. The method of abandonment includes removal of PVC casing and filling the hole with bentonite. Monitoring well locations are depicted on Contract Drawings.
 10. All of the existing monitoring wells located on the west side of the Cayadutta Creek must be protected and maintained during project completion. Monitoring wells are depicted on Contract Drawings.
 11. The Contractor must recognize that a Stormwater Pollution Prevention Plan (SWPPP) exists for the site, and the Contractor must comply with the stormwater control measures during construction. SWPPP related notifications have already been submitted by the Owner. At no time should building demolition debris, site soil, dust or untreated runoff enter the Cayadutta Creek. All work shall be performed in accordance with the Stormwater Pollution Prevention Plan for the site, as included in Contract Documents.
 12. It is the responsibility of the Contractor to verify that all utilities have been located and disconnected. Any other utilities encountered during the excavating activities not already disconnected shall be properly terminated.
 13. Work hours for this project will be between 7:30 AM to 5:30 PM Monday through Friday.

1.3 CONTRACT TIME

- A. All work shall be completed within ninety (90) days from project start.

1.4 CONTRACT METHOD

- A. Perform the Remedial Action work under a single Unit Price contract.

1.5 CONTRACTOR USE OF PREMISES

- A. General: Limit use of the premises to activities in areas indicated; allow for City of Gloversville use and use by other Contractors.
 1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which operations are indicated are not to be disturbed.
 2. Keep driveways and entrances serving the premises and adjacent premises clear and available to the City of Gloversville, OWNER, the OWNER's employees and other Contractors at all times.
 3. Coordinate use of premises under direction of OWNER and ENGINEER.

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01010

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. This Section contains a list of Unit Price Contract Payment Items. Payment Items are listed in this section by Payment Item number exactly as they appear on the Bid Form. Payment Items are grouped under the Section in which they are specified or most appropriately associated.
- B. Subject to the provisions in GENERAL CONDITIONS, Article 10 - Changes in the Work and Article 11 - Change of Contract Price, all Work and payment for the Work of this Contract are represented by Payment Items and associated unit prices.
 - 1. Payment items include all incidental costs and subsidiary obligations reasonably required to complete the work.
 - 2. Payment items include all Work Units combined as specified in this Section.
- C. Definitions:
 - 1. PAYMENT ITEM: a specifically described unit of Work or a combination of described units of Work for which a price is provided in the Contract.
 - 2. WORK UNIT: an element of work specifically described in one of the Specification Sections which may be:
 - a. Combined with other Work Units into a single Payment Item as specified in this Section; or
 - b. Specified as a Payment Item in this Section. The Work Unit may appear in the Contract as a discrete Payment Item, and appear in the Contract as a discrete Payment Item, and also be combined with other Work Units as a part of another Payment Item.
 - 3. SUBSIDIARY OBLIGATIONS: All material, labor, supplies, equipment, and services not specifically described as Payment Items but which are reasonably required to complete the Work.

1.2 PAYMENT

- A. Subject to all other Contract requirements, the CONTRACTOR shall be paid for "as-built" quantities of Payment Items.
- B. Estimated Quantities on the Bid Form are for comparison in competitive bidding only and do not constitute the basis for payment or measurement of quantities.
- C. Unless otherwise specified or further qualified in this Section, Estimated Quantities on the Bid Form are:
 - 1. Accurate within 25%±.
 - a. As-built quantities of Payment Items failing to meet such accuracy are defined as significantly changed, and subject to the provisions in GENERAL CONDITIONS, ARTICLE 11, paragraph 11.03.
- D. When the Work is divided into groups of Payment Items and the same Item description, regardless of item number, appears in more than one group, the accuracy of quantities specified in paragraph 1.2.C.1 applies to the total quantity of that Item in the Project, which is equal to the sum of that Item quantity from all groups.
- E. Payment Items listed in this Section by Item Number with the prefix "C" are contingency Payment Items, and are not subject to the accuracy of quantities specified in paragraph 1.2.C of this Section.

1.3 MEASUREMENT FOR PAYMENT

A. Payment limit lines:

1. Where payment limit lines are shown on the Contract Drawings, measurement of a Payment Item quantity will be made up to, but not beyond such lines.
2. Where the actual work of a Payment Item falls short of the payment limit line, measurement will be made to the line of the actual work.
3. No measurement for payment will be made for quantities outside of payment limit lines unless authorized in writing by the Engineer/Architect.

B. Methods of Measurement:

1. Measurements of lengths, widths, slope angles, and depths or elevations shall be made to determine "as built" quantities of lengths, areas, and volumes pertinent to Payment Items.
 - a. Unless otherwise specified, all lengths shall be horizontal distances.
 - b. Slope angles and elevations shall be measured using land surveying equipment appropriate to the situation.
2. Graphic representations of measured quantities shall be drafted to scale using the Contract Drawings where convenient and appropriate. Additional drawings shall be drafted if required.
 - a. Irregular shapes representing areas and volumes shall be measured using a compensating polar planimeter or a computer digitizer.
 - b. Regular shapes shall be scaled.
3. Use of Contract Drawings:
 - a. Unless otherwise agreed upon between the Contractor and Engineer/Architect the Contract Drawings shall be used as the basis to establish existing grades and other existing topographic features prior to the start of work.
4. The method of measuring the quantity of contaminated soil/fill excavated shall be based on weight tickets from a certified scale for each trailer load.
5. The method of measuring the quantity of imported fill materials used to backfill excavations shall be based on weight tickets or other quantity documentation provided by the supplier of the backfill.

C. Other Measurements for Payment:

1. Pipe Lengths: Measurement of pipe shall be made along the top of pipe in place, taken as the laying length for the following:
 - a. Water pipe, including fittings and valves.
 - b. Sewer pipe, including branches, fittings, and excluding flared end sections, and the inside dimension of manholes, catch basins, and vaults.
2. Except as otherwise specified, measurement of Payment Item quantities of weights, lengths, areas, and volumes shall be made:
 - a. On "as-built" and in-place completed work, during construction or at the time of Substantial Completion.
 - b. If no other feasible and practical method of measurement is available, by delivery slips delivered to the Engineer/Architect.
3. Adjustments shall be made to eliminate overlaps in area and volume calculations.
4. Deductions shall be made for volumes occupied by pipes, manholes, and other structures built under this Contract.

1.4 DESCRIPTION OF UNIT PRICE CONTRACT PAYMENT ITEMS

A. Division 1 - General Requirements

1. Bid Item I – Mobilization/Demobilization: Includes but is not limited to general project set-up tasks, bonds and insurance, submissions, submittals, project meetings, coordination, safety meetings, construction facilities, temporary controls, protection of existing facilities and structures,

and project close out. Demobilization includes remaining breakdown/clean up tasks. Generally, payment for mobilization will be allowed up to approximately 60% of the bid amount with the remaining 40% retained as demobilization.

B. Division 2 – Site Work

1. Bid Item II-1: Includes all labor, equipment, material and tools to prepare and provide a Site Specific Health and Safety Plan by a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP).
2. Bid Item II-2: Includes all labor, equipment, materials, and tools to repair existing and install new silt fence at the locations shown on Contract Drawings.
3. Bid Items II-3: Includes all labor, equipment, material and tools to clear and grub areas of the site where the soil barrier to contact is to be installed, and legally dispose removed materials off-site.
4. Bid Item II-4: Includes all labor, equipment, material and tools to construct a decontamination pad of sufficient size to clean heavy equipment and contain wash fluids and sediments.
5. Bid Item II-5: Includes all labor, equipment, material and tools to relocate, repair and maintain existing gravel access road for construction traffic and to install new gravel access road for construction traffic.
6. Bid Item II-6: Includes all labor, equipment, material and tools to break-up, excavate and temporarily stockpile remaining building materials. This includes concrete slabs on grade, loading dock, above grade/below grade foundation walls and wood timbers.
7. Bid Item II-7: Includes all labor, equipment, material, tools and tipping fees to load, transport and dispose building materials at the Fulton County Landfill.
8. Bid Item II-8: Includes all labor, equipment, material and tools to decommission monitoring wells via PVC pipe removal and filling the void with bentonite.
9. Bid Item II-9: Includes all labor, equipment, material and tools to terminate the inactive drain pipe located on the north side of the building per City requirements.
10. Bid Item III-1: Includes all labor, equipment, material and tools to excavate petroleum contaminated soil at the direction of the Engineer; control dust generation; temporarily stage soil on the east side of the Cayadutta Creek, and protect soil piles from wind and precipitation erosion on a daily basis until transported off-site for disposal.
11. Bid Item III-2: Includes all labor, equipment, material and tools to coordinate, load, transport and dispose non-hazardous contaminated soil at Fulton County Landfill and control dust generation.
12. Bid Item III-3: Includes all labor, equipment, material and tools to develop and implement air monitoring program for site workers for organic vapors and particulates for determining and upgrading personal protective equipment.
13. Bid Item III-4: Includes all labor, equipment, material and tools to coordinate, load, transport and dispose hazardous contaminated soil at a facility permitted to accept this type of material, and control dust generation, if required.
14. Bid Item III-5: Includes all labor, equipment, material and tools to collect waste characterization samples and analyze them via Full TCLP as required by Fulton County Landfill for acceptance of non-hazardous contaminated soil, with results available within 48 hours from sample collection.
15. Bid Item III-6: Includes all labor, equipment, material and tools to collect waste characterization samples and analyze them for disposal facility required analysis for acceptance of hazardous contaminated soil, with results available within 48 hours from sample collection, if required.
16. Bid Item III-7: Includes all labor, equipment, material and tools to provide and place clean general backfill to increase site grades (to replace the petroleum contaminated soils removed) after placement of the demarcation layer and prior to placing the topsoil for the soil barrier to contact.
17. Bid Item III-8: Includes all labor, equipment, material and tools to decontaminate heavy equipment and contain wash fluids and sediments for subsequent disposal.
18. Bid Item III-8: Includes all labor, equipment, material and tools to transfer decontamination wash fluids from decontamination pad to 55-gallon drums, characterize liquid and properly dispose at a facility permitted to accept this type of non-hazardous waste.
19. Bid Item IV-1: Includes all labor, equipment, material and tools to complete exploratory excavation of the suspect vent pipe to determine if pipe is connected to an underground storage tank.

20. Bid Item IV-2: Includes all labor, equipment, material and tools to empty, excavate, remove, clean and dispose underground storage tank and associated piping, if located, assuming 275 to 1,499 gallons.
21. Bid Item IV-3: Includes all labor, equipment, material and tools to transport and dispose tank contents assuming No. 2 fuel oil, diesel or kerosene mixed with water at a facility permitted to accept this type of non-hazardous waste.
22. Bid Item IV-4: Includes all labor, equipment, material and tools to transport and dispose tank bottom sludge in 55 gallon drum at a facility permitted to accept this type of non-hazardous waste
23. Bid Item V-1: Mobilization/Demobilization: Includes all labor, equipment, material and tools to construct, set-up and dismantle temporary groundwater treatment system; and cleaning of the temporary storage tank.
24. Item V-2: Includes all labor, equipment, material and tools to perform soil dewatering and groundwater treatment including 20,000 gallon untreated water storage capacity, treatment with a minimum of 2-55 gallon granular activated carbon units plumbed in series, bag filter as necessary, installation of water meter, and sampling before and during treatment.
25. Item V-3: Includes all labor, equipment, material and tools to collect and analyze samples from the groundwater treatment system by EPA Methods 8021 and 8270 (base neutrals only), and arsenic and chromium by standard methods to be analyzed within 24 hours.
26. Item V-4: Includes all labor, equipment, material and tools to supply 55-gallon virgin granular activated carbon (GAC) units and dispose of spent 55-gallon GAC unit.
27. Item VI-1: Includes all labor, equipment, material and tools to supply and place general fill, preliminary grade and final grade soil barrier to contact. The actual quantity of fill will be determined on the basis of surveying data and computer calculations completed by the Engineer. The in-place volume of soil will be determined by the difference between the surface of the site after preliminary grading and prior to placement of fill, and the surface after placement of fill and final grading. The quantity of topsoil placed will be subtracted from this pay item as the topsoil is paid for under Bid Item VI-2.
28. Item VI-2: Includes all labor, equipment, material and tools to supply and place 3" of clean topsoil to construct soil barrier to contact. The actual quantity of topsoil will be determined on the basis of the Engineer's surveying information of the final soil barrier to contact surface.
29. Item VI-3: Includes all labor, equipment, material and tools to supply and install provide a demarcation layer beneath clean imported fill and soil barrier to contact. The actual quantity of demarcation layer will be determined on the basis of the Engineer's surveying information of the final soil barrier to contact surface.
30. Item VI-4: Includes all labor, equipment, material and tools to collect and analyze soil samples from the source (i.e., borrow pit) of imported material used for backfill and topsoil for Target Compound List (TCL) volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide) analyses.
31. Item VI-5: Includes all labor, equipment, material and tools to apply hydroseed to the soil barrier to contact and protect until establishment of vegetative cover. The actual quantity of hydroseed will be determined on the basis of the Engineer's surveying information of the final soil barrier to contact surface.

END OF SECTION 01025

SECTION 01027 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer/Architect and paid for by the Owner.
 - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment-Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment or as approved by the Engineer/Architect.
- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Engineer will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to the Engineer/Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Engineer/Architect.
- F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who is lawfully entitled to file a mechanics lien arising out of the Contract and related to the Work covered by the payment.

- G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
 - 1. List of subcontractors.
 - 2. List of principal suppliers and fabricators.
 - 3. Contractor's Construction Schedule (preliminary if not final).
 - 4. Schedule of unit prices.
 - 5. Submittal Schedule (preliminary if not final).
 - 6. Initial progress report.
 - 7. Report of preconstruction meeting.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
 - 1. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Warranties (guarantees) and maintenance agreements.
 - b. Disposal documentation/weight tickets.
 - c. Imported backfill quantity documentation from supplier.
 - d. Final cleaning.
 - e. List of incomplete Work, recognized as exceptions to Engineer/Architect's Certificate of Substantial Completion.
- I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
 - a. Completion of Project closeout requirements.
 - b. Completion of items specified for completion after Substantial Completion.
 - c. Ensure that unsettled claims will be settled.
 - d. Ensure that incomplete Work is not accepted and will be completed without undue delay.
 - e. Transmittal of required Project construction records to the Owner.
 - f. Proof that taxes, fees, and similar obligations were paid.
 - g. Removal of temporary facilities and services.
 - h. Removal of surplus materials, rubbish, and similar elements.
 - i. Waiver of liens from subcontractors and suppliers.
 - j. Required documentation of minority and women owned business enterprises participation.
 - k. Certified payroll paperwork.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01027

SECTION 01028 - CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Execution of change orders.

1.2 RELATED SECTIONS

- A. Section 00500 - Agreement Forms.
- B. Section 00700 - General Conditions: Governing requirements for changes in the Work, in Contract Sum/Price, and Contract Time.
- C. Section 00810 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
- D. Section 01027 - Applications for Payment.
- E. Section 01300 - Submittals.
- F. Section 01600 - Material and Equipment: Product options and substitutions.
- G. Section 01700 - Contract Closeout: Project Record Documents.

1.3 SUBMITTALS

- A. Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. Change Order Forms: AIA G701 or approved equal.

1.4 DOCUMENTATION OF CHANGE IN CONTRACT SUM/PRICE AND CONTRACT TIME

- A. Maintain detailed records of work done on a time and material force account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
- B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
- C. On request, provide additional data to support computations:
 - 1. Quantities of products, labor, and equipment.
 - 2. Insurance and bonds.
 - 3. Overhead and profit.
 - 4. Justification for any change in Contract Time.
 - 5. Credit for deletions from Contract, similarly documented.
- D. Support each claim for additional costs, and for work done on a time and material, force account basis, with additional information:

1. Origin and date of claim.
2. Dates and times work was performed, and by whom.
3. Time records and wage rates paid.
4. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

1.5 CHANGE PROCEDURES

- A. The Engineer/Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by EJCDC 1910-B Paragraph 9.5 by issuing supplemental instructions or approved equal.
- B. The Engineer/Architect may issue a Proposal Request or Notice of Change which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid.
- C. The Contractor may propose a change by submitting a request for change to the Engineer/Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01600.

1.6 CONSTRUCTION CHANGE AUTHORIZATION, WORK DIRECTIVE CHANGE

- A. All changes affecting the project's construction cost of modifications of the terms or conditions of the contract must be authorized by means of a written contract change order which is mutually agreed to by the Owner and Contractor.
- B. The document will describe changes in the Work, and will designate method of determining any change in the Contract Sum/Price of Contract Time.
- C. Promptly execute the change in Work.

1.7 STIPULATED PRICE CHANGE ORDER

- A. Based on Proposal Request or Notice of Change and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Engineer/Architect.

1.8 UNIT PRICE CHANGE ORDER

- A. For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis.
- B. For unit costs or quantities of units of work which are not pre-determined, execute Work under a Construction Change Authorization, Work Directive Change.
- C. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material, Force Account Change Order.

1.9 TIME AND MATERIAL, FORCE ACCOUNT CHANGE ORDER

- A. Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- B. Engineer/Architect will determine the change allowable in Contract Sum/Price and Contract Time as provided in the Contract Documents.
- C. Maintain detailed records of work done on Time and Material, Force Account basis.
- D. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

1.10 EXECUTION OF CHANGE ORDERS

- A. Execution of Change Orders: Engineer/Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.11 CORRELATION OF CONTRACTOR SUBMITTALS

- A. Promptly revise Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum/Price.
- B. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of work affected by the change, and resubmit.
- C. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01028

SECTION 01041 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Project coordination administrator.
- B. Construction mobilization.
- C. Schedules.
- D. Submittals.
- E. Coordination drawings.
- F. Closeout procedures.

1.2 RELATED SECTIONS

- A. Section 01700 - Contract Closeout: Contract closeout procedures.

1.3 PROJECT COORDINATION ADMINISTRATOR

- A. Project Coordination Administrator: Engineer/Architect

1.4 CONSTRUCTION MOBILIZATION

- A. Cooperate with the Administrator in allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- B. During construction, coordinate use of site and facilities through the Engineer/Architect.
- C. Comply with Administrator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- D. Comply with instructions of the Engineer/Architect for use of temporary utilities and construction facilities.
- E. Coordinate filed engineering and layout work under instructions of the Administrator.

1.5 SCHEDULES

- A. Submit preliminary progress schedule in accordance with Section 01300.
- B. After review, revise and resubmit schedule to comply with revised Project schedule.
- C. During progress of Work, revise and resubmit as directed.

1.6 SUBMITTALS

- A. Provide submittals to Engineer/Architect for review.

1.7 CLOSEOUT PROCEDURES

- A. Notify Engineer/Architect when Work is considered ready for Substantial Completion. Accompany Engineer/Architect on preliminary project observation to determine items to be listed for completion or correction in Contractor's notice of Substantial Completion.
- B. Comply with Engineer/Architect's instructions to correct items of Work listed in executed Certificates of Substantial Completion.
- C. Notify Engineer/Architect when Work is considered finally complete.
- D. Comply with instructions for completion of items of Work determined by the Engineer/Architect's final project observation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01041

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Contractor participation in preconstruction conferences.
- B. Contractor administration of progress meetings and pre-installation conferences.

1.2 RELATED REQUIREMENTS

- A. Section 00100 - Instructions to Bidders: Pre-Bid Conference.
- B. Section 01041 - Project Coordination.
- C. Section 01300 - Submittals: Progress Schedules.
- D. Section 01400 - Quality Control.
- E. Section 01700 - Contract Closeout: Project record documents.

1.3 PRECONSTRUCTION CONFERENCES.

- A. The Owner and Engineer/ Architect will administer a pre-construction conference for execution of Owner-Contractor Agreement and exchange of preliminary submittals.
 - 1. Preconstruction conference will be held at a time and place to be determined. Owner and/or Engineer/Architect will confirm day, date, and time prior to meeting.

1.4 PROGRESS MEETINGS

- A. The owner and/or Engineer/Architect will Schedule and administer Project meetings throughout progress of the Work as needed.
- B. Make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Engineer/Architect, participants, and those affected by decisions made at meetings.
- C. Attendance: Job superintendent, major subcontractors and suppliers; Owner and Engineer/Architect as appropriate to agenda topics for each meeting.
- D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments thereto, delivery schedules, submittals, maintenance of quality standards, pending changes and substitutions, and other items affecting progress of Work.

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 - Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Shop Drawings.
 - 4. Product Data.
 - 5. Samples.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Permits.
 - 2. Applications for payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of Subcontractors.
- C. Site Specific Health and Safety Plan and Air Monitoring Program are included in Section "Health and Safety".
- D. Inspection and test reports are included in Section "Quality Control Services."
- E. Submittal of Project photographs is included under Section "Building Demolition."

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Engineer/Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer/Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.

- d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer/Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Provide a space on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 - 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Number and title of appropriate Specification Section.
 - d. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer/Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
 - 1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
 - 2. Transmittal Form: Use AIA Document G 810 or similar form.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit within 15 days of the date established for "Commencement of the Work".
 - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer/Architect, Owner, subcontractors, and other parties required to comply with scheduled dates.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 5 days of the date required for establishment of the Contractor's construction schedule.
 - 1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 - 2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category.
 - d. Name of subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date the Engineer/Architect's final release or approval.

- B. Distribution: Following response to initial submittal, print and distribute copies to the Engineer/Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
 - 7. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Engineer/Architect's review; the reproducible print will be returned.
 - 8. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
 - a. One of the prints returned shall be marked-up and maintained as a "Record Document".
 - 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
 - 1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
 - 2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.7 ENGINEER/ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 - 1. Final Unrestricted Release: Where submittals are marked "Furnish As Submitted," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

2. Final-But-Restricted Release: When submittals are marked "Furnish as Corrected," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. Returned for Resubmittal: When submittal is marked "Rejected, Revise and Resubmit, or Submit Specified Item," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Rejected, Revise and Resubmit, or Submit Specified Item" to be used at the Project site, or elsewhere where Work is in progress.
4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01300

SECTION 01400 - QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Engineer/Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by the Engineer/Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
 - 1. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
 - 2. The Owner will engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibility.
 - 3. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
 - 4. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

- a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.
- B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Engineer/Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Engineer/Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Engineer/Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretations of test results.
 - j. Ambient conditions at the time of sample-taking and testing.
 - k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.
- C. Construction Facilities: Access road, parking and progress cleaning.

1.2 RELATED SECTIONS

- A. Section 01700 - Contract Closeout: Final cleaning.

1.3 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required from Utility source.

1.4 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required. Connect to existing water source for construction operations.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.5 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures.

1.6 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.
- C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.7 FENCING

- A. Construction: 6-foot-high chain link fence on the east side of the Cayadutta Creek and 15-foot-wide double swing chain link gate on the west side of the bridge crossing the Cayadutta Creek already exists and shall be utilized. 4-foot-high orange construction fence shall be installed on the west side of the Cayadutta Creek prior to start of work, as shown in the Contract Drawings.

1.8 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment. Notify Engineer/Architect prior to implementing groundwater pumping activities.
- B. Protect site from puddling or running water.
- C. Provide method, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.9 PROTECTION OF INSTALLED WORK

- A. Prohibit traffic or storage upon finish graded surfaces.

1.10 SECURITY

- A. Provide security to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

1.11 ACCESS ROAD AND PARKING

- A. Provide temporary access road and surface parking areas to accommodate construction personnel and equipment.
- B. When site space is not adequate, provide additional off-site parking.

1.12 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove waste materials, debris, and rubbish from site and dispose off-site.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Existing water and service laterals to be cut and capped per City of Gloversville requirements. Existing gas and electric services to be discontinued per utility company requirements.
- B. Existing water main, sanitary sewer and structures, storm sewer and structures to remain.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01500

SECTION 01565 - DUST CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Application of Water for Dust Control.
- B. Application of Calcium Chloride for Dust Control.

1.2 RELATED SECTIONS

- A. Section 01500 - Construction Facilities and Temporary Controls.
- B. Section 02090 - Contaminated Soil Remediation

1.3 SUBMITTALS

- A. Submit manufacturer's product literature and specifications for calcium chloride meeting the requirements of this section.
- B. Submit Material's Safety Data Sheet for calcium chloride.
- C. Submit in accordance with Section 01300 - Submittals.

PART 2 - PRODUCTS

2.1 CALCIUM CHLORIDE

- A. Calcium Chloride shall be supplied in either the liquid or solid flake form. Other forms will not be acceptable.
- B. Liquid Form:
 - 1. Liquid calcium chloride shall be supplied as a mixed solution which upon analysis shall show no less than 33.0% CaCl_2 .
 - 2. Liquid calcium chloride shall be delivered in bulk shipments on a supplied-and-applied basis. The delivery equipment shall be capable of applying the liquid solution at the specified rate(s). The delivery equipment shall be equipped with suitable calibration devices to insure the correct rate of application.
- C. Solid Flake Form:
 - 1. Solid flake calcium chloride shall meet the requirements of ASTM D98 and upon analysis shall show no less than 77.0% CaCl_2 .
 - 2. The solid flake form calcium chloride shall be supplied in the form of dry, loose flakes, and shall be fine enough to feed through the common types of spreaders used in road work.
 - 3. Solid calcium chloride shall be packaged in moisture proof bags containing not more than 100 lbs. each. All shipments that are to be stored and stockpiled on the job site shall be protected with waterproof covers.

PART 3 - EXECUTION

3.1 METHOD OF DUST CONTROL

- A. The Contractor shall provide a method of dust control which prevents fugitive dust generation from exceeding NYS Department of Health Generic Community Air Monitoring Plan action levels. The Engineer will be conducting electronic dust monitoring upwind and downwind of the work area to document that action levels are not being exceeded during ground intrusive work activities. If action levels are exceeded, work will halt and the Contractor shall upgrade or modify dust control techniques prior to resuming work.
- B. Application of Calcium Chloride for dust control shall not be utilized in areas of the site where topsoil and hydroseeding will be performed.

3.2 APPLICATION OF WATER FOR DUST CONTROL

- A. The Contractor shall arrange to have water available for dust control at all times during construction. Utilization of the municipal water system for dust control shall be coordinated with the City of Plattsburgh Public Works Department. The Contractor shall pay for connection and water used, as required by the City of Plattsburgh. Water may be supplied for dust control with water trucks or any other means available to the Contractor. Utilization of surface water (pond, stream, etc.) for dust control will neither be acceptable nor allowed. In any event, the Contractor shall have a water truck on site at all times. The truck shall have a minimum holding capacity of 3,000 gallons and shall disperse water through a manifold-type system. The water truck shall be filled to its maximum capacity at the end of each workday. A suitable device for a positive shut-off and for regulating the flow of water shall be provided.
- B. The water truck shall have a minimum application width of 8 feet.
- C. Apply water to the areas requiring dust control at a uniform rate of 0.5 gallons per square yard. The Engineer will determine the area within the work zone which needs watering. Those areas requiring dust control shall be watered a minimum of once per day or more as ordered by the Engineer.
- D. The Engineer will notify the Contractor in the event that the weather conditions preclude the need for watering the site.

3.3 APPLICATION OF CALCIUM CHLORIDE FOR DUST CONTROL

- A. Liquid Calcium Chloride Application:
 - 1. The calcium chloride distributor shall be so designed, equipped, maintained and operated so that the calcium chloride can be applied uniformly on available widths of surface up to 15 feet at readily determined and controlled area at 0.30 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallons per square yard. Distributor equipment shall include tachometer, accurate volume measuring devices or a calibrated tank. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically.
 - 2. Speed Control: Mechanical distributors must be fitted with an accurate means of indicating the road speed when the vehicle is traveling at operational speeds. The road speed indicator must be independent of the normal vehicle speedometer and must be so placed that the driver can read it with the least possible distraction from driving the vehicle or operating the plant, and tested and certified as accurate to within $\pm 5\%$. Digital speed meters may be used provided the digits are clearly visible.

3. Pumping System: A positive system must be provided to circulate the material in the spray bar and tank and another positive system should be provided to clean the pump and spray bar if the tank is not emptied.

The supply system to the nozzles must be such that all nozzles in use substantially commence spraying simultaneously, with a full spray at the start of a run, and shut off simultaneously at the end of a run so that no excessive discharge occurs (i.e., linkages should not be worn, etc.).

The material distribution system is supplied from a pipe carrying material under pressure, the spray rate of the material must be controlled by the following method:

- a. using a metering pump synchronized with the road speed of the vehicle. In this case the pump must be driven at a speed which remains proportional to that of the vehicle.
 - b. During full-width spraying, the whole delivery of the pump must be passed to the spray bar, any bypass valve being closed.
4. Sample Valve: The distributor shall be equipped with a sampling valve so designed and installed as to be non-clogging and safe. The type of valve and its general location shall be according to written instruction by the Department.
 5. Information regarding pump revolutions, road speed, etc. must be supplied with each machine to enable the operator to ensure that the specified spray rate is obtained. This will normally be in the form of a spray chart and the relevant information should be tabulated.

B. Solid Flake Calcium Chloride:

1. The calcium chloride distributor may be any common type of spreader used in road work which can apply the calcium chloride uniformly on variable widths of surface up to 15 feet at readily determined and controlled areas at 1.75 pounds per square yard.
2. Water shall be added to the material in amounts as directed by the Engineer.
3. Solid flake calcium chloride which has become caked or otherwise damaged shall not be utilized. The acceptability of the calcium chloride shall be determined by the Engineer.
4. Any adequate supply of solid flake calcium chloride for one (1) application to the roadways of the entire project site shall be available at all times, including those times when water or liquid calcium chloride is utilized for dust control
5. The solid flake calcium chloride shall be stored in waterproof containers legibly marked with the name of the manufacturer, name of the product, net weight, and the percentage of calcium chloride (CaCl_2) guaranteed by the manufacturer.

END OF SECTION 01565

SECTION 01570 - TRAFFIC REGULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Traffic Control Plan.
- B. Construction Parking Control.
- C. Flagmen.
- D. Flares and Lights.
- E. Haul Routes.
- F. Traffic Signs and Signals.
- G. Removal.

1.2 RELATED SECTIONS

- A. Section 01500 - Construction Facilities and Temporary Controls.

1.3 TRAFFIC CONTROL PLAN

- A. Whenever the construction work zone involves a roadway or walkway presently used by vehicular or pedestrian traffic, the Contractor shall present to the Owner for approval a traffic control plan. This plan may reference directly or modify existing methods in the "New York State Manual of Uniform Traffic Control Devices" July 1, 1983 and addenda. Large, complex project will require that these plans be added to the Contract Documents.

1.4 SIGNS, SIGNALS, AND DEVICES

- A. Traffic Control Signals: As approved by local jurisdictions.
- B. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- C. Flagman Equipment: As approved by local jurisdictions.

1.5 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

1.6 FLAGMEN

- A. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

1.7 FLARES AND LIGHTS

- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

1.8 HAUL ROUTES

- A. Consult with authority having jurisdiction in establishing public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

1.9 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Install and operate [automatic] traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
- C. Relocate as Work progresses, to maintain effective traffic control.

1.10 REMOVAL

- A. Remove equipment and devices when no longer required.
- B. Repair damage caused by installation.
- C. Remove post settings to a depth of 2 feet.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01570

SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Product options.
- E. Substitutions.

1.2 RELATED SECTIONS

- A. Document - Instructions to Bidders: Product options and substitution procedures.
- B. Section 01400 - Quality Control: Product quality monitoring.

1.3 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.
- B. For exterior storage of fabricated products, place on sloped supports, above ground.

- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.
- F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.7 SUBSTITUTIONS

- A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.

1.2 RELATED SECTIONS

- A. Section 01500 - Construction Facilities and Temporary Controls: Progress cleaning.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer/Architect's inspection.
- B. Provide submittals to Engineer/Architect that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 FINAL CLEANING

- A. Execute final cleaning prior to final inspection
- B. Clean site; mechanically sweep paved areas and remaining concrete floor slab, and rake clean landscaped surfaces.
- C. Remove waste and surplus materials, rubbish, and construction facilities from the site. Barriers to remain.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Store Record Documents separate from documents used for construction.

C.T. MALE ASSOCIATES, P.C.

INDEPENDENT LEATHER
REMEDIAL ACTION

- C. Record information concurrent with construction progress.
- D. Submit documents with claim for final Application for Payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01700

SECTION 02000 – HEALTH AND SAFETY

PART 1 - GENERAL

1.1 WORK UNITS

- A. Definitions.
- B. Scope of Work.
- C. Regulations and Reference Standards.
- D. Submittals.
- E. Existing Conditions
- F. Health and Safety Plan.
- G. Air Monitoring Program.

1.2 RELATED SECTIONS

- A. Section 00220 - Reports of Exploration.
- B. Section 02060 - Building Demolition.
- C. Section 02090 - Contaminated Soil Remediation.
- D. Section 02095 - Treatment of Contaminated Groundwater.
- E. Section 02097 - Soil Barrier to Contact.
- F. Section 02100 - Site Preparation.
- G. Section 02140 - Dewatering.

1.3 DEFINITIONS

- A. Project Personnel: Project personnel include NYSDEC, the Contractor, its Subcontractors, and Federal and State Representatives working and having business at the Project site.
- B. Authorized Visitor: Authorized visitors are individuals who do not have specific knowledge or involvement with the Project but have demonstrated through written proof that they are medically certified and trained in accordance with 29 CFR 1910.120 to enter the work area. All visitors shall be escorted by the Owner, the Owner's Representative and/or NYSDEC.
- C. Health and Safety Officer (HSO): The Contractor's employee or its Subcontractor responsible for the preparation and implementation of the site specific Health and Safety Plan (HASP) and Air Monitoring Program (AMP). The HSO will be responsible for the day to day implementation and enforcement of the HASP and AMP.

- D. Health and Safety Technician (HST): The Contractor's employee or its Subcontractor who will assist the HSO in implementing the HASP and the air monitoring in work areas, and maintaining monitoring and safety equipment in good working condition.
- E. Monitoring: The use of direct-read field instruments to provide information on the levels of organic vapors and particulates, which may be present during remedial action. Monitoring shall be performed by the Contractor's employee or its Subcontractor with calibrated equipment to evaluate for employee exposures to site conditions.

1.4 SCOPE OF WORK

- A. The work covered under this section shall consist of furnishing all labor, materials, tools and equipment necessary to prepare and implement a site specific Health and Safety Plan (HASP) and Air Monitoring Program (AMP). A HASP and AMP is required at the site due to the environmental impacts that exist in soil and groundwater at the site.
- B. The Contractor shall understand that this section describes the minimum health and safety requirements for reference in the Contractor's development of a written site specific Health and Safety Plan (HASP). The HASP shall be prepared by a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP) and submitted to the Engineer within fourteen (14) days from receipt of the Notice to Proceed.
- C. The Contractor shall develop and implement an AMP for his/her personnel for organic vapors and particulates. The AMP shall be used by the Contractor to determine the proper level of personnel protective equipment to use, and to document that the level of protection utilized is adequate. The Contractor will not be responsible for developing and implementing area or perimeter air monitoring as this will be the responsibility of the Owner. The Contractor will be responsible for assuring levels of organic vapors and particulates during intrusive site work and backfilling do not exceed established action levels indicated in New York State Department of Health's Generic Community Air Monitoring Plan.

1.5 REGULATIONS AND REFERENCE STANDARDS

- A. Occupational Safety and Health Administration Regulations.
- B. 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response (HAZWOPER).
- C. 29 CFR Part 1926.- Safety and Health Regulations for Construction

1.6 SUBMITTALS

- A. Site Specific Health and Safety Plan prepared by Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP) within fourteen (14) days from receipt of the Notice to Proceed.
- B. Qualifications of Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP).
- C. Qualifications of Health and Safety Officer (HSO) and Health and Safety Technician (HST) prior to start of work.
- D. A copy of the worker's training certificates such as OSHA 40 Hour and 8 Hour Refresher HAZWOPER training certificates prior to mobilizing to the site or a certification by the Contractor that the personnel entering the work areas have received the appropriate health and safety training in accordance with 29 CFR 1910 and 1926.

- E. A copy of the worker's medical surveillance documentation prior to mobilizing to the site or a certification by the Contractor that the personnel entering the work areas have received the appropriate medical surveillance in accordance with 29 CFR 1910.
- F. Air monitoring results on a weekly basis.

1.7 EXISTING CONDITIONS

- A. Environmental impacts have been identified within surface and subsurface soils at the site. The contaminants of concern in soil have been primarily identified as petroleum related volatile and semi-volatile organic compounds and metals. Typical concentrations of total volatile organic compounds and semi-volatile organic compounds detected on the east side of the Cayadutta Creek are generally less than 75 mg/kg and 170 mg/kg, respectively. The primary metals of concern are arsenic and chromium, which have been typically detected on the east side of the Cayadutta Creek at concentrations ranging from non-detect to 3,510 mg/kg and non-detect to 2,560 mg/kg, respectively.
- B. Environmental impacts have been identified within groundwater at the site. The contaminants of concern in groundwater have been primarily identified as petroleum related volatile and semi-volatile organic compounds and metals. The concentrations of total volatile organic compounds and semi-volatile organic compounds typically detected on the east side of the Cayadutta Creek are generally less than 100 ug/l and 250 ug/l, respectively. The primary metal of concern is arsenic, which have been typically detected in groundwater within the eastern side of the Cayadutta Creek at concentrations ranging from non-detect to 494 ug/l.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 HEALTH AND SAFETY PLAN

- A. The Contractor will be responsible for ensuring the health and safety of his employees and subcontractor employees during the work; for health and safety monitoring; for enforcing health and safety procedures; and for complying with all Local, State and Federal regulations through implementation of the site specific HASP. The HASP shall be prepared in accordance with the requirements of 29 CFR 1910.120.
- B. The Contractor shall determine the appropriate level of worker protection during completion of the remedial action and adjust the personal protective equipment on the basis of site conditions and air monitoring results in accordance with the Contractor's HASP.
- C. The Contractor shall be responsible for protecting project personnel and the general public from hazards due to the handling and transportation of contaminated materials. Barricades, orange fencing and signage shall be furnished to safeguard the project personnel and the public at all times.
- D. Generic Health and Safety Modules were independently prepared by a toxicologist and are referenced in Section 00220. These modules contain non-site specific toxicological information on arsenic, chromium and petroleum hydrocarbons. It is the Contractor's decision whether to utilize these health and safety modules, by inclusion or by reference, in the preparation of the site specific HASP.
- E. Notify the Owner and/or the Owner's Representative of any unforeseen or unsafe site condition, and in the interim the Contractor shall take action to maintain safe working conditions until the situation is resolved.

3.2 AIR MONITORING PROGRAM

- A. The Contractor will be responsible for developing and implementing an AMP to determine and monitor for the proper level of personnel protective equipment necessary during completion of work, to document that the level of worker protection is adequate, and to assess the potential for migration of contaminants outside of the work areas.
- B. The Contractor shall provide real-time monitoring for organic vapors and particulates, the number of instruments dependent on the work activities and environmental conditions. The purpose of the air monitoring will be for the Contractor to determine if additional personal protective equipment is required.
- C. The anticipated level of personal protective equipment is Level D, but is subject to change as a result of air monitoring and judgement by the Contractor's HSO. Upgrading to Level C may be required for this project and the Contractor shall have respirators immediately available in the event the Contractor's air monitoring results indicate an upgrade is necessary. The determination of the proper level of protection for each task shall be the responsibility of the Contractor. The task specific levels of protection shall be stated in the Contractors HASP.

END OF SECTION 02000

SECTION 02060 - BUILDING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 - Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of building slabs, foundations and structures.
 - 2. Disconnecting, capping or sealing, and abandoning building utilities in place.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 - Section "Summary of Work and Contract Time" for demolition schedule requirements.
 - 2. Division 1 - Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for demolition operations.
 - 3. Division 1 - Section "Project Closeout" for record document requirements.
 - 4. Division 2 - Section "Roadway and Miscellaneous Surfaces" for gravel access road construction

1.3 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the City of Gloversville property.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the City of Gloversville property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition the Contractor's responsibility.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 - Specification Sections, for Engineer/Architect review and approval, unless otherwise indicated.
- B. Proposed dust-control measures.
- C. Proposed noise-control measures.
- D. Schedule of demolition activities indicating the following:
 - 1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
 - 2. Dates for shutoff, capping, and continuation of utility services.

- E. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.
- F. Record drawings at Project closeout according to Division 1 - Section "Project Closeout."
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.
- G. Landfill records for record purposes indicating receipt and acceptance of demolition or other wastes by a landfill or other facility licensed/permitted to accept the waste being delivered.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA or other agency notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Pre-demolition Conference: Conduct conference at Project site to comply with pre-installation conference requirements of Division 1 - Section "Project Meetings."

1.7 PROJECT CONDITIONS

- A. The majority of the Building has been demolished and the building/site is currently vacant.
- B. Owner assumes no responsibility for actual condition of building slabs and foundations to be demolished.
- C. Gravel access road exists for construction traffic and shall be maintained in accordance with Section 02234.
- D. Storage or sale of removed items or materials on-site will not be permitted.

1.8 SCHEDULING

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations and other required Project work items.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities (electric, phone, CATV and gas) have been disconnected and capped. Contractor is responsible to disconnect and cap water, sewer and storm drainage piping at main and coordinate with the City of Gloversville.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

- C. Survey the condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
- D. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.2 UTILITY SERVICES

- A. Utility Requirements: Verify, prior to starting any building demolition work, that electric, phone, CATV and gas utilities have been shut off and/or abandonment by others and that it is safe to proceed with the building demolition work.
- B. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
 - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving structures to be demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by the Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.

3.3 PREPARATION

- A. Properly decommission monitoring wells that would be damaged by demolition operations.
- B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.

3.4 EXPLOSIVES

- A. Explosives: Use of explosives will not be permitted.

3.5 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
 - 1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.

- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 1. Contain debris to concrete slabs to limit disturbance to site soils.
- C. Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.6 DEMOLITION

- A. Building Demolition: Demolish building slabs and foundations completely and remove from the site all material. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. Remove foundation walls in their entirety unless directed by the Engineer to allow foundation walls to remain below grade.
 - 2. Remove concrete slabs on grade in their entirety.
 - 3. Remove wooden building materials.
 - 4. Demolish concrete and masonry in small manageable sections.
 - 5. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
- B. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off City of Gloversville property and legally dispose them at Fulton County Landfill.

END OF SECTION 02060

SECTION 02090 - CONTAMINATED SOIL REMEDIATION

PART 1 - GENERAL

1.1 WORK UNITS

- A. Scope of Work.
- B. Regulations and Reference Standards.
- C. Submittals.
- D. Existing Conditions.
- E. Excavation and Stockpiling of Petroleum Contaminated Soil.
- F. Loading, Transportation and Disposal of Petroleum Contaminated Soil.

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals.
- B. Section 01565 - Dust Control.
- C. Section 02000 - Health and Safety.
- D. Section 02095 - Treatment of Contaminated Groundwater.
- E. Section 02097 - Soil Barrier to Contact.
- F. Section 02100 - Site Preparation.
- G. Section 02140 - Dewatering.

1.3 SCOPE OF WORK

- A. The work covered under this section shall consist of furnishing all labor, materials, tools and equipment necessary to excavate contaminated soil and stockpile it on-site; place demarcation layer, to backfill and compact the excavation(s) with general fill; to load contaminated soil into transportation vehicles; and to dispose the non-hazardous contaminated soils at Fulton County Landfill. The suspected areas of contaminated soil removal are located beneath the floor slab of the former tannery building and in the area of the former 20,000 gallon fuel oil tank as shown on Contract Drawings.
- B. The work will also include loading and transporting hazardous soils to a disposal facility permitted to accept this type of waste, if waste characterization of the non-hazardous soils classifies the contaminated soil to be hazardous.
- C. The work will also include facilitating the soil sampling to be conducted by the Engineer described in Section 3.1 by providing heavy equipment and operator to obtain samples where directed by the Engineer. Delays may occur due to soil sampling and are to be accounted for in the Bid.

- D. Coordinate with the Engineer for surveying services to locate the horizontal and vertical limits of excavations after completion of petroleum contaminated soil removal and building materials removal.
- E. The Contractor is responsible for any sampling and analysis of petroleum contaminated soil that as required by the disposal facility.

1.4 REGULATIONS AND REFERENCE STANDARDS

- A. New York State Department of Environmental Conservation (NYSDEC) Stars Memo #1, Petroleum - Contaminated Soil Guidance Policy, August 1992.
- B. NYSDEC TAGM 4046, Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1995 and December 20, 2000 Addendum.
- C. Occupational Safety and Health Administration Regulations.
- D. 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response (HAZWOPER).
- E. 6NYCRR Part 364 - Waste Transporter Permits.
- F. 49 CFR Parts 170-178 - Department of Transportation Regulations.

1.5 SUBMITTALS

- A. Name of transporter that will be transporting the contaminated soil and a copy of their valid 6NYCRR Part 364 transporter permit.
- B. Name of disposal facility that will be accepting the contaminated soil and a copy of their operating permit or other means of documenting the facility is permitted to accept the waste being disposed of, and a copy of the approved waste profile form from the disposal facility.
- C. An example of how the transportation and disposal documents for contaminated soil disposal will be completed prior to actual shipment of waste off-site.
- D. Laboratory analyses reports and chain of custody records of contaminated soil sampling results required for disposal.
- E. A copy of completed and signed transportation and disposal documents at the time of shipment; and a copy signed by the disposal facility indicating receipt at the facility. Disposal documentation to include bills of lading, waste manifests, weight tickets, etc.

1.6 EXISTING CONDITIONS

- A. The soil conditions on the east side of the Cayadutta Creek generally consist of fill materials overlying glacial till. The fill materials are generally silty sand or sandy gravel from the surface to about four (4) to six (6) feet below grade. The till generally consists of sand with silt and embedded gravel.
- B. The water table is estimated to be 1 to 6 feet below grade on the east side of the Cayadutta Creek.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 NOTIFICATIONS

- A. Notify Underground Facilities Protection Organization 1-800-962-7962, 72 hours prior to starting excavation, for location of gas, telephone, electric lines and other participating utilities.
- B. Notify other private and public utilities in the work area.
- C. Notify Owner and Engineer at least 72 hours in advance of performing contaminated soil excavation work.
- D. Notify the Engineer 24 to 48 hours prior to backfilling excavations so that a survey crew can locate the horizontal and vertical extent of excavation activities prior to placement of the demarcation layer.

3.2 EXCAVATION AND STOCKPILING OF PETROLEUM CONTAMINATED SOIL

- A. The Contractor will be responsible for ensuring the health and safety of his employees and subcontractor employees during the work; for health and safety monitoring; for enforcing health and safety procedures; and for complying with all Local, State and Federal regulations.
- B. The Contractor shall excavate petroleum contaminated soil at the direction of the Engineer that is suspected in the area of the former tannery building and the former 20,000 gallon fuel oil tank as shown on Contract Drawings. The excavation of contaminated soil shall not be performed without the Engineer being present.
- C. Dewater the excavations as necessary in accordance with Section 02140 to facilitate the removal of contaminated soil.
- D. Non-petroleum soil above the petroleum contaminated soil shall be excavated in lifts as directed by the Engineer and stockpiled where directed by the Engineer to be reused as backfill material. The Engineer will check the soil during excavation using field instruments that detect volatile ionizable organic vapors and visual observations to determine how the soil will be segregated. The Contractor shall facilitate the soil sampling to be conducted by the Engineer by providing heavy equipment and operator to obtain samples where directed by the Engineer.
- E. The petroleum contaminated soil shall be excavated in a manner that allows the Engineer to evaluate the soils being excavated for petroleum impacts. The extent of petroleum contaminated soil to be removed will be determined by use of field instruments operated by the Engineer that detect volatile (ionizable) organic vapors (PID meter) and visual observations. The Contractor shall facilitate the soil sampling to be conducted by the Engineer by providing heavy equipment and operator to obtain samples where directed by the Engineer.
- F. The soil generally shall be considered non-petroleum contaminated if it doesn't exhibit any petroleum odors, if there is no visual evidence of staining and if headspace analysis readings on the PID meter do not exceed approximately 5 ppm above background levels.
- G. Petroleum contaminated soil shall be excavated in a manner that will not damage or compromise the integrity of existing structures (fence, bridge, creek walls, etc.), utilities and roadways. The Contractor shall be responsible for maintaining a safe excavation and protecting existing site structures.

- H. The excavation of petroleum contaminated soil must be done in a manner which will avoid spreading the contamination and contaminating clean surfaces at grade.
- I. At completion of excavating the contaminated soil to the satisfaction of the Engineer based on PID meter readings in the field, soil sampling of the bottom and side walls of the excavation for laboratory analyses may be conducted by the Engineer to confirm that no additional soil needs to be excavated. The Engineer will obtain soil samples from the excavation for NYSDEC STARS volatile organic compounds and base-neutral semi-volatile organic compound analyses in the laboratory by EPA Method 8021 and 8270, respectively. Soil samples may also be collected and analyzed in the laboratory for total arsenic by standard methods. The number of samples will depend on the quantity of soil excavated and the size of the excavation. The Contractor shall facilitate the soil sampling by providing heavy equipment and operator to obtain samples where directed by the Engineer. The excavation shall not be backfilled until analytical results have been received and reviewed by the Engineer and deemed acceptable. Analyses will be performed on a 48 hour turn around time.
- J. The Contractor will be required to temporarily stockpile the excavated contaminated soil on a minimum of two layers of 6 mil polyethylene in area approved by Owner. The polyethylene sheeting shall extend out at least 3 feet from the edge of the soil. The pile will be covered on the end of each work day by pulling excess sheeting up over the top of the soil and then covering the pile with 2 layers of 6 mil polyethylene. The sheeting must be secured at the base and along its slope to hold the sheeting in place.
- K. The Contractor will be responsible for maintaining the integrity of the stockpile and plastic sheeting, and for preventing the migration of contaminants outside the sheeting until the soil is disposed of off-site.
- L. At completion of the contaminated soil excavation, place demarcation layer, backfill excavation to pre-existing grades, and compact backfill to not less than 90% of modified Proctor maximum density, at or below optimum moisture content in conformance with ASTM D 1557.
- M. Petroleum contaminated soils shall only be staged on the east side of the Cayadutta Creek. Non-contaminated soils (i.e., clean imported backfill) may be temporarily staged on the east side of the Cayadutta Creek provided it is placed on plastic and not intermingled with existing site soils. Non-contaminated soils may also be staged in the west side of the Cayadutta Creek (within the Contract Limit lines) if needed.

3.3 LOADING, TRANSPORTATION AND DISPOSAL OF PETROLEUM CONTAMINATED SOIL

- A. The Contractor will be responsible for the coordination, testing, transportation and disposal of the non-hazardous petroleum contaminated soil off-site at the Fulton County Landfill in accordance with all applicable Local, State and Federal regulations.
- B. If waste characterization testing identifies the petroleum contaminated soils to be hazardous, the Contractor will be responsible for the coordination, testing, transportation and disposal of the hazardous petroleum contaminated soil off-site at a facility permitted to accept this type of material. Supplemental analytical testing of the hazardous soils may be performed by the Engineer to further determine the extent of hazardous soils. Supplemental testing required by the hazardous waste disposal facility is the Contractor's responsibility.
- C. The Contractor shall load the petroleum contaminated soil into the transportation vehicles properly dispose of the polyethylene base and cover, and restore grade under soil stockpile to original condition.
- D. The Contractor shall line the dump trailers or other transportation vehicles with polyethylene sheeting prior to the loading them with the contaminated soil, and shall be covered with a tarp prior to transportation off-site.

- E. The Contractor will be responsible for preparing the transportation and disposal documents and coordinating with the disposal facility. The Contractor shall submit a copy of the completed documents to the Engineer for review prior to shipment of the soil off-site.

END OF SECTION 02090

SECTION 02095 - TREATMENT OF CONTAMINATED GROUNDWATER

PART 1 - GENERAL

1.1 WORK UNITS

- A. Scope of Work.
- B. Regulations and Reference Standards.
- C. Submittals.
- D. Notices and Permits.
- E. Activated Carbon Treatment System.
- F. Groundwater Treatment.

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals.
- B. Section 02000 - Health and Safety.
- C. Section 02090 - Contaminated Soil Remediation.
- D. Section 02140 - Dewatering.

1.3 SCOPE OF WORK

- A. The work covered by these specifications shall consist of furnishing labor, materials, equipment and tools necessary to provide a temporary treatment system to treat contaminated groundwater encountered during excavation operations and removed by dewatering activities. Groundwater treatment shall consist of passing the contaminated groundwater through a prefiltration system to remove silt and sediment and then an adequate granular activated carbon system prior to discharging the water to a nearby sewer manhole as directed by the Owner. The dewatered groundwater shall be treated to meet City of Gloversville Treatment Plant requirements (operated by Gloversville-Johnstown Joint Sewer Board) specified in Section 3.1 of this specification. The supply, installation, operation and maintenance of the groundwater treatment system, including supply of additional carbon as required; and the transportation and disposal off-site of spent carbon, filtered sediment, and sediments within temporary tank is included in the work.
- B. Provide groundwater treatment system to treat dewatered groundwater from excavations, where it is necessary to facilitate contaminated soil excavation.
- C. Influent and effluent sampling of the treatment system and laboratory analyses at start-up and during system operation will be conducted by the Contractor. The transportation and proper disposal off-site of spent activated carbon and filtered sediments will be the responsibility of the Contractor.
- D. The Owner will pre-approve all disposal/discharge activities prior to implementation.
- E. All submittals must be received and approved prior to the start of work.

1.4 REGULATIONS AND REFERENCE STANDARDS

- A. NYSDEC Division of Water Technical and Operational Guidance Services (TOGS) 1.1.1 and 1.2.1.
- B. Occupational Safety and Health Administration Regulations.
- C. 6NYCRR Part 360 - Solid Waste Regulations.
- D. 6NYCRR Part 364 - Waste Transporter Permits.

1.5 SUBMITTALS

- A. Groundwater treatment system layout and manufacturer(s) product data, where applicable.
- B. Prior to start of work, submit environmental testing laboratory name, address and telephone; qualifications; and NYS Department of Health Environmental Laboratory Approval Program (ELAP) certification.
- C. Prior to start of work, submit sampling procedures for sampling the influent and effluent for the groundwater treatment system.
- D. Submit an example of how the transportation and disposal documents for disposal of spent carbon and filtered sediment will be completed prior to actual shipment of waste off-site.
- E. Laboratory analyses reports and chain of custody records for influent and effluent sampling results for the groundwater treatment system.
- F. Name of transporter that will be transporting the spent carbon and associated groundwater treatment waste and a copy of their valid 6NYCRR Part 364 transporter permit.
- G. Name of disposal facility that will be accepting the spent carbon and associated groundwater treatment waste and a copy of their operating permit documenting the facility is permitted to accept the waste being disposed of, and a copy of the approved waste profile form from the disposal facility.
- H. A copy of the completed and signed transportation and disposal documents at the time of shipment, and a copy signed by the disposal facility indicating receipt at the facility.

1.6 NOTICES AND PERMITS

- A. A determination will be made by the Owner and the Engineer if contaminated groundwater is present and whether soil dewatering groundwater treatment is necessary. Dewatering shall be performed in accordance with Section 02140.

PART 2 - PRODUCTS

2.1 ACTIVATED CARBON TREATMENT SYSTEM

- A. The temporary treatment system shall consist of a prefiltration unit (bag filter or equal) to settle out/filter sediment prior to pumping the groundwater through the carbon treatment units; minimum of two granular activated carbon absorption units with a minimum of 200 pounds of activated carbon per unit, pressure gauges, sampling ports and control valves on the influent and effluent piping and between the units; and pump(s) to pump the groundwater from the holding tank specified in Section 02140 through the

prefiltration unit and activated carbon units and pump level controls. The two carbon units shall be plumbed in series with a single effluent discharge line. A flow totalizer shall be installed on the effluent side of the treatment system. Temporary power to operate the treatment system shall be provided by the Contractor.

- B. The granular activated carbon shall be virgin carbon (i.e., not reactivated) and have an apparent density of 0.47 to 0.52 g/ml, a minimum iodine number of 900 mg/g and minimum abrasion number of 70.
- C. The activated carbon groundwater treatment system shall be designed to treat a constant flow between 10 to 20 gpm.

PART 3 - EXECUTION

3.1 GROUNDWATER TREATMENT

- A. If the presence of contaminated groundwater is confirmed by the Owner/Engineer provide treatment of the contaminated dewatered groundwater via granular activated carbon absorption. The treated water shall be discharged to a City of Gloversville sanitary sewer manhole as directed by the Owner/Engineer.
- B. The treatment system shall treat the dewatered groundwater in accordance with the following standards and the parameters set forth by the Gloversville-Johnstown Joint Sewer Board:

<u>PARAMETER</u>	<u>EFFLUENT STANDARD</u>
Volatile Organic Compounds:	
Benzene	5 ug/l
Ethylbenzene	5 ug/l
Toluene	5 ug/l
Naphthalene	10 ug/l
Xylenes	5 ug/l
Isopropylbenzene	5 ug/l
1,2,4-Trimethylbenzene	5 ug/l
1,3,5-Trimethylbenzene	5 ug/l
n-Butylbenzene	5 ug/l
sec-Butylbenzene	5 ug/l
p-Isopropyltoluene	5 ug/l
t-Butylbenzene	5 ug/l
pH	6.5-8.5 SU
Semi-Volatile Organic Compounds:	
Acenaphthene	20 ug/l
Anthracene	50 ug/l
Benzo(a)anthracene	0.002 ug/l
Benzo(a)pyrene	Non-detect
Benzo(b)fluoranthene	0.002 ug/l
Benzo(k)fluoranthene	0.002 ug/l
Chrysene	0.002 ug/l
Fluoranthene	50 ug/l
Fluorene	50 ug/l
Indeno(1,2,3-c,d)pyrene	0.002 ug/l
Naphthalene	10 ug/l
Phenanthrene	50 ug/l
Pyrene	50 ug/l
Metals	
Arsenic	25 ug/l
Chromium	50 ug/l

- C. The Contractor shall be responsible for retaining an independent testing laboratory for sampling and laboratory analysis to confirm that the effluent limits are being achieved. Samples shall be analyzed for the NYSDEC STARS Memo No. 1 list of volatile organic compounds by EPA Method 8021, semi-volatile organic compounds (base-neutral only) by EPA Method 8270, and arsenic and chromium by standard methods. Samples will be analyzed in the laboratory within 24 hours of sampling. The Contractor shall measure the pH in the field at the time of sampling.
- D. At start-up, the treatment system shall be started temporarily to enable the Contractor to collect a sample. The treatment system shall then be shut down until the laboratory analyses have been received confirming that the treatment system is working. After receipt of the start-up analyses results, the temporary groundwater treatment system shall be re-started and operated until the dewatered contaminated groundwater has been treated.
- E. During groundwater treatment, the Contractor will be required to collect and analyze groundwater samples after each 10,000 gallons or as required by the City of Gloversville discharge requirements.
- F. The treatment system shall be shut down immediately if the specified effluent limits are exceeded. The system shall be adjusted as necessary to meet the limits, or an alternative system installed. The Contractor shall be responsible for confirming that the effluent limits are being met prior to restart.
- G. The Contractor shall be responsible for daily monitoring of the treatment system (i.e., pressure gauges, etc.) to make sure it is operational and for changing out spent and clogged carbon units.
- H. The Contractor shall clean and remove the temporary groundwater treatment system at completion of the work. The Contractor shall drum the spent/waste activated carbon and sediments in 55 gallon DOT drums. The Contractor will be responsible for the transportation and proper disposal off-site of the waste activated carbon after it has been drummed by the Contractor.

END OF SECTION 02095

SECTION 02097 – SOIL BARRIER TO CONTACT

PART 1 - GENERAL

1.1 WORK UNITS

- A. Scope of Work.
- B. Regulations and Reference Standards.
- C. Submittals.
- D. Notifications.
- E. Placement of Soil Barrier to Contact.
- F. Analytical Sampling Requirements.

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals.
- B. Section 01565 - Dust Control.
- C. Section 02000 - Health and Safety.
- D. Section 02095 - Contaminated Soil Remediation
- E. Section 02100 - Site Preparation.
- F. Section 02121 - Environmental Protection.
- G. Section 02932 - Hydroseeding.

1.3 SCOPE OF WORK

- A. The work covered under this section shall consist of furnishing all labor, materials, tools and equipment necessary to place a minimum one foot thick soil barrier to contact in designated areas of the site, grade the areas of the site receiving the soil barrier before and after placement of the soil barrier to promote positive drainage, place a demarcation layer prior to placing the clean general fill and the soil barrier to contact to differentiate between existing soils and clean imported backfill, apply hydroseed to the surface of the soil barrier after final grading and raking in accordance with Section 02932, and hydrate as necessary to establish vegetative cover.
- B. The soil barrier shall consist of three (3) inches of topsoil underlain by a minimum of nine (9) inches of clean general fill. The soil barrier to contact shall be compacted to achieve 90% Modified Proctor Density Compaction.
- C. The work will also include analytical sampling of the source(s) of clean soil fill to document the environmental quality of the soil used for the soil barrier. The intent of the sampling is to document that the borrow pit is "clean" and free of contamination.

- D. Soils along the property boundaries shall be excavated and/or graded to allow for placement of the one foot thick soil barrier and thereby maintaining the pre-existing grades at the adjoining properties or limits of construction. Excess soil from cutting activities may be spoiled in low areas on the east side of the Cayadutta Creek at the direction of the Engineer. Soils not allowed by the Engineer to be spoiled on-site or that contain elevated contaminant levels on the basis of analytical testing by the Engineer or Contractor shall be transported and disposed off-site by the Contractor.
- E. No off-site disposal of excavated soil will be permitted without characterization and prior authorization.

1.4 REGULATIONS AND REFERENCE STANDARDS

- A. New York State Department of Environmental Conservation (NYSDEC) TAGM 4046 – Determination of Soil Cleanup Objectives and Cleanup Levels.
- B. Occupational Safety and Health Administration (OSHA) Regulations.

1.5 SUBMITTALS

- A. Two 6" x 6" samples of non-woven filter fabric(s) for demarcation layer, manufacturer's construction specifications, and manufacturer's guarantee that product conforms to specifications.
- B. Decontamination plan describing the decontamination methods and procedures to be implemented before, during and after excavation activities. This plan should include cleaning procedures for tools, heavy equipment and field personnel and handling methods for the excess solids and liquids generated from these procedures.
- C. Analytical laboratory certifications.
- D. Laboratory analytical results and chain of custody records for soil samples representing the source(s) of imported fill.
- E. Provide documentation on the type of topsoil and general fill.
- F. Provide lab test and compaction testing results to document in-place density of the soil barrier to contact.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amoco Fabrics and Fiber Co.
- B. Other manufacturers whose products meet or exceed the Specification.

2.2 DEMARCATION LAYER

- A. Non-woven Filter Fabric shall be Amoco Propex 4545 (or equivalent).

PART 3 - EXECUTION

3.1 NOTIFICATIONS

- A. Notify Underground Facilities Protection Organization 1-800-962-7962, 72 hours prior to starting excavation, for location of gas, telephone, electric lines and other participating utilities.
- B. Notify other private and public utilities in the work area.
- C. Notify the Engineer 24 to 48 hours after the soil barrier to contact is complete (i.e., final grading and topsoil has been placed) to allow the Engineer to provide a survey crew to locate the horizontal and vertical extent of soil barrier to contact.

3.2 PLACEMENT OF SOIL BARRIER TO CONTACT

- A. Clear and grub trees and brush, and strip gravel within the areas subjected to the placement of the soil barrier to contact. Care shall be taken to remove excess soil after removal and prior to removing the trees from the site. Site clearing shall be conducted in accordance with Section 02100. Trees that are removed will not be required to be replaced.
- B. Complete excavation of petroleum contaminated soil in accordance with Section 02090, and then grade the site to achieve slopes at least 2% but no more than 33% for placement of a demarcation layer. The demarcation layer shall be placed after preliminary grading and prior to placement of clean backfill. Placement of the demarcation layer shall have a minimum one foot overlap and should extend vertically along excavation sidewalls.
- C. Coordinate with Engineer to complete a topographic survey of the area(s) of the site before or after placement of the demarcation layer and prior to backfilling, and again after final grading of the soil barrier to contact to verify minimum thicknesses of the soil barrier to contact (i.e., greater than one foot) has been obtained and to prepare as-built topography drawings of the site after completion of work. This survey information will also be used to determine quantities for payment.
- D. The Contractor will be responsible for placing the soil barrier to contact in a controlled manner to minimize, control and/or eliminate dust generation. This will include dust control in accordance with Section 01565.
- E. Placement of the soil barrier to contact must be completed in a manner which will avoid spreading the contamination above the demarcation layer.
- F. Apply hydroseeding in accordance with Section 02932.
- G. Implement erosion and sediment controls in accordance with Section 02121.

3.3 ANALYTICAL SAMPLING REQUIREMENTS

- A. The Contractor shall be responsible for collecting and analyzing representative soil samples of the clean soil fill to be used for general backfill and for the barrier to contact. The samples shall be collected in new clean glass jars provided by the analytical laboratory while wearing new clean nitrile gloves. The analytical samples must be placed in a cooler, retained on ice at 4°C until delivery to the laboratory, and accompanied by a chain of custody record.
- B. The analytical laboratory used for analysis of soil samples shall be by New York State Department of Health Environmental Laboratory Approval Program (ELAP) certified.

- C. Imported soil fill will not be used nor allowed on-site until the analytical results have been reviewed and approved by the Engineer and/or New York State Department of Environmental Conservation.
- D. Analytical requirements and frequencies for soil sampling shall be performed in accordance with the following:
 - a. Virgin soil will be subject to collection of one representative composite sample per source. The sample should be analyzed for the Target Compound List (TCL) volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide). The soil will be acceptable for use as backfill provided that all parameters are equal to or below those SCGs established in New York State Department of Environmental Conservation (NYSDEC) TAGM 4046 – Determination of Soil Cleanup Objectives and Cleanup Levels. Virgin soil (i.e., derived from a natural pit) shall be documented in writing to be native soil material from areas not having supported any known prior historical industrial, commercial development, or agricultural use.
 - b. Non-virgin soils (i.e., not derived from a natural pit) will be analyzed for the TCL volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, and metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and cyanide) at a frequency of one composite sample for every 500 cubic yards of material from each source area. If more than 1,000 cubic yards of soil are borrowed from a given off-site non-virgin soil source area and both samples for the first 1,000 cubic yards meet site SCGs, the sample collection frequency will be reduced to one composite sample for every 2,500 cubic yards of additional soils from the same source, up to 5,000 cubic yards. For borrow sources greater than 5,000 cubic yards, sampling frequency may be reduced to one sample for every 5,000 cubic yards, provided previous samples met SCGs established in New York State Department of Environmental Conservation (NYSDEC) TAGM 4046 – Determination of Soil Cleanup Objectives and Cleanup Levels.

END OF SECTION 02097

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.1 WORK UNITS

- A. Clearing.
- B. Grubbing.
- C. Stripping.

1.2 RELATED WORK

- A. Section 02000 - Health and Safety.
- B. Section 02097 - Soil Barrier to Contact.
- C. Section 02121 - Environmental Protection.

1.3 DEFINITIONS

- A. CLEARING: Removal of trees, shrubs, bushes, and other organic matter found at or above original ground level.
- B. GRUBBING: Removal of stumps, roots, boards, logs, and other organic matter found at or below original ground level.
- C. STRIPPING: Removal of gravel found at original ground level which is the existing access road.
- D. SOD: Grass (turf) and vegetative-covered surface of the ground.

1.4 QUALITY ASSURANCE

- A. Protect roadways, walkways, adjacent property, and other works to remain in accordance with all environmental guidelines set forth by the State Department of Environmental Conservation and local regulatory agencies.
- B. Existing trees, shrubs, and bushes to remain:
 - 1. Protect trees by fencing, barricades, or wrapping.
 - 2. Protect shrubs and bushes by fencing or barricades.
 - 3. Protect shallow-rooted plants at ground surface, under and on outside the branch spread, by fencing, barricades, or ground cover.
- C. Regulatory Requirements: State and local codes shall control tree and shrub disposal.

1.5 SUBMITTALS

- A. Certificates: Furnish certificates of conformance for materials required to meet ASTM, State, or other standards.
- B. Samples: Furnish samples of pruning paint and herbicides if used.
- C. Analysis: Furnish manufacturer's certified analysis of pruning paint and herbicides.

1.6 SITE CONDITIONS

- A. No clearing, grubbing, or any construction work shall occur within 15 feet of the stream, except where necessary for designated stream crossings approved by the Engineer/Architect. Such crossings shall be in strict conformance with the provisions of Section 02121. No excess, spoiled, or stored materials shall be permitted within the 15-foot strip. Silt fence to be installed along the edge of the stream in accordance with Contract Drawings.
- B. Stripping gravel shall occur only in areas of the site as shown on Contract Drawings or as necessary to remove concrete slabs and/or petroleum contaminated soils. Filter fabric exists at the interface between the gravel and existing soils.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fencing and/or Barricades.
- B. Wrapping Materials: One or more of the following:
 - 1. Jute Burlap: 4-inch wide strips, weigh eight ounces per square yard minimum.
 - 2. Wrapping Paper: Waterproof, 4-inch wide strips.
- C. Pruning Paint: Antiseptic, waterproof, adhesive, and elastic, such as asphalt, and certain oils with fungicide. Paint to remain tacky for 4 hours and retain elasticity after setting. Paint not to contain kerosene, coal tar creosote, or other material harmful to trees.
- D. Herbicides: Commercial herbicides as approved by the Engineer/Architect.
- E. Do not use explosives.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before clearing, carefully inspect the site and verify:
 - 1. Work layout, horizontal, and vertical clearances for equipment, storage of materials, and operating room.
 - 2. Limits of construction and of easements.
 - 3. Condition of trees, shrubs, and fences in the way of or close to the construction.
 - 4. Location of plants, fences, lawn furniture, and other articles to be removed and replaced.
- B. If there is a discrepancy or unsatisfactory condition, notify Engineer/Architect.

3.2 PREPARATION

- A. Notification: Before clearing, grubbing and stripping, notify:
1. The Engineer/Architect.
 2. Adjacent and affected property occupants.
 3. All public and private utilities whose facilities are in the clearing and grubbing zone. For gas, telephone, or electric lines, notify Underground Facilities Protective Organization, Inc., 1-800-962-7962, 72 hours before work. Include notification for overhead lines where a tree or machinery could contact the lines.

3.3 CLEARING

- A. Clear minimal areas within the contract limit, easement, and right-of-way lines. Protect existing natural appearance, conserve natural resources, minimize scarring of the landscape, and prevent degrading of all areas.
- B. Do not damage common native trees and shrubs, other than those permitted by the Engineer/Architect.
- C. Limit clearing to material posing a hazard or hindrance to construction.
- D. When clearing, consider soil stability, protection of natural habitat for wildlife, fish spawning seasons, and stream flow.
- E. If excavations expose roots without removing the plant:
1. Protect roots by hand excavating.
 2. Keep roots wet, covered with burlap, and tied.
 3. Backfill as soon as practicable. Use planting soil around roots. Apply mulch at surface.
- F. Where trees and shrubs can be moved and replanted:
1. Carefully excavate.
 2. Prune and tie limbs.
 3. Store and heel in the plants during construction.
 4. Water, spray, and maintain plants in a healthy condition.
 5. Replant in original location as soon as possible.
 - a. Excavate pit with vertical sides, flat bottom, at least 6 inches deeper, and 2 feet larger in diameter than ball or spread of roots.
 - b. Center plant in pit and face for best effect. Set plumb and hold rigidly in position until soil has been tamped firmly. Use only planting soil under and around ball or roots. Fill pit with water and leave pit surface even with finished surface of surrounding ground.
 - c. Provide watering saucer.
 6. Stake, brace, and guy trees.
 7. Mulch planting pit saucer.
 8. Wrap tree trunk, prune, spray, and maintain until final acceptance of work.
- G. Where tree or shrub removal by cutting is unavoidable, obtain an order to proceed from the Engineer/Architect before cutting. If such tree or shrub can be saved by special construction methods, such work may be authorized by the Engineer/Architect.
- H. Replacement of trees or shrubs that cannot be successfully moved and replanted is the Contractor's responsibility.
- I. Engineer/Architect will control stump removal and work around stumps. Cut stumps not removed flush with ground.
- J. Leave root systems intact where erosion is likely.

- K. Herbicides:
 - 1. Treat stumps over 4 inches in diameter with herbicide to prevent regrowth.
 - 2. Apply in accordance with manufacturer's directions.
- L. Slope grade beneath branches without abrupt changes.
- M. Damaged trees to remain shall be repaired by an approved tree surgeon at the Contractor's expense. If damage renders tree undesirable if treated, Contractor shall be assessed a fine of \$100.00 per inch of trunk diameter. Engineer/Architect will determine the extent of damage and undesirability. Fines shall be deducted from the total compensation due the Contractor before release of retainage.
- N. Clear all other items away from construction area, and replace or reconstruct in as good condition as when moved.
 - 1. Remove fencing at the direction of the Engineer. Corner or end posts should be replaced with a temporary terminal providing similar tension.
 - 2. Store removed fencing materials, posts, fabric, wire, braces, rails, and fastenings in neat piles. Protect from damage or loss.
 - 3. Reconstruct fencing after construction. Provide new fastenings if required.
 - 4. Fencing which is not of a quality or condition to be reinstalled without replacement parts should not be removed until any questions on reinstallation have been answered.
 - 5. Betterment of fencing and other articles removed and replaced under this Section is the Owner's responsibility.

3.4 GRUBBING

- A. Limits, time, and methods of grubbing shall coincide with those limits of clearing.
- B. Remove all stumps and roots over 1-inch in diameter, and matted roots to the depths below:
 - 1. Footings: 18 inches.
 - 2. Walks: 12 inches.
 - 3. Roads: 18 inches.
 - 4. Parking areas: 12 inches.
 - 5. Lawn areas: 8 inches.
 - 6. Fills: 12 inches.
 - 7. In the case of footings, roads, walks, or other construction on fills, the greater depth shall apply.

3.5 STRIPPING

- A. Strip gravel areas shown on Contract Drawings to facilitate soil excavation activities and concrete removal.
- B. Excess gravel from stripping the east side of the Cayadutta Creek to be utilized to repair or supplement the access road on the west side of the Cayadutta Creek.

3.6 SALVAGE

- A. Salvage material from clearing operations:
 - 1. Logs over 6 inches butt diameter.
 - 2. Branches over 3 inches butt diameter.
 - 3. Parts suitable as mulch.
 - 4. Live plants suitable for replanting.

- B. Cut logs (and branches) into cordwood, 2 feet in length and store on site where approved by Owner and/or Engineer/ Architect.

3.7 DISPOSAL OF SALVAGEABLE MATERIAL

- A. No open burning will be permitted.
- B. Removal:
 - 1. Remove material from the site daily.
 - 2. Should Contractor work beyond normal working hours, remove material within 48 hours.
- C. Dumping:
 - 1. No dumping shall be allowed in any stream, lake, corridor, wetlands, surface waters, or at unspecified locations or at locations not approved by the Engineer/ Architect, or regulatory agencies.
- D. Chipping: Reduce material to dimensions of 1/4" x 2" using an approved chipping machine.

END OF SECTION 02100

SECTION 02121 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 WORK UNITS

- A. Minimize the potential short-term adverse environmental impacts associated with construction activity in environmentally sensitive areas.

1.2 RELATED WORK

- A. Section 01560 - Temporary Controls.
- B. Section 02100 - Site Preparation.

1.3 DEFINITIONS

- A. Critical Environmental Areas: Those areas, conditions, or features which, when disturbed by construction activities, create an adverse environmental impact. These areas include, but are not necessarily limited to, densely wooded areas, wetland areas, stream crossings and steep slopes. Critical environmental areas are shown on the Contract Drawings.

1.4 SUBMITTALS

- A. Contingency action plan for prompt remedial action in the event spillage of petroleum products or other pollutants should occur. Contingency action plan shall be submitted to the Engineer/Architect for approval prior to the start of construction.

1.5 ACCIDENT PREVENTION MEASURES

- A. All preventative measures should be taken to avoid spillage of petroleum products and other pollutants.
- B. Every precaution should be taken to prevent the possibility of accidentally starting fires. Construction programs should include fire prevention planning, training of personnel in fire fighting, and a fire prevention inspection program.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials used for maintenance and protection of the environment shall conform to the material requirements set forth in the relevant section of the Project Manual (i.e., riprap, topsoil, seeding, etc.).

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. All construction details outlined herein and shown on the Contract Drawings shall be implemented to insure minimum damage to the environment during construction and for the long term.
- B. All construction details shall meet environmental objectives and constraints specified herein, outlined in permits or directed by the Engineer/Architect and/or Project Arborist to protect the natural resources within the Project Area.
- C. Temporary, permanent, or unspecified alteration of the flow line of any stream or watercourse will be prohibited, unless specifically approved in writing by the Engineer/Architect.
- D. Vegetation adjacent to or outside of access roads or rights-of-way shall not be damaged other than as specified in Contract Drawings.
- E. Disposal of spoil material shall not be in any flood plain, wetland, or sensitive environmental area. The Contractor shall advise the Engineer/Architect of proposed spoil disposal sites and provide the Engineer/Architect with a copy of agreement/release form from the landowner.
- F. The Contractor shall be required to protect and preserve existing trees and shrubs in areas designated on the drawings as easements and rights-of-ways. Should any replacement of trees or shrubs be deemed necessary by the Project Engineer/Architect and/or Project Arborist, the number and type shall be shown on the plans.

3.2 CLEARING

- A. Clearing, or any construction work not specifically authorized and permitted within 15 feet of a stream shall be prohibited. The edge of the stream shall be marked by a silt fence installed by Contractor prior to construction.
- B. Tree trunks and roots, and vegetation shall not be disposed of in trenches or excavations.
- C. Logistical structures and storage areas shall not be located in critical environmental areas. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion.

3.3 STREAM CROSSINGS

- A. There are a number of stream classifications and the classification varies from stream to stream, but in general, the Contractor shall conform to the following construction requirements:
 - 1. Stream crossings are only allowed via the existing pre-engineered vehicular bridge. The bridge is designed to support its own dead load plus an HS-20 vehicular live load in accordance with American Association of State Highway and Transportation Officials (AASHTO) "Standard Specifications for Highway Bridges".
 - 2. Work in the stream is prohibited unless at the direction of the Engineer/Architect.
 - 3. The Contractor shall submit for approval by the Engineer/Architect the details or methods to be used to protect the stream. All phases of protection of streams and the surrounding areas shall be subject to the approval of officials of the New York State Department of Environmental Conservation.

4. Care shall be taken to prevent or reduce to a minimum any damage to any stream from pollution by debris, sediment or other material or from the manipulation of equipment and/or materials in or near such streams.
 - a. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream.
5. Where work necessitates disturbing banks, they shall be returned to original condition, planted with suitable grasses, trees, and shrubs so as to prevent erosion. All tree and brush removal shall be kept to a minimum.

3.4 EROSION AND SEDIMENTATION CONTROL

- A. The Contractor shall, at the direction of the Engineer/Architect, use necessary methods to minimize erosion within easements and from access roads, especially in stream or watercourse areas. Right-of-way slopes at surface water crossings and drainage ways shall be protected by sheeting, sandbagging, mulch, or the use of jute excelsior blankets.
- B. Cuts, fills, and other disturbed areas should be seeded or sodded as soon as possible to prevent erosion. If such seedings fail to provide adequate cover, the area will be promptly reseeded.
- C. Water, resulting from dewatering operations that will reduce the quality of the water in the stream, shall not be directly discharged.
- D. No other procedures utilizing placement of gravel, stone, or rocks for the purpose of erosion protection, riprap, or like structures shall be used in lieu of seeding or soddings or other horticultural remedies unless, necessary to prevent irreparable injury or damage to the environment arising out of unusually difficult conditions at a specific site where the establishment of protective vegetation is neither possible, nor feasible, and for which injury and damage there is no adequate horticultural remedy. Nor shall such procedures be implemented without the express permission of the Engineer/Architect.
- E. The Contractor must recognize that a Stormwater Pollution Prevention Plan (SWPPP) exists for the site, and the Contractor must comply with the stormwater control measures during construction. At no time should building demolition debris, site soil, dust or runoff enter the Cayadutta Creek. All work shall be performed in accordance with the Stormwater Pollution Prevention Plan for the site, as included in Contract Documents. At any time, if debris/soil/dust/runoff is observed in the creek, the ENGINEER will immediately stop work, the Contractor will be required to remove the material from the creek and implement additional means for protecting the creek. Any fines or permit requirements imposed by New York State Department of Environmental Conservation or other regulatory agencies will be the responsibility of the Contractor.
- F. The Contractor shall install silt fence at the locations shown on Contract Drawings.
- G. The Contractor shall cover staged soil piles at the end of each work day to prevent release of soil particles to air or land via wind and/or precipitation runoff.

END OF SECTION 02121

SECTION 02140 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Section 01300 - Submittals
- B. Section 02090 - Health and Safety.
- C. Section 02090 - Contaminated Soil Remediation.
- D. Section 02095 - Treatment of Contaminated Groundwater.

1.2 SUMMARY

- A. This Section includes provisions for site dewatering during excavation of contaminated soil. The Contractor shall be responsible for dewatering, as necessary, to enable the soil excavation work to be performed.
- B. Dewatering consists of lowering and controlling groundwater levels and hydrostatic pressures to permit excavation and construction to be performed in near-dry conditions.
- C. The Contractor shall notify the Owner and/or Owner's Representative prior to discharging any groundwater from dewatering operations.
- D. Dewatered groundwater shall be discharged into a holding tank to enable it to be sampled and tested by the Contractor to determine if it is contaminated. If the presence of contaminated groundwater is confirmed by the Owner/Engineer, the groundwater shall be treated in accordance with Section 02095.

1.3 SUBMITTALS

- A. Submit a plan with the method and layout of dewatering system.

1.4 QUALITY ASSURANCE

- A. Maintain adequate supervision and control to ensure that stability of excavated slopes are not adversely affected by water, erosion is controlled, and flooding of excavation or damage to structures does not occur.

PART 2 - PRODUCTS

2.1 HOLDING TANK

- A. The holding tank shall have a minimum capacity of 20,000 gallons.

PART 3 - EXECUTION

3.1 DEWATERING

- A. If water with a visible oil sheen or water known to be contaminated enters the excavation and dewatering is necessary, the Contractor shall immediately notify the Owner and/or Owner's Representative prior to the start of dewatering.
- B. Provide an adequate system to lower and control groundwater in order to permit excavation of contaminated soil and placement of fill materials under dry conditions. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of excavations. The dewatering system could consist of a vertical perforated pipe placed in washed stone, trash pump and associated discharge piping or other type of system.
- C. Reduce hydrostatic head in water-bearing strata below structure foundations and excavations to extent that the water level in construction areas is below prevailing excavation surface.
- D. Place system into operation to lower water levels as required and necessary. Operate and maintain system as necessary.
- E. Discharge water removed from non-contaminated and contaminated soil excavations into a holding tank. Discharge water into holding tank in a manner to avoid inconvenience to others. Provide flow control devices as required to prevent tank from overflowing. Do not discharge pollutants. Treat dewatered contaminated groundwater in accordance with Section 02095.
- F. Provide standby equipment on site, installed and available, for immediate operation to maintain dewatering on a continuous basis in event any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damage at no additional expense.

END OF SECTION 02140

SECTION 02234 - ROADWAY AND MISCELLANEOUS SURFACES

PART 1 - GENERAL

1.1 WORK UNITS

- A. Construction of miscellaneous surfaces.

1.2 RELATED WORK

- A. Section 02060 - Building Demolition.

1.3 SYSTEM DESCRIPTION

- A. Miscellaneous surfaces shall be constructed at locations specified on the Remedial Action Implementation Plan.
- B. Definitions:
 - 1. Miscellaneous Surfaces: An approved Crusher Run Stone as specified herein, to be used as a base for the haul road and as necessary, driveways and parking areas.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Rules, regulations, laws concerning construction in roads of the applicable jurisdiction.
 - 2. Comply with all other Federal and State regulations.

1.5 SUBMITTALS

- A. Samples: Before using material, submit samples from each typical source to testing laboratory and submit reports for approval as follows:
 - 1. Two copies of gradation analysis and compaction requirements for each soil.
 - a. Report should state any special manipulation or compaction requirements required to achieve specified density for all soils.
 - b. Retesting of in place soils may be required at any time or place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crusher Run Stone:
 - 1. Material shall be Type 2 Subbase, Section 304-2.02, NYSDOT Standard Specification, January 2, 1995.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Carefully inspect the site and verify that construction may properly commence before placing subbase:
 - 1. Work layout; horizontal and vertical, and conformance of layout with Contract Drawings.
 - 2. Limits of construction.
- B. If an unsatisfactory condition exists, notify the Engineer/Architect.

3.2 PREPARATION

- A. Clear, grub and remove deleterious material only as necessary and as approved by the Engineer/Architect. Do not strip topsoil and ground surface must remain undisturbed.
- B. Place Geotextile Fabric (Amoco 4553 or equal) over the existing ground surface.

3.3 INSTALLATION

- A. Construct surface subbase as a temporary roadway surface to carry construction traffic:
 - 1. Temporary Roadway Surface:
 - a. Construct subbase to depths and locations specified in Contract Documents.
 - b. Maintain subbase compacted depth of a minimum of 12 inches.
 - c. Subbase to remain at the completion of the project.
 - d. Achieve 90% Modified Proctor Density Compaction:
- B. All subbases shall be spread to compacted depths no greater than 12 inches. Water shall be added to obtain satisfactory compaction.
- C. Compact with rollers or other machinery to obtain required density to carry construction traffic.

END OF SECTION 02234

SECTION 02921 - SOIL PREPARATION AND SOIL MIXES

PART 1 - GENERAL

1.1 WORK UNITS

- A. Construction of native topsoil.
- B. Construction of delivered topsoil.

1.2 RELATED WORK

- A. Section 02100 - Site Preparation.
- B. Section 02090 - Contaminated Soil Remediation
- C. Section 02097 - Soil Barrier to Contact
- D. Section 02932 - Hydroseeding.

1.3 SYSTEM DESCRIPTION

- A. Topsoil required for this project shall not consist of site soils.
- B. Topsoil for the soil barrier to contact shall be obtained from an off-site source and shall conform to the following specification. The topsoil shall be spread directly on prepared subsoil or on general fill for areas to be hydroseeded unless otherwise directed by the Engineer/Architect.
- C. Definitions:
 - 1. AVAILABLE NUTRIENT - The portion of the supply of a nutrient which can be assimilated by a plant.
 - 2. pH - A symbol denoting the negative logarithm of the concentration of the hydrogen ion in gram atoms/litre, used in expressing both acidity and alkalinity.
 - 3. SCARIFY - To loosen and aerate soil without turning it over.
 - 4. SOIL CONDITIONER - A material which when added to compacted soil, tends to make it more loose, crumbly, or porous.
 - 5. SUBSOIL - Soil below the usual level of cultivation, containing little or no humus, and characteristically more dense than topsoil.
 - 6. TOPSOIL - The original dark colored upper humus soil ranging from a fraction of an inch to many feet in depth.

1.4 QUALITY ASSURANCE

- A. Reference Standard:
New York State Department of Transportation, Standard Specifications, Construction and Materials, January 2, 1981.
- B. Testing Laboratory:
Approved by Engineer/Architect for analysis of topsoil.

1.5 SUBMITTALS

- A. Manufacturers' or suppliers' certification that content of materials meets specification requirements.
 - 1. Fertilizer.
 - 2. Lime (if required).
- B. Test Reports: Topsoil analysis.

1.6 JOB CONDITIONS

- A. Environmental requirements: Do not prepare or place frozen soils or soils in a muddy condition.
- B. Protection: Protect designated trees and shrubs against damage.

PART 2 - PRODUCTS

2.1 MATERIAL - TOPSOIL

- A. Native topsoil stripped from ordinary construction operations within the Contract Limit Lines will not be allowed to remain at the surface of the site and shall be placed beneath the clean imported soil barrier to contact.
- B. Imported topsoil shall be provided conforming to the following requirements:
 - 1. All topsoil must be acceptable to the Engineer/Architect.
 - 2. Topsoil shall be excavated from an area which possesses such uniformity of soil depth, color, texture, and drainage, as to offer assurance that the material shall be homogeneous with good normal drainage, and which is in the ordinary sense of the term arable or cultivable.
 - 3. Topsoil shall be original loam of rich, uniform grade, without admixture of subsoil and shall be free from hard clods, stiff clay, hard pan, sods, large stones, lime, cement, bricks, coal ashes, cinders, slags, concrete, tar or its residue, boards, sticks, or other deleterious matter.
 - 4. Topsoil shall contain not less than 4% or more than 20% organic matter in that portion of any sample which passes a 1/4-inch sieve, when determined by the wet combustion method of a sample dried at 105 degrees C. The pH value shall be within the range of 5.5 to 6.5 on that portion of a sample which passes a 1/4-inch sieve.
 - 5. One hundred percent by weight shall pass a 1-inch sieve and 97% to 100% shall pass a 1/4-inch sieve. Of the material passing the 1/4-inch sieve not less than 20% nor more than 65% shall pass a No. 200 sieve as determined by a wash test conducted in conformance with ASTM D 1140-54 (1971).
 - 6. The Contractor may be required to collect and submit a sample of the topsoil from the supply site or a delivery truck and submitted to a testing laboratory for analysis so as to insure the topsoil's conformity.
 - 7. The Contractor is required to collect and analyze representative samples for each source of topsoil in accordance with the parameters set forth in Section 02097.

2.2 MIXES

- A. Fertilizer: Available nutrients, percent by total weight.
 - 1. 10% nitrogen.
 - 2. 10% phosphorus.
 - 3. 10% potassium.
 - 4. Hard, caked material will not be acceptable.

- B. Limestone: Ground limestone with a minimum total neutralizing value of 88% calcium carbonate equivalence; minimum 90% passing the 20 mesh sieve and minimum 60% passing the 100 mesh sieve; hard, caked material will not be accepted.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas to receive soil preparation to assure work of other trades has been completed.
- B. Verify that all subsoils are positively drained and free of ponded areas and debris.
- C. Verify that plants to remain undisturbed have been identified and protected.
- D. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Just prior to placing the topsoil, the subsoil material shall be scarified to a depth of 3 inches so as to insure a proper bond between the subsoil material and the topsoil.

3.3 INSTALLATION

- A. Topsoil:
 - 1. Spread topsoil on all disturbed areas within Contract Limit Lines to depth of at least 3 inches.
 - 2. Fine rake topsoil to break up lumps and remove stones, debris, and foreign material one inch or larger in any dimension.
 - 3. Final grades shall not vary more than one-tenth of a foot from elevations shown on Contract Drawings or fixed by the Engineer/Architect.
 - 4. No unsightly variations, bumps, ridges, or other depressions which will hold water shall be acceptable.
- B. Fertilization:
 - 1. Apply fertilizer at rate of 500 pounds per acre, or roughly 11.5 pounds per thousand square feet to all topsoil.
 - 2. Lightly work fertilizer into the topsoil.
- C. Liming:
 - 1. Test topsoil in an approved laboratory for pH.
 - 2. Based on laboratory analysis and recommendations, adjust pH of all areas to be between 5.5 pH and 6.5 pH.
- D. Compaction:
 - 1. Exercise extreme caution in all topsoil areas so that soil is not overly compacted.
 - 2. Soil that has become overly compacted, in the judgment of the Engineer/Architect, shall be re-worked to achieve a satisfactory condition at no additional cost.
 - 3. Topsoil on sloped areas may be rolled to prevent erosion.
 - 4. Topsoil shall be compacted to achieve 90% Modified Proctor Density Compaction.

3.4 CLEAN-UP

- A. Immediately clean up spills, soil, and conditioners on paved and finished surface areas.
- B. Remove debris and excess materials from project site.

END OF SECTION 02921

SECTION 02932 - HYDROSEEDING

PART 1 - GENERAL

1.1 WORK UNITS

- A. Application of Hydroseeding.

1.2 RELATED WORK

- A. Section 02097 - Soil Barrier to Contact.
- B. Section 02921 - Soil Preparation and Soil Mixes.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Standard Specifications, Construction and Materials, New York State Department of Transportation, January 2, 1981.
- B. Source Quality Control: Producer's tests for purity and germination of seed, dated within nine months of hydroseeding.

1.4 SUBMITTALS

- A. Manufacturer's or supplier's certification that materials meet specification requirements.

1.5 JOB CONDITIONS

- A. Existing Conditions: Perform hydroseeding only after preceding work affecting ground surface is complete.
- B. Environmental Requirements:
 - 1. Do not hydroseed when soil is in a frozen or muddy condition.
 - 2. Do not hydroseed when wind exceeds 5 mph.
 - 3. Time of hydroseeding:
 - a. April 1 through May 15.
 - b. August 15 through September 15.
 - c. These periods may be extended or reduced according to prevailing weather conditions, upon approval by the Engineer/Architect.
- C. Protection: Restrict foot and vehicular traffic from seeded areas after hydroseeding and until the end of the establishment period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Seed shall be fresh, clean, new crop seed; weed content not exceeding 0.3 percent. It shall conform to Federal and State Standards. Each type of seed in the mixture shall meet or exceed the minimum percentage of purity and germination listed for that type of seed.
- B. Mulching shall consist of paper or wood cellulose fibers, processed to contain no growth - or germination - inhibiting factors and dyed an appropriate color to facilitate visual metering of the materials application. The mulch material shall be supplied in packages having a maximum gross weight of 100 pounds. The mulch will have a maximum 10% moisture content, air dry weight basis.
- C. The binder material shall be a biodegradable type as manufactured under the trade names of TERRATAK or CURASOL or equal. The manufacturers suggestions for storage, mixing, and application shall be strictly adhered to and the Engineer/Architect may sample the binder for testing purposes at any time. Other binders may be used if it can be demonstrated to the Engineer/Architect's satisfaction that they are at least equal to the binders mentioned in all respects.
- D. All water used shall be potable. Use of on-site groundwater will not be allowed.

2.2 MIXES

- A. Seed:
 - 1. Seed shall be a mixture of the species specified mixed in the proportion as listed below:

TYPE I PERENNIAL RYE

Species	Percentage by Weight	Purity %	Germination %
Pure	98	90	95
Crop	1.5	--	--
Inert and Other	0.5	--	--

- 2. That portion of the above mixture listed as inert and other shall consist of non-viable seed, chaff, hulls, live seeds of crop plants and harmless inert matter.
 - 3. The seed mixture shall be mixed by the vender and shall be delivered in standard sized bags of the vendor, showing the weight, analysis, and vendor's name.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Check that preceding work affecting ground surface is complete.
- B. Verify that soil is unfrozen and within acceptable range of mixture content.
- C. Do not start until conditions are satisfactory.

3.2 APPLICATION

- A. The required materials shall be mechanically agitated to form a homogeneous slurry. The slurry shall be sprayed on the ground by a hydraulic seeder equipped to apply up to 200 gallons per minute at 100 pounds pressure from the nozzle with a clearance for 1/2-inch solids.
- B. When hydraulically sprayed on the ground, the material shall form a blotter-like cover impregnated uniformly with grass seed. The cover will allow the absorption of moisture and allow rainfall or added water to percolate to the underlying soil.
- C. The suggestions of the manufacturer of the individual materials shall be followed in preparing and applying this hydroseeding mixture, however, the following minimum ingredient amounts shall be used and thoroughly and consecutively mixed together:

Nitrogen	-0.5 lbs./MSF (when required)
Water	-as per manufacturer's directions
Seed	-3 lbs./MSF TYPE II, 6 lbs./MSF TYPE I
Fertilizer	-12 lbs./MSF
Biodegradable Binder	-as per manufacturer's directions
Fiber Mulch	-27.5 lbs./MSF
Lime	-as req'd by soil analysis (50 lbs./MSF max.)

- D. Biodegradable Binder shall only be used where erosion control is a problem or on slopes steeper than 4H to 1V.
- E. All containers and tanks used for holding and mixing the ingredients and the final homogeneous hydroseeding mixture shall have been thoroughly cleaned of all material incompatible with seed germination and which is not readily biodegradable.

3.3 PROTECTION

- A. Immediately after seeding, erect barricades and warning signs to protect seeded areas from all traffic until lawn is established.
- B. The Contractor shall be responsible for correction of all damage done by unauthorized traffic at no additional cost.

3.4 LAWN ESTABLISHMENT

- A. Watering:
 - 1. Keep seed bed moist until germination of seed by application of fine spray.
 - 2. Continue fine spraying after germination at four to seven days intervals as required to supplement natural rainfall so that all lawn areas receive sufficient water for normal plant growth.
 - 3. The Contractor shall furnish all equipment necessary for artificial watering and shall be responsible for securing an adequate supply of water.
- B. Reseeding:
 - 1. Reseed spots larger than one square foot not having a uniform stand of grass after the first mowing.
 - 2. If a dense lawn is not established after three mowings in the first germination period, return in the following planting season to refertilize, reseed, and mulch to establish a uniform stand of grass after three mowings in that following season.

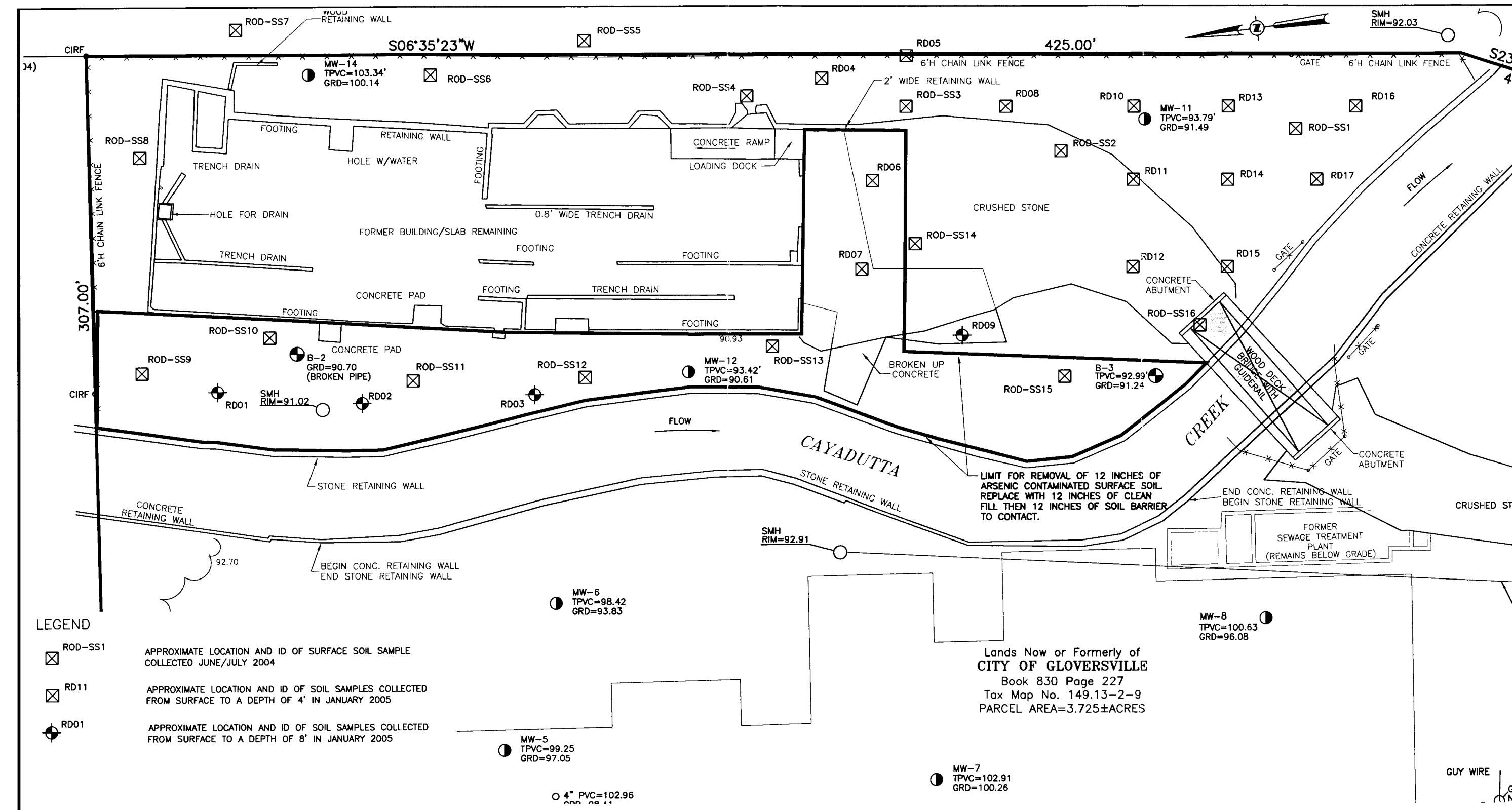
3.5 CLEANUP

- A. Remove trash and excess materials from project site.
- B. Maintain paved areas in a clean condition.
- C. Remove barriers and signs from project site at termination of establishment period.

3.6 PERFORMANCE

- A. Lawn will not be considered for payment and acceptance until a satisfactory stand of grass, as judged by the Engineer/Architect, is evident after three consecutive mowings in any one growing season, and refertilization.
- B. The Engineer/Architect will inspect the established lawn upon written request by the Contractor.
- C. Upon acceptance of the work specified in this section, the Contractor shall be relieved of further responsibility for care and maintenance of lawn.

END OF SECTION 02932



CAD DWG. FILE NAME: ARSENIC REMOVAL.DWG

NOTES:
1. THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.

MAP REFERENCE:
1. TOPOGRAPHIC SURVEY, 321 SOUTH MAIN STREET, PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG. NO. 04-0662, DATED OCTOBER 25, 2004, LAST REVISED JULY 18, 2005

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DESIGNED :

DRAFTED : J.MARX

CHECKED : K.MOLINE

PROJ. NO: 01.7293

SCALE : 1"=30" ±

DATE : AUG. 29, 2005

LIMIT OF ARSENIC CONTAMINATED SOIL REMOVAL

INDEPENDENT LEATHER TANNERY

CITY OF GLOVERSVILLE

FULTON COUNTY, NEW YORK

C.T. MALE ASSOCIATES, P.C.

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SHEET 1 OF 1

DWG. NO:

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Tax Map No. 149.06-29-1

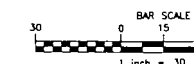
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MARK KILMER
Book 796 Page 6
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CITY OF GLOVERSVILLE
Book 830 Page 227
Tax Map No. 149.13-2-9
PARCEL AREA=3.725±ACRES

BENCHMARK
BOX CUT ON SOUTH-
WEST CORNER OF
CONC VACUUM BASE
ELEVATION=102.72'

LEGEND

- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- UP UTILITY POLE
- MH MANHOLE
- SMH SANITARY MANHOLE
- UV UNKNOWN VALVE
- × TC=100.86 TOP OF CURB ELEVATION
- + 95.00 SPOT ELEVATION
- MW-9 TOPVC=101.47' GRD=96.11' MONITOR WELL LOCATION & NUMBER (2002)
- TOP OF PVC ELEVATION
- GRADE ELEVATION
- B-3 TOPVC=93.16' GRD=91.08' EXISTING MONITOR WELL (PRE-1988)
- TOP OF PVC ELEVATION
- GRADE ELEVATION
- SG-1 APPROXIMATE LOCATION AND ID OF SOIL GAS SAMPLE
- SG-551 APPROXIMATE LOCATION AND ID OF SURFACE SOIL SAMPLE COLLECTED JUNE/JULY 2004
- RD11 APPROXIMATE LOCATION AND ID OF SOIL SAMPLES COLLECTED FROM SURFACE TO A DEPTH OF 4' IN JANUARY 2005
- RD01 APPROXIMATE LOCATION AND ID OF SOIL SAMPLES COLLECTED FROM SURFACE TO A DEPTH OF 8' IN JANUARY 2005



NOTE:
1.) THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.

MAP REFERENCE:
1.) TOPOGRAPHIC SURVEY, 321 SOUTH MAIN STREET, PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG NO. 04-0662, DATED JANUARY 29, 2002, REVISED OCTOBER 25, 2004.

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					CHECKED : K.MOLINE
					PROJ. NO : 01.7293
					SCALE : 1"=30'
					DATE : MAY 2005

RECORD OF DECISION AND REMEDIAL DESIGN SAMPLING LOCATIONS MAP

INDEPENDENT LEATHER TANNERY
321-333 SOUTH MAIN STREET

CITY OF GLOVERSVILLE

COUNTY OF FULTON, NEW YORK

C.T. MALE ASSOCIATES, P.C.

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SHEET 1 OF 1

DWG. NO:

00220 - 54

TABLE 1 - VALIDATED ANALYTICAL SUMMARY TABLE FOR INDEPENDENT LEATHER TANNERY (C.T. MALE PROJECT NO. 01.7293)

Lab ID	Sample ID ⁽¹⁾	Arsenic (mg/kg)	Chromium (mg/kg)	Lab ID	Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)	Lab ID	Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)
208623-1	RD01 (0-2)	416	265 NJ	208624-1	RD03 (0-2)	44.8	39.1 NJ	208624-20	RD06 (0-2)	161	488 NJ
208623-2	RD01 (10-12)	77.5	29.7 NJ	208624-2	RD03 (10-12)	115	59.1 NJ	208625-1	RD06 (10-12)	1.47 B	7.02
208623-3	RD01 (18-20)	769 (**)	81.5 NJ	208624-3	RD03 (18-20)	447	38.1 NJ	208625-2	RD06 (18-20)	2.42 B	3.49
208623-4	RD01 (24-26)	Not Analyzed	Not Analyzed	208629-8	RD03 (24-26)	Not Analyzed	Not Analyzed	208629-5	RD06 (24-26)	Not Analyzed	Not Analyzed
208623-5	RD01 (36-38)	135 NJ	94.7 *	208624-4	RD03 (36-38)	181 NJ	74.8 *	208625-3	RD06 (36-38)	31.2 NJ	11.5 *
208623-6	RD01 (46-48)	20.3 NJ	27.8 *	208624-5	RD03 (46-48)	1800 NJ	64.5 *	208625-4	RD06 (46-48)	Not Analyzed	Not Analyzed
208623-7	RD01 (60-62)	Not Analyzed	Not Analyzed	208624-6	RD03 (60-62)	Not Analyzed	Not Analyzed				
208623-8	RD01 (72-74)	Not Analyzed	Not Analyzed	208624-7	RD03 (72-74)	Not Analyzed	Not Analyzed	208625-5	RD07 (0-2)	183	160
208623-9	RD01 (84-86)	Not Analyzed	Not Analyzed	208624-8	RD03 (84-86)	Not Analyzed	Not Analyzed	208625-6	RD07 (10-12)	104	158
208623-10	RD01 (94-96)	Not Analyzed	Not Analyzed	208624-9	RD03 (94-96)	Not Analyzed	Not Analyzed	208625-7	RD07 (18-20)	69	286
								208629-4	RD07 (24-26)	Not Analyzed	Not Analyzed
208623-11	RD02 (0-2)	69.7	64.1 NJ	208624-10	RD04 (0-2)	10.4	15.1 NJ	208625-8	RD07 (36-38)	30.9 NJ	31 *
208623-12	RD02 (10-12)	81	70.2 NJ	208624-11	RD04 (10-12)	10.8	11.7 NJ	208625-9	RD07 (46-48)	285 NJ	11.1 *
208623-13	RD02 (18-20)	128	254 NJ	208624-12	RD04 (18-20)	1.57 B	5.57 NJ				
208623-14	RD02 (24-26)	Not Analyzed	Not Analyzed	208629-6	RD04 (24-26)	Not Analyzed	Not Analyzed	208625-10	RD08 (0-2)	25.1	23.9
208623-15	RD02 (36-38)	79.7 NJ	147 *	208624-13	RD04 (36-38)	3.23 BNJ	6.37 *	208625-11	RD08 (10-12)	5.45	192
208623-16	RD02 (46-48)	26.7 NJ	24.2 *	208624-14	RD04 (46-48)	Not Analyzed	Not Analyzed	208625-12	RD08 (18-20)	171	498
208623-17	RD02 (60-62)	Not Analyzed	Not Analyzed					208629-1	RD08 (24-26)	Not Analyzed	Not Analyzed
208623-18	RD02 (72-74)	Not Analyzed	Not Analyzed	208624-15	RD05 (0-2)	15	20.5 NJ	208625-13	RD08 (36-38)	845 NJ	91.3 *
208623-19	RD02 (84-86)	Not Analyzed	Not Analyzed	208624-16	RD05 (10-12)	2.84 B	12.8 NJ	208625-14	RD08 (46-48)	232 NJ	101 *
208623-20	RD02 (94-96)	Not Analyzed	Not Analyzed	208624-17	RD05 (18-20)	57.5	39.9 NJ				
				208629-3	RD05 (24-26)	Not Analyzed	Not Analyzed				
Lab ID	Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)	208624-18	RD05 (36-38)	94.2 NJ	16.5 *	Lab ID	Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)
208625-15	RD09 (0-2)	76.5	171	208624-19	RD05 (46-48)	12.8 NJ	54.4 *	208627-9	RD15 (0-2)	107 *	360 *
208625-16	RD09 (10-12)	46.9	112	Lab ID	Sample ID	Arsenic (mg/kg)	Chromium (mg/kg)	208627-10	RD15 (10-12)	338 *	490 *
208625-17	RD09 (18-20)	40.1	161	208626-14	RD12 (0-2)	6.96	12	208627-11	RD15 (18-20)	93.3 *	366 *
208629-7	RD09 (24-26)	Not Analyzed	Not Analyzed	208626-15	RD12 (10-12)	66.1	96.4	208628-18	RD15 (24-26)	Not Analyzed	Not Analyzed
208625-18	RD09 (36-38)	43.1 NJ	66.9 *	208626-16	RD12 (18-20)	36.8	38.7	208627-12	RD15 (36-38)	25.5 NJ	99.7 *
208625-19	RD09 (46-48)	47 NJ	11.6 *	208628-16	RD12 (24-26)	Not Analyzed	Not Analyzed	208627-13	RD15 (46-48)	45.2 NJ	208 *
208625-20	RD09 (60-62)	Not Analyzed	Not Analyzed	208626-17	RD12 (36-38)	5.66	14.6	208627-14	RD16 (0-2)	2.17 B*	9.37 *
208626-1	RD09 (72-74)	Not Analyzed	Not Analyzed	208626-18	RD12 (46-48)	1,940 NJ (**)	1,090 * (**)	208627-15	RD16 (10-12)	56.7 *	69.7 *
208626-2	RD09 (84-86)	Not Analyzed	Not Analyzed					208627-16	RD16 (18-20)	28.9 *	63.4 *
208626-3	RD09 (94-96)	Not Analyzed	Not Analyzed	208626-19	RD13 (0-2)	3.18 B	105	208629-10	RD16 (24-26)	Not Analyzed	Not Analyzed
				208626-20	RD13 (10-12)	130	429	208627-17	RD16 (36-38)	180 NJ	334 *
208626-4	RD10 (0-2)	4.79 B	7.46	208627-1	RD13 (18-20)	102 *	78.8 *	208627-18	RD16 (46-48)	207 NJ	196 *
208626-5	RD10 (10-12)	28.9	38.8	208629-2	RD13 (24-26)	24 NJ	1,570 * (**)				
208626-6	RD10 (18-20)	4.84	6.73	208627-2	RD13 (36-38)	17.2 NJ	2,560 * (**)	208627-19	RD17 (0-2)	3.57 B*	20.1 *
208626-20	RD10 (24-26)	Not Analyzed	Not Analyzed	208627-3	RD13 (46-48)	91.6 NJ	375 *	208627-20	RD17 (10-12)	67.9 *	142 *
208626-7	RD10 (36-38)	1.99 BNJ	2.68 *					208628-1	RD17 (18-20)	509 * (**)	662 * (**)
208626-8	RD10 (46-48)	Not Analyzed	Not Analyzed	208627-4	RD14 (0-2)	17.7 *	80.3 *	208628-19	RD17 (24-26)	Not Analyzed	Not Analyzed
				208627-5	RD14 (10-12)	1.98 B*	8.48 *	208628-2	RD17 (36-38)	138 NJ	275 *
208626-9	RD11 (0-2)	14.1	30.7	208627-6	RD14 (18-20)	88.8 *	357 *	208628-3	RD17 (46-48)	307 NJ	453 *
208626-10	RD11 (10-12)	3.04 B	3.54	208629-9	RD14 (24-26)	Not Analyzed	Not Analyzed	208628-4	FD1	114 *	338 *
208626-11	RD11 (18-20)	0.726 B	3.44	208627-7	RD14 (36-38)	91.4 NJ	306 *	208628-5	FD2	149 *	192 *
208628-17	RD11 (24-26)	Not Analyzed	Not Analyzed	208627-8	RD14 (46-48)	43.4 NJ	103 *	208628-6	FD3	30.3 *	3,770 *
208626-12	RD11 (36-38)	67.2 NJ	107 *	208628-10	EB1	ND	ND	208628-7	FD4	3.61 BNJ	9.13 *
208626-13	RD11 (46-48)	Not Analyzed	Not Analyzed	208628-11	EB2	ND	ND	208628-8	FD5	43.3 NJ	33.4 *
				208628-12	EB3	ND	ND				
				208628-13	EB4	ND	ND				
				208628-14	EB5	ND	ND				

(1) Inches below ground surface noted in parenthesis. Note that these measurements are approximate as sample recovery varied.

(**) Denotes that the sample will be subject to TCLP arsenic and/or chromium analysis.

Qualifiers: B denotes that the reported values is less than CRDL, but greater than IDL, N denotes spiked recovery not within control limits, J denotes estimated value, and * denotes duplicate analysis not within control limits.

Lands Now or Formerly of
CITY OF GLOVERSVILLE
Book 696 Page 149
Tax Map No. 149.06-29-1

Lands Now or Formerly of
MARK KILMER
Book 796 Page 5
Tax Map No. 149.13-2-8

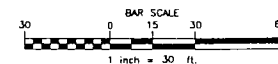
Lands Now or Formerly of
CITY OF GLOVERSVILLE
Book 830 Page 227
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PARCEL AREA=3.725±ACRES

Lands Now or Formerly of
MARK VROOMAN
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Lands Now or Formerly of
KENNETH E. CARMEN
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LEGEND

- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- UP UTILITY POLE
- MH MANHOLE
- SMH SANITARY MANHOLE
- UV UNKNOWN VALVE
- × TC=100.86 TOP OF CURB ELEVATION
- 95.00 SPOT ELEVATION
- MW-9 TOPIC=101.47' GRD=96.11' MONITOR WELL LOCATION & NUMBER (2002)
- TOP OF PVC ELEVATION
- GRADE ELEVATION
- B-3 TOPIC=93.15' GRD=91.08' EXISTING MONITOR WELL (PRE-1988)
- TOP OF PVC ELEVATION
- GRADE ELEVATION
- SG-1 APPROXIMATE LOCATION AND ID OF SOIL GAS SAMPLE
- RD-SS1 APPROXIMATE LOCATION AND ID OF SURFACE SOIL SAMPLE COLLECTED JUNE/JULY 2004
- RD-11 APPROXIMATE LOCATION AND ID OF SOIL SAMPLES COLLECTED FROM SURFACE TO A DEPTH OF 4' IN JANUARY 2005
- RD-01 APPROXIMATE LOCATION AND ID OF SOIL SAMPLES COLLECTED FROM SURFACE TO A DEPTH OF 8' IN JANUARY 2005



NOTE:
1.) THE LOCATIONS AND FEATURES DEPICTED ON THIS MAP ARE APPROXIMATE AND DO NOT REPRESENT AN ACTUAL FIELD SURVEY.
MAP REFERENCE:
1.) TOPOGRAPHIC SURVEY, 321 SOUTH MAIN STREET, PREPARED BY C.T. MALE ASSOCIATES, P.C., DWG NO. 04-0682, DATED JANUARY 29, 2002, REVISED OCTOBER 25, 2004.

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					DESIGNED :
					DRAFTED : J.MARX
					CHECKED : K.MOLINE
					PROJ. NO: 01.7293
					SCALE : 1"=30'
					DATE : MAY 2005

RECORD OF DECISION AND REMEDIAL DESIGN SAMPLING LOCATIONS MAP

INDEPENDENT LEATHER TANNERY
321-333 SOUTH MAIN STREET

CITY OF GLOVERSVILLE COUNTY OF FULTON, NEW YORK

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SHEET 1 OF 1

DWG. NO:

00220 - 56

Draft Table 5.4.2-1
Volatile Organic Compounds for Exploratory Soil Borings
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽¹⁾	MW-5 (2'-4')	MW-6 (2'-4')	MW-7 (2'-4')	MW-8 (2'-4')	MW-9 (2'-4')	MW-10 (4'-6')	MW-11 (2'-4')	Field Duplicate (MW-11 2'-4')	MW-12 (2'-4')	MW-13 DL (0'-4')	MW-14 (2'-4')	Trip Blank	Equipment Blank
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/L	ug/L
Acetone	0.2	<0.016 B	<0.012 J	0.009 JB	<0.023 B	<0.011	0.75 J	0.37 J	0.19 JB	<0.012 B	0.3 JB	<0.011 B	<0.010 J	<10 J
Benzene	0.06	<0.006	<0.006	<0.006	<0.006	<0.006	0.005 J	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Bromodichloromethane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Bromoform	NA	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Bromomethane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
2-Butanone	0.3	<0.012	<0.012	<0.011	<0.012	<0.011	0.2 J	0.089 J	0.054 J	<0.012 J	0.12 J	<0.011	<0.010 J	<10 J
Carbon Disulfide	2.7	<0.006	<0.006	<0.006	0.002 J	<0.006	0.009 J	0.002 J	0.002 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Carbon Tetrachloride	0.6	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Chlorobenzene	1.7	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Chloroethane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Chloroform	0.3	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	0.9 J
Chloromethane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Dibromochloromethane	NA	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,1-Dichloroethane	0.2	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,2-Dichloroethane	0.1	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,2-Dichloroethene (cis)	0.25	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,2-Dichloroethene (trans)	0.3	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,1-Dichloroethene	0.4	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,2-Dichloropropane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,3-Dichloropropene (cis)	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,3-Dichloropropene (trans)	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Ethylbenzene	5.5	<0.006	<0.006	<0.006	<0.006 J	<0.006	0.013 J	<0.006	<0.007 J	<0.006 J	0.029 J	<0.006	<0.005	<5.0
2-Hexanone	NA	<0.012	<0.012	<0.011	<0.012 J	<0.011	<0.018 J	<0.013	<0.015 J	<0.012 J	<0.066	<0.011	<0.010	<10
Methylene Chloride	0.1	<0.007	<0.006	0.004 J	<0.006	<0.006	<0.009	0.003 JB	<0.007	<0.006	<0.033	<0.009	<0.005 B	<5.0 B
4-Methyl-2-Pentanone	1.0	<0.012	<0.012	<0.011	<0.12	<0.011	<0.018	<0.013	<0.015	<0.012 J	<0.066	<0.011	<0.010	<10
Styrene	NA	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Tetrachloroethene	1.4	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	0.02 J	<0.006	<0.005	<5.0
1,1,2,2-Tetrachloroethane	0.6	<0.006	<0.006	<0.006	<0.006 J	<0.006	<0.009 J	<0.006	<0.007 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Toluene	1.5	<0.006	<0.006	<0.006	<0.006	<0.006	0.013 J	<0.006	<0.007	<0.006 J	0.004 J	<0.006	<0.005	<5.0
1,1,1-Trichloroethane	0.8	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
1,1,2-Trichloroethane	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Trichloroethene	0.7	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Vinyl Acetate	NA	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	<0.006	<0.007	<0.006 J	<0.033	<0.006	<0.005	<5.0
Vinyl Chloride	0.12	<0.006	<0.006	<0.006	<0.006	<0.006	<0.009	0.004 J	0.005 J	<0.006 J	<0.033	<0.006	<0.005	<5.0
Xylenes (total)	1.2	<0.006	<0.006	<0.006	<0.006 J	<0.006	0.3 J	<0.001	<0.007 J	<0.006 J	0.019 J	<0.006	<0.005	<5.0
Total VOCs	10	ND	ND	0.013	0.002	ND	1.29	0.468	0.251	ND	0.492	ND	ND	0.9

⁽¹⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995.
VOCs analyzed using EPA Method 8260.
B indicates the analyte was detected in the blank as well as the sample.
J indicates an estimated value.
NA is Not Applicable.

Draft Table 5.4.3-1
Semi-Volatile Organic Compounds for Exploratory Soil Borings
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽¹⁾ mg/kg	MW-5 (2'-4') mg/kg	MW-6 (2'-4') mg/kg	MW-7 (2'-4') mg/kg	MW-8 (2'-4') mg/kg	MW-9 (2'-4') mg/kg	MW-10 DL (4'-6') mg/kg	MW-11 (2'-4') mg/kg	Field Duplicate (MW-11 2'-4') mg/kg	MW-12 (2'-4') mg/kg	MW-13 (0'-4') mg/kg	MW-14 (2'-4') mg/kg	Equipment Blank ug/L
Acenaphthene	50	<0.39	<0.4	<0.37	0.043 J	<0.37	0.21 J	<0.42	<0.48	0.082 J	0.043 J	<0.38	<10
Acenaphthylene	41	<0.39	<0.4	<0.37	0.048 J	<0.37	0.19 J	<0.42	<0.48	0.097 J	<0.43	<0.38	<10
Anthracene	50	<0.390 M	<0.4	<0.37	0.17 J	<0.37	0.29 J	0.024 JM	0.072 J	1.0	<0.43	<0.38	<10
Benzo(a)anthracene ¹	0.224 or MDL	0.022 J	0.081 J	<0.37	0.48	<0.37	0.47 J	0.085 J	0.21 J	2.6	<0.43	<0.38	<10
Benzo(a)pyrene ¹	0.061 or MDL	0.019 J	0.061 J	<0.37	0.45	<0.37	0.68 J	<0.42	<0.48	1.9	<0.43	<0.38	<10
Benzo(b)fluoranthene ¹	0.224 or MDL	<0.39	<0.4	<0.37	0.5	<0.37	0.52 JM	<0.42	<0.48	1.3	<0.43	<0.38	<10
Benzo(k)fluoranthene ¹	0.224 or MDL	<0.39	0.064 J	<0.37	0.39 J	<0.37	0.65 JM	<0.42	<0.48	1.8	<0.43	<0.38	<10
Benzo(g,h,i)perylene	50	<0.39	<0.4	<0.37	0.74	<0.37	<1.2	<0.42	<0.48	1.2	<0.43	<0.38	<10
Benzoic Acid	2.7	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
Benzyl Alcohol	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
bis(2-Chloroethoxy)methane	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
bis(2-Chloroethyl)ether	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
bis(2-ethylhexyl)phthalate ¹	50	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.52	<0.48	<0.79	<0.43	<0.38	<10
4-Bromophenyl-phenylether	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Butylbenzylphthalate	50	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Carbazole	NA	<0.39	<0.4	<0.37	0.082 J	<0.37	<1.2	<0.42	<0.48	0.1 J	<0.43	<0.38	<10
4-Chlorophenyl-phenylether	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
4-Chloroaniline ¹	0.220 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
4-Chloro-3-methylphenol	0.240 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	0.099 J	<0.38	<10
2-Chloronaphthalene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2-Chlorophenol	0.8	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Chrysene	0.4	0.027 J	0.079 J	<0.37	0.64	<0.37	0.72 J	0.15 J	0.22 J	2.4	<0.43	<0.38	<10
Dibenzofuran	6.2	<0.39	<0.4	<0.37	0.092 J	<0.37	0.084 J	<0.42	<0.48	0.11 J	<0.43	<0.38	<10
Dibenzo(a,h)anthracene ¹	0.014 or MDL	<0.39	<0.4	<0.37	0.24 J	<0.37	<1.2	<0.42	<0.48	0.48 J	<0.43	<0.38	<10
1,2-Dichlorobenzene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
1,3-Dichlorobenzene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
1,4-Dichlorobenzene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
3,3'-Dichlorobenzidine ¹	NA	<0.77	<0.81	<0.73	<0.78	<0.74	<2.4 J	<0.84 J	<0.96 J	<1.6	<0.86 J	<0.75	<20 J
2,4-Dichlorophenol	0.4	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Diethylphthlate	7.1	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Dimethylphthlate	2.0	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2,4-Dimethylphenol	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Di-n-butyl phthalate	8.1	<0.39 B	<0.4 B	<0.037 B	<0.39	<0.37 B	<1.2	<0.42	<0.48	<0.79 B	<0.43	<0.38	<10
Di-n-octyl phthalate	50	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
4,6-Dinitro-2-methylphenol	NA	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
2,4-Dinitrophenol	0.200 or MDL	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
2,4-Dinitrotoluene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2,6-Dinitrotoluene ¹	1.0	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Fluoranthene	50	0.033 J	0.098 J	<0.37	0.89	<0.37	1.4	0.14 J	0.4 J	4.4	0.068 J	0.03 J	<10
Fluorene	50	<0.39	<0.4	<0.37	0.053 J	<0.37	0.31 J	<0.42	<0.48	0.16 JM	<0.43	<0.38	<10
Indeno(1,2,3-cd)pyrene	3.2	<0.39	0.029 J	<0.37	0.63	<0.37	<1.2	<0.42	0.14 J	1.2	<0.43	<0.38	<10
Hexachlorobenzene ¹	0.41	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10

Draft Table 5.4.3-1
Semi-Volatile Organic Compounds for Exploratory Soil Borings
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values ⁽¹⁾ mg/kg	MW-5 (2'-4') mg/kg	MW-6 (2'-4') mg/kg	MW-7 (2'-4') mg/kg	MW-8 (2'-4') mg/kg	MW-9 (2'-4') mg/kg	MW-10 DL (4'-6') mg/kg	MW-11 (2'-4') mg/kg	Field Duplicate (MW-11 2'-4') mg/kg	MW-12 (2'-4') mg/kg	MW-13 (0'-4') mg/kg	MW-14 (2'-4') mg/kg	Equipment Blank ug/L
Hexachlorobutadiene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Hexachlorocyclopentadiene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Hexachloroethane	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Isophorone ¹	4.4	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2-Methylnaphthalene	36.4	<0.39	<0.4	<0.37	0.21 J	<0.37	0.41 J	<0.42	<0.48	0.16 J	0.25 J	<0.38	<10
2-Methylphenol	0.100 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
4-Methylphenol	NA	<0.39	<0.4	<0.37	0.07 J	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Naphthalene	13	<0.39	<0.4	<0.37	0.69	<0.37	7.6 M	1.7	1.2	0.14 J	2.5	<0.38	<10
Nitrobenzene	0.200 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2-Nitroaniline	0.430 or MDL	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
3-Nitroaniline	0.500 or MDL	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
4-Nitroaniline	NA	<0.77	<0.81	<0.73	<0.78	<0.74	<2.4	<0.84	<0.96	<1.6	<0.86	<0.75	<20
2-Nitrophenol	0.330 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
4-Nitrophenol	0.100 or MDL	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
n-Nitroso-di-n-propylamine	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
n-Nitrosodiphenylamine	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2,2'-oxybis(1-Chloropropane)	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Pentachlorophenol ¹	1.0 or MDL	<1.9	<2.0	<1.8	<1.9	<1.8	1.0 J	<0.42	<2.3	<3.8	<2.1	<1.8	<50
Phenanthrene	50	<0.39	0.031 J	<0.37	0.81	<0.027	0.67 J	0.089 J	0.24 J	2.2	0.074 J	<0.38	<10
Phenol	0.03 or MDL	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Pyrene	50	0.035 J	0.097 J	<0.37	0.84	<0.37	0.97 J	0.13 J	0.36 J	4.0	0.077 JM	0.028 J	<10
1,2,4-Trichlorobenzene	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
2,4,5-Trichlorophenol	0.1	<1.9	<2.0	<1.8	<1.9	<1.8	<5.8	<2.0	<2.3	<3.8	<2.1	<1.8	<50
2,4,6-Trichlorophenol	NA	<0.39	<0.4	<0.37	<0.39	<0.37	<1.2	<0.42	<0.48	<0.79	<0.43	<0.38	<10
Total SVOCs	500	0.136	0.54	ND	8.173	ND	16.174	2.318	2.842	25.329	3.111	0.058	ND

⁽¹⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995.
SVOCs analyzed using EPA Method 8270.
MDL is Method Detection Limit.
B indicates the analyte was detected in the blank as well as the sample.
J indicates an estimated value.
M indicates a manually integrated compound.
NA is Not Applicable.

Draft Table 5.4.4-1
Pesticides and Polychlorinated Biphenyl Compounds for Exploratory Soil Borings
Independent Leather - Project #01.7293
Data Validated

Parameter	⁽¹⁾ mg/kg	MW-5 (2'-4') mg/kg	MW-6 (2'-4') mg/kg	MW-7 (2'-4') mg/kg	MW-8 (2'-4') mg/kg	MW-9 (2'-4') mg/kg	MW-10 (4'-6') mg/kg	MW-11 (2'-4') mg/kg	Field Duplicate (MW-11 2'-4') mg/kg	MW-12 (2'-4') mg/kg	MW-13 (0'-4') mg/kg	MW-14 (2'-4') mg/kg	Equipment Blank ug/L
Aldrin	0.041	<0.0023	<0.0024	<0.0022	<0.0024	<0.0022	<0.0036	<0.0025	<0.003	<0.0024	<0.0026	<0.0023	<0.05
alpha-BHC	0.11	<0.0038	<0.0021	<0.0019	<0.002	<0.0019	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
beta-BHC	0.2	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.0095	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
delta-BHC	0.3	<0.002	<0.0021	<0.0019	<0.002	0.00049 J	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
gamma-BHC (Lindane)	0.06	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
alpha-Chlordane	NA	<0.002	<0.0021	<0.0019	<0.002	<0.0019	0.013 J	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
gamma-chlordane	0.54	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.018	<0.0021	<0.0025	<0.0032	<0.00012	<0.0019	<0.05
4,4'-DDD	2.9	<0.0038	<0.0021	<0.0037	<0.0039	<0.0037	0.11 J	<0.0042	<0.0049	<0.0083	<0.0005	<0.0038	<0.15
4,4'-DDE	2.1	<0.0038	<0.004	<0.0037	<0.0039	<0.0037	0.063 J	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
4,4'-DDT	2.1	<0.0038	<0.0021	<0.0037	<0.0039	<0.0037	<0.015 M	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Dieldrin	0.044	<0.0038	<0.004	<0.0037	<0.0039	<0.0037	<0.02	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Endosulfan I	0.9	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
Endosulfan II	0.9	<0.0038	<0.0021	<0.0037	<0.0039	<0.0037	<0.006	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Endosulfan Sulfate	1.0	<0.0038	<0.0021	<0.0037	<0.0039	<0.0037	<0.006	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Endrin	0.1	<0.0058	<0.0061	<0.0055	<0.0059	<0.0056	<0.052 M	<0.0063	<0.0074	<0.006	<0.0066	<0.0057	<0.1
Endrin aldehyde	NA	<0.0038	<0.004	<0.0037	<0.0039	<0.0037	<0.006	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Endrin ketone	NA	<0.0038	<0.004	<0.0037	<0.0039	<0.0037	<0.006	<0.0042	<0.0049	<0.004	<0.0043	<0.0038	<0.1
Heptachlor	0.1	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
Heptachlor epoxide	0.02	<0.002	<0.0021	<0.0019	<0.002	<0.0019	<0.0031	<0.0021	<0.0025	<0.002	<0.0022	<0.0019	<0.05
Methoxychlor	NA	<0.0025	<0.021	<0.019	0.015 J	<0.019	<0.031	<0.021	<0.025	<0.02	<0.022	<0.019	<0.5
Toxaphene	NA	<0.096	<0.1	<0.092	<0.098	<0.093	<0.15	<0.1	<0.12	<0.1	<0.11	<0.095	<2.5
Total Pesticides	10	ND	ND	ND	0.015	0.00049	0.173	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls													
Aroclor 1016	1.0	<0.02	<0.021	<0.020	<0.020	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Aroclor 1221	1.0	<0.038	<0.04	<0.039	<0.039	<0.037	<0.060	<0.042	<0.049	<0.040	<0.043	<0.038	<1.0
Aroclor 1232	1.0	<0.02	<0.021	<0.020	<0.020	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Aroclor 1242	1.0	<0.02	<0.021	<0.020	0.04 M	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Aroclor 1248	1.0	<0.02	<0.021	<0.020	<0.020	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Aroclor 1254	1.0	<0.02	<0.021	<0.020	<0.020	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Aroclor 1260	1.0	<0.02	<0.021	<0.020	<0.020	<0.020	<0.031	<0.021	<0.025	<0.020	<0.022	<0.019	<0.5
Total PCBs	1.0	ND	ND	ND	0.04 M	ND	ND	ND	ND	ND	ND	ND	ND

⁽¹⁾ Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995.
Pesticides and PCBs analyzed using EPA Method 8082.
J indicates an estimated value.
M indicates a manually integrated compound.
NA is Not Applicable.
ND is Not Detected.

Draft Table 5.4.5-1
Metal Analytes for Exploratory Soil Borings
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC TAGM 4046 Values (1) mg/kg	NYSDEC TAGM 4046 Eastern USA Background (1) mg/kg	MW-5 (2'-4') mg/kg	MW-6 (2'-4') mg/kg	MW-7 (2'-4') mg/kg	MW-8 (2'-4') mg/kg	MW-9 (2'-4') mg/kg	MW-10 (4'-6') mg/kg	MW-11 (2'-4') mg/kg	Field Duplicate (MW-11 2'-4') mg/kg	MW-12 (2'-4') mg/kg	MW-13 (0'-4') mg/kg	MW-14 (2'-4') mg/kg	Equipment Blank ug/L
Aluminum	SB	33,000	4,230	4,180	7,540	5,890	3,030	6,200	7,330	8,060	2,200	7,740	7,400	<500
Antimony	SB	NA	0.25 JB	<11.4 J	<11.5 J	1.4 JB	0.28 JB	<14.9 J	41.9 J	13.4 J	<0.0124 J	<11.2 J	0.45 JB	<20
Arsenic	7.5 or SB	3-12**	1.2 B	2.3 B	1.6 B	252	0.81 B	8.4 B	700	709	300	596	2.2 B	<40
Barium	300 or SB	15-600	14.4	18.1	6.3	112	12.5	74	1,390 J	1,160 J	28.7	36.3 J	17.1	<5.0
Beryllium	0.16 or SB	0-1.75	0.31 B	0.27 B	0.24 B	0.68 B	0.25 B	0.35 JB	0.34 B	0.34	0.68 B	0.46 B	0.38 B	<5.0
Cadmium	10	0.1-1	<2.7	<2.9	<2.9	0.21 B	<0.0026	6.1	23.4	27.2	<0.0032	<2.9	<2.9	<10
Calcium	SB	130-35,000**	15,000	3,700	2,430	40,400	1,270	21,500	27,500	40,300	3,810	4,290	1,890	406
Chromium	50	1.5-40**	91.1	<6.4	<4.4	308	<9.0	9,870	1,470	1,690	45.4	29.5	<7.2	16.7
Cobalt	30 or SB	2.5-60**	2.8	2.5	2.0	10.8	1.7	5.2	11.7	10.3	2.9	5.0	3.3	<10
Copper	25 or SB	1-50	7.6	4.1 B	1.6 B	27.6	4.1 B	63.6	459 J	2,100 J	8.4	6.3	4.5 B	<10
Cyanide	NA	NA	<0.568 J	<0.583 J	<0.532 J	<0.57 J	<0.546 J	<0.893	<0.613	<0.725	<0.595 J	<0.644	<0.571 J	<10
Iron	2,000 or SB	2,000-550,000	9,000	8,300	8,790	14,800	7,340	27,400	107,000	90,800	5,610	14,600	10,600	91.2 B
Lead	***	***	5.4 JB	4.1 JB	2.8 JB	111 J	1.8 JB	145 J	6,900	5,080	44.3 J	14.3	4.7 JB	<10
Magnesium	SB	100-5,000	2,930	1,150	714	2,470	731	5,760	3,110	3,410	1,480	1,140	903	22.8 B
Manganese	SB	50-5,000	131	105	32.7	109	45	221	556	536	118	171	98.7	<15
Mercury	0.1	0.001-0.2	<0.097	<0.1	<0.092	0.41	<0.097	27.3 J	0.42 J	0.35 J	0.2	<0.094	<0.091	<0.20
Nickel	13 or SB	0.5-25	5.3	4.5 B	3.2 B	19.2	3.8 B	12.6	71.6	80.1	6.5	5.6	5.9	<10
Potassium	SB	8,500-43,000**	470	293	239	969	381	1,090	552	648	203 B	576	369	247 B
Selenium	2 or SB	0.1-3.9	0.26 B	<15.5	<15.7	1.3 B	0.035 B	4.1 JB	1.7 JB	1.9 JB	0.75 B	1.7 JB	0.18 B	<30
Silver	SB	NA	<2.7	0.033 B	0.062 B	0.19 B	0.028 B	0.28 B	0.56 B	0.59 B	0.15 B	0.097 B	0.042 B	<6.0
Sodium	SB	6,000-8,000	166 J	187 J	3,440 J	925 J	64.1 JB	594	584	578	106 J	372	73.6 JB	107 B
Thallium	SB	NA	<20.1	<21.4	0.84 B	1.4 B	0.54 B	1.5 JB	<20.4 J	<23.9 J	0.54 B	0.18 JB	0.48 B	<40
Vanadium	150 or SB	1-300	14.5	13.9	13.1	22.9	11.3	39.7	21.3	22	8.8	29.5	17.4	<6.0
Zinc	20 or SB	9-50	26.1	19.4 B	15.4 B	113	12.5 B	186	1,630	1,570	41.7	35.1	18.9 B	<50
% Solids	NA	NA	85.5	81.7	90.4	85.1	89.7	54.9	77.7	67.6	83.2	75.4	87.5	NA

(1) Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994, Revised April 1995.

** New York State Background.

*** Background levels for lead vary widely. Average background levels in metropolitan areas near highways are much higher and typically range from 200-500 ppm. The USEPA's Interim Lead Hazard Guidance (7/14/94) establishes a residential screening level of 400 ppm.

Metals were analyzed using EPA Method 6010 and 7471 for Mercury.

SB is Site Background.

B indicates value was obtained from a reading less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).

J indicates an estimated value.

NA is Not Applicable.

Draft Table 5.5.2-1
Volatile Organic Compounds for Groundwater Monitoring Wells
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC Water Quality Standard (ug/L)	MW-5 ug/L	MW-6 ug/L	MW-7 ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 ug/L	MW-11 ug/L	MW-12 ug/L	MW-13 ug/L	MW-14 ug/L	MW-15 ug/L	B-2 ug/L	B-3 ug/L	Field Duplicate (B-3) ug/L	Equipment Blank ug/L	Trip Blank 5/6/02 ug/L	Trip Blank 5/7/02 ug/L	Trip Blank 5/8/02 ug/L
Acetone	50 (GV)	<10	<10	40 H	<10	<10	<10	<11	<10	25	<10	<10	<10	<10	<10	9.0 J	2.0 J	<10	4.0 J
Benzene	1.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.0 M	<5.0	<5.0	3.0 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Bromodichloromethane	50 (GV)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Bromoform	50 (GV)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Bromomethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Butanone	NA	<10	<10	<10 J	<10	<10	<10	<10	<10	<10 J	<10	<10	<10	<10	<10 J	<10	<10	<10	<10
Carbon Disulfide	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.6 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	3.0 J	<5.0	<5.0
Carbon Tetrachloride	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chlorobenzene	5	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloroform	7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloromethane	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dibromochloromethane	50 (GV)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethane	0.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1-Dichloroethene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethene (cis)	5	<5.0	<5.0	<5.0	<5.0	<5.0	0.4 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloroethene (trans)	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,2-Dichloropropane	1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichloropropene (cis)	0.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichloropropene (trans)	0.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene	5	<5.0	<5.0	3.0 J	<5.0	<5.0	10	<5.0	<5.0	10	<5.0	8.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone	50 (GV)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylene Chloride	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.0 J	0.8 J	<5.0	0.8 J
4-Methyl-2-Pentanone	NA	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Styrene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Tetrachloroethene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1-Trichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2-Trichloroethane	1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,2,2-Tetrachloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene	5	<5.0	<5.0	<5.0	<5.0	<5.0	0.8 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl Acetate	NA	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl Chloride	2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.8 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes (total)	5	<5.0	<5.0	9.0	<5.0	<5.0	75	<5.0	<5.0	10	<5.0	48	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total VOCs	NA	ND	ND	52	ND	ND	93.2	0.8	ND	48	ND	56	ND	ND	ND	10	58	ND	4.8

⁽¹⁾ TOGS 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, NYSDEC, June 1998 and Addendum, April 2000.
Based on Water Class GA, Source of Drinking Water (Groundwater).
(GV) denotes a Guidance Value.
VOCs analyzed using EPA Method 8260.
J indicates an estimated value.
H indicates alternate peak selection upon analytical review.
M indicates a manually integrated compound.
NA is Not Applicable.
ND is Not Detected.

Draft Table 5.5.3-1
Semi-Volatile Organic Compounds for Groundwater Monitoring Wells
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC Water Quality Standard (ug/L)	MW-5 ug/L	MW-6 ug/L	MW-7 ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 DL ug/L	MW-11 ug/L	MW-12 ug/L	MW-13 DL ug/L	MW-14 ug/L	MW-15 ug/L	B-2 ug/L	B-3 ug/L	Field Duplicate (B-3) ug/L	Equipment Blank ug/L
Acenaphthene	20 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	0.9 J	<10	<10	<10	<10	<10	<10
Acenaphthylene	NA	<10	<10	0.5 JM	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Anthracene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzo(a)anthracene	0.002 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzo(a)pyrene	ND	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	0.002 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	0.002 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Benzoic Acid	5	<50	<50	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
Benzyl Alcohol	1	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
bis(2-Chloroethoxy)methane	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
bis(2-Chloroethyl)ether	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4-Bromophenyl-phenylether	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Butylbenzylphthalate	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Carbazole	5	<10	<10	<10	<10	<10	<200	<10	<10	0.9 J	<10	<10	<10	<10	<10	<10
4-Chlorophenyl-phenylether	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4-Chloroaniline	10	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol	NA	<10	<10	<10	<10	<10	<200	<10	<10	28	<10	<10	<10	<10	<10	<10
2-Chloronaphthalene	0.002 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2-Chlorophenol	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Chrysene	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene	3	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Dibenzofuran	3	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	3	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	50 (GV)	<20	<20	<20	<20	<20	<1,000	<20	<20	<40	<20	<20	<20	<20	<20	<20
2,4-Dichlorophenol	NA	<10	<10	<10	<10	<10	<200	<10	<10	8.0 J	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	10 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4,6-Dinitro-2-methylphenol	5	<50	<50	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
2,4-Dinitrophenol	5	<50 J	<50	<50 J	<50 J	<50 J	<50	<50	<50 J	<100 J	<50	<50 J	<50	<50 J	<50 J	<50
2,4-Dinitrotoluene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2,6-Dinitrotoluene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Diethylphthlate	50	<10	<10	22	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Dimethylphthlate	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Di-n-butyl phthalate	50 (GV)	<10	<10	<10 H	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Di-n-octyl phthalate	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Fluoranthene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	0.6 J	<10	<10
Fluorene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	0.04	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	0.5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10

Draft Table 5.5.3-1
Semi-Volatile Organic Compounds for Groundwater Monitoring Wells
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC Water Quality Standard (ug/L)	MW-5 ug/L	MW-6 ug/L	MW-7 ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 DL ug/L	MW-11 ug/L	MW-12 ug/L	MW-13 DL ug/L	MW-14 ug/L	MW-15 ug/L	B-2 ug/L	B-3 ug/L	Field Duplicate (B-3) ug/L	Equipment Blank ug/L
Hexachloroethane	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene	0.002(GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Isophorone	50	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene	NA	<10	<10	<10	<10	<10	<200	<10	0.5 J	8.0 J	<10	0.6 J	<10	<10	<10	<10
2-Methylphenol	NA	<10	<10	3.0 J	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4-Methylphenol	NS	<10	<10	4.0 J	<10	<10	<200	<10	<10	23	<10	<10	<10	<10	<10	<10
Naphthalene	10	<10	<10	15	<10	<10	<200	<10	11	130	<10	12	<10	<10	<10	<10
Nitrobenzene	0.4	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2-Nitroaniline	5	<50	<50	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
3-Nitroaniline	5	<50	<50	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
4-Nitroaniline	5	<20	<20	<20	<20	<20	<400	<20	<20	<40	<20	<20	<20	<20	<20	<20
2-Nitrophenol	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
4-Nitrophenol	NA	<50	<50	<50	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
n-Nitroso-di-n-propylamine	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
n-Nitrosodiphenylamine	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2,2'-oxybis(1-Chloropropane)	NA	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
Pentachlorophenol	1	<50	<50	3.0 J	<50	<50	<50	<50	<50	<100	<50	<50	<50	<50	<50	<50
Phenanthrene	50 (GV)	<10	<10	<10	<10	<10	<200	<10	<10	1.0 J	<10	<10	<10	0.4 J	<10	<10
Phenol	1	<10	<10	<10	<10	<10	<200	<10	<10	22	<10	<10	<10	<10	<10	<10
Pyrene	50	<10	<10	<10	<10	<10	<200	<10	<10	<20 M	<10	<10 M	<10 M	0.5 J	<10 M	<10
1,2,4-Trichlorobenzene	5	<10	<10	<10	<10	<10	<200	<10	<10	<20	<10	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol	NA	<50	<50	<50	<50	<50	<50	<50	<50	4.0 J	<50	<50	<50	<50	<50	<50
2,4,6-Trichlorophenol	NA	<10	<10	<10	<10	<10	<200	<10	<10	15 J	<10	1.0 J	<10	<10	<10	<10
Total SVOCs	NA	ND	ND	47.5	ND	ND	ND	ND	11.5	240.8	ND	13.6	ND	1.5	ND	ND

⁽¹⁾ TOGS 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent
Limitations, NYSDEC, June 1998 and Addendum, April 2000.
Based on Water Class GA, Source of Drinking Water (Groundwater).
SVOCs analyzed using EPA Method 8270.
(GV) denotes a Guidance Value.
H indicates alternate peak selection upon analytical review.
J indicates an estimated value; M indicates manually integrated compound.
M indicates a manually integrated compound.
NA is Not Applicable; ND is Not Detected.
DL indicates laboratory dilution applied.

Draft Table 5.5.4-1
Pesticides and Polychlorinated Biphenyl Compounds for Groundwater Monitoring Wells
Independent Leather - Project #01.7293
Data Validated

Parameter	NYSDEC Water Quality Standard ug/L	MW-5 ug/L	MW-6 ug/L	MW-7 ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 ug/L	MW-11 ug/L	MW-12 ug/L	MW-13 ug/L	MW-14 ug/L	MW-15 ug/L	B-2 ug/L	B-3 ug/L	Field Duplicate (B-3) ug/L	Equipment Blank ug/L
Aldrin	ND	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-BHC	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC (Lindane)	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Chlordane	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-chlordane	NA	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDD	0.3	<0.15	<0.15	<0.15	<0.15	<0.16	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
4,4'-DDE	0.2	<0.1	<0.1	0.071 J	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4,4'-DDT	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	0.004	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	NA	<0.05	<0.05	<0.11	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan II	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulfate	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	ND	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	NA	<0.1	<0.1	<0.1	<0.1	<0.1	0.069 JN	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin keytone	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	0.05	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	0.03	<0.05	<0.05	<0.05	<0.05	<0.052	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	35	<0.5	<0.5	<0.5	<0.5	<0.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Toxaphene	NA	<2.5	<2.5	<2.5	<2.5	<2.6	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Total Pesticides	NA	ND	ND	0.071	ND	ND	0.069	ND	ND	ND	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls																
Aroclor 1016	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.045	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1221	0.09	<1.0	<1.0	<1.0	<1.0	<1.0	< 0.092	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aroclor 1232	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.16	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1242	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.076	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1248	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.075	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1254	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.074	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1260	0.09	<0.5	<0.5	<0.5	<0.5	<0.52	< 0.037	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PCBs	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

⁽¹⁾ TOGS 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, NYSDEC, June 1998 and Addendum, April 2000.
Based on Water Class GA, Source of Drinking Water (Groundwater).
Pesticides/PCBs analyzed using EPA Method 8082.
(GV) denotes a Guidance Value.
J indicates an estimated value; M indicates manually integrated compound.
N indicates spiked sample recovery not within control limits.
NA is Not Applicable; ND is Not Detected.

Draft Table 5.5.5-1
Metal Analytes for Groundwater Monitoring Wells
Independent Leather - Project #01.7293
Data Validated

Contaminant	NYSDEC Water Quality Standard (ug/L)	MW-5 ug/L	MW-6 ug/L	MW-7 DL ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 ug/L	MW-11 ug/L	MW-12 ug/L	MW-13 ug/L	MW-14 ug/L	MW-15 ug/L	B-2 ug/L	B-3 ug/L	Field Duplicate (B-3) ug/L	Equipment Blank ug/L
Aluminum	2,000	258 B	778	<2,500	1,210	436 B	1,360	525	415 B	1,320	383 B	1,740	<500	210 B	115 B	<500
Antimony	3	<20	<20	<100	54.9	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Arsenic	25	18 B	<40	<200	4,780	<20	8.0 B	401	437	173	<40	187	100	494	471	<40
Barium	1,000	44.4	23.3	313	49.4	31.4	93.8	177	123	112	47.8	12.4	36.5	14.1	13.8	<5.0
Beryllium	3 (GV)	<5.0	<5.0	<25	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	5	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Calcium	NA	77,000	40,700	396,000	108,000	146,000	222,000	95,300	76,700	102,000	156,000	83,800	112,000	79,100	76,600	130 B
Chromium	50	4.1 B	3.2	<50	13.4	5.0 B	148	15.2	9.2 B	6.5 B	2.5 B	6.2 B	3.9 B	2.6 B	3.2 B	<10
Cobalt	NA	<10	<10	21.8 B	2.9 B	<10	4.3 B	<10	<10	<10	<10	<10	1.7 B	<10	<10	<10
Copper	200	2.1 B	<10	<50	7.3 B	1.5 B	2.1 B	2.3 B	2.2 B	2.7 B	<10	2.7 B	1.5 B	2.4 B	3.0 B	<10
Cyanide	200	<10	<10	<10	<10	<10	195	<10	<10	<10	<10	<10	<10	<10	<10	<10
Iron	300	1,210	806	33,900	1,340	570	3,040	3,510	9,500	8,860	332	3,360	2,430	1,090	943	<200
Lead	25	9.0 B	<10	<50	<10	<10	<10	16.3	<10	4.8 B	<10	<10	<10	<10	<10	<10
Magnesium	35,000 (GV)	8,170	4,170	70,000	4,970	14,400	72,800	8,740	14,400	6,300	9,450	8,140	7,740	8,780	8,460	28.9 B
Manganese	300	343	33.8	7,420	197	28.8	327	345	504	122	206	337	44.7	160	154	<15
Mercury	0.7	<0.20	<0.20	< 0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nickel	100	2.2 B	<10	18 B	8.9 B	<10	2.3 B	<10	2.3 B	3.5 B	<10	2.4 B	<10	<10	<10	<10
Potassium	NA	4,440 J	4,740	61,100 J	22,500 J	4,250 J	16,600	1,780	17,000 J	27,200 J	1,770	5,320 J	1,250	3,820 J	3,630 J	<400
Selenium	10	<30 J	<30	<150 J	<30 J	< 30 J	<30	<30	<30 J	<30 J	<30	<30 J	<30	<30 J	<30 J	<30
Silver	50	<6.0 J	<6.0	<30 J	<6.0 J	< 6.0 J	<6.0	<6.0	<6.0 J	<6.0 J	<6.0	<6.0 J	<6.0	<6.0 J	<6.0 J	<6.0
Sodium	20,000	76,200	52,000 J	3,910,000	345,000	21,300	253,000 J	14,400 J	88,400	141,000	8,870 J	118,000	6,600 J	98,000	95,600	148 JB
Thallium	0.5 (GV)	<40	<40	<200	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Vanadium	NA	<6.0	<6.0	<30	8.6	<6.0	<6.0	<6.0	1.4 B	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
Zinc	2,000 (GV)	<50	<50	<250	<50	<50	<50	19.1 B	<50	<50	<50	<50	88.8	<50	<50	<50

⁽¹⁾ TOGS 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, NYSDEC, June 1998 and Addendum, April 2000.
Based on Water Class GA, Source of Drinking Water (Groundwater).
Metals were analyzed using EPA Method 6010 and 7471 for Mercury.
(GV) denotes a Guidance Value.
B indicates value was obtained from a reading less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).
E indicates the reported value is estimate because of the presence of interference.
J indicates an estimated value; M indicates manually integrated compound.
N indicates spiked sample recovery not within control limits.
NA is Not Applicable.
DL indicates laboratory dilution applied.

RAM TRAC Corporation

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Toxicology & Risk Assessment Consulting

Health and Safety Plan (HASP) Module for: Arsenic (and Compounds) CAS No. 7440-38-2

prepared by

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24 July 2005



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APPENDICES

Tech Support Appendix 1
Toxicological Profile of Arsenic and Compounds
Tech Support Appendix 2
Selected Risk Assessment Model Input and Output Screens

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2005.

ABBREVIATIONS AND ACRONYMS

abbreviation or acronym	full word or phrase
ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry, U S Public Health Service
BW	body weight
CAG	Carcinogen Assessment Group (US EPA Office of Research and Development)
CAS	Chemical Abstract Service
CDC	U. S. Centers for Disease Control
d	day(s)
D	diameter
eq.	equation
expl	explodes; explosive
FDA	U. S. Food and Drug Administration
h	hour(s)
HASP	health and safety plan
HRA	health risk assessment
IARC	United Nations International Agency for Research on Cancer
ICRP	Int'nat'l Commission for Radiological Protection
ign	ignites
i. p.	irregular pagination
kg	kilogram(s)
L	liter(s)
LC ₅₀	lethal conc. to 50 percent of exposed organisms
LD ₅₀	lethal dose to 50 percent of exposed organisms
LMS	linear multistage (low-dose extrapolation) model
LOAEL	Lowest Observed Adverse Effect Level
m	minute(s)
M	meter(s)
mg	milligram(s)
MW	molecular weight, in daltons (grams/mole)
NAS	U. S. National Academy of Sciences
NCI	U. S. National Cancer Institute
NIEHS	U. S. National Institute of Environmental Health Sciences

continued on following page

abbreviation or acronym	full word or phrase
NIOSH	US National Institute for Occupational Safety and Health, US Public Health Service
NOAEL	No Observed Adverse Effect Level
NRC	U. S. National Research Council
NTP	U. S. National Toxicology Program
NYS DEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PCB(s)	polychlorinated biphenyl(s)
PHS	U. S. Public Health Service
ppm-v	part(s) per million, by volume
ppm-w	part(s) per million, by weight
r	radius
RBCA	risk-based corrective action
RE	relative effectiveness (factor)
RfC	Risk Reference Concentration
RfD	Risk Reference Dose
RTECS	<i>Registry of Toxic Effects of Chemical Substances</i> , publication of NIOSH
s	second(s)
SA	surface area
SMR	Standard Mortality Ratio
sol	soluble
STP	standard temperature and pressure
subl	sublimes (changes state between gas and solid phases, with no liquid phase)
T	ton(s), where 1 ton = 2,000 pounds)
TD _{Lo}	lowest dose toxic to exposed organisms
TLV	Threshold Limit Value
TSCA	US Toxic Substances Control Act of 1976
TWA	time-weighted average
µg	microgram (10 ⁶ picograms, 10 ⁻⁶ gram)
U. S. EPA	U. S. Environmental Protection Agency
U. S. FDA	U. S. Food and Drug Administration
v	volume
vac	vacuum; in a vacuum
v sl sol	very slightly soluble
VOC	volatile organic compound(s)
WHO	United Nations World Health Organization
y	year(s)

INTRODUCTION

This document is designed to augment an existing corporate health and safety plan (HASP). Its purpose, most generally, is to enhance employee preparation for work at sites potentially posing risks of exposure to arsenic and/or (more commonly) arsenic compounds. This HASP module, therefore, presents information about arsenic and arsenic compounds, the potential for occupational exposure to them, the routes and pathways by which exposure can occur, and about risks to employee health potentially posed by such exposure.

This module augments, it does not replace, the corporate HASP. Indeed, the scope of this module excludes HASP issues to avoid redundancy and possibly even inconsistencies with an available HASP. For example, the available HASP should address respiratory protection at workplaces where grinding occurs, lofting particles into the air. This module refers employees to the available HASP for recommended procedures to manage exposure and risks to health potentially posed by inhalation of airborne metallic particles resulting from grinding of metallic arsenic. This module does not present this information, because such presentation would be redundant and could introduce inconsistencies with the HASP document.

Exposure and health risks are within the province of toxicology, known colloquially as the 'science of poisons'. That science is highly technical, and its primary research sources inaccessible and/or incomprehensible to most people. This module distills the vast technical information to communicate sound science understandably. Some readers, however, will find this module to be more credible if it documents in detail its findings made and conclusions drawn via reference to the technical literature. Accordingly, this module is divided into two parts. Its main section (this section) presents main ideas. A section containing 'Tech Support' appendices follows. These appendices are of two types: 1. a toxicological profile of arsenic, and 2. selected health risk assessment (HRA) model input and output screens (see the *Methods* section, below). The appendices are provided for

completeness, not for detailed perusal by most readers, much as a library reference section is provided for selective consultation rather than exhaustive, systematic perusal.

METHODS

This HASP module has been prepared based upon examination of relevant technical literature in areas such as toxicology (including regulatory toxicology), epidemiology, medicine, and other sciences. Exposure dynamics also were modeled consistent with risk-based corrective action (RBCA) consensus standards promulgated by the American Association for Testing and Materials (ASTM) and adopted in the Federal government and in numerous states including New York State. RBCA standards initially were formulated in connection with petroleum spill remediation, but their expanded use for substances, such as metals, that also might be present at petroleum release sites has become widely accepted and, indeed, promoted by ASTM.

ASTM RBCA standards for health risk assessment at work sites where toxic exposures might occur were implemented via software published by ASTM specifically for this purpose. The software, termed the *RBCA Tool Kit*, is abundantly documented (see *Literature Cited* items 1-3). Of course, as with any software, the caveat must apply that routine verification of its output is unrealistic for most if not all users. Presumably, however, ASTM's RBCA software was thoroughly tested before publication, and for that reason confidence in it would seem well placed. Readers interested in US EPA guidelines for health risk assessment can consult *Literature Cited* items 4-17, with which the ASTM RBCA tool kit should be fully consistent.

To prepare the RBCA HRA, default parameter values were selected for use in this HASP module. HRA model output pertaining to default scenarios can help readers to understand the dynamics of potential exposure and risks to health even under real-world circumstances that differ from the default scenarios. For example, if respiratory protection is worn, risks potentially posed via inhalation can be eliminated from further consideration.

The generic nature of this HASP module precludes use of any single scenario to represent the real work places at which this document will be relevant. Accordingly, simple whole-number substance concentrations were assumed, with which the risk output can be compared and related. Readers can extrapolate at least roughly from assumed whole-number substance concentrations to the concentrations that might apply at a particular work site. One caveat, however, is that risks might be changed in a proportion different from the proportion by which substance concentrations might be changed. For example, reducing substance concentration by half could reduce risk by 100 percent if a threshold toxic concentration no longer is present.

Some details of the HRA model are important to present to enable readers to gain insight into their own real-world work environments. Table 1 (following page) describes modeled routes and pathways by which exposure might occur at a work site. In the HRA model output screens, these are divided into pathways most commonly associated with residential settings, commercial/industrial settings, and construction settings. In the latter case, for example, exposure duration is relatively short compared with residential settings (lifetime) and commercial settings (occupational lifetime). Table 2 (on the page after Table 1) reports the default values of HRA parameters to enable readers to compare their own real-world work places with the default scenario assumed in this HASP module.

Table 1. Exposure Pathways Modeled

air exposure pathways	exposure routes
source medium: air	inhalation
source medium: surface soil	
--vapor release	inhalation
--windblown particles	inhalation
source medium: subsurface soil	
--vapor release	inhalation
groundwater exposure pathways	exposure routes
source medium: groundwater	
--volatilization to outdoor air	inhalation
--volatilization to indoor air	inhalation
--ingestion	ingestion
soil exposure pathways	exposure routes
source medium: surface soil	
--leaching to groundwater	ingestion
--ingestion, inhalation, dermal contact	mixed
--construction worker	mixed
source medium: subsurface soil	
--leaching to groundwater	ingestion
--volatilization to indoor air	inhalation
--volatilization to outdoor air	inhalation

Table 2. Risk Assessment Model Default Parameter Values

exposure parameter	unit	residential exposure scenario			commercial/industrial exposure scenario	
		adult	age 1-6 years	age 1-16 years	chronic	construction
averaging time for carcinogens	years	70	...	...	...	...
averaging time for non-carcinogens	years	30	6	16	25	1
body weight	kilograms	70	15	35	70	...
exposure duration	years	30	6	16	25	1
exposure frequency	days/year	350	...	...	250	180
exposure frequency for dermal exposure	days/year	350	...	...	250	...
ingestion rate of water	liters/day	2	...	...	1	...
ingestion rate of soil	mg/day	100	200	...	50	100
inhalation rate indoor	M ³ /day	15	...	...	20	...
inhalation rate outdoor	M ³ /day	20	...	...	20	10
skin surface area (dermal)	cm ²	5,800	...	2,023	5,800	5,800
soil to skin adherence factor	none	1	...	...	...	...

FINDINGS

Arsenic is a historically important poison and, as such, also has been the subject of who-done-it novels and other fiction. The hilarious 1944 farce "*Arsenic and Old Lace*" by Joseph Kesselring depicts a pair of spinsters with a dark secret: they poisoned lonely old men with arsenic, and buried them in a basement. More factually, a 14-July 2005 BBC story suggests that the episodic madness of Britain's King George III (1738-1820) was attributable to arsenic. This suggestion was based upon detection of high arsenic levels in samples of the King's hair found preserved in an envelope in a London museum. Perusal of the King's medical records revealed that he took James' powders, an antimony-bearing pharmaceutical, medicinally. In those days, antimony commonly harbored high levels of arsenic as an impurity.

The subsections below describe dynamics of arsenic that can lead to occupational exposure, and toxic consequences potentially arising from such exposure. Except for the US EPA's IRIS database (citation 4), no other citations of technical literature specific to arsenic and its compounds are provided in this *Findings* section of this HASP module. Rather, all information provided in the subsections below is derived from, and documented in, *Tech Support Appendix 1*, which is a detailed *Toxicological Profile* of arsenic and arsenic compounds. *Tech Support Appendix 1* addresses each of the subjects addressed below, but in more detail, and provides complete citations of technical literature documenting the findings that are made. Thus, *Tech Support Appendix 1* effectively constitutes the sole source citation documenting this *Findings* section.

Physical and Chemical Properties

Arsenic is a naturally occurring element that is ubiquitous at trace levels in soil and water globally. Elemental (metallic) arsenic exhibits neutral electrical charge ('valence' or 'oxidation state'). Arsenic, however, commonly assumes the trivalent (+3) or pentavalent (+5) oxidation state when forming its many compounds. Many arsenic compounds are highly soluble in water. This property tends to increase the mobility of such compounds in groundwater, and the potential for human exposure via water. As an element, arsenic decays only via nuclear reactions. It does not decay via physical or chemical processes, although arsenic compounds of course do undergo physical and chemical transformations. Consequently, arsenic must be regarded as a persistent though often mobile class of potentially toxic substances.

Absorption, Distribution, Metabolism, and Excretion

Absorption efficiencies, by route, have been reported to be 30 percent via inhalation and 96.5 percent via ingestion. Dermal absorption appears to be slow, but might be facilitated by prolonged adherence of arsenic to skin. Once absorbed into the body, arsenic has been reported to accumulate in blood following exposure of animals via inhalation or via drinking water. The principal tissues and organs to which arsenic is distributed are: skin, nails, hair, heart, kidney, liver, and lungs. Occupational exposure has been documented abundantly. For example, among smelter workers, lung tissue of exposed individuals was found to harbor seven times levels measured in the lungs of control individuals lacking such occupational exposure. Arsenic metabolism involves conversion of the pentavalent form to the trivalent. Arsenic excreted primarily in the urine, and predominantly in the trivalent form. The half-life of ingested inorganic arsenic (the time required for 50 percent of an absorbed dose to be eliminated) has been reported to equal about ten hours.

Acute Toxicity

Acute toxic effects associated with arsenic compounds can occur in humans under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. After absorption, arsenic may cause multi-organ failure by inhibiting cellular enzymes. The primary initial target organs are the gastrointestinal tract, heart, brain, and kidneys. Eventually the skin, bone marrow, and peripheral nervous system may be damaged. Convulsions, coma, and death may follow within one day of a severe exposure. The lethal dose of arsenic depends upon the oxidation state of the arsenic compound administered. Trivalent arsenic compounds have been reported to be about four times as potent as pentavalent compounds. Acutely toxic doses of arsenic may cause diverse symptoms, including fever, anorexia, hepatomegaly, melanosis, cardiac arrhythmia possibly followed by heart failure, upper respiratory disturbances, peripheral neuropathy (loss of sensory functioning), mucus membrane damage and vesicle formation, as well as various gastrointestinal and hematopoietic (blood formation) effects.

Cancer Causation

Arsenic is a human carcinogen whose critical--but not only--target is the skin. Skin cancers and angiosarcomas* arising from arsenic, first associated with chronic ingestion of an arsenical preparation known as Fowler's solution, have later been associated with drinking water and occupational exposure. Occupational exposures, especially chronic inhalation of particles to which arsenic has been adsorbed, have also been associated with elevated lung cancer rates among workers engaged in smelting and production of arsenical pesticides. Lung cancers have exhibited a variable latency period in the range of 13 to 50 years.

Human skin cancer induced by arsenic appears to be distinguishable from skin cancers of ultraviolet sunlight origin in being frequently located in areas of skin which are usually unexposed to sunlight, such as palms and soles. The cancers tend to occur as multiple lesions with a variable latency period of from six to 50 years. Skin cancers are preceded by a sequence of histopathological changes, from hyperpigmentation to hyperkeratosis. These changes may or may not progress to skin cancer. Skin cancers include squamous carcinomas in keratotic areas or basal cell carcinomas.

Chronic Toxicity

Arsenic and its compounds together have been shown to cause toxic effects as a result of chronic exposure, which is defined as continuous or sporadic exposure over a long period of time (months to years). Details of chronic toxic effects exerted by arsenic and arsenic compounds are provided in *Tech Support Appendix 1*. They include effects on many organs and organ systems too numerous to enumerate here except via selected examples. Chronic inhalation of inorganic arsenic compounds has been reported to be the most common cause of industrial poisoning. Chronic poisoning symptoms may include weakness, anorexia, hepatomegaly (liver enlargement), jaundice, and gastrointestinal complaints. These may be followed by conjunctivitis and irritation of the throat and respiratory tract, perforation of the nasal septum, hyperkeratosis, hyperpigmentation, eczemoid, and allergic dermatitis. Other chronic effects associated with exposure to inorganic arsenic include dermatological disorders, such as contact dermatitis; and peripheral neuropathy.

RBCA Risk Assessment

The RBCA risk assessment, implemented via ASTM's *RBCA Tool Kit* software package (1-3), was completed using as input data default assumptions described in the *Methods* section of this HASP module. Dose-response parameter values for arsenic that might have been provided with the software were updated to confirm their currency. These values for arsenic and compounds are reported in Table 3 (next page).

Input assumptions about the concentrations of arsenic present in environmental media were selected arbitrarily, except that values were adjusted to produce output risks within maximum acceptable target risk levels selected as defaults within the software. Default values of acceptable risk benchmarks were one per million incremental cancer risk (one per hundred thousand for the construction worker scenario) and a hazard quotient of unity (one) for non-cancer effects. This means that arsenic exposure levels were maintained below levels that would be expected to produce a clinically significant toxic effect, with an adequate margin of safety reflecting uncertainties and variability in susceptibility among people who might be exposed to arsenic and its compounds.

Results of the RBCA HRA are set forth in Table 4 (on the page after Table 3). They reveal that arsenic concentrations of 0.001 mg/kg in surface and subsurface soil and 0.0001 mg/L in groundwater produced cancer and non-cancer risks within the default values adopted as acceptable risk benchmarks. Note that Table 4 uses a scientific format for reporting numbers. This was necessary to express, within reasonable space, numbers spanning many orders of magnitude (powers of 10). To clarify, 0.001 mg/kg is expressed as 1.0 e-3 mg/kg in Table 4, where the e-3 means 10^{-3} , or 0.001. Accordingly, 1.0 e-3 is 0.001 multiplied by 1.0, which remains 0.001. To avoid mixing formats, and to facilitate comparison of numbers with one another, all numbers were reported using this format, even though some numbers easily could have been expressed in a more familiar format.

Table 3. Dose-Response Parameters for Arsenic Compounds

cancer potency			non-cancer potency		
inhalation slope factor		oral slope factor	inhalation risk reference concentration (RfC)	oral risk reference dose (RfD)	
(risk per mg/M ³)	[risk per mg/(kg d)]		(mg/M ³)	[mg/(kg d)]	
Class A: <i>human carcinogen</i>			...	...	3.00 e-4
4.30 e+0	1.23 e+0	1.50 e+0			

Table 4. Potential Health Risks Associated with Modeled Exposure Pathways

exposure pathways		conc. in source medium	unit	health risk	
				cancer	non-cancer
air exposure pathways					
	--surface soil: inhalation of vapor and dust	1.0 e-3	mg/kg	6.2 e-13	0.0 e+0
	--subsurface soil: inhalation of vapor	1.0 e-3	mg/kg		
	SSTL*: not applicable				
groundwater exposure pathways					
	source medium: groundwater	1.0 e-4	mg/L	5.2 e-7	3.5 e-3
	--soil leaching to groundwater, ingestion	...	...		
	--groundwater, ingestion	...	...		
	--volatilization to outdoor air	...	...		
	--volatilization to indoor air	...	...		
	SSTL*: 1.9 e+0 mg/L				
soil exposure pathways					
	source medium: surface soil	1.0 e-3	mg/kg	2.6 e-10	1.6 e-6
	--leaching to groundwater	...	...		
	--ingestion, inhalation, dermal contact	...	...		
	--construction worker	...	...		
	SSTL*: 2.2 e-2 mg/kg				
	source medium: subsurface soil	1.0 e-3	mg/kg	2.6 e-10	1.6 e-6
	--leaching to groundwater	...	...		
	--ingestion, inhalation, dermal contact	...	...		
	SSTL*: 2.2 e-2 mg/kg				
*SSTL: site-specific target level					

CONCLUSIONS

Conclusions drawn based upon findings made in the *Findings* section above are, most generally, that arsenic is a ubiquitous element present in numerous toxic compounds. Consequently, to survive, life on earth had to evolve adaptations to live with arsenic and its compounds in the environment; including terrestrial, marine, and aquatic habitats. However, with the onset of the Industrial Revolution, mining brought more arsenic to the earth's surface, and industrial processes used it or produced it as a waste when purifying other useful minerals (such as antimony mentioned in the example of apparent arsenic poisoning of King George III). This gave rise to environmental levels of arsenic toxic to organisms, including humans.

Clearly, arsenic can be present in occupational (and residential) environments at levels that can cause acute and/or chronic toxic effects. Environmental levels used as inputs to the RBCA HRA appear to be well within such toxic environmental levels, at least under the default scenario adopted by the ASTM *RBCA Tool Kit* software. Some assumptions (such as longer exposure time) can increase risks potentially posed by arsenic, and other assumptions (such as wearing respiratory protection) can reduce those risks. The generic nature of this HASP module precludes resolution of this issue for specific workplaces, but the value of the HASP module is undiminished: it still allows the reader to understand better the dynamics of arsenic in the environment, and to discern 'red flags' that should trigger concern. Such 'red flags' could include higher arsenic concentrations than those assumed in the RBCA HRA, or the applicability of significantly different exposure assumptions.

Individuals assigned to workplaces at which arsenic compounds are present at levels above natural background should be familiarized with this HASP module, and thereby enabled to manage effectively potential risks of exposure and health damage. As a final conclusion, this HASP module focuses on arsenic in the context of occupational health and safety planning, but it is not a substitute for a HASP. This HASP module should be used in conjunction with a well-prepared HASP.

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TECH SUPPORT APPENDIX 1

Toxicological Profile: **ARSENIC (and compounds)** **CAS No. 7440-38-2**

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Physical and Chemical Properties

Arsenic (symbol, As) is a metalloid* of atomic number 33 and weight 74.92 daltons. It has been assigned Chemical Abstract Service (CAS) Number 7440-38-2. Elemental (metallic) arsenic exhibits zero valence. Arsenic may, however, assume either the trivalent or the pentavalent oxidation state when forming its many compounds (30, 34). These include the pentavalent arsenates (AsO_4^-): calcium *ortho*arsenate [$\text{Ca}_3(\text{AsO}_4)_2$] and arsenic pentoxide (As_2O_5); the trivalent arsenites: (As^{3-}), such as potassium *ortho*arsenite (K_3AsO_3) and *meta*arsenite (KAsO_2), arsine (AsH_3), and arsenic trioxide (As_2O_3); as well as the trivalent organic arsenites: sodium cacodylate $\{\text{Na}[(\text{CH}_3)_2\text{AsO}_2] \cdot 3\text{H}_2\text{O}\}$, arsanilic acid ($\text{C}_6\text{H}_8\text{AsNO}_3$), dimethylarsinic acid [$(\text{CH}_3)_2\text{AsO}_2\text{H}$], and methanearsonic acid [$\text{CH}_3\text{AsO}(\text{OH})_2$]. Physical and chemical properties of arsenic and selected compounds are set forth in Table 1.

*Whereas a *metal* yields positive ions in aqueous solutions of its salts, some *metalloid* ions may be negative. A metalloid may be regarded as an element that resembles both a metal and a non-metal.

Table 1. Physical-Chemical Properties of Arsenic and Compounds*

element or compound	chemical formula	density (g/cm ³)	melting point (° C)	boiling point (° C)	water solubility (g/100 ml)
elemental form					
arsenic	As	5.727 ¹⁴	817 ²⁸ atm	sublimes	--
trivalent inorganic form					
potassium <i>meta</i> arsenite	KAsO ₂	--	--	--	soluble
potassium <i>ortho</i> arsenite	K ₃ AsO ₃	--	--	--	very soluble
arsine	AsH ₃	gas (<1)	-113.5	-55	20 ml
arsenic trioxide	As ₂ O ₃	3.738	312.3	465	3.7 ²⁰
arsenic trisulfide	As ₂ S ₃	3.43	300	707	0.00005 ¹⁸
trivalent organic form					
arsanilic acid	C ₆ H ₈ AsNO ₃	1.9571 ²⁰	232	--	soluble hot
dimethylarsinic acid	(CH ₃) ₂ As ₂ H	--	200	--	--
Na cacodylate	Na(CH ₃) ₂ AsO ₂ ·3H ₂ O		~60	120	-- 200 ¹⁵⁻²⁰
methanearsonic acid	CH ₃ AsO(OH) ₂	--	~160.5	--	soluble
pentavalent form					
calcium <i>ortho</i> arsenate	Ca(AsO ₄) ₂	3.620	1.455	--	0.13 ²⁵
lead <i>meta</i> arsenate	Pb(AsO ₃) ₂	6.42 ¹⁵	--	--	decomposes
lead <i>ortho</i> arsenate	Pb ₃ (AsO ₄) ₂	7.80	1,042	--	v sl soluble
potassium <i>ortho</i> arsenate	K ₃ AsO ₄	--	1,310	--	18.87
arsenic pentoxide	As ₂ O ₅	4.32	315	--	150 ¹⁶

*Adapted from: **U. S. EPA.** *Health Assessment Document for Inorganic Arsenic. Final Report.* Washington, DC, Office of Health and Environmental Assessment, EPA/600/8-83-021F, i. p., March 1984; and **Weast, R. C.** *Handbook of Chemistry and Physics, 49th edition.* Cleveland, Chemical Rubber Company, i. p., 1968. Superscripted numbers are applicable temperatures or other conditions.

Pharmacokinetics

Absorption

Absorption efficiencies, by route, have been reported to be: 30 percent by inhalation, and 96.5 percent by ingestion (8, 30). According to ATSDR: "No quantitative studies were located on absorption of inorganic arsenicals in humans after dermal exposure. Uptake of arsenic into blood or tissues was undetectable for up to 24 hours in rats whose tails were immersed in solutions of sodium arsenate for 1 hour. However, arsenic began to increase in blood, liver, and spleen over the next 5 days (Dutkiewicz 1977). The rate of uptake was estimated to be 1-33 mg/cm² /hr. These findings suggest that dermal exposure leads initially to arsenic binding to skin, and that the bound arsenic may slowly be taken up into the blood, even after exposure ends... No studies were located on absorption of organic arsenicals in humans or animals after dermal exposure" (1).

Distribution

Arsenic has been reported to accumulate in blood following exposure of animals via inhalation or drinking water (20). Tissue levels were reported to increase for the first weeks or months, but then to diminish, even with prolonged exposure. Rats exposed once to arsenic exhibited a long biological half time (9, 20).

The principal tissues and organs to which arsenic is distributed are: skin, nails, hair, heart, kidney, liver, and lungs (11, 30). Concentrations of arsenic in lung, liver, and kidney tissue of dead smelter workers and from a control group were compared (9, 35). Lung tissue of exposed smelter workers was found to be seven times levels in comparable tissues of control individuals.

Metabolism

Inorganic arsenic compounds, which may exist in pentavalent or trivalent form, are metabolized by reduction of the pentavalent form to the trivalent (11). This reduction is followed by methylation, that is, addition of one or, more usually, two methyl groups (CH_3 - groups) to the arsenic moiety. Methylation of arsenic yields monomethylarsinic or dimethylarsinic acid, the latter of which is the major form of arsenic found in the urine (8, 15). Metabolism of organic arsenic (which may also exist in pentavalent or trivalent form) is poorly understood. However, it must differ from metabolism of inorganic forms, inasmuch as ingestion of seafood containing arsenic has apparently not resulted in conversion to either monomethylarsinic or dimethylarsinic acid *in vivo* (11).

Excretion

The half-life of ingested inorganic arsenic (oxidation state unspecified), which is the time required for 50 percent of an absorbed dose to be eliminated from the body, has been reported to equal about ten hours; 50 to 80 percent has been reported to be eliminated in about three days. One study involving organic (methylated) arsenic revealed a half-life in humans of 30 hours (11). The principal route of arsenic excretion is via urine, in which the major excretion product is dimethylarsinic acid resulting from methylation during prior arsenic metabolism. Human milk contains about 3 $\mu\text{g/L}$ of arsenic. Feces contain very little arsenic because of efficient reabsorption of arsenic from bile following entry into the intestines (30). Clearance time increases with dose, so that very low doses which may be associated with combustion-related contamination would be expected to be eliminated with maximum rapidity.

Pharmacodynamics

Acute Toxicity

Acute toxic effects associated with arsenic compounds can occur in humans under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. After absorption, arsenic may cause multi-organ failure by inhibiting cellular enzymes containing sulfhydryl (S-H) groups (9). The primary initial target organs are the gastrointestinal tract, heart, brain, and kidneys. Eventually the skin, bone marrow, and peripheral nervous system may be damaged. Convulsions, coma, and death may follow within one day of a severe exposure.

The lethal dose of arsenic depends upon the oxidation state of the arsenic compound administered (30). Trivalent arsenic compounds have been reported to be about four times as potent as pentavalent compounds. Trivalent arsenic compounds have been reported to exhibit oral LD₅₀ values (oral doses lethal to 50 percent of exposed individuals) in the range of 15-293 mg/kg of body weight, depending upon such variables as species, route of exposure, vehicle of exposure, and bioavailability of the formulation of arsenic administered. The amount of arsenic trioxide lethal to humans (presumably adults) was reported to be in the range of 70 to 180 mg.

Acutely toxic doses of arsenic may cause diverse symptoms, including fever, anorexia, hepatomegaly, melanosis, cardiac arrhythmia possibly followed by heart failure, upper respiratory disturbances, peripheral neuropathy (loss of sensory functioning), mucus membrane damage and vesicle formation, as well as various gastrointestinal and hematopoietic effects (11).

Mutagenicity

Arsenic is a relatively weak mutagen compared with other metals (30). Although bioassays of laboratory animals have not as yet revealed an ability of arsenic to cause chromosome aberrations, some studies--which are inconclusive--suggest that humans exposed to arsenic exhibit elevated frequencies of sister chromatid exchanges and chromosome aberrations. Arsenic has been observed to cause clastogenesis (chromosome breakage) and sister chromatid exchanges *in vitro* in a variety of laboratory-cultured cell types, including human cells, with trivalent arsenic exhibiting about ten times the potency of pentavalent arsenic. Arsenic may be substituted for phosphorus in the DNA backbone, and may also inhibit DNA repair mechanisms (30). Finally, trivalent arsenic has been reported to enhance the mutagenicity of ultraviolet (UV) light and chemical mutagens (12, 27).

According to ATSDR: "Investigations of genotoxic effects of ingested arsenic have yielded mixed results. In humans exposed to Fowler's solution (potassium arsenite, usually taken at a dose of about 0.3 mg As/kg/day [Holland 1904]), increased sister chromatid exchange but no increase in chromosomal aberrations was reported in one study (Burgdorf *et al.* 1977), while just the converse (increased aberrations but no increase in sister chromatid exchange) was reported in another (Nordenson *et al.* 1979). In animal studies, an increased incidence of chromosomal abnormalities was detected in rats given oral doses of sodium arsenate (4 mg As/kg/day) for 2-3 weeks (Datta *et al.* 1986), but no consistent increase in chromosomal aberrations was detected in bone marrow cells or spermatogonia from mice given sodium arsenite (about 50 mg As/kg/day) for up to 8 weeks (Poma *et al.* 1987). These studies suggest that ingested arsenic may cause chromosomal effects, but these data are too limited to draw a firm conclusion. Other genotoxicity studies on inorganic arsenicals are discussed in Section 2.4.

No studies were located regarding genotoxic effects in humans after oral exposure to organic arsenicals. An increased number of DNA strand breaks were detected in lung and other tissues of mice given oral doses of DMA (Yamanaka *et al.* 1989a), an effect which appeared to be related to the formation of some active oxygen species. These breaks were largely repaired within 24 hours, so the relevance with respect to health risk is uncertain. Other genotoxicity studies on organic arsenicals are discussed in Section 2.4" (1).

Carcinogenicity

Arsenic is a human carcinogen whose critical--but not only--target is the skin (11). Skin cancers and angiosarcomas* arising from arsenic, first associated with chronic ingestion of an arsenical preparation known as Fowler's solution, have later been associated with drinking water and occupational exposure. Occupational exposures, especially chronic inhalation of particles to which arsenic has been adsorbed, have also been associated with elevated lung cancer rates among workers engaged in smelting and production of arsenical pesticides (11). Lung cancer also has been associated with animal exposure to arsenic, as observed in hamsters (23, 24).

Human skin cancer induced by arsenic appears to be distinguishable from skin cancers of ultraviolet sunlight origin in being frequently located in areas of skin which are usually unexposed to sunlight, such as palms and soles (30). The cancers tend to occur as multiple lesions with a variable latency period of from six to 50 years. Skin cancers are preceded by a sequence of histopathological changes, from hyperpigmentation to hyperkeratosis. These changes may or may not progress to skin cancer. Skin cancers include squamous carcinomas in keratotic areas or basal cell carcinomas.

Lung cancers have exhibited a variable latency period in the range of 13 to 50 years (30). Occupational lung cancers are principally poorly differentiated and small-cell undifferentiated epidermoid carcinomas, although acinar adenocarcinomas have also been observed. Dose levels associated with these effects are difficult to estimate, and some epidemiological studies have failed to account for the potentially confounding effects of tobacco-smoking behavior of the study populations.

*Angiosarcoma: a rare malignant neoplasm most frequently occurring in the breast and skin, believed to arise from blood vessel endothelial cells (12). Sarcomas are distinct from carcinomas in that carcinomas, strictly speaking, have an epithelial rather than endothelial origin.

Teratogenicity

Arsenic has been reported to induce teratogenic effects in such bioassay organisms as hamsters, rats, and mice (30). In one study, golden hamsters injected on day 8 of pregnancy with either 20 mg/kg of arsenic as arsenate or 2-10 mg/kg as arsenite produced offspring exhibiting a variety of skeletal abnormalities. Hamsters treated with arsenate exhibited a delay in neural fold elevation and neural tube closure 10 hours after dosing. In addition to its teratogenic effects, arsenic has been associated with fetotoxicity; for example, arsenic trioxide has been reported to be fetotoxic to mice (19). It is important to emphasize, however, that fetotoxicity is qualitatively distinct from teratogenicity, and not always correlated with it.

Teratogenic effects associated with arsenic administered parenterally as arsenate (pentavalent form of inorganic arsenic) or arsenite (trivalent form) involved animals. However, humans would appear to be also susceptible, inasmuch as arsenic has been shown to cross the human placenta (11). Indeed, umbilical cord blood levels of arsenic have been reported to be in the same range as maternal blood levels.

Reproductive Effects

"No studies were located regarding reproductive effects in humans after oral exposure to inorganic arsenicals, and only one study has been performed in animals. In this study (a three-generation study in mice given sodium arsenite in drinking water at an average dose of 1 mg As/kg/day), no significant effects were detected on a number of reproductive parameters, although a trend toward a decreased number of pups per litter and slightly altered male:female sex ratio were observed (Schroeder and Mitchener 1971). In the absence of any further data, it is difficult to judge whether these effects are either statistically or biologically significant.

No studies were located regarding reproductive effects in humans after oral exposure to organic arsenicals. Male and female mice dosed with MMA (55 mg As/kg/day) prior to mating and during pregnancy produced fewer litters than normal, an effect which was attributable mainly to decreased fertility of the males (Prukop and Savage 1986). This observation (shown in Figure 2-4 and summarized in Table 2-4) suggests that spermatogenesis or sperm function might be impaired by organic arsenicals, but this was not studied directly" (1).

Other Chronic Effects

Chronic inhalation of inorganic arsenic compounds has been reported to be the most common cause of industrial poisoning (9, 30). Chronic poisoning symptoms may include weakness, anorexia, hepatomegaly, jaundice, and gastrointestinal complaints. These may be followed by conjunctivitis and irritation of the throat and respiratory tract, perforation of the nasal septum, hyperkeratosis, hyperpigmentation, eczemoid, and allergic dermatitis (9). Other chronic effects associated with inorganic arsenic include dermatological disorders, such as contact dermatitis; and peripheral neuropathy. In animals, chronic oral administration of arsenic induced cardiovascular changes, hepatotoxicity, dermal effects, and immuno-suppression. Hepatic effects have included cirrhosis of the liver and portal hypertension, possibly influenced by alcohol consumption patterns.

Hematological. Laboratory animal bioassays have revealed depression of hemoglobin synthesis by mice, rats, and cats exposed to arsenate or arsenite (9, 30). This effect was caused by interference with activity of the enzymes ALA-synthetase and heme-synthetase in the heme biosynthetic pathway. Disturbances in the heme biosynthetic pathway in mice and rats orally administered arsenate occurred at levels of 20, 40, or 85 ppm.

Chronic human exposure to arsenic has been associated with a variety of hematological and circulatory effects (9, 30). These include a reversible anemia with chronic exposure to arsenic via well water, pharmaceuticals, and the workplace; pancytopenia (reduced count of circulating red blood cells, white blood cells, and platelets), and possible causation of blackfoot disease, a peripheral vascular disease progressing to gangrene of the extremities, exhibited by Taiwanese individuals consuming arsenic-rich well water. Blackfoot disease was associated with exposures to levels of inorganic arsenic in drinking water of as low as <0.3 ppm. Assuming daily consumption of two liters of water by 70-kilogram Taiwanese adults, this concentration is equivalent to exposure levels of 8.57×10^{-3} mg/kg/d and 3.13 mg/kg/y.

Peripheral vascular changes have also been documented among German vintners occupationally exposed to arsenical pesticides and arsine (AsH_3) in wine (9, 30). (The arsenical pesticides to which German vintners were exposed were measured as arsenic trioxide; 15).

According to ATSDR (1): "A number of studies in humans indicate that arsenic ingestion may lead to serious effects on the cardiovascular system.

Characteristic effects on the heart from both acute and long-term exposure include altered myocardial depolarization (prolonged Q-T interval, nonspecific S-T segment changes) and cardiac arrhythmias (Glazener *et al.* 1968; Goldsmith and From 1986; Heyman *et al.* 1956; Little *et al.* 1990; Mizuta *et al.* 1956). Long-term low-level exposures may also lead to damage to the vascular system. The most dramatic example of this is "Blackfoot disease," a condition that is endemic in an area of Taiwan where average drinking water levels of arsenic range from 0.17 to 0.80 ppm (Tseng 1977), corresponding to doses of about 0.014 to 0.065 mg As/kg/day (Abernathy *et al.* 1989). The disease is characterized by a progressive loss of circulation in the hands and feet, leading ultimately to necrosis and gangrene (Chen *et al.* 1988b; Chi and Blackwell 1968; Tseng 1977, 1989; Tseng *et al.* 1968). Several researchers have presented evidence that other factors besides arsenic (e.g., other water contaminants, dietary deficits) may play a role in the etiology of this disease (Ko 1986; Lu *et al.* 1990; Yu *et al.* 1984). While this may be true, the clear association between the occurrence of Blackfoot disease and the intake of elevated arsenic levels indicates that arsenic is at least a contributing factor. Moreover, effects of arsenic on the vascular system have also been reported in a number of other populations. For example, studies in Chile indicate that ingestion of 0.6-0.8 ppm arsenic in drinking water (corresponding to doses of 0.02-0.06 mg As/kg/day, depending on age) increase the incidence of Raynaud's disease and of cyanosis of fingers and toes (Borgono and Greiber 1972; Zaldivar and Guillier 1977). Autopsy of five children from this region who died of apparent arsenic toxicity showed a marked thickening of small and medium sized arteries in tissues throughout the body, especially the heart (Rosenberg 1974). Likewise, thickening and vascular occlusion of blood vessels were noted in German vintners exposed to arsenical pesticides in wine (Roth 1957). Similar alterations in vascular reactivity have been noted in rats given repeated oral doses of arsenic trioxide (11 mg As/kg/day) for several weeks (Bekemeier and Hirschelmann 1989), although no histological effects could be detected in the hearts of rats or dogs exposed to arsenate or arsenite for 2 years (Byron *et al.* 1967)"

Anemia and leukopenia are common effects of arsenic poisoning in humans, and have been reported following acute (Armstrong *et al.* 1984; Fincher and Koerker 1987), intermediate (Franzblau and Lilis 1989; Goldsmith and From 1986; Heyman *et al.* 1956; Mizuta *et al.* 1956; Westhoff *et al.* 1975), and chronic oral exposures (Glazener *et al.* 1968; Kyle and Pease 1965; Nagai *et al.* 1956; Tay and Seah 1975). These effects may be due to both a direct cytotoxic or hemolytic effect on the blood cells (Armstrong *et al.* 1984; Fincher and Koerker 1987; Goldsmith and From 1986; Kyle and Pease 1965; Lerman *et al.* 1980) and a suppression of erythropoiesis (Kyle and Pease 1965; Lerman *et al.* 1980). Hematological effects are usually not observed in humans exposed to levels of 0.07 mg As/kg/day or less (Harrington *et al.* 1978; Huang *et al.* 1985; silver and Wainman 1952; Southwick *et al.* 1981), although intermediate-duration exposure to 0.05 mg/kg/day resulted in mild anemia in one study (Mizuta *et al.* 1956).

Hematological effects of ingested arsenic have not been thoroughly studied in laboratory animals, but no hematological effects have been detected in monkeys

exposed to arsenate for 2 weeks (Heywood and Sortwell 1979), or in rats or dogs exposed to arsenate or arsenite for 1-2 years (Byron *et al.* 1967; Kroes *et al.* 1974; Schroeder *et al.* 1968). Rats exposed to arsenate for 6 weeks or more had decreased activities of several enzymes involved in heme synthesis, but data were not provided on whether this resulted in anemia (Woods and Fowler 1977, 1978).

Renal. "Most case studies of acute and chronic arsenic toxicity do not report clinical signs of significant renal injury, even when other systems are severely impaired (e.g., Franzblau and Lilis 1989; Jenkins 1966; Kersjes *et al.* 1987; Mizuta *et al.* 1956; Silver and Wainman 1952). In some cases, elevated serum levels of creatinine or bilirubin have been noted (Armstrong *et al.* 1984; Levin-Scherz *et al.* 1987), and mild proteinuria may occur (Armstrong *et al.* 1984; Glazener *et al.* 1968; Tay and Seah 1975). In rare cases, renal failure may occur (e.g., Fincher and Koerker 1987), probably as a result of fluid imbalances or vascular injury. Studies in animals also indicate that the kidney is not a major target organ (Byron *et al.* 1967; Schroeder and Balassa 1967; Woods and Southern 1989), although some mild histological changes in renal tubules of monkeys exposed to arsenate for 2 weeks was noted by Heywood and Sortwell (1979), and some mild alterations in renal mitochondria in rats exposed to arsenate for 6 weeks were noted by Brown *et al.* (1976). These data suggest that the kidney is relatively less sensitive to arsenic than most other organ systems, and renal effects are unlikely to be of concern except secondary to fluid imbalances or cardiovascular injury.

No studies were located on renal effects in humans after oral exposure to organic arsenicals. Tubular degeneration and necrosis have been noted in rats (but not mice) given repeated oral doses of roxarsone (Abdo *et al.* 1989; NTP 1989b), and interstitial nephritis and tubular nephrosis have been noted in rabbits given repeated oral doses of MMA (Jaghabir *et al.* 1989). These data suggest that organic arsenicals can lead to significant renal injury, although the minimal dose is not well defined" (1).

Dermal. "One of the most common and characteristic effects of arsenic ingestion is a pattern of skin changes that include generalized hyperkeratosis and formation of hyperkeratotic warts or corns on the palms and soles, along with areas of hyperpigmentation interspersed with small areas of hypopigmentation on the face, neck, and back. These effects have been noted in a large majority of human studies involving intermediate- or chronic-duration oral exposure (e.g., Bickley and Papa 1989; Borgono and Greiber 1972; Borgono *et al.* 1980; Cebrian *et al.* 1983; Chakraborty and Saha 1987; Franklin *et al.* 1950; Franzblau and Lilis 1989; Huang *et al.* 1985; Luchtrath 1983; Mazumder *et al.* 1988; Nagai *et al.* 1956; Saha and Poddar 1986; Silver and Wainman 1952; Szuler *et al.* 1979; Tay and Seah 1975; Tseng *et al.* 1968; Wade and Frazer 1953; Wagner *et al.* 1979; Zaldivar 1974, 1977). In cases of low-level chronic exposure (usually from water), these skin lesions appear to be the most sensitive indication of effect, so this end point is considered to be the most appropriate basis for establishing a chronic oral MRL. However, other effects (hepatic injury, vascular disease, neurological effects) also appear to have similar thresholds. As shown in Table 2-3 and Figure 2-3, numerous studies in humans have reported dermal effects at chronic dose levels ranging from about 0.01-0.1 mg As/kg/day (Bickley and Papa 1989; Borgono and Greiber 1972;

Borgono *et al.* 1980; Cebrian *et al.* 1983; Chakraborty and Saha 1987; Franklin *et al.* 1950; Huang *et al.* 1985; Luchtrath 1983; Mazumder *et al.* 1988; Piontek *et al.* 1989; Silver and Wainman 1952; Tseng *et al.* 1968; Zaldivar 1974, 1977). Several epidemiological studies of moderately-sized populations (20-200 people) exposed to arsenic through drinking water have detected no dermal or other effects at average chronic doses of 0.0004-0.01 mg As/kg/day (Cebrian *et al.* 1983; Harrington *et al.* 1978; Mazumder *et al.* 1988; Southwick *et al.* 1981; Valentine *et al.* 1985), and one very large study (based on 17,000 people) detected no effects in any person at an average total daily intake (from water plus food) of 0.0008 mg As/kg/day (Tseng *et al.* 1968). This value has been used to calculate a chronic oral MRL for inorganic arsenic of 0.0003 mg/kg/day, as described in footnote b in Table 2-3. An uncertainty factor of 10 was not required since the NOAEL is based on a relatively large human study. An uncertainty factor of 3 was selected to account for both the lack of data to preclude reproductive toxicity as a critical effect and to account for some uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals (IRIS 1992).

Another prominent dermal effect associated with chronic ingestion of inorganic arsenic is skin cancer. As discussed in greater detail in Section 2.2.2.8 (below), some of these skin cancers may evolve from the hyperkeratotic corns or warts, while the areas of altered pigmentation are not considered to be precancerous (EPA 1988e).

Dermal lesions similar to those observed in humans have not been noted in oral exposure studies in monkeys (Heywood and Sortwell 1979), dogs (Byron *et al.* 1967), or rodents (Schroeder *et al.* 1968)... No studies were located regarding dermal/ocular effects in humans or animals after oral exposure to organic arsenicals" (1).

Respiratory. "Ingestion of arsenic by humans is usually not associated with serious injury to the respiratory system, although pulmonary edema and hemorrhagic bronchitis may occur in moderate to severe cases (e.g., Campbell and Alvarez 1989; Fincher and Koerker 1987). It is possible that this is primarily a secondary effect due to injury to the pulmonary vasculature (see Cardiovascular Effects, below), although there are no studies specifically on this point. No respiratory effects were noted in dogs or rats after chronic oral exposure to arsenate or arsenite (Byron *et al.* 1967)... No studies were located regarding respiratory effects in humans or animals after oral exposure to organic arsenicals" (1).

Neurological. "A large number of epidemiological studies and case reports indicate that ingestion of inorganic arsenic can cause injury to the nervous system. Acute, high-dose exposures (1 mg As/kg/day or above) often lead to encephalopathy, with signs and symptoms such as headache, lethargy, mental confusion, hallucination, seizures, and coma (Armstrong *et al.* 1984; Danan *et al.* 1984; Fincher and Koerker 1987). Intermediate- and chronic-duration exposures to lower levels (0.019-0.5 mg As/kg/day) are typically characterized by a symmetrical peripheral neuropathy (Franzblau and Lilis 1989; Hindmarsh *et al.* 1977; Huang *et al.* 1985; Mizuta *et al.* 1956; Silver and Wainman 1952; Wagner *et al.* 1979). This neuropathy usually begins as a numbness in the hands and feet, but later may

develop into a painful "pins and needles" sensation. Both sensory and motor nerves are affected, and muscle weakness often develops, sometimes leading to wrist-drop or ankle-drop (Chhuttani *et al.* 1967; Heyman *et al.* 1956). Histological examination of nerves from affected individuals reveals a dying-back axonopathy with demyelination (Goebel *et al.* 1990; Hindmarsh and McCurdy 1986). Some recovery may occur following cessation of exposure, but this is a slow process and recovery is usually incomplete (Fincher and Koerker 1987; LeQuesne and McLeod 1977; Murphy *et al.* 1981). No neurological effects could be detected in populations chronically exposed to doses of 0.01 mg As/kg/day or less (Harrington *et al.* 1978; Hindmarsh *et al.* 1977; Southwick *et al.* 1981; Valentine *et al.* 1985). Neurological effects have not been reported in dogs or monkeys chronically exposed to arsenate or arsenite by the oral route (Byron *et al.* 1967; Heywood and Sortwell 1979).

The highest NOAEL values and all reliable LOAEL values for neurological effects from inorganic arsenic in each species and duration category are recorded in Table 2-3 and plotted in Figure 2-3.

No studies were located regarding neurological effects in humans after oral exposure to organic arsenicals. However, several studies in pigs indicate that repeated oral doses of roxarsone (0.87-5.8 mg As/kg/day for 1 month) can cause significant neurotoxicity (Edmonds and Baker 1986; Rice *et al.* 1985). The main signs were muscle tremors, partial paralysis, and seizures. Histological examinations of the spinal cord revealed a time-dependent degeneration of myelin and axons (Kennedy *et al.* 1986). Such prominent signs of neurological effects were not detected in rats or mice exposed to roxarsone, although suggestive evidence of neurological effects (hyperexcitability, ataxia, trembling) was noted in rats at the highest dose (11.4 mg As/kg/day) (NTP 1989b). These data (shown in Table 2-4 and Figure 2-4) suggest that organic arsenicals (at least the phenyl arsenates) are neurotoxic at high doses" (1).

Hepatic. "A number of studies in humans exposed to inorganic arsenic by the oral route have noted signs or symptoms of hepatic injury. Clinical examination often reveals that the liver is swollen and tender (Chakraborty and Saha 1987; Franklin *et al.* 1950; Mazumder *et al.* 1988; Mizuta *et al.* 1956; Silver and Wainman 1952; Wade and Frazer 1953), and analysis of blood sometimes shows elevated levels of hepatic enzymes (Armstrong *et al.* 1984; Franzblau and Lilis 1989). These effects are most often observed after chronic exposure to doses of 0.019-0.1 mg As/kg/day (Chakraborty and Saha 1987; Franklin *et al.* 1950; Mazumder *et al.* 1988; Silver and Wainman 1985; Wade and Frazer 1953), but may also occur after acute exposures to higher doses (Armstrong *et al.* 1984). Histological examination of the livers of persons chronically exposed to similar doses has revealed a consistent finding of portal tract fibrosis (Mazumder *et al.* 1988; Morris *et al.* 1974; Piontek *et al.* 1989; Szuler *et al.* 1979), leading in some cases to portal hypertension and bleeding from esophageal varices (Szuler *et al.* 1979). Several researchers consider that these hepatic effects are secondary to damage to the hepatic blood vessels (Morris *et al.* 1974; Rosenberg 1974), but this is not directly established. Studies in dogs have not detected clinically significant hepatic injury following exposure to either arsenite or arsenate (Byron *et al.* 1967; Neiger and Osweiler 1989), although enlargement of the common bile duct was noted in rats given either arsenate or arsenite for two

years (Byron *et al.* 1967).

No studies were located regarding hepatic effects in humans after oral exposure to organic arsenicals. Some small fluctuations in liver weight have been noted in rats and mice given repeated oral doses of roxarsone (NTP 1989b), but the toxicological significance of this is not clear. Histological examination of liver from rabbits given repeated oral doses of MMA showed diffuse inflammation and hepatocellular degeneration (Jaghabir *et al.* 1989), but the lesions were not severe. No effects were observed in rats exposed to DMA (Siewicki 1981). These data suggest that organic arsenicals may cause mild injury to the liver, but the data are too limited to draw firm conclusions" (1).

Immunological. "No studies were located regarding immunological effects in humans after oral exposure to inorganic arsenicals. No evidence of immunosuppression was detected in mice exposed to arsenate at levels up to 100 ppm [20 mg As/(kg day)] (Kerkvliet *et al.* 1980)... No studies were located regarding immunological effects in humans or animals after oral exposure to organic arsenicals" (1).

Sensitive Subpopulations

Populations relying upon groundwater or surface water near geologic or man-made sources of arsenic may be exposed to excessively high levels of arsenic (1). Since inorganic arsenic is primarily detoxified by methylation in the liver, individuals with low enzyme activity ('nonmethylators') may be more sensitive to arsenic than the general population. However, the clinical significance of low methylation activity in populations exposed to arsenic has apparently not been studied, and the prevalence of low methylation activity in the general population is also apparently unknown. Moreover, low-protein diets may lead to increased sensitivity to arsenic (1).

Chemical Interactions

Arsenic may decrease the toxicity of selenium (14), but selenium does not appear to alter the toxicity of arsenic (25). The effects of lead and arsenic in the diet were reported to be additive with regard to coproporphyrin excretion in rats (1). Exposure to cadmium has been shown to reduce tissue concentrations of arsenic by an unknown mechanism (1, 16). Marlowe *et al.* (17) reported that arsenic and other metals increased the neurotoxic effect of lead in children as measured by aggressive behavior, and decreased reading and spelling ability. No dose-response relationship for these effects have apparently been derived, however.

Dose-Response Parameter Estimation

Cancer

Inhalation. Arsenic is classified as a known human carcinogen (Group A) by the U. S. EPA (10). The basis selected for quantifying the inhalation cancer potency of arsenic is the U. S. EPA Carcinogen Assessment Group's (CAG's) *Health Assessment Document for Inorganic Arsenic* (30) as updated in the *Integrated Risk Information System* (IRIS) database (10). These documents develop a unit risk value for arsenic in air: $4.3 \times 10^{-3} (\mu\text{g}/\text{M}^3)^{-1}$. That is, an individual breathing air containing inorganic arsenic at an ambient concentration of $1 \mu\text{g}/\text{M}^3$ continuously from birth to age 70 would experience an incremental cancer risk attributable to arsenic of 4.29 per thousand or, equivalently, 0.429 percent or 4,290 per million ($4,290 \times 10^{-6}$). This individual risk is equivalent to a population risk stated as follows: a population breathing air containing arsenic at an ambient concentration of $1 \mu\text{g}/\text{M}^3$ for life would experience an average of 4,290 excess cancer cases per million population as a result of the airborne arsenic.

The unit risk value for airborne inorganic arsenic was based upon consideration of five epidemiological studies, each of a different population of individuals occupationally exposed to trivalent and/or pentavalent arsenic (1-4, 6, 17). Unit risk values were estimated based upon each study population, and ranged from 1.05×10^{-4} to $1.36 \times 10^{-2} (\mu\text{g}/\text{M}^3)^{-1}$. The values relating to trivalent arsenic exposure were preferred as being more representative of the risks posed by environmentally occurring low-level arsenic exposure. This preference narrowed the range of unit risk values to 1.25×10^{-3} to $7.6 \times 10^{-3} (\mu\text{g}/\text{M}^3)^{-1}$. The value of $4.29 \times 10^{-3} (\mu\text{g}/\text{M}^3)^{-1}$ represents the geometric mean of all five individual values. The incremental lifetime cancer risk may be calculated based upon ambient air levels of arsenic. The cancer risk is calculated simply as the product of the unit risk value and

the ambient air concentration. The inhalation cancer potency of inorganic arsenic is summarized as follows in IRIS (1997; 10):

INHALATION EXPOSURE CARCINOGENICITY ASSESSMENT

- o CLASSIFICATION : A; human carcinogen
- o BASIS FOR CLASSIFICATION : based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.
- o INHALATION UNIT RISK: 4.3E-3 per (ug/cu.m)
- o DOSE EXTRAPOLATION METHOD: absolute-risk linear model
- o RISK/AIR CONCENTRATIONS :

Air concentrations at Specified Risk Levels:

Risk Level	Concentration
-----	-----
E-4 (1 in 10,000)	2E-2 per (ug/cu.m)
E-5 (1 in 100,000)	2E-3 per (ug/cu.m)
E-6 (1 in 1,000,000)	2E-4 per (ug/cu.m)

o **INHALATION DOSE-RESPONSE DATA :**

Tumor Type -- lung cancer
 Test Animals -- human, male
 Route -- inhalation, occupational exposure
 Reference -- Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Higgins, 1982;
 Enterline and Marsh, 1982

Ambient Unit Risk Estimates (per (ug/cu.m))

Exposure Source	Study	Unit Risk	Geometric Mean Unit Risk	Final Estimates Unit Risk
Anaconda smelter	Brown and Chu, 1983a,b,c	1.25E-3		
	Lee-Feldstein, 1983	2.80E-3	2.56E-3	
	Higgins, 1982;	4.90E-3		4.29E-3
	Higgins <i>et al.</i> , 1982; Welch <i>et al.</i> , 1982			
ASARCO smelter	Enterline and Marsh, 1982	7.6E-3	6.81E-3	7.19E-3

o **ADDITIONAL COMMENTS :**

A geometric mean was obtained for data sets obtained with distinct exposed populations (U.S. EPA, 1984). The final estimate is the geometric mean of those two values. It was assumed that the increase in age-specific mortality rate of lung cancer was a function only of cumulative exposures.

The unit risk should not be used if the air concentration exceeds 2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

Ingestion. The CAG's original unit risk estimate for waterborne arsenic was $4.3 \times 10^{-4} (\mu\text{g/L})^{-1}$ (10). That is, an individual consuming two liters per day of water containing inorganic arsenic at a concentration of 1 $\mu\text{g/L}$ from birth to age 70 would experience an incremental cancer risk of 4.3 in ten thousand (4.3×10^{-4}) or, equivalently, 430 in a million (430×10^{-6}) attributable to the arsenic. This is equivalent to saying that a population exposed for life to drinking water containing 1 $\mu\text{g/L}$ of inorganic arsenic would experience an average of 430 excess cancer cases per million population as a result of the arsenic.

The basis for CAG's original (1984) unit risk value for waterborne inorganic arsenic (30), which was recently lowered (31), consisted primarily of an epidemiological study of a rural Taiwanese population consuming well water (28). The study established a relationship between the levels of arsenic in the well water and the risk of contracting skin cancer among individuals in the study population. In particular, the male population was selected by CAG as the basis for the estimation of unit risk because males seemed to exhibit a greater arsenic-related skin cancer risk than females. Since 1984, new considerations have resulted in reduction of the cancer potency value for arsenic ingestion by a factor of approximately ten, from $15.0 \text{ (mg/kg/d)}^{-1}$ to $1.5 \text{ (mg/kg/d)}^{-1}$ [compared with an inhalation potency value of $50.1 \text{ (mg/kg/d)}^{-1}$]. The basis for the revision is set forth in the recent CAG document titled *Special Report on Ingested Inorganic Arsenic--Skin Cancer; Nutritional Essentiality* (31), as follows:

In 1984, EPA estimated the unit risk for arsenic concentrations in drinking water using the data of Tseng et al..... Some modifications and additional considerations of the 1984 assessment are made on the current document to calculate a new risk estimate. These modifications include an adjustment for the larger amount of water believed to be consumed by the Taiwanese males in the study population as compared to persons in the United States. The previous estimate assumed that males and females in Taiwan and the United States drink 2 liters of water per day. The current estimate assumes that the Taiwanese male in the study population drinks 75% more water than does a person in the United States. The current assumption is based on the fact that the males of the study population performed heavy outdoor work in a very hot climate. As with the 1984 analysis, the current analysis assumes that Taiwanese females consume the same amount of water per day as a person in the United States (2 liters per day).

Also, the current analysis uses a life-table approach using age-specific U. S. mortality data to calculate a lifetime risk of skin cancers from chronic ingestion of water containing $1 \text{ } \mu\text{g/L}$ of inorganic arsenic. The previous analysis produces an estimate of the risk of developing skin cancer from chronic ingestion of water containing $1 \text{ } \mu\text{g/L}$ of inorganic arsenic by age 76.2 years, assuming that one lived to that age. In addition the current analysis uses a maximum likelihood approach, whereas the previous analysis used a least-squares linear regression of the prevalence rates. The maximum likelihood approach is considered a better approach because it takes account of the relatively small populations in the older age groups. Furthermore, the previous model was only linear in dose. The fit of the data to the model employing linear and quadratic terms is significantly better than if only a linear term is used ($p < 0.05$)" source document, pp. 28-29).

CAG also compared the cancer potency of arsenic to that of other substances CAG has evaluated. Potency is a measure of the carcinogenic response produced by an increment in dose; graphically, it can be envisioned as the linear portion of the dose-response curve. Steeper slopes of this line correspond to more potent carcinogens, whereas shallower slopes, approaching a horizontal line, correspond to less potent carcinogens. In the extreme case of a horizontal line, any increase in

dose of a substance produces absolutely no increase in carcinogenic response in the population receiving the dose. This extreme represents the conceptual minimum (zero) carcinogenic potency of a substance.

Potency is estimated on a per-mole basis, where a mole of any substance is the number of molecules of the substance in a gram molecular (or gram atomic) weight of the substance. This is a superior basis to weight of a chemical for comparing carcinogenic potency because chemicals may have a wide range of different atomic or molecular weights and, therefore, any particular weight may contain significantly different numbers of atoms or molecules, depending upon the molecular or atomic weight of the substance. In contrast, a mole of any substance contains exactly the same number of atoms or molecules, known as the Avogadro number, which is equal to $(6.02257 \pm 0.00009) \times 10^{23}$ molecules. Thus, arsenic has an atomic weight of 74.9216 grams; therefore, 74.9216 grams of arsenic is equal to one mole and contains 6.02257×10^{23} arsenic atoms. Arsenic trioxide (As_2O_3) has a molecular weight of 197.84; therefore, 197.84 grams of arsenic trioxide is equal to one mole and contains 6.02257×10^{23} arsenic trioxide molecules.

If cancer potency depends, as would be expected, upon the number of toxic molecules distributed to potential targets of toxic action in the body, dose-comparison on a *per-mole* basis indicates which substances are highly efficient and which are less efficient as carcinogens. Efficient substances require a relatively small number of atoms or molecules to exert their toxic effect(s). The unit adopted by CAG for comparing carcinogenic potency is, simply, the relative potency index, which has units of potency per millimole per kilogram per day $(\text{mMol/kg/d})^{-1}$. The relative potency index of arsenic was calculated to be $2.25 \times 10^3 (\text{mMol/kg/d})^{-1}$, placing arsenic in the first (highest) quartile among 52 carcinogens or suspected carcinogens CAG had evaluated at the time of its original report (March 1984).

The EPA's more recent thinking about the ingestion cancer potency of arsenic was set forth in IRIS (1997; 10):

ORAL EXPOSURE CARCINOGENICITY ASSESSMENT (IRIS 1997; 10):

- o CLASSIFICATION : A; human carcinogen
- o BASIS FOR CLASSIFICATION : based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.

- o ORAL SLOPE FACTOR : 1.5×10^0 per (mg/kg)/day
- o DRINKING WATER UNIT RISK : 5×10^{-5} per (ug/L)
- o DOSE EXTRAPOLATION METHOD : Time- and dose-related formulation of the multistage
- o RISK/WATER CONCENTRATIONS :

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
-----	-----
E-4 (1 in 10,000)	2E+0 ug/L
E-5 (1 in 100,000)	2E-1 ug/L
E-6 (1 in 100,000)	2E-2 ug/L
-----	-----

Non-Cancer Effects

ORAL RFD SUMMARY (IRIS 1997; 10):

NOTE: There was not a clear consensus among Agency scientists on the oral RfD. Applying the Agency's RfD methodology, strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value, i.e., 0.1 to 0.8 ug/kg/day. It should be noted, however, that the RfD methodology, by definition, yields a number with inherent uncertainty spanning perhaps an order of magnitude. New data that possibly impact on the recommended RfD for arsenic will be evaluated by the Work Group as it becomes available. Risk managers should recognize the considerable flexibility afforded them in formulating regulatory decisions when uncertainty and lack of clear consensus are taken into account.

Critical Effect	Experimental Doses*	UF	MF	RfD
Hyperpigmentation, keratosis and possible vascular complications	NOAEL: 0.009 mg/L converted to 0.0008 mg/kg-day	3	1	3E-4 mg/kg-day
Human chronic oral exposure	LOAEL: 0.17 mg/L converted to 0.014 mg/kg-day			

Tseng (1977; 26);
Tseng *et al.* (1968; 14)

*Conversion Factors: NOAEL was based on an arithmetic mean of 0.009 mg/L in a range of arsenic concentration of 0.001 to 0.017 mg/L. This NOAEL also included estimation of arsenic from food. Since experimental data were missing, arsenic concentrations in sweet potatoes and rice were estimated as 0.002 mg/day. Other assumptions included consumption of 4.5 L water/day and 55 kg bw (Abernathy *et al.*, 1989). $\text{NOAEL} = [(0.009 \text{ mg/L} \times 4.5 \text{ L/day}) + 0.002 \text{ mg/day}] / 55 \text{ kg} = 0.0008 \text{ mg/kg-day}$. The LOAEL dose was estimated using the same assumptions as the NOAEL starting with an arithmetic mean water concentration from Tseng (1977) of 0.17 mg/L. $\text{LOAEL} = [(0.17 \text{ mg/L} \times 4.5 \text{ L/day}) + 0.002 \text{ mg/day}] / 55 \text{ kg} = 0.014 \text{ mg/kg-day}$.

Teratogenic. An oral teratogen RfD may be derived based upon golden hamsters exhibiting skeletal abnormalities after exposure to arsenic at 2 mg/kg, as reported earlier. The RfD may be derived by applying three safety/uncertainty factors of 10 to extrapolate from a LOAEL to a NOAEL, from animals to humans, and from humans to potentially sensitive human subpopulations. This produces an oral teratogen RfD of 2 µg/kg/d.

Reproductive. An oral reproductive effects RfD may be derived based upon mice administered arsenic in the form of sodium arsenite at 1 mg/kg/d in drinking water, as reported earlier. This level may be regarded as a LOAEL. The RfD may be derived by applying three safety/uncertainty factors of 10 to extrapolate from a LOAEL to a NOAEL, from animals to humans, and from humans to potentially sensitive human subpopulations. This produces an oral reproductive effects RfD of 1 µg/kg/d.

Hematological. An oral hematological effects RfC may be derived based upon increased incidence of Raynaud's disease and cyanosis of fingers and toes associated with arsenic in drinking water at 0.6 to 0.8 ppm, producing arsenic exposures of 0.02 to 0.06 mg/kg/d, as reported earlier. The RfD may be derived by applying two safety/uncertainty factors of 10 to extrapolate from a LOAEL to a NOAEL, and from humans to potentially sensitive human subpopulations. This produces an oral hematological effects RfD of 4.00×10^{-4} mg/kg/d.

Renal. A renal effects oral RfD cannot be derived based upon available data.

Dermal. The dermal effects oral RfD may be equated with EPA's oral RfD for arsenic, which was based upon dermal effects produced by oral exposure, in drinking water.

Respiratory. A respiratory effects inhalation RfD cannot be derived based upon available data.

Neurological. A neurological effects oral RfD may be derived based upon the association of peripheral neuropathy with exposure to arsenic at 0.019 to 0.5 mg/kg/d, as reported earlier. A NOAEL of 0.01 mg/kg/d was reported for this effect. The RfD may be derived by applying a safety/uncertainty factor of 10 to extrapolate from humans to potentially sensitive human subpopulations. This produces an oral neurological effects RfD of 1.00×10^{-3} mg/kg/d.

Hepatic. A hepatic effects oral RfD may be derived based upon the association of hepatic injury, including swelling and tenderness of the liver, and elevation of hepatic enzymes in blood, with chronic oral exposure to arsenic at 0.019 to 0.1 mg/kg/d, as reported earlier. The RfD may be derived by applying two safety/uncertainty factors of 10 to extrapolate from a LOAEL to a NOAEL, and from humans to potentially sensitive human subpopulations. This produces an oral hepatic effects RfD of 1.90×10^{-4} mg/kg/d.

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TECH SUPPORT APPENDIX 2

***Selected Health
Risk Assessment Model
Input and Output Screens***

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: HASP Module: Arsenic
Site Location: Generic

Job Identification: CT Male
Date Completed: 7/17/05
Completed By: Dr. Robert A. Michaels

Software: GSI RBCA Spreadsheet
Version: v 1.0

NOTE: values which differ from Tier 1 default values are shown in bold *italics* and underlined.

DEFAULT PARAMETERS

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (l/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m³3/day)	15			20	
IRa.out	Inhalation rate outdoor (m³3/day)	20			20	10
SA	Skin surface area (dermal) (cm²2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm²2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential		Commercial/Industrial	
		Distance	On-Site	Distance	On-Site

Groundwater Pathways:					
GW.i	Groundwater Ingestion	FALSE		TRUE	
GW.v	Volatilization to Outdoor Air	FALSE		TRUE	
GW.b	Vapor Intrusion to Buildings	FALSE		TRUE	
Soil Pathways					
S.v	Volatiles from Subsurface Soils	FALSE		TRUE	
SS.v	Volatiles and Particulate Inhalation	FALSE		TRUE	TRUE
SS.d	Direct Ingestion and Dermal Contact	FALSE		TRUE	TRUE
S.I	Leaching to Groundwater from all Soils	FALSE		TRUE	
S.b	Intrusion to Buildings - Subsurface Soils	FALSE		TRUE	

Matrix of Receptor Distance and Location on- or off-site		Residential		Commercial/Industrial	
		Distance	On-Site	Distance	On-Site

GW	Groundwater receptor (cm)		FALSE		TRUE
S	Inhalation receptor (cm)		FALSE		TRUE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential		Commercial/Industrial	
		Chronic	Construction	Chronic	Construction
t	Exposure duration (yr)	30		25	1
A	Contaminated soil area (cm²2)	2.2E+06			1.0E+06
W	Length of affected soil parallel to wind (cm)	1.5E+03			1.0E+03
W.gw	Length of affected soil parallel to groundwater (cm)	1.5E+03			
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02			
delta	Air mixing zone height (cm)	2.0E+02			
Lss	Definition of surficial soils (cm)	1.0E+02			
Pe	Particulate areal emission rate (g/cm²2/s)	2.2E-10			

Groundwater Definition (Units)		Value		
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02		
I	Groundwater infiltration rate (cm/yr)	3.0E+01		
Ugw	Groundwater Darcy velocity (cm/yr)			
Ugw.tr	Groundwater Transport velocity (cm/yr)			
Ks	Saturated Hydraulic Conductivity(cm/s)			
grad	Groundwater Gradient (cm/cm)			
Sw	Width of groundwater source zone (cm)			
Sd	Depth of groundwater source zone (cm)			
BC	Biodegradation Capacity (mg/L)			
BIO?	Is Bioattenuation Considered	FALSE		
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01		
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03		

Soil	Definition (Units)	Value		
		capillary	vadose	foundation
hc	Capillary zone thickness (cm)	5.0E+00		
hv	Vadose zone thickness (cm)	3.0E+02		
rho	Soil density (g/cm³3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	3.0E+02		
Ls	Depth to top of affected soil (cm)	1.0E+02		
Lsubs	Thickness of affected subsurface soils (cm)	2.0E+02		
pH	Soil/groundwater pH	6.5		
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
		Distance	On-Site
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s⁻¹-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

Dispersive Transport Parameters		Residential	Commercial
Groundwater		Distance	On-Site
ax	Longitudinal dispersion coefficient (cm)		
ay	Transverse dispersion coefficient (cm)		
az	Vertical dispersion coefficient (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: HASP Module: Arsenic
Site Location: Generic

Completed By: Dr. Robert A. Michaels
Date Completed: 7/17/2005

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X	Groundwater Ingestion			X	Groundwater Volatilization to Indoor Air		X	Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)		Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)		Residential: (on-site)	Commercial: (on-site)		Residential (on-site)	Commercial: (on-site)	(mg/L)	"  If yes	Only if "yes" left
7440-38-2	Arsenic	1.0E-4		NA	1.9E-4	NA		NA	>Sol		NA	>Sol	1.9E-4		<1

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.1

Site Name: HASP Module: Arsenic

Completed By: Dr. Robert A. Michaels

Site Location: Generic

Date Completed: 7/17/2005

1 OF 1

SURFACE SOIL SSTL VALUES (< 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X	Soil Leaching to Groundwater			X	Ingestion, Inhalation and Dermal Contact		X	Construction Worker	Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)		Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)		Residential: (on-site)	Commercial: (on-site)		Commercial: (on-site)	(mg/kg)	"  " If yes	Only if "yes" left
7440-38-2	Arsenic	1.0E-3		NA	2.2E-2	NA		NA	3.8E+0		6.6E+1	2.2E-2		<1

Site Name: HASP Module: Arsenic

Job Identification: CT Male

Site Location: Generic

Date Completed: 7/17/2005

SUMMARY CALCULATIONS - SSTL BY CUMULATIVE RISK

CAS No.	Constituent	Representative Concentration Groundwater (mg/L)	Representative Concentration Surface Soil (mg/kg)	Representative Concentration Subsurface Soil (mg/kg)	SSTL exceeded?			Relevant SSTL		
					Groundwater	Surface Soil	Subsurface Soil	Groundwater (mg/L)	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)
7440-38-2	Arsenic	1.0E-4	1.0E-3	1.0E-3	O	O	O	< 1.0E-2	< 5.3E-2	> 1.0E-1

Completed By: Dr. Robert A. Michaels

Cumulative Target Risk: 0.0E+0

Target Hazard Index: 0.0E+0

Software: GSI RBCA Spreadsheet

Version: v 1.0

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Serial: 0

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

1 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

AIR EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS: VAPOR AND

DUST INHALATION

Exposure Concentration

Constituents of Concern

Arsenic

1) Source Medium

Surface Soil Conc. (mg/kg)

1.0E-3

2) NAF Value (m³/kg)
Receptor

On-Site Commercial

1.4E+8

3) Exposure Medium

Air: POE Conc. (mg/m³) (1) / (2)

On-Site Commercial

7.2E-12

4) Exposure Multiplier

(IRxETxEFxED)/(BWxAT) (m³/kg-day)

On-Site Commercial

7.0E-2

5) Average Daily Intake Rate
(mg/kg-day) (3) X (4)

On-Site Commercial

5.1E-13

NOTE: ABS = Dermal absorption factor (dim)
AF = Adherence factor
AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure
SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.1

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

2 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION
AIR EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS: VAPOR		Exposure Concentration		TOTAL PATHWAY INTAKE (mg/kg-day)	
INHALATION	1) <u>Source Medium</u>	2) <u>NAF Value</u> (m ³ /kg) Receptor	3) <u>Exposure Medium</u> Air: POE Conc. (mg/m ³) (1) / (2)	4) <u>Exposure Multiplier</u> (IRxETxEFxED)/(BWxAT) (m ³ /kg-day)	5) Average Daily Intake Rate (mg/kg-day) (3) X (4)
	Subsurface Soil Conc. (mg/kg)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Constituents of Concern					
Arsenic	1.0E-3	#DIV/0!	#DIV/0!	7.0E-2	#DIV/0!

NOTE:	ABS = Dermal absorption factor (dim)	BW = Body Weight (kg)	EF = Exposure frequency (days/yr)	POE = Point of exposure
	AF = Adherence factor	CF = Units conversion factor	ET = Exposure time (hrs/day)	SA = Skin surface area (cm ²)
	AT = Averaging time (days)	ED = Exp. duration (yrs)	IR = Intake rate (L/day or mg/day)	

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

1 OF 3

TIER 2 PATHWAY RISK CALCULATION
AIR EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	CARCINOGENIC RISK				TOXIC EFFECTS			
	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial	(3) Inhalation Slope Factor (mg/kg-day) ⁻¹	(4) Individual COC Risk (2) x (3) On-Site Commercial	(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial	(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
	A	5.1E-13	1.2E+0	6.2E-13				
Arsenic	A	5.1E-13	1.2E+0	6.2E-13				

 Total Pathway Carcinogenic Risk = **6.2E-13** **0.0E+0**

 Total Pathway Hazard Index = **0.0E+0** **0.0E+0**

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.1

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

3 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION
SOIL EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

DERMAL CONTACT

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

 $(SA \times AF \times ABS \times CF \times EF \times ED) / (BW \times AT)$ (1/day)

5) Average Daily Intake Rate

(mg/kg-day)

Constituents of Concern

Surface Soil Conc. (mg/kg)

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

Arsenic

1.0E-3

0.0E+0

0.0E+0

 NOTE: ABS = Dermal absorption factor (dim)
 AF = Adherence factor
 AT = Averaging time (days)

 BW = Body Weight (kg)
 CF = Units conversion factor
 ED = Exp. duration (yrs)

 EF = Exposure frequency (days/yr)
 ET = Exposure time (hrs/day)
 IR = Intake rate (L/day or mg/day)

 POE = Point of exposure
 SA = Skin surface area (cm²)

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Micr Date Completed: 7/17/2005

4 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

INGESTION

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

 $(IR \times C \times EF \times ED) / (BW \times AT)$ (1/day)

5) Average Daily Intake Rate

(mg/kg-day)

TOTAL PATHWAY INTAKE (mg/kg-day)

*(Sum intake values from
dermal & ingestion routes.)*

Constituents of Concern

Surface Soil Conc. (mg/kg)

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

Arsenic

1.0E-3

1.7E-7

1.7E-10

1.7E-10

NOTE:

ABS = Dermal absorption factor (dim)

AF = Adherence factor

AT = Averaging time (days)

BW = Body Weight (kg)

CF = Units conversion factor

ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)

ET = Exposure time (hrs/day)

IR = Intake rate (L/day or mg/day)

POE = Point of exposure

SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

2 OF 3

TIER 2 PATHWAY RISK CALCULATION
SOIL EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	CARCINOGENIC RISK						TOXIC EFFECTS				
	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
		On-Site Residential	On-Site Commercial	(mg/kg-day)^-1	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	(mg/kg-day)	On-Site Residential	On-Site Commercial
Arsenic	A		1.7E-10	1.5E+0		2.6E-10		4.9E-10	3.0E-4		1.6E-6
Total Pathway Carcinogenic Risk =				0.0E+0	2.6E-10	Total Pathway Hazard Index =				0.0E+0	1.6E-6

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.1

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

5 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION
GROUNDWATER EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAY IS ACTIVE)

SOIL: LEACHING TO GROUNDWATER/

INGESTION

Exposure Concentration
Constituents of Concern

Arsenic

 1) Source Medium

Soil Concentration (mg/kg)

1.0E-3

 2) NAF Value (L/kg)

Receptor

On-Site Commercial

1.2E+2

 3) Exposure Medium

(1)/(2)

On-Site Commercial

8.6E-6

 4) Exposure Multiplier

(IRxEFxED)/(BWxAT) (L/kg-day)

On-Site Commercial

3.5E-3

5) Average Daily Intake Rate

(mg/kg-day)

On-Site Commercial

3.0E-8

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)

CF = Units conversion factor

ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)

IR = Intake rate (L/day)

POE = Point of exposure

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

6 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

GROUNDWATER EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER: INGESTION

Exposure Concentration

MAX. PATHWAY INTAKE (mg/kg-day)

Constituents of Concern	1) Source Medium	2) NAF Value (dim) Receptor	3) Exposure Medium Groundwater: POE Conc. (mg/L) (1)/(2)	4) Exposure Multiplier (IRxEFxED)/(BWxAT) (L/kg-day)	5) Average Daily Intake Rate (mg/kg-day)	(Maximum intake of active pathways soil leaching & groundwater routes.)
	Groundwater Concentration (mg/L)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Arsenic	1.0E-4	1.0E+0	1.0E-4	3.5E-3	3.5E-7	3.5E-7

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)EF = Exposure frequency (days/yr)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Arsenic

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/17/2005

3 OF 3

TIER 2 PATHWAY RISK CALCULATION
GROUNDWATER EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

CARCINOGENIC RISK
TOXIC EFFECTS

Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
		On-Site	Commercial	(mg/kg-day) ⁻¹	On-Site	Commercial	On-Site	Commercial	(mg/kg-day)	On-Site	Commercial
Arsenic	A	3.5E-7		1.5E+0	5.2E-7		1.1E-6		3.0E-4	3.5E-3	

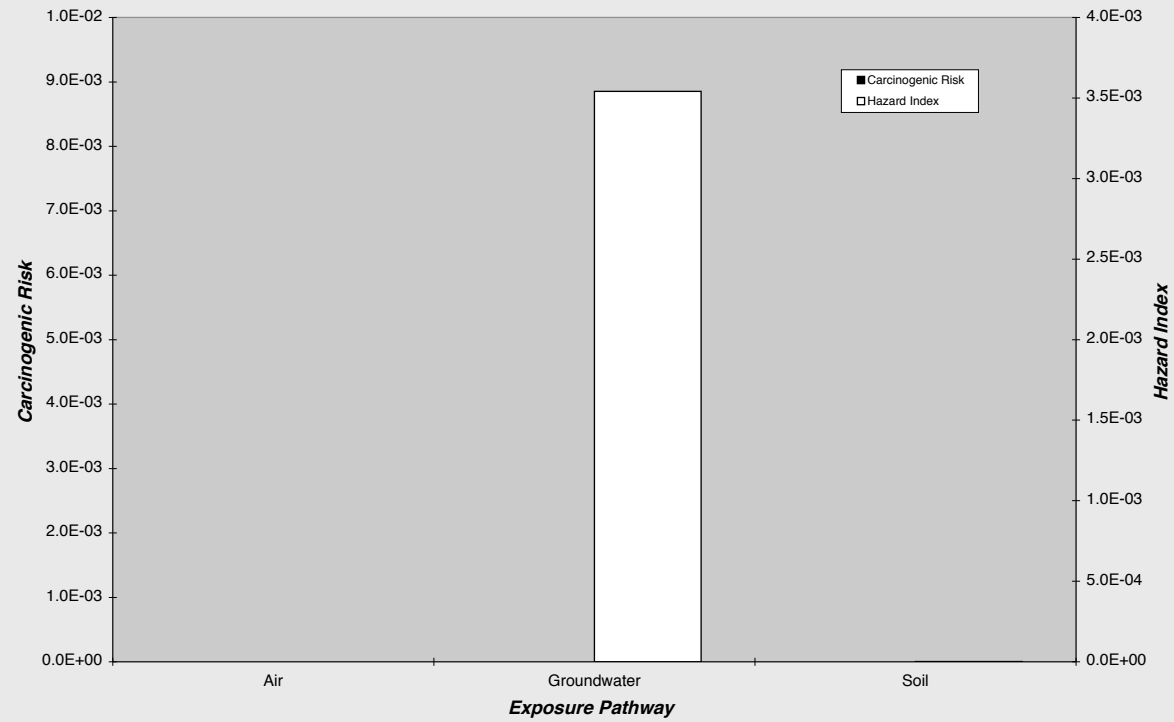
Total Pathway Carcinogenic Risk =

5.2E-7	0.0E+0

Total Pathway Hazard Index =

3.5E-3	0.0E+0

Total Risk for Each Pathway



RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.3

Site Name: HASP Module: Arsenic
Site Location: Generic

Completed By: Dr. Robert A. Michaels
Date Completed: 7/17/2005

1 of 1

TIER 2 BASELINE RISK SUMMARY TABLE

EXPOSURE PATHWAY	BASELINE CARCINOGENIC RISK					BASELINE TOXIC EFFECTS				
	Individual COC Risk		Cumulative COC Risk		Risk Limit(s) Exceeded?	Hazard Quotient		Hazard Index		Toxicity Limit(s) Exceeded?
	Maximum Value	Target Risk	Total Value	Target Risk		Maximum Value	Applicable Limit	Total Value	Applicable Limit	
AIR EXPOSURE PATHWAYS										
Complete:	6.2E-13	1.0E-6	6.2E-13	N/A	☐	0.0E+0	1.0E+0	0.0E+0	N/A	☐
GROUNDWATER EXPOSURE PATHWAYS										
Complete:	5.2E-7	1.0E-6	5.2E-7	N/A	☐	3.5E-3	1.0E+0	3.5E-3	N/A	☐
SOIL EXPOSURE PATHWAYS										
Complete:	2.6E-10	1.0E-6	2.6E-10	N/A	☐	1.6E-6	1.0E+0	1.6E-6	N/A	☐
CRITICAL EXPOSURE PATHWAY (Select Maximum Values From Complete Pathways)										
	5.2E-7	1.0E-6	5.2E-7	N/A	☐	3.5E-3	1.0E+0	3.5E-3	N/A	☐

RBCA CHEMICAL DATABASE

Physical Property Data

													Vapor							
CAS Number		Constituent	type	Molecular Weight (g/mole)		Diffusion Coefficients			log (Koc) or log(Kd) (@ 20 - 25 C)		Henry's Law Constant (@ 20 - 25 C)		Pressure (@ 20 - 25 C)		Solubility (@ 20 - 25 C)		acid pKa	base pKb		
						in air (cm2/s)	in water (cm2/s)	(l/kg)	(atm-m3)	(unitless)	(mm Hg)	(mg/l)								
					ref	Dair	ref	Dwat	ref	Koc	ref	mol		ref	Pure Component	ref	Pure Component	ref		
7440-38-2	Arsenic	N	74.9	4		N/A		N/A		2.07	24	0.00E+00	0.00E+00		0.00E+00	14	4.41E+05	27		

Site Name: HASP Module: Arse Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/17/2005

Software version: v 1.0

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CAS Number	Constituent	Reference Dose (mg/kg/day)				Slope Factors 1/(mg/kg/day)				EPA Weight of Evidence	Is Constituent Carcinogenic ?
		Oral RfD_oral	ref	Inhalation RfD_inhal	ref	Oral SF_oral	ref	Inhalation SF_inhal	ref		
7440-38-2	Arsenic	3.00E-04	R	-	R	1.50E+00	R	1.23E+00	R	A	TRUE

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/17/2005

Software version: v 1.0

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Chemistry and Physics, 67th edition, (CRC Press, Inc., Boca Raton), 1987.

CAS Number	Constituent	Maximum Contaminant Level		Permissible Exposure Limit PEL/TLV		Relative Absorption Factors		Detection Limits Groundwater		Soil (mg/kg)		Half Life (First-Order Decay) (days)		
		MCL (mg/L)	reference	(mg/m3)	ref	Oral	Dermal	(mg/L)	ref	(mg/kg)	ref	Saturated	Unsaturated	ref
7440-38-2	Arsenic	5.00E-02	0 FR 46936 (13 Nov 8)	1.00E-02	OSHA	1	0	0.01	C	0.053	S			

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Misk Date Completed: 7/17/2005

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1 and Toxicology, vol 123, 1-155.

Standards, EPA-451/R-93-005,



**Health and Safety
Plan (HASP) Module for:
Chromium: Cr 0, CAS No. 7440-47-3 and
Compounds: Cr III, CAS No. 16065-83-1
Cr VI, CAS No. 18540-29-9**

prepared by

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24 July 2005



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APPENDICES

Tech Support Appendix 1

Toxicological Profile of Chromium and Compounds

Tech Support Appendix 2

Selected Risk Assessment Model Input and Output Screens

*Citation:

RAM TRAC. *Health and Safety Plan (HASP) Module for: Chromium: Cr 0, CAS No. 7440-47-3 and Compounds: Cr III, CAS No. 16065-83-1; Cr VI, CAS No. 18540-29-9.* Schenectady, New York; RAM TRAC Corporation; Project Director Robert A. Michaels; PhD, CEP; 24 pages plus appendices, 24 July 2005.

ABBREVIATIONS AND ACRONYMS

abbreviation or acronym	full word or phrase
ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry, U S Public Health Service
BW	body weight
CAG	Carcinogen Assessment Group (US EPA Office of Research and Development)
CAS	Chemical Abstract Service
CDC	U. S. Centers for Disease Control
d	day(s)
D	diameter
eq.	equation
expl	explodes; explosive
FDA	U. S. Food and Drug Administration
h	hour(s)
HASP	health and safety plan
HRA	health risk assessment
IARC	United Nations International Agency for Research on Cancer
ICRP	Int'nat'l Commission for Radiological Protection
ign	ignites
i. p.	irregular pagination
kg	kilogram(s)
L	liter(s)
LC ₅₀	lethal conc. to 50 percent of exposed organisms
LD ₅₀	lethal dose to 50 percent of exposed organisms
LMS	linear multistage (low-dose extrapolation) model
LOAEL	Lowest Observed Adverse Effect Level
m	minute(s)
M	meter(s)
mg	milligram(s)
MW	molecular weight, in daltons (grams/mole)
NAS	U. S. National Academy of Sciences
NCI	U. S. National Cancer Institute
NIEHS	U. S. National Institute of Environmental Health Sciences

continued on following page

abbreviation or acronym	full word or phrase
NIOSH	US National Institute for Occupational Safety and Health, US Public Health Service
NOAEL	No Observed Adverse Effect Level
NRC	U. S. National Research Council
NTP	U. S. National Toxicology Program
NYS DEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PCB(s)	polychlorinated biphenyl(s)
PHS	U. S. Public Health Service
ppm-v	part(s) per million, by volume
ppm-w	part(s) per million, by weight
r	radius
RBCA	risk-based corrective action
RE	relative effectiveness (factor)
RfC	Risk Reference Concentration
RfD	Risk Reference Dose
RTECS	<i>Registry of Toxic Effects of Chemical Substances</i> , publication of NIOSH
s	second(s)
SA	surface area
SMR	Standard Mortality Ratio
sol	soluble
STP	standard temperature and pressure
subl	sublimes (changes state between gas and solid phases, with no liquid phase)
T	ton(s), where 1 ton = 2,000 pounds)
TD _{Lo}	lowest dose toxic to exposed organisms
TLV	Threshold Limit Value
TSCA	US Toxic Substances Control Act of 1976
TWA	time-weighted average
µg	microgram (10 ⁶ picograms, 10 ⁻⁶ gram)
U. S. EPA	U. S. Environmental Protection Agency
U. S. FDA	U. S. Food and Drug Administration
v	volume
vac	vacuum; in a vacuum
v sl sol	very slightly soluble
VOC	volatile organic compound(s)
WHO	United Nations World Health Organization
y	year(s)

INTRODUCTION

This document is designed to augment an existing corporate health and safety plan (HASP). Its purpose, most generally, is to enhance employee preparation for work at sites potentially posing risks of exposure to chromium and/or (more commonly) chromium compounds. This HASP module, therefore, presents information about chromium and chromium compounds, the potential for occupational exposure to them, the routes and pathways by which exposure can occur, and about risks to employee health potentially posed by such exposure.

This module augments, it does not replace, the corporate HASP. Indeed, the scope of this module excludes HASP issues to avoid redundancy and possibly even inconsistencies with an available HASP. For example, the available HASP should address respiratory protection at workplaces where grinding occurs, lofting particles into the air. This module refers employees to the available HASP for recommended procedures to manage exposure and risks to health potentially posed by inhalation of airborne metallic particles resulting from grinding of metallic chromium. This module does not present this information, because such presentation would be redundant and could introduce inconsistencies with the HASP document.

Exposure and health risks are within the province of toxicology, known colloquially as the 'science of poisons'. That science is highly technical, and its primary research sources inaccessible and/or incomprehensible to most people. This module distills the vast technical information to communicate sound science understandably. Some readers, however, will find this module to be more credible if it documents in detail its findings made and conclusions drawn via reference to the technical literature. Accordingly, this module is divided into two parts. Its main section (this section) presents

main ideas. A section containing 'Tech Support' appendices follows. These appendices are of two types: 1. toxicological profiles, and 2. selected health risk assessment (HRA) model input and output screens (see the *Methods* section, below). The appendices are provided for completeness, not for detailed perusal by most readers, much as a library reference section is provided for selective consultation rather than exhaustive, systematic perusal.

METHODS

This HASP module has been prepared based upon examination of relevant technical literature in areas such as toxicology (including regulatory toxicology), epidemiology, medicine, and other sciences. Exposure dynamics also were modeled consistent with risk-based corrective action (RBCA) consensus standards promulgated by the American Association for Testing and Materials (ASTM) and adopted in the Federal government and in numerous states including New York State. RBCA standards initially were formulated in connection with petroleum spill remediation, but their expanded use for substances, such as metals, that also might be present at petroleum release sites has become widely accepted and, indeed, promoted by ASTM.

ASTM RBCA standards for health risk assessment at work sites where toxic exposures might occur were implemented via software published by ASTM specifically for this purpose. The software, termed the *RBCA Tool Kit*, is abundantly documented (see *Literature Cited* items 1-3). Of course, as with any software, the caveat must apply that routine verification of its output is unrealistic for most if not all users. Presumably, however, ASTM's RBCA software was thoroughly tested before publication, and for that reason confidence in it would seem well placed. Readers interested in US EPA guidelines for health risk assessment can consult *Literature Cited* items 4-17,

with which the ASTM RBCA tool kit should be fully consistent.

To prepare the RBCA HRA, default parameter values were selected for use in this HASP module. HRA model output pertaining to default scenarios can help readers to understand the dynamics of potential exposure and risks to health even under real-world circumstances that differ from the default scenarios. For example, if respiratory protection is worn, risks potentially posed via inhalation can be eliminated from further consideration.

The generic nature of this HASP module precludes use of any single scenario to represent the real work places at which this document will be relevant. Accordingly, simple whole-number substance concentrations were assumed, with which the risk output can be compared and related. Readers can extrapolate at least roughly from assumed whole-number substance concentrations to the concentrations that might apply at a particular work site. One caveat, however, is that risks might be changed in a proportion different from the proportion by which substance concentrations might be changed. For example, reducing substance concentration by half could reduce risk by 100 percent if a threshold toxic concentration no longer is present.

Some details of the HRA model are important to present to enable readers to gain insight into their own real-world work environments. Table 1 (following page) describes modeled routes and pathways by which exposure might occur at a work site. In the HRA model output screens, these are divided into pathways most commonly associated with residential settings, commercial/industrial settings, and construction settings. In the latter case, for example, exposure duration is relatively short compared with residential settings (lifetime) and commercial settings (occupational lifetime). Table 2 (on the page after Table 1) reports the default values of HRA parameters to enable readers to compare their own real-world work places with the default scenario assumed in this HASP module.

Table 1. Exposure Pathways Modeled

air exposure pathways	exposure routes
source medium: air	inhalation
source medium: surface soil	
--vapor release	inhalation
--windblown particles	inhalation
source medium: subsurface soil	
--vapor release	inhalation
 groundwater exposure pathways	 exposure routes
source medium: groundwater	
--volatilization to outdoor air	inhalation
--volatilization to indoor air	inhalation
--ingestion	ingestion
 soil exposure pathways	 exposure routes
source medium: surface soil	
--leaching to groundwater	ingestion
--direct ingestion (hand-to-mouth)	ingestion
--inhalation of gases and particulates	inhalation
--dermal contact, skin absorption	dermal
source medium: subsurface soil	
--leaching to groundwater	ingestion
--volatilization to indoor air	inhalation
--volatilization to outdoor air	inhalation

Table 2. Risk Assessment Model Default Parameter Values

exposure parameter	unit	residential exposure scenario			commercial/industrial exposure scenario	
		adult	age 1-6 years	age 1-16 years	chronic	construction
averaging time for carcinogens	years	70	...	...	...	...
averaging time for non-carcinogens	years	30	6	16	25	1
body weight	kilograms	70	15	35	70	...
exposure duration	years	30	6	16	25	1
exposure frequency	days/year	350	...	...	250	180
exposure frequency for dermal exposure	days/year	350	...	...	250	...
ingestion rate of water	liters/day	2	...	...	1	...
ingestion rate of soil	mg/day	100	200	...	50	100
inhalation rate indoor	M ³ /day	15	...	...	20	...
inhalation rate outdoor	M ³ /day	20	...	...	20	10
skin surface area (dermal)	cm ²	5,800	...	2,023	5,800	5,800
soil to skin adherence factor	none	1	...	...	...	...

FINDINGS

The subsections below describe dynamics of chromium that can lead to occupational exposure, and toxic consequences potentially arising from such exposure. Except for the US EPA's IRIS database (citation 4), no other citations of technical literature specific to chromium and its compounds are provided in this *Findings* section of this HASP module. Rather, all information provided in the subsections below is derived from, and documented in, *Tech Support Appendix 1*, which is a detailed *Toxicological Profile* of chromium and chromium compounds. *Tech Support Appendix 1* addresses each of the subjects addressed below, but in more detail, and provides complete citations of technical literature documenting the findings that are made. Thus, *Tech Support Appendix 1* effectively constitutes the sole source citation documenting this *Findings* section.

Physical and Chemical Properties

Chromium is a naturally occurring element that is ubiquitous at trace levels in soil and water globally. Elemental (metallic) chromium exhibits neutral electrical charge ('valence' or 'oxidation state'). Chromium, however, commonly assumes the trivalent (+3) or hexavalent (+6) oxidation state when forming its many compounds. Many chromium compounds are insoluble soluble in water, but many others are soluble. Water solubility tends to increase the mobility of compounds in groundwater, and the potential for human exposure via water. As an element, chromium decays only via nuclear reactions. It does not decay via physical or chemical processes, although chromium compounds of course do undergo physical and chemical transformations. Consequently, chromium must be regarded as a persistent though often mobile class of potentially toxic substances.

Absorption, Distribution, Metabolism, and Excretion

Identification of chromium in urine and serum of people occupationally exposed to soluble chromium (III) or chromium (VI) compounds in workplace air indicates that chromium can be absorbed from the lungs, but the fraction absorbed is unknown. A reasonable estimate of the absorption efficiencies of ingested chromium III and chromium VI has been reported to be five percent. The U. S. EPA reported variability in the efficiencies with which trivalent and hexavalent chromium are absorbed percutaneously (dermally, via the skin). Cr III was absorbed with an efficiency of 30 percent in one study, whereas CrVI was absorbed with efficiencies of one percent and four percent in different studies. According to ATSDR, both chromium (III)

and chromium (VI) can penetrate human skin to some extent, especially if the skin is damaged

The principal tissues and organs to which chromium and its compounds are distributed have been reported to include chromosomes, lungs, kidneys, blood, spleen, and liver. Metabolism of hexavalent chromium typically involves reduction of its oxidation state (valence) to the less toxic trivalent form. Metabolically produced trivalent chromium may interact (form complexes) with intracellular macromolecules such as RNA.

Chromium elimination is a non-linear process based upon a three-compartment model of distribution characterized in one study by half-times of the compartments of 0.5, 5.9, and 83.4 days. The three half-times may relate to clearance from the blood, soft tissues, and an unspecified deep body compartment, respectively. Urinary excretion constituted from 51-64 percent of total plasma clearance; fecal excretion constituted five to eight percent; and 31-41 percent of plasma chromium was directed into an unspecified 'body sink' of extremely long half life, possibly including the liver and spleen, which may store chromium for up to 12 months. Biliary excretion also contributes to total fecal excretion. NYS DOH has emphasized that the above pattern of chromium elimination is principally based upon data derived from rats exposed intravenously to a traceable radioactive isotope of trivalent chromium (^{51}Cr), not direct studies with humans. Thus, some differences are likely to exist relating to species, route, and chromium compound(s) administered.

Acute Toxicity

Acute toxic effects associated with chromium compounds (involving exposure over a period of up to a day) can occur in people under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. The major toxic effect associated with acute chromium exposure is renal tubular necrosis, an effect which has been associated with an oral dose level of under 2 g (<28.57 mg/kg for a 70-kg individual). Most toxic incidents involve hexavalent chromium. In occupational exposures by inhalation and dermal contact, acute toxic reactions of the lungs and skin may ensue. These may be characterized as involving chronic ulceration of skin surfaces, independent of hypersensitivity reactions, as well as chronic ulceration and perforation of the nasal septum. Oral exposure is relatively less toxic.

Cancer Causation

Chromium has been associated with occupational lung cancer as early as 1936. The major industries in which the association was exhibited were the chromate-producing and chrome pigment industries. Cancer types among workers in these industries included squamous cell carcinomas, anaplastic tumors, and adenocarcinomas. These findings have been augmented by numerous epidemiological studies. Consistent with the greater genotoxic potency of hexavalent than trivalent chromium, the hexavalent form also appears to pose greater carcinogenic risks to occupationally exposed individuals. The U. S. EPA places Cr III in carcinogenesis class D: "not classifiable as to human carcinogenicity." Cr VI, however, is placed in Class D for oral exposure, but in Class A for inhalation exposure. EPA Class A refers to a "human carcinogen."

Chronic Toxicity

Chromium and its compounds together have been shown to cause toxic effects as a result of chronic exposure, which is defined as continuous or sporadic exposure over a long period of time (months to years). Details of chronic toxic effects exerted by chromium and chromium compounds are provided in *Tech Support Appendix 1*. They include effects on many organs and organ systems too numerous to enumerate here except via selected examples. Gastrointestinal effects have included inflammatory and ulcerative conditions. Renal (kidney) effects have been associated with low doses of chromium, producing a relatively specific necrosis of the proximal convoluted tubule and pronounced glucosuria (glucose in urine). Kidney surfaces exhibit signs of ischemia (oxygen starvation) and tissue damage.

Hematological effects also have been observed following chronic exposure to chromium compounds. A cross sectional (epidemiological) study was conducted in 1965 involving 155 villagers in the People's Republic of China whose well water contained chromium VI compounds at an average concentration of 20 mg/L as a result of pollution from an alloy plant. Drinking this polluted water was found to be associated with leukocytosis and the presence of immature neutrophils. The alloy plant had begun chromium smelting in 1961, and had begun regular production in 1965. Similar results emerged from similar studies in two other villages.

Respiratory effects have included nasal septum perforation among (hexavalent) chromium plating industry employees, respiratory tract irritation, pneumoconiosis (a lung inflammation associated with occupational dust inhalation, commonly leading to fibrosis), bronchitis, and chronic lung congestion. Ulceration and perforation of the nasal septum were recognized as early as 1928 among U. S. chromium plating workers exposed to air

levels of (hexavalent) chromium trioxide (CrO_3) of as little as 0.003 mg/M^3 . Chromic acid ($\text{H}_2\text{Cr}^{\text{VI}}\text{O}_4$) exposure at levels of $>0.1 \text{ mg/M}^3$ also was associated with with nasal tissue injury.

Many more studies of potential respiratory effects following chronic inhalation of chromium have been conducted since 1928. One example is a report indicating that nickel-chrome plating employees exhibited significant nasal pathology and skin lesions associated with chronic exposure to chromic acid. Specifically, 35 of 37 (95 percent) of employees chronically exposed to air levels of 0.0071 mg/M^3 , measured as total chromium, developed these symptoms, which are typical following exposure to chromic acid. Still lower exposure levels have been associated with adverse respiratory impacts. For example, nasal perforation or ulceration was reported in 12 of 37 individuals (32 percent) occupationally exposed for up to only one year to hexavalent chromium at levels of as little as <0.71 to $9.12 \text{ }\mu\text{g/M}^3$ in a chromium plating plant.

RBCA Risk Assessment

The RBCA risk assessment, implemented via ASTM's *RBCA Tool Kit* software package (1-3), was completed using as input data default assumptions described in the *Methods* section of this HASP module. Dose-response parameter values for chromium that might have been provided with the software were updated to confirm their currency. These values for chromium and compounds are reported in Table 3 (next page).

Input assumptions about the concentrations of chromium present in environmental media were selected arbitrarily, except that values were adjusted to produce output risks within maximum acceptable target risk levels selected as defaults within the software. Default values of acceptable risk benchmarks were one per million incremental cancer risk (one per hundred thousand for the construction worker scenario) and a hazard quotient of unity (one) for non-cancer effects. This means that chromium exposure levels were maintained below levels that would be expected to produce a clinically significant toxic effect, with an adequate margin of safety reflecting uncertainties and variability in susceptibility among people who might be exposed to chromium and its compounds.

Results of the RBCA HRA are set forth in Table 4 (on the page after Table 3). They reveal that Cr III and Cr VI concentrations of 1.0 mg/kg in surface and subsurface soil, and Cr III and Cr VI concentrations of 1.0 and 0.01 mg/L respectively in groundwater produced cancer and non-cancer risks within the default values adopted as acceptable risk benchmarks. Note that Table 4 uses a scientific format for reporting numbers. This was necessary to express, within reasonable space, numbers spanning many orders of magnitude (powers of 10). To clarify, 0.01 mg/L is expressed as 1.0 e-2

Table 3. Dose-Response Parameters for Chromium Compounds

valence	cancer potency			non-cancer potency		
	inhalation slope factor		oral slope factor	inhalation risk reference concentration (RfC)	oral risk reference dose (RfD)	
	(risk per mg/M³)	[risk per mg/(kg d)]		(mg/M³)	[mg/(kg d)]	
Cr III	Class D: not classifiable as to human carcinogenicity			2.00 e-6	5.71 e-7	1.50 e+0
	0.00 e+0	0.00 e+0	0.00 e+0			
Cr VI	Class A: human carcinogen		Class D: not classifiable as to human carcinogenicity	Cr VI airborne particles		3.00 e-3
	1.20 e+1	3.43 e+0		0.00 e+0	8.00 e-3	
				Cr VI airborne gases		3.00 e-3
				1.00 e-4	2.86 e-5	

Table 4. Potential Health Risks Associated with Modeled Exposure Pathways

exposure pathways		conc. in source medium		unit	health risk	
		Cr III	Cr VI		cancer	non-cancer
air exposure pathways						
	--surface soil: inhalation of vapor and dust	1.0 e+0	1.0 e+0	mg/kg	6.1 e-9	0.0 e+0
	--subsurface soil: inhalation of vapor	1.0 e+0	1.0 e+0	mg/kg		
	SSTL*: not applicable					
groundwater exposure pathways						
	source medium: groundwater	1.0 e+0	1.0 e-2	mg/L	0.0 e+0	1.3 e-1
	--soil leaching to groundwater, ingestion	...	...	...		
	--groundwater, ingestion	...	...	...		
	--volatilization to outdoor air	...	...	...		
	--volatilization to indoor air	...	...	...		
	SSTLs*: Cr III 2.9e-1; Cr VI <1.0e-2 mg/L					
soil exposure pathways						
	source medium: surface soil	1.0 e+0	1.0 e+0	mg/kg	0.0 e+0	1.6 e-4
	--leaching to groundwater	...	...	...		
	--ingestion, inhalation, dermal contact	...	...	...		
	--construction worker	...	...	...		
	SSTLs*: Cr III 9.6e-2; Cr VI 9.6e-2 mg/kg					
	source medium: subsurface soil	1.0 e+0	1.0 e+0	mg/kg	0.0 e+0	1.6 e-4
	--leaching to groundwater	...	...	...		
	--ingestion, inhalation, dermal contact	...	...	...		
	SSTLs*: Cr III >1.0e-2; Cr VI >1.0e-2 mg/kg					
*SSTL: site-specific target level						

mg/L in Table 4, where the e-2 means 10^{-2} , or 0.01. Accordingly, 1.0 e-2 is 0.01 multiplied by 1.0, which remains 0.01. To avoid mixing formats, and to facilitate comparison of numbers with one another, all numbers were reported using this format, even though some numbers easily could have been expressed in a more familiar format.

CONCLUSIONS

Conclusions drawn based upon findings made in the *Findings* section above are, most generally, that chromium is a ubiquitous element present in numerous toxic compounds. Consequently, to survive, life on earth had to evolve adaptations to live with chromium and its compounds in the environment; including terrestrial, marine, and aquatic habitats. However, with the onset of the Industrial Revolution, mining brought more chromium to the earth's surface, and industrial processes used it or produced it as a waste when purifying other useful minerals. This gave rise to environmental levels of chromium toxic to organisms, including humans.

Clearly, chromium can be present in occupational (and residential) environments at levels that can cause acute and/or chronic toxic effects. Environmental levels used as inputs to the RBCA HRA appear to be well within such toxic environmental levels, at least under the default scenario adopted by the ASTM *RBCA Tool Kit* software. Some assumptions (such as longer exposure time) can increase risks potentially posed by chromium, and other assumptions (such as wearing respiratory protection) can reduce those risks. The generic nature of this HASP module precludes resolution of this issue for specific workplaces, but the value of the HASP module is undiminished: it still allows the reader to understand better the dynamics of chromium in the environment, and to discern 'red flags' that should trigger concern. Such 'red flags' could include higher chromium concentrations than those assumed in the RBCA HRA, or the applicability of significantly different exposure assumptions.

Individuals assigned to workplaces at which chromium compounds are present at levels above natural background should be familiarized with this HASP module, and thereby enabled to manage effectively potential risks of exposure and health damage. As a final conclusion, this HASP module

focuses on chromium in the context of occupational health and safety planning, but it is not a substitute for a well-prepared HASP. This HASP module should be used in conjunction with a well-prepared HASP.

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TECH SUPPORT APPENDIX 1

Toxicological Profile:
CHROMIUM:
Cr 0, CAS No. 7440-47-3

and compounds:
Cr III, CAS No. 16065-83-1
Cr VI, CAS No. 18540-29-9

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Physical and Chemical Properties

Chromium (symbol, Cr) is a transition metal* with atomic number 24 and atomic weight 51.996 daltons, which has been assigned CAS No. 7440-47-3. Elemental (metallic) chromium exhibits zero valence. Chromium may, however, assume the trivalent (Cr III) or the hexavalent (Cr VI) oxidation state when forming its many compounds (20, 25). These include such trivalent chromic compounds as the following: chromic acetate $[\text{Cr}(\text{CH}_3\text{COO})_3 \cdot \text{H}_2\text{O}]$; chromic chloride (CrCl_3); chromic formate, hexahydrate $\{[\text{Cr}(\text{HCOO})_3] \cdot 6\text{H}_2\text{O}\}$; chromic oxide (Cr_2O_3); chromic phosphate, hydrated ($\text{CrPO}_4 \cdot 2\text{H}_2\text{O}$); and chromic sulfate $[\text{Cr}_2(\text{SO}_4)_3]$. Hexavalent chromium compounds include the following chromates: ammonium chromate $[(\text{NH}_4)_2\text{CrO}_4]$, ammonium dichromate $[(\text{NH}_4)_2\text{Cr}_2\text{O}_7]$, barium chromate (BaCrO_4), lead chromate (PbCrO_4), mercurous chromate (Hg_2CrO_4), and mercuric chromate (HgCrO_4); as well as other forms besides chromates, such as chromium oxide (CrO_3). Useful physical-chemical properties of chromium and its compounds are set forth in Table 1.

*A transition metal is any metal among the series of elements having atomic numbers 21-30, 39-48, 57-80, and 89-103.

Table 1. Physical-Chemical Properties of Chromium and Compounds*

element or compound	chemical formula	density (g/cm ³)	melting point (° C)	boiling point (° C)	water solubility (g/100 ml)
elemental form					
chromium	Cr	7.20 ²⁸	1,890	2,482	--
trivalent inorganic form					
chromic chloride	CrCl ₃	2.76 ¹⁵	~1,150	sublimes	insoluble
chromic oxide	Cr ₂ O ₃	5.21	2,266	4,000	insoluble
chromic sulfate	Cr ₂ (SO ₄) ₃	3.012	--	--	insoluble
chromic phosphate,	CrPO ₄ ·2H ₂ O	2.42 ^{32.5}	--	--	slightly sol.
hydrated	CrPO ₄ ·6H ₂ O	2.121 ¹⁴	100	--	insoluble
chromic formate	Cr(HCOO) ₃	--	--	--	soluble
chromic acetate	Cr(CH ₃ COO) ₃ ·H ₂ O	--	--	--	slightly sol.
hexavalent form					
ammonium chromate	(NH ₄) ₂ CrO ₄	1.91 ¹²	180	--	40.5 ³⁰
ammonium dichromate	(NH ₄) ₂ Cr ₂ O ₇	2.155 ²⁵	180	--	30.8 ¹⁵
barium chromate	BaCrO ₄	4.498 ²⁵	decomposes	--	0.00034 ¹⁶⁰
lead chromate	PbCrO ₄	6.12	844.	decomposes	0.0000058 ²⁵
mercurous chromate	Hg ₂ CrO ₄	--	decomposes	--	v sl soluble
mercuric chromate	HgCrO ₄	--	decomposes	--	slightly sol
					decomposes
potassium chromate	K ₂ CrO ₄	2.732 ¹⁸	971	--	62.9 ²⁰
potassium dichromate	K ₂ Cr ₂ O ₇	2.676 ²⁵	398	500	4.9 ⁰
sodium chromate	Na ₂ CrO ₄	2.723 ²⁵	792	--	87.3 ³⁰
sodium dichromate	Na ₂ Cr ₂ O ₇ ·2H ₂ O	2.348	--	400	180 ²⁰ decomposes
chromium oxide	CrO ₃	2.70 ²⁵	197	decomposes	67.45 ¹⁰⁰

*Adapted from: **U. S. EPA.** *Health Assessment Document for Chromium. Final Report.* Research Triangle Park, NC, Environmental Criteria and Assessment Office, EPA/600/8-83-014F, i. p., August 1984; and **Weast, R. C.** *Handbook of Chemistry and Physics, 49th edition.* Cleveland, Chemical Rubber Company, i. p., 1968. Superscripted numbers are applicable temperatures.

Pharmacokinetics

Absorption

Inhalation. In one study, five percent of trivalent chromium instilled intratracheally was absorbed by guinea pigs (22). Guinea pigs exposed intratracheally to water-soluble hexavalent chromium salts for 10 minutes absorbed 25 percent (20 percent in the blood, five percent in soft tissues; 8) According to ATSDR (1):

"The absorption of inhaled chromium compounds depends on a number of factors, including physical and chemical properties of the particles (oxidation state, size, solubility) and the activity of alveolar macrophages.

The identification of chromium in urine and serum of humans occupationally exposed to soluble chromium(III) or chromium(VI) compounds in air indicates that chromium can be absorbed from the lungs (Cavalleri and Minoia 1985; Gylseth *et al.* 1977; Kiilunen *et al.* 1983; Minoia and Cavalleri 1988; Randall and Gibson 1987; Tossavainen *et al.* 1980). In most cases, chromium(VI) compounds are more readily absorbed from the lungs than chromium(III) compounds, due in part to differences in the capacity to penetrate biological membranes. Nevertheless, workers exposed to chromium(III) lignosulfonate dust at 0.005-0.23 mg chromium(III)/M³ had clearly detectable concentrations of chromium in the urine at the end of their shifts. Based on a one compartment kinetic model, the biological half-life of chromium(III) from the lignosulfonate dust was 4-10 hours which is the same order of magnitude as the half-life for chromium(VI) compounds (Kiilunen *et al.* 1983).

Rats exposed to 2.1 mg chromium(VI)/M³ as zinc chromate 6 hours/day achieved steady state concentrations in the blood after ~4 days of exposure (Langard *et al.* 1978). Rats that were exposed for a single inhalation of chromic acid mist from electroplating at a concentration of 3.18 mg chromium(VI)/M³ for 30 minutes rapidly absorbed chromium from the lungs. The content of chromium in the lungs declined from 13.0 mg immediately after exposure to 1.1 mg at 4 weeks in a triphasic pattern with an overall half-life of 5 days (Adachi *et al.* 1981). In another study in which rats were exposed to chromium(VI) as potassium dichromate or to chromium(III) as chromium trichloride, the clearance of both valence states was dependent on particle size, but chromium(VI) was more rapidly and extensively transported to the bloodstream than chromium(III). The rats had been exposed to 7.3-15.9 mg chromium(VI)/M³ as potassium dichromate for 2- 6 hours or to 8 or 10.7 mg chromium(III)/M³ as chromium

trichloride for 6 or 2 hours, respectively. Chromium(VI) particles of 1.5 or 1.6 μ m had a two-compartment clearance curve with half-lives of 31.5 hours for the first phase and 737 hours for the second phase. Chromium(VI) particles of 2 μ m had a single component curve with a half-life between 151 and 175 hours. Following exposure to chromium(VI), the ratio of blood chromium/lung chromium was 1.44 at 0.5 hours, 0.81 at 18 hours, 0.85 at 48 hours, and 0.96 at 168 hours after exposure. Chromium(III) particles of 1.5-1.8 μ m had a single component clearance curve with a half-life of 164 hours. Following exposure to chromium(III), the ratio of blood chromium/lung chromium was 0.39 at 0.5 hours, 0.24 at 18 hours, 0.22 at 48 hours, and 0.26 at 168 hours after exposure. Therefore, the amount of chromium(VI) transferred to the blood from the lungs was always at least 3 times greater than the amount of chromium(III) transferred (Suzuki *et al.* 1984). Other studies reporting absorption from the lungs are intratracheal injection studies (Baetjer *et al.* 1959; Bragt and van Dura 1983; Visek *et al.* 1953; Wiegand *et al.* 1984, 1987). These studies indicate that 53-85% of chromium(VI) compounds (particle size $<5 \mu$ m) are cleared from the lungs by absorption into the bloodstream or by mucociliary clearance in the pharynx; the rest remain in the lungs. Absorption by the bloodstream and mucociliary clearance was only 5-30% for chromium(III) compounds.

The kinetics of three chromium(VI) compounds, sodium chromate, zinc chromate, and lead chromate, were compared in rats in relation to their solubility. The rats received intratracheal injections of the ^{51}Cr -labeled compounds [0.38 mg chromium(VI)/kg as sodium chromate, 0.36 mg chromium(VI)/kg as zinc chromate, or 0.21 mg chromium(VI)/kg as lead chromate]. Peak blood levels of ^{51}Cr were reached after 30 minutes for sodium chromate (0.35 mg chromium/mL), and 24 hours for zinc chromate (0.60 mg chromium/mL) and lead chromate (0.007 mg chromium/mL). At 30 minutes after administration, the lungs contained 36%, 25%, and 81% of the respective dose of the sodium, zinc, and lead chromate. On day 6, $>80\%$ of the dose of all three compounds had been cleared from the lungs, during which time the disappearance from lungs followed linear first-order kinetics. The residual amount left in the lungs on day 50 or 51 were 3.0, 3.9, and 13.9%, respectively. The results indicate that zinc chromate, which is $\sim 1,000$ times less soluble than sodium chromate, is more slowly absorbed from the lungs, but peak blood levels are higher, than sodium chromate. Lead chromate was more poorly and slowly absorbed, as indicated by very low levels in blood and other tissues, and greater retention in the lungs (Bragt and van Dura 1983)."

Ingestion. The U. S. EPA reported variability in the efficiencies with which ingested trivalent and hexavalent chromium is absorbed (20). However, based upon the available data, EPA concluded that a reasonable estimate of the absorption efficiencies of both chromium III and chromium VI is five percent. According to ATSDR (1):

"Chromium(III) is an essential nutrient required for normal energy

metabolism. The National Research Council recommends a dietary intake of 50-200 mg/day (NRC 1989). The biologically active form is an unidentified organic complex of chromium(III) often referred to a glucose tolerance factor (GTF).

Approximately 0.5-2.0% of chromium(III) or chromium(VI) is absorbed via the gastrointestinal tract of humans. The absorption efficiency is dependent on the dietary intake. At low levels of dietary intake (10 mg), ~2.0% of the chromium is absorbed. When intake increases to 40 mg, the absorption efficiency drops to ~0.5% (Anderson 1986). Although Mertz (1969) reported that some chromium(III) complexes are absorbed at 25%, this has not been corroborated by other studies (Anderson 1981).

Urinary excretion data from 15 female and 27 male subjects given 200 mg chromium(III) as chromium trichloride indicated that gastrointestinal absorption was at least 0.4% (Anderson *et al.* 1983). Net absorption of chromium(III) by a group of 23 elderly subjects who received an average of 24.5 mg/day [0.00035 mg chromium(III)/kg/day] from their normal diets was calculated to be 0.6 mg chromium(III)/day, based on an excretion of 0.4 mg chromium/day in the urine and 23.9 mg chromium/day in the feces, with a net retention of 0.2 mg/day. Thus about 2.4% was absorbed. The retention was considered adequate for their requirements (Bunker *et al.* 1984). The 6-day fecal and 24-hour urinary excretion patterns of radioactivity in groups of six volunteers given chromium(III) as chromium trichloride or chromium(VI) as sodium chromate labeled with ⁵¹chromium, indicated that at least 0.5% and 2.1% of the chromium(III) and chromium(VI) compounds, respectively, were absorbed. After intraduodenal administration, absorption of the chromium(III) compound was not changed, while at least 10% of the chromium(VI) compound was absorbed. These studies further showed that chromium(VI) compounds are reduced to chromium(III) compounds in the stomach, thereby accounting for the relatively poor gastrointestinal absorption of orally administered chromium(VI) compounds (Donaldson and Barreras 1966). Gastric juices taken from the stomachs of patients effectively reduced chromium(VI) as sodium dichromate to chromium(III) *in vitro*, and the extent of reduction was directly related to the amount of gastric juice. The peak reduction occurred for gastric juice collected 3-4 hours after the patients were given meals, when gastric secretion is greatly stimulated, and amounted to tens of mg chromium(VI) reduced per mL gastric juice per hour. It was estimated that total reduction of chromium(VI) in the gastric environment is on the order of several tens of mg/day (De Flora *et al.* 1987a).

Studies with ⁵¹chromium in animals indicate that chromium and its compounds are also poorly absorbed from the gastrointestinal tract after oral exposure. When radioactive sodium chromate [chromium(VI)] was given orally to rats, the amount of chromium in the feces was greater than that found when sodium chromate was injected directly into the jejunum. Since chromium(III) is absorbed less readily than chromium(VI) by the

gastrointestinal tract, these results indicate that the gastric environment has a capacity to reduce chromium(VI) to chromium(III). Furthermore, the administration of radioactive chromium(III) or chromium(VI) compounds directly into the jejunum decreased the amount of chromium recovery in the feces indicating that the jejunum is the absorption site for chromium (Donaldson and Barreras 1966). Absorption of either valence state was 0.14% of the administered oral dose in rats (Sayato *et al.* 1980) and hamsters (Henderson *et al.* 1979). Based on distribution (see Section 2.3.2.2) and excretion (see Section 2.3.4.2) studies in rats administered chromium by gavage for 2-14 days from various sources, that is, from sodium chromate [chromium(VI)], from calcium chromate [chromium(VI)], or from soil contaminated with chromium [30% chromium(VI) and 70% chromium(III)], the low gastrointestinal absorption of chromium from any source was confirmed. Chromium appeared to be better absorbed from the soil than from chromate salts, but less than 50% of the administered chromium could be accounted for in these studies, partly because not all tissues were examined for chromium content and excretion was not followed to completion (Witmer *et al.* 1989, 1991). Adult and immature rats given chromium(III) chloride absorbed 0.1% and 1.2% of the oral dose, respectively (Sullivan *et al.* 1984). This suggests that immature rats may be more susceptible to potential toxic effects of chromium(III) compounds.

Although chromium or chromium compounds alone are poorly absorbed from the gastrointestinal tract, the association of chromium with chelating agents, which may be naturally present in feed, can alter the bioavailability from food. In rats that were given ⁵¹chromium-chromium trichloride mixed with chelating agents, either oxalate or phytate, phytate significantly ($p < 0.05$) decreased the levels of radioactivity in blood, whole body, and urine achieved with chromium trichloride alone. Oxalate, however, greatly increased the levels in blood, whole body, and urine. The oxalate served as a strong ligand to protect against the tendency of chromium(III) to form insoluble macromolecular chromium oxides at physiological pH. Fasted rats absorbed significantly more ⁵¹chromium than did nonfasted rats, indicating that the presence of food in the gastrointestinal tract slows the absorption of chromium. Results of an *in vitro* experiment in this study indicated that the midsection had greater uptake than the duodenum or ileum and that oxalate significantly ($p < 0.05$) increased, while phytate significantly ($p < 0.05$) decreased, the transport of chromium(III) across all three sections, paralleling the *in vivo* results. Ethylenediamine tetraacetic (EDTA) and citrate were also tested in the *in vitro* system, but were found to have no effect on chromium(III) intestinal transport; therefore, these chelating agents were not tested *in vivo* (Chen *et al.* 1973).

Treatment of rats by gavage with a nonencapsulated lead chromate pigment or with a silica-encapsulated lead chromate pigment resulted in no measurable blood levels of chromium (detection limit=10 mg/L) after 2 or 4 weeks of treatment or after a 2-week recovery period. However, kidney levels of chromium were significantly higher in the rats that received the

nonencapsulated pigment than in the rats that received the encapsulated pigment, indicating that silica encapsulation reduces the gastrointestinal bioavailability of chromium from lead chromate pigments (Clapp *et al.* 1991)."

Dermal. The U. S. EPA has reported variability in the efficiencies with which trivalent and hexavalent chromium is absorbed percutaneously (20). Cr III was absorbed with an efficiency of 30 percent in one study, whereas Cr VI was absorbed with efficiencies of one percent and four percent in different studies. According to ATSDR (1):

"Both chromium (III) and chromium(VI) can penetrate human skin to some extent, especially if the skin is damaged. Systemic toxicity has been observed in humans following dermal exposure to chromium compounds, indicating significant cutaneous absorption (see Section 2.2.3). Fourteen days after a salve containing potassium chromate was applied to the skin of an individual to treat scabies, appreciable amounts of chromium were found in the blood, urine, feces, and stomach contents (Brieger 1920) (see Section 2.3.2.3). It should be noted that the preexisting condition of scabies or the necrosis caused by the potassium chromate (see Section 2.2.3) could have facilitated dermal absorption of potassium chromate. Potassium dichromate [chromium(VI)], but not chromium(III) sulfate, penetrated the excised intact epidermis of humans (Mali *et al.* 1963). Dermal absorption by humans of chromium(III) sulfate in aqueous solution was negligible, with slightly larger amounts of chromium(III) nitrate in aqueous solution absorbed. The absorption of chromium (III) chloride was similar to potassium dichromate (VI) (Samitz and Shrager 1966). Chromium (III) from a concentrated chromium sulfate solution at pH 3 penetrated cadaverous human skin at a rate of 5×10^{-11} cm/sec, compared with a rate for chromium (VI) (source unspecified) of 5×10^{-7} cm/sec (Spruit and van Neer 1966). In contrast, both chromium(VI) from sodium chromate and chromium(III) from chromium trichloride penetrated excised human mammary skin at similar rates, but the rate was generally slightly faster for chromium(VI). Absolute rates of absorption in nmol chromium/hour/cm² increased with increasing concentration of both chromium(VI) and chromium(III) (Wahlberg 1970).

The influence of solvent on the cutaneous penetration of potassium dichromate by humans has been studied. The test solutions of potassium dichromate in petrolatum or in water were applied as occluded circular patches of filter paper to the skin. Results with dichromate in water revealed that chromium(VI) penetrated beyond the dermis and penetration reached steady state with resorption by the lymph and blood vessels by 5 hours. About 10 times more chromium penetrated when potassium dichromate was applied in petrolatum than when applied in water. About 5 times more chromium penetrated when potassium dichromate was applied than when a chromium trichloride glycine complex was applied (Liden and Lundberg 1979). The rates of absorption of solutions of sodium chromate from the occluded forearm skin of volunteers increased with increasing concentration.

The rates were 1.1 mg chromium(VI)/cm²/hour for a 0.01 M solution, 6.4 mg chromium(VI)/cm²/hour for a 0.1 M solution, and 10 mg chromium(VI)/cm²/hour for a 0.2 M solution (Baranowska-Dutkiewicz 1981).

Chromium and its compounds are also absorbed dermally by animals. The dermal absorption of sodium chromate [chromium(VI)] by guinea pigs was somewhat higher than that of chromium(III) trichloride, but the difference was not significant. At higher concentrations (0.261-0.398 M), absorption of sodium chromate was statistically higher than that of chromium trichloride. The peak rates of absorption were 690-725 and 315-330 nmol/hour/cm² for sodium chromate at 0.261-0.398 M and chromium trichloride at 0.239-0.261 M, respectively. Percutaneous absorption of sodium chromate was higher at pH 6.5 compared with pH 5.6 (Wahlberg and Skog 1965)."

Distribution

The principal tissues and organs to which chromium and its compounds are distributed have been reported to include chromosomes (nucleic acids), lungs, kidneys, blood, spleen, and liver (13).

Metabolism

Chromium exists in hexavalent, trivalent, and neutral forms, but hexavalent chromium is of principal toxicological concern. It exists in several oxides, including CrO₃ and CrO₄²⁻, as well as oxidizing forms, such as CrO₂Cl₂ (1, 20-22). In solution, hexavalent chromium exists ionically as hydrochromate (HCrO₄⁻), chromate (CrO₄²⁻), and dichromate (Cr₂O₇²⁻). Metabolism of hexavalent chromium typically involves reduction of valence to the less toxic trivalent form; however, metabolically produced trivalent chromium may interact via complexation with intracellular macromolecules, such as RNA (13). Reduction of hexavalent chromium is mediated by electrons donated by the enzymes glutathione (GSH), NADPH, and NADH (20).

Excretion

Chromium elimination is a non-linear process based upon a three-compartment model of distribution characterized in one study by half-times of the compartments of 0.5, 5.9, and 83.4 days (13). The three half-times may relate to clearance from the blood, soft tissues including the reticuloendothelial system, and an unspecified deep body compartment, respectively (20). Urinary excretion constituted from 51-64 percent of total plasma clearance; fecal excretion constituted 5-8 percent; and 31-41 percent of plasma chromium was directed into an unspecified 'body sink' of extremely long half life, possibly including the liver and spleen, which may store chromium for up to 12 months. Biliary excretion also contributes to total fecal excretion, and is mediated via chromium complexation with glutathione (13). NYS DOH has emphasized that the above pattern of chromium elimination is principally based upon data derived from rats exposed intravenously to a traceable radioactive isotope of trivalent chromium (^{51}Cr), not upon direct studies with humans. Thus, some differences are likely to exist relating to species, route, and chromium compound(s) administered.

Data derived from humans exposed via inhalation to trivalent chromium have been related to urinary elimination (20). In one study, individuals occupationally exposed to trivalent chromium lignosulfonate at an air level of 50 μg of chromium per cubic meter of air (50 $\mu\text{g}/\text{M}^3$) excreted one to two percent of the inhaled chromium in their urine. It is likely that there was only slight pulmonary absorption of this trivalent form of chromium, inasmuch as a high percentage of absorbed chromium is eliminated in the urine (indeed, kinetic studies in humans have identified a chromium compartment in red blood cells (erythrocytes) which is almost exclusively eliminated in the urine; 13). The lignosulfonate form of chromium was reported to behave pharmacokinetically in a manner similar to water soluble hexavalent chromium compounds. Chromium concentration in the urine was reported to be 14 $\mu\text{g}/\text{l}$; by comparison, the concentration of hexavalent chromium in urine following inhalation exposure of humans to 50 $\mu\text{g}/\text{M}^3$ was 40 $\mu\text{g}/\text{l}$ in one study, and 10 - 20 $\mu\text{g}/\text{L}$ in another (20).

Pharmacodynamics

Acute Toxicity

Acute toxic effects associated with chromium compounds can occur in humans under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. The major toxic effect associated with acute chromium exposure is renal tubular necrosis (13), an effect which has been associated with an oral dose level of under 2 g (<28.57 mg/kg for a 70-kg individual; 1). Most toxic incidents involve hexavalent chromium (20). In occupational exposures by inhalation and dermal contact, acute toxic reactions of the lungs and skin may ensue. These may be characterized as involving chronic ulceration of skin surfaces, independent of hypersensitivity reactions, as well as chronic ulceration and perforation of the nasal septum.

Oral exposure is relatively less toxic. Rats have been reported to exhibit oral LD₅₀s of 51-58 mg/kg when exposed to hexavalent chromium (6). Trivalent chromium has been associated with higher LD₅₀ values (in rats). These have included 1.87 g/kg (1,870 mg/kg) when exposed to chromic chloride, 11.26 g/kg (11,260 mg/kg) when exposed to chromium acetate, and 3.25 g/kg (3,250 mg/kg) when exposed to chromium nitrate. Symptoms in rodents may include diarrhea, cyanosis (bluish coloration), tail necrosis, and gastric ulceration. Finally, chromium has been associated with hypersensitization and resulting allergic contact dermatitis.

Mutagenicity

Chromium has exhibited genotoxic effects at the DNA, gene, and chromosome levels (20). Trivalent and hexavalent chromium have been shown to interact with DNA in microbial assays, and to cause infidelity in DNA replication. Hexavalent chromium inhibited DNA synthesis but also induced unscheduled DNA synthesis indicative of DNA repair in mammalian cell cultures. Several bacterial assays have revealed hexavalent chromium's ability to cause gene mutations when administered in the absence of metabolic activation. Moreover, mutagenic potential disappeared following metabolism, suggesting reduction to the trivalent form. At the chromosome level, both trivalent and hexavalent chromium have induced clastogenic effects, including sister chromatid exchange and the appearance of micronuclei in erythrocytes (red blood cells; 20).

Although most studies of chromium genotoxicity were conducted *in vitro*, in laboratory-cultured cellular systems, several *in vivo* studies have also been conducted (20). In one study, clastogenic potency of hexavalent potassium chromate (K_2CrO_4) was indicated based upon the micronucleus test using NMRI mice administered chromate intraperitoneally at reported doses of 0, 12.12, 24, 25, or 48.5 mg/kg. A dose-response relationship was reported, in which the percent of micronucleus-containing red blood cells observed out of 1000 polychromatic cells examined from the bone marrow of each mouse increased with dose. These elevations were statistically significant in the two highest-dose groups: 9.6 and 15.0 percent, respectively, compared with only 3.1 percent in controls. Other studies have involved clastogenesis reported in fish gills following exposure of the fish to sodium dichromate ($Na_2Cr_2O_7$), as well as clastogenesis reported in human lymphocytes of workers exposed occupationally to hexavalent chromium compounds, including K_2CrO_7 , $CaCrO_4$ (calcium chromate), and CrO_3 (chromium trioxide). Trivalent chromium in the form of chromium chloride ($CrCl_3$) was, however, clastogenically inactive.

Carcinogenicity

Chromium has been associated with occupational lung cancer as early as 1936 (13). The major industries in which the association was exhibited were the chromate-producing and chrome pigment industries. Cancer types among workers in these industries included squamous cell carcinomas, anaplastic tumors, and adenocarcinomas. These findings have been augmented by numerous epidemiological studies (21). Consistent with the greater genotoxic potency of hexavalent than trivalent chromium, the hexavalent form also appears to pose greater carcinogenic risks to occupationally exposed individuals (13, 20).

In addition to epidemiological studies, numerous bioassays of chromium carcinogenicity to laboratory animals have been conducted (20). These have involved various strains of mice (13 studies), rats (about 26 studies), guinea pigs (three studies), rabbits (four studies), and dogs (one study). Routes of administration (and numbers of studies) have included inhalation (seven), intratracheal instillation or application (seven), intrapleural implantation or injection (ten), intrabronchial administration (two), intrafemoral administration (three), intraperitoneal injection (three), intravenous injection (three), subcutaneous injection (two), and intramuscular injection (seven). A variety of chromium compounds, and metallic chromium, were administered. Of all these studies, only several yielded positive results, including two or three studies revealing statistically significant elevations of lung tumors in mice and rats. In four studies, injection- or implantation-site sarcomas were produced in rats. More recently, positive results have also been obtained in inhalation and intrabroncheal inhalation studies in rats (8, 15, 16).

Quantification of carcinogenic potency. The basis selected for quantifying the carcinogenic potency of chromium is the U. S. EPA Carcinogen Assessment Group's (CAG's) *Health Assessment Document for Chromium* (20) and *Health Effects Assessment for Hexavalent Chromium* (21). These documents developed one unit risk value for chromium in air: $1.2 \times 10^{-2} (\mu\text{g}/\text{M}^3)^{-1}$. CAG based its estimated unit risk value upon data derived from an epidemiological study of a cohort of white males occupationally exposed to trivalent and hexavalent chromium (assumed 6:1 ratio) at a chromate plant between 1931 and 1937, and who were followed until 1974 (18, 19, 21, 22). The study revealed an association between exposure to chromium and lung cancer death rate. The unit risk value of $1.2 \times 10^{-2} (\mu\text{g}/\text{M}^3)^{-1}$ is principally associated with hexavalent chromium. CAG estimated the relative potency index of hexavalent chromium at $4 \times 10^3 (\text{mMol}/\text{kg}/\text{d})^{-1}$, placing chromium in the first (highest) quartile among 53 carcinogens or suspected carcinogens evaluated by CAG at the time of its report (August 1984).

Teratogenicity

Chromium salts have been reported to be teratogenic in mice and hamsters following injection (20). Hamsters administered chromium trioxide intravenously on day eight of gestation exhibited elevated incidence of cleft palate, but the effects were associated with maternal toxicity. Maternal toxicity is regarded as a potentially confounding factor in teratogenicity studies. Mice administered chromium by intraperitoneal injection exhibited elevated incidence of skeletal malformations, sometimes and possibly always in association with maternal toxicity (20).

ATSDR (1) reports the following:

"No studies were located regarding developmental effects in humans after oral exposure to chromium or its compounds.

Oral exposure to chromium(VI) compounds caused severe developmental effects in mice. Exposure of pregnant mice to 57 mg chromium(VI)/kg/day as potassium dichromate in drinking water during gestation resulted in embryolethal effects (i.e., increased resorptions and increased postimplantation loss) and gross abnormalities (i.e., subdermal hemorrhage, decreased cranial ossification, tail kinking), decreased crown-rump length, and decreased fetal weight). The incidence and severity of abnormalities increased at higher doses. Maternal toxicity, evidenced by decreased body weight gain, occurred at doses ≥ 120 mg chromium(VI)/kg/day. No implantations were observed in the dams given 234 mg chromium(VI)/kg/day (Trivedi *et al.* 1989). Chromium(III) does not appear to cause fetotoxic or teratogenic effects in rats. Male and female rats fed 1,806 mg chromium(III)/kg/day as chromium oxide 5 days/week for 60 days before mating and throughout the female rat gestational period produced healthy offspring (Ivankovic and Preussmann 1975). The NOAEL and LOAEL values for developmental effects in each species are recorded in Table 2-2 and plotted in Figure 2-2."

Reproductive Effects

Available literature revealed few investigations of reproductive effects exerted by chromium (10, 13, 20-22). In one investigation, rabbits were injected intraperitoneally with chromium nitrate (a form of hexavalent chromium) or potassium dichromate (a form of trivalent chromium) at doses of 2 mg/kg for three or six weeks. Rabbits exhibited decreased activity of the enzymes succinic dehydrogenase and adenosine triphosphatase (ATPase) in their testicles. Trivalent chromium proved to be the more potent ATPase inhibitor, and also inhibited the enzyme acid phosphatase. Other effects of trivalent chromium included thickening of the tunica albuginea (a surrounding tunic structure), blood vessel congestion, and degeneration of seminiferous tubules, with eventual absence of spermatocytes in the lumen. Trivalent chromium caused edema of testicular interstitial tissue, blood vessel congestion, and aspermia in the otherwise normal-appearing seminiferous tubules. Other investigations have revealed testicular and epididymal uptake of chromium, and sterility in rats exposed to chromates in their diet.

ATSDR (1) reports the following:

"No studies were located regarding reproductive effects in humans after oral exposure to chromium or its compounds.

Oral exposure to chromium(VI) compounds caused severe reproductive effects in mice. Exposure of pregnant mice to 57 mg chromium(VI)/kg/day as potassium dichromate in drinking water during gestation resulted in increased preimplantation and postimplantation loss, and decreased litter size. Maternal body weight gain decreased at doses ≥ 120 mg chromium(VI)/kg/day (Trivedi et al. 1989). Mice exposed for 7 weeks to 4.6 mg chromium(VI)/kg/day as potassium dichromate or 3.5 mg chromium(III)/kg/day as chromium sulfate in the diet had reduced sperm count and degeneration of the outer cellular layer of the seminiferous tubules. Morphologically altered sperm occurred in mice given diets providing 9.1 mg chromium(VI)/kg/day as potassium dichromate and 14 mg chromium(III)/kg/day as chromium sulfate (Zahid et al. 1990). No effect was found on testis or epididymis weight, and reproduction function was not assessed. Chromium(III) as chromium oxide did not cause reproductive effects in rats. Male and female rats fed 1,806 mg chromium(III)/kg/day as chromium oxide 5 days/week for 60 days before gestation and throughout the gestational period were observed to have normal fertility, gestational length, and litter size (Ivankovic and Preussmann 1975). The highest NOAEL value and all reliable LOAEL values for reproductive effects in each species and duration category are recorded in Table 2-2 and plotted in Figure 2-2."

Other Chronic Effects

Gastrointestinal. Gastrointestinal effects have included inflammatory and ulcerative conditions (20).

Hematological. INHALATION. The lowest inhalation dose of chromium reported to elicit a toxic effect involved an animal study (7). In the study, Wistar rats breathed hexavalent chromium 22 h/d for 28 or 90 days at concentrations of 25, 50, 100, and 200 $\mu\text{g}/\text{M}^3$. All concentrations were reported to produce no adverse effects upon behavior or clinical condition of exposed animals. However, at concentrations of 50 $\mu\text{g}/\text{M}^3$ and higher, macrophage cell counts were significantly diminished, and at 200 $\mu\text{g}/\text{M}^3$, serum triglyceride levels were elevated and phospholipid levels diminished.

INGESTION. According to ATSDR (1):

"In a cross sectional study conducted in 1965 of 155 villagers whose well water contained 20 mg chromium(VI)/L as a result of pollution from an alloy plant in the People's Republic of China, associations were found between drinking the contaminated water and leukocytosis and immature neutrophils. The alloy plant began chromium smelting in 1961 and began regular production in 1965. Similar results were found in two similar studies in other villages, but further details were not provided (Zhang and Li 1987). The 20 mg chromium(VI)/L concentration is equivalent to a dose of 0.57 mg chromium(VI)/kg/day.

Hematological effects were not observed in animals after oral exposure to chromium(VI) or chromium(III) compounds. Routine hematological examination revealed no changes in rats exposed to 3.5 mg chromium(VI)/kg/day as potassium chromate in the drinking water for 1 year (MacKenzie *et al.* 1958). Similarly, no hematological abnormalities were found in rats fed diets providing 1,806 mg chromium(III)/kg/day as chromium oxide 5 days/week for 90 days (Ivankovic and Preussmann 1975), or in rats exposed to 2.7 mg chromium(III)/kg/day as chromium trichloride in the drinking water for 1 year (MacKenzie *et al.* 1958)."

Renal. HSDB NON-HUMAN TOXICITY EXCERPT: "Low doses of chromium produce a relatively specific necrosis of the proximal convoluted tubule. Functionally, this leads to pronounced glucosuria. After low doses of chromium the surface of the kidney shows marked signs of ischemia and tissue damage. ... when the dose of the chromium is incr, toxicity is seen throughout the proximal tubule. [Doull, J., C.D.Klassen, and M.D. Amdur (eds.). Casarett and Doull's Toxicology. 3rd ed., New York: Macmillan Co., Inc., 1986., p. 319] **PEER REVIEWED**" (10).

Renal effects have also been reported by ATSDR (1):

"Case studies were located regarding renal effects in humans after oral exposure to chromium(VI) compounds. Acute renal failure, characterized by proteinuria, hematuria, followed by anuria, developed in a chrome plating worker who had accidentally swallowed an unreported volume of a plating fluid containing 300 g chromium trioxide/L. He was treated by hemodialysis, which saved his life (Fristedt *et al.* 1965). Necrosis of renal tubules was found upon autopsy of a 22-month-old boy who died after ingesting an unknown amount of sodium dichromate (Ellis *et al.* 1982) and of a 17-year-old boy who died after ingesting 29 mg chromium(VI)/kg as potassium dichromate (Clochesy 1984; Iseron *et al.* 1983). A fatal ingestion of 4.1 mg chromium(VI)/kg as a chromic acid solution in a 44-year-old man resulted in acute tubular necrosis and renal failure (Saryan and Reedy 1988). A 14-year-old boy who ingested 7.5 mg chromium(VI)/kg as potassium dichromate died from renal failure 8 days after he was admitted to the hospital. Upon postmortem examination, the kidneys were pale, enlarged, and necrotic with tubular necrosis and edema (Kaufman *et al.* 1970). Another case study of an 18-year-old woman who ingested a few grams of potassium dichromate reported proteinuria, oliguria, and destruction of the tubular epithelium of the kidneys. She regained renal function following dialysis (Sharma *et al.* 1978). Proteinuria and oliguria were also observed after ingestion of potassium dichromate by a 25-year-old woman (Goldman and Karotkin 1935).

Effects on the kidneys of rats exposed to potassium chromate have been detected by biochemical and histochemical techniques. Rats treated by gavage with 13.5 mg chromium(VI)/kg/day for 20 days had increased accumulation of lipids and accumulated triglycerides and phospholipids in different regions of the kidney than controls (Kumar and Rana 1982). Similar treatment of rats also resulted in inhibition of membrane enzymes (alkaline phosphatase, acid phosphatase, glucose-6-phosphatase, and lipase) in the kidneys (Kumar and Rana 1984). Oliguria and proteinuria were observed in rats exposed to 98 mg chromium(VI)/kg/day as sodium chromate in drinking water for 28 days (Diaz-Mayans *et al.* 1986). However, histological examination revealed no morphological changes in the kidneys of rats exposed to 3.5 mg chromium(VI)/kg/day as potassium chromate in drinking water for 1 year (MacKenzie *et al.* 1958). Animals exposed to oral doses of chromium(III) compounds had no evidence of kidney damage. Histological examination revealed no morphological changes in the kidneys of rats exposed to 2,040 mg chromium(III)/kg/day as chromium oxide in the diet 5 days/week for 2 years (Ivankovic and Preussmann 1975), of rats exposed to 2.7 mg chromium(III)/kg/day as chromium trichloride in drinking water for 1 year (MacKenzie *et al.* 1958), or in rats exposed to 0.46 mg chromium(III)/kg/day as chromium acetate in the drinking water for 2-3 years (Schroeder *et al.* 1965)."

Dermal. HSDB HUMAN TOXICITY EXCERPT: "Potential symptoms as a

result of exposure /to chromium, chromic, chromous salts (as Cr)/: sensitive dermatitis. /Chromium, chromic, chromous salts (as Cr)/ [NIOSH. Pocket Guide to Chemical Hazards. 5th Printing/Revision. DHHS (NIOSH) Publ. No. 85-114. Washington, D.C.: U.S. Dept. of Health and Human Services,, p. 85] NIOSH/Supt. of Documents, GPO, Sept 1985., p. 85] **PEER REVIEWED**" (10).

Dermal effects reported by ATSDR (1) are as follows:

"Administration of 0.04 mg chromium(VI)/kg as potassium dichromate as an oral tolerance test exacerbated the dermatitis of a building worker who had a 20-year history of chromium contact dermatitis. A double dose led to dyshidrotic lesions (vesicular eruptions) on the hands (Goitre *et al.* 1982). Dermatitis in 11 of 31 chromium-sensitive individuals worsened after ingestion of 0.036 mg chromium(VI)/kg as potassium dichromate (Kaaber and Veien 1977). The sensitizing exposures were not discussed or quantified.

No studies were located regarding dermal or ocular effects in animals after oral exposure to chromium or its compounds."

Respiratory. Respiratory effects have included nasal septum perforation among (hexavalent) chromium plating industry employees, respiratory tract irritation, pneumoconiosis (a lung inflammation associated with occupational dust inhalation, commonly leading to fibrosis), bronchitis, and chronic lung congestion. Ulceration and perforation of the nasal septum were recognized as early as 1928, when Bloomfield and Blum (3) reported cases of septal perforation among U. S. chromium plating workers exposed to air levels of (hexavalent) chromium trioxide (CrO_3) of as little as 0.003 mg/M^3 . Bloomfield and Blum also associated chromic acid ($\text{H}_2 \text{CrVIO}_4$) exposure at levels of $>0.1 \text{ mg/M}^3$ with nasal tissue injury.

Many more studies of potential respiratory effects following chronic inhalation of chromium have been conducted since 1928. One example is the report of Cohen *et al.* (5) indicating that nickel-chrome plating employees exhibited significant nasal pathology and skin lesions associated with chronic exposure to chromic acid. Specifically, 35 of 37 (95 percent) of employees chronically exposed to air levels of 0.0071 mg/M^3 , measured as total chromium, developed these symptoms, which are typical of chromic acid exposure. Still lower exposure levels have been associated with adverse respiratory impacts. For example, Cohen and Kramkowski (4) reported the presence of nasal perforation or ulceration in 12 of 37 individuals (32 percent) occupationally exposed for up to only one year to hexavalent chromium at levels of as little as <0.71 to $9.12 \text{ } \mu\text{g/M}^3$ in a chromium plating plant. At a similar facility in which airborne chromium levels were within $3 \text{ } \mu\text{g/M}^3$ ($0.98 \text{ } \mu\text{g/kg/d}$), however, neither ulcerated nasal mucosa nor

perforated septa were reported, although approximately half of exposed employees reported experiencing nasal mucosal irritation.

HSDB HUMAN TOXICITY EXCERPT: "250 volunteers were exposed to 12 different chromium aerosols in concn of 1.5 ug/cu m to 40 ug cu m. Levels from 10 to 24 ug/cu m, even for brief periods, caused shock and irritation of the upper respiratory tract. [Waldbott GL; Health Effects of Environ Poll p.201 (1973)]" (10).

Neurological. ATSDR (1) reports the following effects:

"The only information regarding neurological effects in humans after oral exposure to chromium(VI) is the report of an enlarged brain and cerebral edema upon autopsy of a 14-year-old boy who died after ingesting 7.5 mg chromium(VI)/kg as potassium dichromate (Table 2-2 and Figure 2-2). These effects may be the result of accompanying renal failure (Kaufman *et al.* 1970).

A decrease in motor activity and balance was reported in rats given 98 mg chromium(VI)/kg/day as sodium chromate in drinking water for 28 days (Diaz-Mayans *et al.* 1986) (Table 2-2 and Figure 2-2). Histological examination of the brain and nervous system did not reveal abnormalities in rats fed 2,040 mg chromium (III)/kg/day as chromium oxide in the diet 5 days/week for 2 years (Ivankovic and Preussmann 1975); however, more sensitive neurological, neurochemical, or neurobehavioral tests were not conducted."

Hepatic. Hepatic effects have included jaundice and microscopic changes which were likened to those of toxic hepatitis. Levels at which these effects were elicited were unreported (20). According to ATSDR (1):

"Effects on the liver have been described in case reports of humans who had ingested chromium(VI) compounds. Liver damage, evidenced by the development of jaundice, increased bilirubin, and increased serum lactic dehydrogenase, was described in a case of a chrome plating worker who had accidentally swallowed an unreported volume of a plating fluid containing 300 g chromium trioxide/L (Fristedt *et al.* 1965). In a 14-year-old boy who died after ingesting 7.5 mg chromium(VI)/kg as potassium dichromate, high levels of the liver enzymes, glutamic-oxaloacetic transaminase (aspartate aminotransferase) and glutamic-pyruvic transaminase (alanine aminotransferase), were found in the serum 24 hours after ingestion. Upon postmortem examination, the liver had marked necrosis (Kaufman *et al.* 1970).

"Effects on the liver of rats exposed to chromium compounds have been detected by biochemical and histochemical techniques, but not by microscopic examination. Rats treated by gavage with 13.5 mg chromium(VI)/kg/day as potassium chromate for 20 days had increased accumulations of lipids (Kumar and Rana 1982) and changes and relocalization of liver enzymes (alkaline phosphatase, acid phosphatase, glucose-6-phosphatase, cholinesterase, and lipase) (Kumar *et al.* 1985), as determined by histochemical means. No morphological changes, however, were detected in the livers of rats exposed to 3.5 mg chromium(VI)/kg/day as potassium chromate in the drinking water for 1 year (MacKenzie *et al.* 1958). Similarly, animals orally exposed to chromium(III) compounds had no evidence of liver damage. Histological examination revealed no morphological changes in the livers of rats exposed to 2,040 mg chromium(III)/kg/day as chromium oxide in the diet 5 days/week for 2 years (Ivankovic and Preussmann 1975), of rats exposed to 2.7 mg chromium(III)/kg/day as chromium trichloride in the drinking water for 1 year (MacKenzie *et al.* 1958), or of rats exposed to 0.46 mg chromium(III)/kg/day as chromium acetate in the drinking water for 2-3 years (Schroeder *et al.* 1965)."

Immunological. ATSDR (1) reports the following effects:

"The only reported effect of human exposure on the immune system was the exacerbation of chromium dermatitis in chromium-sensitive individuals as noted for dermal/ocular effects in Section 2.2.2.2.

Splenocytes prepared from rats given potassium chromate in their drinking water at 7 mg chromium(VI)/kg/day for 3 weeks showed an elevated proliferative response of T-and B-lymphocytes to the mitogens, concanavalin A and liposaccharide, compared with splenocytes from control rats. A 5-fold enhancement of the proliferative response to mitomycin C was also seen when splenocytes from rats exposed for 10 weeks were incubated with splenocytes from nonexposed rats and additional chromium (0.1 mg chromium(VI)/L) was added to the incubation compared to the system without added chromium. It was suggested that these increased proliferative responses represent chromium-induced sensitization (Snyder and Valle 1991). The LOAEL values are recorded in Table 2-2 and plotted in Figure 2-2."

Sensitive Subpopulations

Individuals who slowly reduce (detoxify) chromium +6 to chromium +3 may have an increased susceptibility to liver and kidney effects resulting toxicity from chromium +6 exposure (1). Apparently, no other human subpopulations are thought to be at increased risk (22).

Chemical Interactions

The influence of other chemicals on the *in vivo* toxicity of chromium has not been well studied. Bianchi and Lewis (2) reviewed some studies of chemical interactions between chromium and other genotoxic agents. Data indicated a synergistic effect for inducing cell transformation between hexavalent chromium and certain oncogenic viruses, zinc and benzo(a)pyrene.

Dose-Response Parameter Estimation

Cancer. The US EPA places inhaled hexavalent chromium (Cr VI) in Class A: *human carcinogen*, and ingested Cr VI in Class D: *not classifiable as to human carcinogenicity* (11). US EPA places trivalent chromium (Cr III) in Class D: *not classifiable as to human carcinogenicity* (11). Under US EPA health risk assessment standard procedures, the cancer potency of a substance in Class D is estimated as zero. Following is the US EPA summary in the IRIS data base of its classification of Cr III and Cr VI with respect to carcinogenicity.

Integrated Risk Information System Chromium(III), insoluble salts (CASRN 16065-83-1)

Status of Data for Chromium(III), insoluble salts

File First On-Line: 01/31/1987

Last Significant Revision: 09/03/1998

Category Status Last Revised

Oral RfD Assessment On-line 09/03/1998

Inhalation RfC Assessment On-line 09/03/1998

Carcinogenicity Assessment On-line 09/03/1998

Carcinogenicity Assessment for Lifetime Exposure

Weight of Evidence Characterization

Weight of Evidence (1986 US EPA Guidelines):

D (Not classifiable as to human carcinogenicity)

Weight of Evidence Narrative:

Using the Proposed Guidelines for Carcinogen Risk Assessment (EPA, 1996), there are inadequate data to determine the potential carcinogenicity of trivalent chromium, as discussed below. However, the classification of hexavalent chromium as a known human carcinogen raises a concern for the carcinogenic potential of trivalent chromium.

This may be a synopsis of the full weight-of-evidence narrative.

See Full IRIS Summary.

Quantitative Estimate of Carcinogenic Risk from Oral Exposure

Not Assessed under the IRIS Program.

Quantitative Estimate of Carcinogenic Risk from Inhalation Exposure

Not Assessed under the IRIS Program.

Revision History

Review Full IRIS Summary for complete Revision History.

Last Updated on Wednesday, November 3, 2004

URL: http://cfpub.epa.gov/iris/quickview.cfm?substance_nmbr=0028

**Integrated Risk Information System
Chromium(VI) (CASRN 18540-29-9)**

File First On-Line: 03/31/1987

Last Significant Revision: 09/03/1998

Category Status Last Revised

Oral RfD Assessment On-line 09/03/1998

Inhalation RfC Assessment On-line 09/03/1998

Carcinogenicity Assessment On-line 09/03/1998

Carcinogenicity Assessment for Lifetime Exposure**Weight of Evidence Characterization****Weight of Evidence (1986 US EPA Guidelines):**

A (Human carcinogen) (Inhalation route)

D (Not classifiable as to human carcinogenicity)

Weight of Evidence Narrative:

Under the proposed guidelines (EPA, 1996), Cr (VI) would be characterized as a known human carcinogen by the inhalation route of exposure. The oral carcinogenicity of Cr (VI) cannot be determined. No data were located in the available literature that suggested that Cr (VI) is carcinogenic by the oral route of exposure. This may be a synopsis of the full weight-of-evidence narrative. See Full IRIS Summary.

Quantitative Estimate of Carcinogenic Risk from Oral Exposure

Information reviewed but value not estimated. Refer to Full IRIS Summary.

Quantitative Estimate of Carcinogenic Risk from Inhalation Exposure**Air Unit Risk(s) Extrapolation Method**1.2x10⁻² per ug/m³ Multistage, extra risk**Air Concentrations at Specified Risk Levels****Risk Level Concentration**E-4 (1 in 10,000) 8x10⁻³ ug/m³E-5 (1 in 100,000) 8x10⁻⁴ ug/m³E-6 (1 in 1,000,000) 8x10⁻⁵ ug/m³**Dose-Response Data (Carcinogenicity, Inhalation Exposure)**

Tumor Type: Lung cancer

Test Species: Human

Route: Inhalation, Occupational exposure

Reference: Mancuso, 1975

Revision History

Review Full IRIS Summary for complete Revision History.

Non-cancer effects. Following are the IRIS Database summaries of US EPA derivations of risk reference doses (RfDs) and risk reference concentrations (RfCs) for hexavalent chromium (Cr VI) and trivalent chromium (Cr III).

Integrated Risk Information System

Chromium(III), insoluble salts (CASRN 16065-83-1)

Status of Data for Chromium(III), insoluble salts

File First On-Line: 01/31/1987

Last Significant Revision: 09/03/1998

Category Status Last Revised

Oral RfD Assessment On-line 09/03/1998

Inhalation RfC Assessment On-line 09/03/1998

Carcinogenicity Assessment On-line 09/03/1998

Chronic Health Hazard Assessments for Noncarcinogenic Effects

Reference Dose for Chronic Oral Exposure (RfD)

Critical Effect Experimental Dose UF MF RfD

No effects observed NOAEL (ADJ):

1468 mg/kg-day

100 10 1.5 mg/kg-day

The Experimental Dose listed serves as a basis from which the Oral RfD was derived. See Discussion of Conversion Factors and Assumptions for more details.

Principal Study

Rat chronic feeding study, Ivankovic and Preussman, 1975

Confidence in the Oral RfD

Study -- Low

Database -- Low

RfD -- Low

Reference Concentration for Chronic Inhalation Exposure (RfC)

Information reviewed but value not estimated. Refer to Full IRIS Summary.

**Integrated Risk Information System
Chromium(VI) (CASRN 18540-29-9)****Status of Data for Chromium(VI)**

File First On-Line: 03/31/1987

Last Significant Revision: 09/03/1998

Category Status Last Revised

Oral RfD Assessment On-line 09/03/1998

Inhalation RfC Assessment On-line 09/03/1998

Carcinogenicity Assessment On-line 09/03/1998

Chronic Health Hazard Assessments for Noncarcinogenic Effects**Reference Dose for Chronic Oral Exposure (RfD)****Critical Effect Experimental Dose UF MF RfD**

None reported NOAEL (ADJ): 2.5 mg/kgday

300 3 3 x10⁻³ mg/kg-day

The Experimental Dose listed serves as a basis from which the Oral RfD was derived. See Discussion of Conversion Factors and Assumptions for more details.

Principal Study

Rat, 1-year drinking water study, MacKenzie et al., 1958

Confidence in the Oral RfD

Study -- Low

Database -- Low

RfD -- Low

Reference Concentration for Chronic Inhalation Exposure (RfC)**Critical Effect Experimental Dose UF MF RfC**

Lactate dehydrogenase in bronchioalveolar lavage fluid

BMC10 (ADJ): 0.034 mg/m³ 300 1 1x10⁻⁴ mg/m³

(Cr (VI) particulates)

Nasal septum atrophy LOAEL (ADJ): 0.000714 mg/m³90 1 8x10⁻⁶ mg/m³mg/m³ (Chromic acid mists and dissolved Cr (VI) aerosols)

The Experimental Dose listed serves as a basis from which the Inhalation RfC was derived. See Discussion of Conversion Factors and Assumptions for more details.

Principal Study

Rat subchronic study, Glaser et al., 1990; Malsch et al., 1994

Human subchronic occupational study, Lindberg and Hedenstierna, 1983

Confidence in the Inhalation RfC

Study -- Medium

Database -- Not Available

RfC -- Medium

Study -- Low

Database -- Low

RfC -- Low

Revision History

Review Full IRIS Summary for complete Revision History.

Derivation of Target Organ-Specific Reference Doses (RfDs) and Reference Concentrations (RfCs)

Teratogenic. An oral teratogen RfD may be derived based upon a reported LOAEL of 57 mg/kg/d Cr VI as potassium dichromate, which was associated with gross abnormalities. Factors of 10 may be applied to convert from a LOAEL to a NOAEL, to extrapolate from animals to humans, and to extrapolate further from the general population to potentially sensitive subpopulations. This produced a teratogen RfD value of 57 $\mu\text{g/kg/d}$ for Cr VI. Large doses of Cr III tested in multiple studies produced no teratogenic effects, as reported earlier.

Reproductive. An oral reproductive effects RfD may be derived based upon mice exposed orally to Cr VI at 4.6 mg/kg/d or Cr III at 3.5 mg/kg/d, which were associated with a variety of adverse reproductive effects, as reported earlier. Factors of 10 may be applied to convert from a LOAEL to a NOAEL, to extrapolate from animals to humans, and to extrapolate further from the general population to potentially sensitive subpopulations. This produced reproductive effects RfD values of 4.6 $\mu\text{g/kg/d}$ for Cr VI and 3.5 $\mu\text{g/kg/d}$ for Cr III.

Hematological. INHALATION. An inhalation hematological effects RfC may be derived based upon a reported mouse inhalation LOAEL of 50 $\mu\text{g/M}^3$ Cr VI, which was associated with significant reduction of macrophage counts, as reported earlier. This concentration may be multiplied by a factor of 2.7 to convert to a human equivalent concentration (HEC), and by 20 M^3/d breathing rate, and then divided by a factor of 70 kg adult body weight, yielding 3.86×10^{-2} mg/kg/d. Factors of 3 may be applied to convert from a LOAEL to a NOAEL, 3 to extrapolate from animals to humans, and 10 to extrapolate further from the general population to potentially sensitive subpopulations. This produces an inhalation hematological effects RfD value of 4.29×10^{-4} mg/kg/d for Cr VI.

INGESTION. An ingestion hematological effects RfC may be derived based upon a reported epidemiological association of 20 mg/L Cr VI contamination in drinking water from an alloy plant in the People's Republic of China with leukocytosis and with the presence of immature leukocytes, as reported earlier. This contamination level was equated with 0.57 mg/kg/d. This value may be divided by a factor of 10 to extrapolate to sensitive subpopulations, producing an ingestion hematological effects RfD value of 5.71×10^{-2} mg/kg/d for Cr VI.

Renal. A renal effects oral RfD may be derived based upon oral exposure of rats to Cr VI at 13.5 mg/kg/d, which was associated with accumulation in the kidneys of lipids, triglycerides, and phospholipids; as reported earlier. Factors of 10 may be applied to convert from a LOAEL to a NOAEL, to extrapolate from animals to humans, and to extrapolate further from the general population to potentially sensitive subpopulations. This produces a renal effects RfD value of 1.35×10^{-2} mg/kg/d for Cr VI. Large doses of Cr III tested in multiple studies produced no adverse renal effects, as reported earlier.

Dermal. A dermal effects oral RfD may be derived based upon occupational exposure to Cr VI orally at 0.04 mg/kg/d, which was associated with exacerbation of dermatitis, as reported earlier. This value may be used without adjustment as a dermal effects oral RfD value.

Respiratory. A respiratory effects inhalation RfD may be derived based upon occupational exposure to Cr VI at <0.71 to $9.12 \mu\text{g}/\text{M}^3$, which was associated with nasal perforation or ulceration, as reported earlier. The median of this range is equivalent to 1.40×10^{-3} mg/kg/d. This value may be divided by a factor of 10 to extrapolate to sensitive subpopulations, producing an inhalation RfD value of 1.40×10^{-4} mg/kg/d.

Neurological. A neurological effects oral RfD may be derived based upon oral exposure of rats to Cr VI at 98 mg/kg/d, which was associated with a decrease in motor activity and balance, as reported earlier. Factors of 10 may be applied to convert from a LOAEL to a NOAEL, to extrapolate from animals to humans, and to extrapolate further from the general population to potentially sensitive subpopulations. This produces a neurological effects oral RfD value of 9.80×10^{-3} mg/kg/d for Cr VI. Large doses of Cr III tested in multiple studies produced no adverse neurological effects, as reported earlier.

Hepatic. A hepatic effects oral RfD may be derived based upon oral exposure of rats to Cr VI at 13.5 mg/kg/d, which was associated with accumulations of lipids and changes and relocation of liver enzymes, as determined by histochemical means, and as reported earlier. A factor of 3 may be applied to convert from a LOAEL to a NOAEL and of 10 to extrapolate from animals to humans, and 10 to extrapolate further from the general population to potentially sensitive subpopulations. This produces a hepatic effects oral RfD value of 4.50×10^{-2} mg/kg/d for Cr VI. Large doses of Cr III tested in multiple studies produced no adverse hepatic effects, as reported earlier.

Immunological. An immunological effects oral RfD may be derived based upon oral exposure of rats to Cr VI in drinking water at 7 mg/kg/d; which was associated with an elevated proliferative response of T-and B-lymphocytes to the mitogens, concanavalin A and liposaccharide, compared with splenocytes from control rats; as reported earlier. Factors of 10 may be applied to convert from a LOAEL to a NOAEL, to extrapolate from animals to humans, and to extrapolate further from the general population to potentially sensitive (or sensitized) subpopulations. This produces an immunological effects oral RfD value of 7.00×10^{-3} mg/kg/d for Cr VI. If 0.1 mg/kg/d is regarded as a LOAEL for sensitized rats, the corresponding immunological effects oral RfD value would be 1.00×10^{-3} mg/kg/d, based upon two rather than three safety/uncertainty factors of 10.

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TECH SUPPORT APPENDIX 2

***Selected Health
Risk Assessment Model
Input and Output Screens***

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: HASP Module: Chromium Job Identification: CT Male
 Site Location: Generic Date Completed: 7/18/05
 Completed By: Dr. Robert A. Michaels

Software: GSI RBCA Spreadsheet
 Version: v 1.0

NOTE: values which differ from Tier 1 default values are shown in bold *italics* and underlined.

DEFAULT PARAMETERS

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (l/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m³3/day)	15			20	
IRa.out	Inhalation rate outdoor (m³3/day)	20			20	10
SA	Skin surface area (dermal) (cm²2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm²2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways	Residential			Commercial/Industrial	
	Distance	On-Site		Distance	On-Site

Groundwater Pathways:					
GW.i	Groundwater Ingestion	FALSE		TRUE	
GW.v	Volatilization to Outdoor Air	FALSE		TRUE	
GW.b	Vapor Intrusion to Buildings	FALSE		TRUE	
Soil Pathways					
S.v	Volatiles from Subsurface Soils	FALSE		TRUE	
SS.v	Volatiles and Particulate Inhalation	FALSE		TRUE	TRUE
SS.d	Direct Ingestion and Dermal Contact	FALSE		TRUE	TRUE
S.I	Leaching to Groundwater from all Soils	FALSE		TRUE	
S.b	Intrusion to Buildings - Subsurface Soils	FALSE		TRUE	

Matrix of Receptor Distance and Location on- or off-site	Residential			Commercial/Industrial	
	Distance	On-Site		Distance	On-Site

GW	Groundwater receptor (cm)	FALSE		TRUE	
S	Inhalation receptor (cm)	FALSE		TRUE	

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential			Commercial/Industrial	
		Chronic	Construction		Chronic	Construction
t	Exposure duration (yr)	30			25	1
A	Contaminated soil area (cm²2)	2.2E+06				1.0E+06
W	Length of affected soil parallel to wind (cm)	1.5E+03				1.0E+03
W.gw	Length of affected soil parallel to groundwater (cm)	1.5E+03				
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02				
delta	Air mixing zone height (cm)	2.0E+02				
Lss	Definition of surficial soils (cm)	1.0E+02				
Pe	Particulate areal emission rate (g/cm²2/s)	2.2E-10				

Groundwater Parameters	Definition (Units)	Value		
		Chronic	Construction	
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02		
I	Groundwater infiltration rate (cm/yr)	3.0E+01		
Ugw	Groundwater Darcy velocity (cm/yr)			
Ugw.tr	Groundwater Transport velocity (cm/yr)			
Ks	Saturated Hydraulic Conductivity(cm/s)			
grad	Groundwater Gradient (cm/cm)			
Sw	Width of groundwater source zone (cm)			
Sd	Depth of groundwater source zone (cm)			
BC	Biodegradation Capacity (mg/L)			
BIO?	Is Bioattenuation Considered	FALSE		
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01		
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03		

Soil Parameters	Definition (Units)	Value		
		Chronic	Construction	
hc	Capillary zone thickness (cm)	5.0E+00		
hv	Vadose zone thickness (cm)	3.0E+02		
rho	Soil density (g/cm³3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	3.0E+02		
LS	Depth to top of affected soil (cm)	1.0E+02		
Lsubs	Thickness of affected subsurface soils (cm)	2.0E+02		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building Parameters	Definition (Units)	Residential		Commercial
		Chronic	Construction	
Lb	Building volume/area ratio (cm)	2.0E+02		3.0E+02
ER	Building air exchange rate (s⁻¹1)	1.4E-04		2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01		
eta	Foundation crack fraction	0.01		

Dispersive Transport Parameters		Residential	Commercial
	Definition (Units)		
Groundwater			
ax	Longitudinal dispersion coefficient (cm)		
ay	Transverse dispersion coefficient (cm)		
az	Vertical dispersion coefficient (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: HASP Module: Chromium
Site Location: Generic

Completed By: Dr. Robert A. Michaels
Date Completed: 7/18/2005

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN			Representative Concentration	X	Groundwater Ingestion			X	Groundwater Volatilization to Indoor Air		X	Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)		Residential: (on-site)	Commercial: (on-site)		Residential (on-site)	Commercial: (on-site)	(mg/L)	"X" If yes	Only if "yes" left
16065-83-1	Chromium (III)	1.0E+0			NA	#DIV/0!	NA		NA	>Sol		NA	>Sol	#DIV/0!	  	#DIV/0!
18540-29-9	Chromium (VI)	1.0E-2			NA	#DIV/0!	NA		NA	>Sol		NA	>Sol	#DIV/0!	  	#DIV/0!

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.1

Site Name: HASP Module: Chromium

Completed By: Dr. Robert A. Michaels

Site Location: Generic

Date Completed: 7/18/2005

1 OF 1

SURFACE SOIL SSTL VALUES (< 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN			Representative Concentration	X	Soil Leaching to Groundwater			X	Ingestion, Inhalation and Dermal Contact		X	Construction Worker	Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)		Residential: (on-site)	Commercial: (on-site)		Commercial: (on-site)	(mg/kg)	" If yes	Only if "yes" left
16065-83-1	Chromium (III)	1.0E+0			NA	#DIV/0!	NA		NA	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!
18540-29-9	Chromium (VI)	1.0E+0			NA	#DIV/0!	NA		NA	1.6E+2		4.3E+3	#DIV/0!		#DIV/0!

CONSTITUENT	Proposed Contaminant																			
	Reduction Factor (RF)																			
	carcinogen										non-carcinogen									
	3.60										0.010									
	1.137										0.010									
	10.16										0.010									
	1.0										1.0									
	1.0										1.0									
	1.0										1.0									
	1.0										1.0									
Representative Concentration																				
Groundwater Surface Soil Subsurface Soil																				
(mg/L) (mg/kg) (mg/kg)																				
Constituent																				
Constituent																				
Groundwater (mg/L)																				
Surface Soil (mg/kg)																				
Subsurface Soil (mg/kg)																				
Constituent																				
Constituent																				
Groundwater Ingestion																				
Residential Receptor																				
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RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

1 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

AIR EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS: VAPOR AND

DUST INHALATION

Exposure Concentration

Constituents of Concern

	1) Source Medium	2) NAF Value (m ³ /kg) Receptor	3) Exposure Medium Air: POE Conc. (mg/m ³) (1) / (2)	4) Exposure Multiplier (IRxETxEFxED)/(BWxAT) (m ³ /kg-day)	5) Average Daily Intake Rate (mg/kg-day) (3) X (4)
	Surface Soil Conc. (mg/kg)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Chromium (III)	1.0E+0	1.4E+8	7.2E-9	7.0E-2	5.1E-10
Chromium (VI)	1.0E+0	1.4E+8	7.2E-9	7.0E-2	5.1E-10

NOTE: ABS = Dermal absorption factor (dim)
AF = Adherence factor
AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure
SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

2 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

AIR EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS: VAPOR

Exposure Concentration

TOTAL PATHWAY INTAKE (mg/kg-day)

INHALATION

1) Source Medium

2) NAF Value (m³/kg)

3) Exposure Medium

4) Exposure Multiplier

5) Average Daily Intake Rate

(Sum intake values from

Subsurface Soil

Receptor

Air: POE Conc. (mg/m³) (1) / (2)(IRxETxEFxED)/(BWxAT) (m³/kg-day)

(mg/kg-day) (3) X (4)

surface & subsurface routes.)

Constituents of Concern

Conc. (mg/kg)

On-Site Commercial

On-Site Commercial

On-Site Commercial

On-Site Commercial

On-Site Commercial

Chromium (III)

1.0E+0

#DIV/0!

#DIV/0!

7.0E-2

#DIV/0!

5.1E-10

Chromium (VI)

1.0E+0

#DIV/0!

#DIV/0!

7.0E-2

#DIV/0!

5.1E-10

NOTE:

ABS = Dermal absorption factor (dim)

AF = Adherence factor

AT = Averaging time (days)

BW = Body Weight (kg)

CF = Units conversion factor

ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)

ET = Exposure time (hrs/day)

IR = Intake rate (L/day or mg/day)

POE = Point of exposure

SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

1 OF 3

TIER 2 PATHWAY RISK CALCULATION
AIR EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK				TOXIC EFFECTS			
		(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial	(3) Inhalation Slope Factor (mg/kg-day) ⁻¹	(4) Individual COC Risk (2) x (3) On-Site Commercial	(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial	(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial		
Chromium (III)	D	5.1E-10	0.0E+0	0.0E+0	#DIV/0!	5.7E-7	#DIV/0!		
Chromium (VI)	A	5.1E-10	1.2E+1	6.1E-9	#DIV/0!	2.3E-3	#DIV/0!		
Total Pathway Carcinogenic Risk =				6.1E-9	0.0E+0	Total Pathway Hazard Index =		#DIV/0!	0.0E+0

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.1

Site Name: HASP Module: Chromium Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

3 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION
SOIL EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

DERMAL CONTACT

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

$$(SA \times AF \times ABS \times CF \times EF \times ED) / (BW \times AT) \quad (1/day)$$

5) Average Daily Intake Rate

(mg/kg-day)

Constituents of Concern

Surface Soil Conc. (mg/kg)

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

Chromium (III)

1.0E+0

0.0E+0

0.0E+0

Chromium (VI)

1.0E+0

0.0E+0

0.0E+0

 NOTE: ABS = Dermal absorption factor (dim)
 AF = Adherence factor
 AT = Averaging time (days)

 BW = Body Weight (kg)
 CF = Units conversion factor
 ED = Exp. duration (yrs)

 EF = Exposure frequency (days/yr)
 ET = Exposure time (hrs/day)
 IR = Intake rate (L/day or mg/day)

 POE = Point of exposure
 SA = Skin surface area (cm²)

Site Name: HASP Module: Chromium Site Location: Generic

Completed By: Dr. Robert A. Micr Date Completed: 7/18/2005

4 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

INGESTION

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

 $(IR \times C \times EF \times ED) / (BW \times AT)$ (1/day)

5) Average Daily Intake Rate

(mg/kg-day)

TOTAL PATHWAY INTAKE (mg/kg-day)

*(Sum intake values from
dermal & ingestion routes.)*

Constituents of Concern

Surface Soil Conc. (mg/kg)

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

Chromium (III)

1.0E+0

1.7E-7

1.7E-7

1.7E-7

Chromium (VI)

1.0E+0

1.7E-7

1.7E-7

1.7E-7

NOTE:

ABS = Dermal absorption factor (dim)

AF = Adherence factor

AT = Averaging time (days)

BW = Body Weight (kg)

CF = Units conversion factor

ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)

ET = Exposure time (hrs/day)

IR = Intake rate (L/day or mg/day)

POE = Point of exposure

SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

2 OF 3

TIER 2 PATHWAY RISK CALCULATION
SOIL EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK				TOXIC EFFECTS					
		(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
		On-Site Residential	On-Site Commercial	(mg/kg-day)^-1	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	(mg/kg-day)	On-Site Residential	On-Site Commercial
Chromium (III)	D		1.7E-7	0.0E+0		0.0E+0		4.9E-7	1.5E+0		3.3E-7
Chromium (VI)	A		1.7E-7	0.0E+0		0.0E+0		4.9E-7	3.0E-3		1.6E-4

Total Pathway Carcinogenic Risk =

0.0E+0	0.0E+0

Total Pathway Hazard Index =

0.0E+0	1.6E-4

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

5 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

GROUNDWATER EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SOIL: LEACHING TO GROUNDWATER/
INGESTION

Exposure Concentration

	1) Source Medium	2) NAF Value (L/kg) Receptor	3) Exposure Medium (mg/L) (1)/(2)	4) Exposure Multiplier (IRxEFxED)/(BWxAT) (L/kg-day)	5) Average Daily Intake Rate (mg/kg-day)
Constituents of Concern	Soil Concentration (mg/kg)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Chromium (III)	1.0E+0	3.6E+1	2.8E-2	3.5E-3	9.8E-5
Chromium (VI)	1.0E+0	3.5E+1	2.8E-2	3.5E-3	9.9E-5

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
IR = Intake rate (L/day)

POE = Point of exposure

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

6 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

GROUNDWATER EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER: INGESTION

Exposure Concentration

MAX. PATHWAY INTAKE (mg/kg-day)

Constituents of Concern	1) Source Medium	2) NAF Value (dim) Receptor	3) Exposure Medium Groundwater: POE Conc. (mg/L) (1)/(2)	4) Exposure Multiplier (IRxEFxED)/(BWxAT) (L/kg-day)	5) Average Daily Intake Rate (mg/kg-day)	(Maximum intake of active pathways soil leaching & groundwater routes.)	
	Groundwater Concentration (mg/L)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial	
Chromium (III)	1.0E+0	1.0E+0	1.0E+0	3.5E-3	3.5E-3	3.5E-3	
Chromium (VI)	1.0E-2	1.0E+0	1.0E-2	3.5E-3	3.5E-5	9.9E-5	

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)EF = Exposure frequency (days/yr)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Chromium

Site Location: Generic

Completed By: Dr. Robert A. Michaels

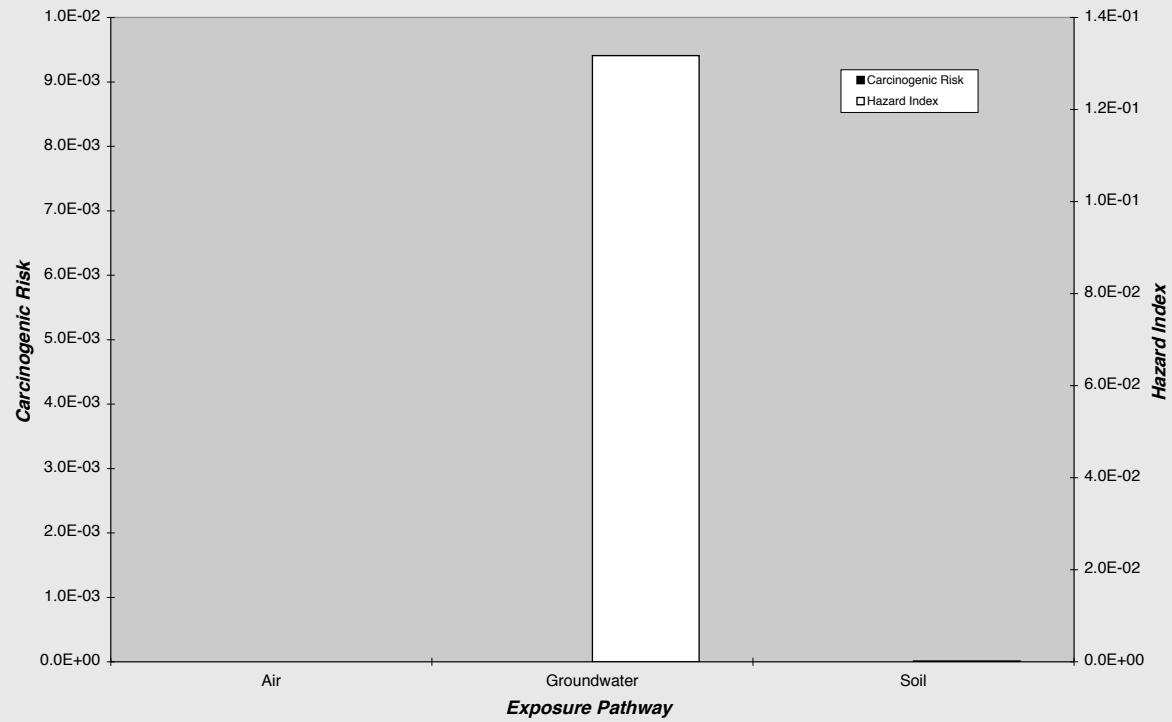
Date Completed: 7/18/2005

3 OF 3

TIER 2 PATHWAY RISK CALCULATION
GROUNDWATER EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK		TOXIC EFFECTS		(6) Oral Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6)	
		(2) Total Carcinogenic Intake Rate (mg/kg/day)	(3) Oral Slope Factor (mg/kg-day) ⁻¹	(4) Individual COC Risk (2) x (3)	(5) Total Toxicant Intake Rate (mg/kg/day)			
		On-Site Commercial		On-Site Commercial	On-Site Commercial		On-Site Commercial	
Chromium (III)	D	3.5E-3	0.0E+0	0.0E+0	1.0E-2	1.5E+0	6.7E-3	
Chromium (VI)	A	9.9E-5	0.0E+0	0.0E+0	3.7E-4	3.0E-3	1.2E-1	
Total Pathway Carcinogenic Risk =		0.0E+0		0.0E+0		Total Pathway Hazard Index =		1.3E-1
								0.0E+0

Total Risk for Each Pathway



Site Name: HASP Module: Chromium
 Site Location: Generic

Completed By: Dr. Robert A. Michaels
 Date Completed: 7/18/2005

1 of 1

TIER 2 BASELINE RISK SUMMARY TABLE

EXPOSURE PATHWAY	BASELINE CARCINOGENIC RISK					BASELINE TOXIC EFFECTS				
	Individual COC Risk		Cumulative COC Risk		Risk Limit(s) Exceeded?	Hazard Quotient		Hazard Index		Toxicity Limit(s) Exceeded?
	Maximum Value	Target Risk	Total Value	Target Risk		Maximum Value	Applicable Limit	Total Value	Applicable Limit	
AIR EXPOSURE PATHWAYS										
Complete:	6.1E-9	1.0E-6	6.1E-9	N/A	☐	NC	1.0E+0	NC	N/A	☐
GROUNDWATER EXPOSURE PATHWAYS										
Complete:	0.0E+0	1.0E-6	0.0E+0	N/A	☐	1.2E-1	1.0E+0	1.3E-1	N/A	☐
SOIL EXPOSURE PATHWAYS										
Complete:	0.0E+0	1.0E-6	0.0E+0	N/A	☐	1.6E-4	1.0E+0	1.6E-4	N/A	☐
CRITICAL EXPOSURE PATHWAY (Select Maximum Values From Complete Pathways)										
	6.1E-9	1.0E-6	6.1E-9	N/A	☐	1.2E-1	1.0E+0	1.3E-1	N/A	☐

RBCA CHEMICAL DATABASE

Physical Property Data

		Vapor																	
				Diffusion Coefficients				log (Koc) or log(Kd)		Henry's Law Constant		Pressure		Solubility		acid		base	
CAS	Constituent	type	MW	ref	Dair	ref	Dwat	ref	Koc	ref	mol	ref	Pure Component	ref	Pure Component	ref	pKa	pKb	ref
16065-83-1	Chromium (III)	N	52		N/A		N/A		1.55	24	0.00E+00	0.00E+00	0.00E+00		1.67E+05	27			
18540-29-9	Chromium (VI)	N	52		N/A		N/A		1.55	24	0.00E+00	0.00E+00	0.00E+00	14	1.67E+05	27			

Site Name: HASP Module: Chrc Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/18/2005

Software version: v 1.0

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Reference Number Reference

- R EPA Region III Risk Based Concentration Table, EPA Region 3, March 7, 1995.
- S USEPA, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, OSWER, November 1986.
- H Howard, Handbook of Environmental Degradation Rates, Lewis Publishers, Chelsea, MI, 1989
- A Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, ASTM, ES 38-94.
- 3 based on Kow from (2) and DiToro, D. M., 1985:"A Particle Interaction Model of Reversible Organic Chemical Sorption
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- 5 Verschueren, Karel, 1983: Handbook of Environmental data on organic Chemicals, Second Ed., (Van nostrand Reinhold)
- 6 Calculated diffusivity using the method of Fuller, Schettler, and Giddings from (9).
- 7 Calculated diffusivity using the method of Hayduk and Laudie and the reference from (9).
- 8 Calculated using Kenaga and Goring Kow/solubility regression equation reference (9) and Kow data from (2), log(S, r
- 9 Handbook of Chemical Property Estimation Methods, 1982, W.J. Lyman, (McGraw-Hill, New York), ISBN -0-07-03911
- 10 Calculated from (Pv/Patm)/(solubility/mol wt).
- 11 Back calculated from solubility, Note (8) and (3).
- 12 Aldrich Chemical Catalog, 1991.
- 13 Calculated using Modified Watson Correlation from (9) and normal boiling point.
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- 24 Buchter, B. et al., 1989: Correlation of Greundlich Kd and N retention Parameters with Soils and Elements, Soil Scien
- 25 USEPA, 1993: Air/Superfund National Technical Guidance Study series: Estimation of Air Impacts for Thermal Desor
- NTIS Accession No. PB93-215630, April 1993.
- 27 Based on salt solubilities in Table 3-120, R. H. Perry and D. W. Green, " Perry's Chemical Engineering Handbook" Si
- 28 Based on salt solubilities in Table of Physical Constants for Inorganic Compounds, Weast, R. C., CRC Handbook of C
- 29 Montgomery and Welkom, "Groundwater Chemicals Desk Reference", Lewis Publishers, Chelsea, MI, 1990.

CAS Number	Constituent	Reference Dose (mg/kg/day)				Slope Factors 1/(mg/kg/day)				EPA Weight of Evidence	Is Constituent Carcinogenic ?
		Oral RfD_oral	ref	Inhalation RfD_inhal	ref	Oral SF_oral	ref	Inhalation SF_inhal	ref		
16065-83-1	Chromium (III)	1.50E+00	R	5.71E-07	R	0.00E+00	R	0.00E+00	R	D	FALSE
18540-29-9	Chromium (VI)	3.00E-03	R	2.29E-03	R	0.00E+00	R	1.20E+01	R	A	TRUE

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/18/2005

Software version: v 1.0

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on", Chemosphere, 14(10), 1505-1538. log(Koc) = 0.00028 + 0.983 log(Kow)
on Models, (EPA-450/3-87-026).
hold Company Inc., New York), ISBN: 0-442-28802-6.

mg/l) = -0.922 log(Kow) + 4.184
75-0.

029a).
36-406-6.

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abase, Accession no. 105543.
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ixth Edition, (McGraw-Hill, New York), 1973.
Chemistry and Physics, 67th edition, (CRC Press, Inc., Boca Raton), 1987.

CAS Number	Constituent	Maximum Contaminant Level		Permissible Exposure Limit PEL/TLV (mg/m3)	ref	Relative Absorption Factors		Detection Limits			Half Life (First-Order Decay) (days)			
		MCL (mg/L)	reference			Oral	Dermal	Groundwater (mg/L)	ref	Soil (mg/kg)	ref	Saturated	Unsaturated	ref
16065-83-1	Chromium (III)	1.00E-01	56 FR 3526 (30 Jan 91)			1	0	0.01	C	0.007	S			
18540-29-9	Chromium (VI)	1.00E-01	56 FR 3526 (30 Jan 91)			1	0	0.01	C	0.007	S			

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Mire Date Completed: 7/18/2005

Software version: v 1.0

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1 and Toxicology, vol 123, 1-155.

Standards, EPA-451/R-93-005,



Health and Safety Plan (HASP) Module for: Petroleum Hydrocarbons

prepared by

**RAM TRAC Corporation,
Project Director:**

Robert A. Michaels; PhD, CEP

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Admitted Member, American College of Toxicology
Admitted Member, Society for Risk Analysis
Admitted Member, Society of Toxicology*

24 July 2005



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APPENDICES

Tech Support Appendix 1
<i>Toxicological Profile of Toluene</i>
Tech Support Appendix 2
<i>Toxicological Profile of Naphthalene</i>
Tech Support Appendix 3
<i>Toxicological Profile of Polycyclic Aromatic Hydrocarbons (PAHs)</i>
Tech Support Appendix 4
<i>Selected Risk Assessment Model Input and Output Screens</i>

*Citation:

RAM TRAC. *Health and Safety Plan (HASP) Module for Petroleum Hydrocarbons.* Schenectady, New York; RAM TRAC Corporation; Project Director Robert A. Michaels; PhD, CEP; 34 pages plus four appendices, 24 July 2005.

ABBREVIATIONS AND ACRONYMS

abbreviation or acronym	full word or phrase
ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry, U S Public Health Service
BW	body weight
CAG	Carcinogen Assessment Group (US EPA Office of Research and Development)
CAS	Chemical Abstract Service
CDC	U. S. Centers for Disease Control
d	day(s)
D	diameter
eq.	equation
expl	explodes; explosive
FDA	U. S. Food and Drug Administration
h	hour(s)
HRA	health risk assessment
IARC	United Nations International Agency for Research on Cancer
ICRP	Int'nat'l Commission for Radiological Protection
ign	ignites
i. p.	irregular pagination
kg	kilogram(s)
L	liter(s)
LC ₅₀	lethal conc. to 50 percent of exposed organisms
LD ₅₀	lethal dose to 50 percent of exposed organisms
LMS	linear multistage (low-dose extrapolation) model
LOAEL	Lowest Observed Adverse Effect Level
m	minute(s)
M	meter(s)
mg	milligram(s)
MW	molecular weight, in daltons (grams/mole)
NAS	U. S. National Academy of Sciences
NCI	U. S. National Cancer Institute
NIEHS	U. S. National Institute of Environmental Health Sciences

continued on following page

abbreviation or acronym	full word or phrase
NIOSH	US National Institute for Occupational Safety and Health, US Public Health Service
NOAEL	No Observed Adverse Effect Level
NRC	U. S. National Research Council
NTP	U. S. National Toxicology Program
NYS DEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PCB(s)	polychlorinated biphenyl(s)
PHS	U. S. Public Health Service
ppm-v	part(s) per million, by volume
ppm-w	part(s) per million, by weight
r	radius
RBCA	risk-based corrective action
RE	relative effectiveness (factor)
RfC	Risk Reference Concentration
RfD	Risk Reference Dose
RTECS	<i>Registry of Toxic Effects of Chemical Substances</i> , publication of NIOSH
s	second(s)
SA	surface area
SMR	Standard Mortality Ratio
sol	soluble
STP	standard temperature and pressure
subl	sublimes (changes state between gas and solid phases, with no liquid phase)
T	ton(s), where 1 ton = 2,000 pounds)
TD _{Lo}	lowest dose toxic to exposed organisms
TLV	Threshold Limit Value
TSCA	US Toxic Substances Control Act of 1976
TWA	time-weighted average
µg	microgram (10 ⁶ picograms, 10 ⁻⁶ gram)
U. S. EPA	U. S. Environmental Protection Agency
U. S. FDA	U. S. Food and Drug Administration
v	volume
vac	vacuum; in a vacuum
v sl sol	very slightly soluble
VOC	volatile organic compound(s)
WHO	United Nations World Health Organization
y	year(s)

INTRODUCTION

This document is designed to augment an existing corporate health and safety plan (HASP). Its purpose, most generally, is to enhance employee preparation for work at sites potentially posing risks of exposure to petroleum hydrocarbons. This HASP module, therefore, presents information about petroleum hydrocarbons, the potential for occupational exposure to them, the routes and pathways by which exposure can occur, and about risks to employee health potentially posed by such exposure.

This module augments, it does not replace, the corporate HASP. Indeed, the scope of this module excludes HASP issues to avoid redundancy and possibly even inconsistencies with an available HASP. For example, the available HASP should address respiratory protection at workplaces where grinding occurs, lofting particles into the air. This module refers employees to the available HASP for recommended procedures to manage exposure and risks to health potentially posed by inhalation of airborne vapors. This module does not present this information, because such presentation would be redundant and could introduce inconsistencies with the HASP document.

Exposure and health risks are within the province of toxicology, known colloquially as the 'science of poisons'. That science is highly technical, and its primary research sources inaccessible and/or incomprehensible to most people. This module distills the vast technical information to communicate sound science understandably. Some readers, however, will find this module to be more credible if it documents in detail its findings made and conclusions drawn via reference to the technical literature. Accordingly, this module is divided into two parts. Its main section (this section) presents main ideas. A section containing 'Tech Support' appendices follows. These appendices are of two types: 1. toxicological profiles, and 2. selected

health risk assessment (HRA) model input and output screens (see the *Methods* section, below). The appendices are provided for completeness, not for detailed perusal by most readers, much as a library reference section is provided for selective consultation rather than exhaustive, systematic perusal.

METHODS

This HASP module has been prepared based upon examination of relevant technical literature in areas such as toxicology (including regulatory toxicology), epidemiology, medicine, and other sciences. Exposure dynamics also were modeled consistent with risk-based corrective action (RBCA) consensus standards promulgated by the American Association for Testing and Materials (ASTM) and adopted in the Federal government and in numerous states including New York State. RBCA standards initially were formulated in connection with petroleum spill remediation.

ASTM RBCA standards for health risk assessment at work sites where toxic exposures might occur were implemented via software published by ASTM specifically for this purpose. The software, termed the *RBCA Tool Kit*, is abundantly documented (see *Literature Cited* items 1-3). Of course, as with any software, the caveat must apply that routine verification of its output is unrealistic for most if not all users. Presumably, however, ASTM's RBCA software was thoroughly tested before publication, and for that reason confidence in it would seem well placed. Readers interested in US EPA guidelines for health risk assessment can consult *Literature Cited* items 4 and 10-22, with which the ASTM RBCA tool kit should be fully consistent.

To prepare the RBCA HRA, default parameter values were selected for use in this HASP module. HRA model output pertaining to default scenarios can help readers to understand the dynamics of potential exposure and risks to health even under real-world circumstances that differ from the default scenarios. For example, if respiratory protection is worn, risks potentially posed via inhalation can be eliminated from further consideration.

The generic nature of this HASP module precludes use of any single scenario to represent the real work places at which this document will be relevant. Accordingly, simple whole-number substance concentrations were assumed, with which the risk output can be compared and related. Readers can extrapolate at least roughly from assumed whole-number substance concentrations to the concentrations that might apply at a particular work site. One caveat, however, is that risks might be changed in a proportion different from the proportion by which substance concentrations might be changed. For example, reducing substance concentration by half could reduce risk, not by half as might be expected based upon proportionality, but by 100 percent if a threshold toxic concentration no longer is present.

Some details of the HRA model are important to present to enable readers to gain insight into their own real-world work environments. Table 1 (following page) describes modeled routes and pathways by which exposure might occur at a work site. In the HRA model output screens, these are divided into pathways most commonly associated with residential settings, commercial/industrial settings, and construction settings. In the latter case, for example, exposure duration is relatively short compared with residential settings (lifetime) and commercial settings (occupational lifetime). Table 2 (on the page after Table 1) reports the default values of HRA parameters to enable readers to compare their own real-world work places with the default scenario assumed in this HASP module.

Table 1. Exposure Pathways Modeled

air exposure pathways	exposure routes
source medium: air	inhalation
source medium: surface soil	
--vapor release	inhalation
--windblown particles	inhalation
source medium: subsurface soil	
--vapor release	inhalation
groundwater exposure pathways	exposure routes
source medium: groundwater	
--volatilization to outdoor air	inhalation
--volatilization to indoor air	inhalation
--ingestion	ingestion
soil exposure pathways	exposure routes
source medium: surface soil	
--leaching to groundwater	ingestion
--direct ingestion (hand-to-mouth)	ingestion
--inhalation of gases and particulates	inhalation
--dermal contact, skin absorption	dermal
source medium: subsurface soil	
--leaching to groundwater	ingestion
--volatilization to indoor air	inhalation
--volatilization to outdoor air	inhalation

Table 2. Risk Assessment Model Default Parameter Values

exposure parameter	unit	residential exposure scenario			commercial/industrial exposure scenario	
		adult	age 1-6 years	age 1-16 years	chronic	construction
averaging time for carcinogens	years	70	...	...	...	...
averaging time for non-carcinogens	years	30	6	16	25	1
body weight	kilograms	70	15	35	70	...
exposure duration	years	30	6	16	25	1
exposure frequency	days/year	350	...	...	250	180
exposure frequency for dermal exposure	days/year	350	...	...	250	...
ingestion rate of water	liters/day	2	...	...	1	...
ingestion rate of soil	mg/day	100	200	...	50	100
inhalation rate indoor	M ³ /day	15	...	...	20	...
inhalation rate outdoor	M ³ /day	20	...	...	20	10
skin surface area (dermal)	cm ²	5,800	...	2,023	5,800	5,800
soil to skin adherence factor	none	1	...	...	...	...

FINDINGS

The subsections below describe dynamics of petroleum hydrocarbons that can lead to occupational exposure, and toxic consequences potentially arising from such exposure. Citations in this *Findings* section of this HASP module are restricted to the US EPA's IRIS database (citation 4) and a five-volume treatise on the problem of how best to address the diversity of petroleum hydrocarbons as a single toxicological entity (citations 5-9). Detailed information on substances exemplifying petroleum hydrocarbon fractions recognized by the *Total Petroleum Hydrocarbon Criteria Working Group* is provided in *Tech Support Appendices 1-3*, which are detailed *Toxicological Profiles* of selected petroleum hydrocarbons [toluene, naphthalene, and polycyclic aromatic hydrocarbons (PAHs)]. With respect to each selected substance, *Tech Support Appendices 1-3* address each of the subjects addressed below, but in more detail, and each profile provides complete citations of technical literature documenting the findings that are made.

Physical and Chemical Properties

PAHs typically are complex molecules principally formed by incomplete combustion or pyrolysis (heat breakdown in an oxygen-starved atmosphere) of organic compounds, such as paper, wood, or rubber. Atmospheric PAHs may be exemplified by naphthalene, phenanthrene, anthracene, fluoranthene, and pyrene, which are principally gases; and benz-a-anthracene, chrysene, benzo[ghi]perylene, and benzo-a-pyrene (BAP), which are predominately particulate. The *Total Petroleum Hydrocarbon Criteria Working Group* (TPH CWG) recommends characterizing petroleum hydrocarbon-containing environments in terms of discrete aliphatic and

aromatic petroleum hydrocarbon fractions rather than in terms of a single concentration number for complex petroleum hydrocarbon mixtures. According to TPH CWG:

"Identification and quantification of aliphatic and aromatic fractions allows one to identify petroleum products and evaluate the extent of product weathering. These fraction data also can be used in risk assessment. Together, the fractions represent the mass of petroleum used to evaluate non-cancer risk. Cancer risk is evaluated separately from the fractions, using concentration data for individual carcinogenic petroleum constituents (e.g., benzene and several PAHs)" (5, page 60).

Inasmuch as this HASP module is, most essentially, a risk-based document, it adopts the TPH CWG approach of using petroleum hydrocarbon fractions for risk assessment. The rationale for this is quoted directly from TPH CWG, Volume 2 (6):

"Risk-based analysis of petroleum contaminated soil is hampered by the lack of readily available data describing the composition of common petroleum products and crude oil. There is not one governmental agency, industry or group which compiles the data in a manner necessary to assess the risks posed by the hydrocarbon constituents. Composition data are rare for several reasons. Crude oil and its products are highly complex and variable mixtures. Consequently, constituent-specific chemical analysis of these mixtures is challenging. In addition, the data necessary for risk analysis are often much more detailed than that required by the petroleum industry for determining the performance characteristics of petroleum mixtures.

In the absence of these data, assumptions regarding composition are made which may be incorrect or misleading. Often assumptions are very

conservative and do not take into account the impacts of weathering. Once petroleum hydrocarbon mixtures are released into the environment, their composition changes due to processes such as biodegradation, dissolution in water and volatilization. Taken together these processes are termed weathering. Each is selective for specific hydrocarbon groups. Generally mixtures become less water-soluble and less volatile as they weather. These changes are functions of the rate at which the more soluble and volatile constituents leach or evaporate from soil...

To advance risk-based analysis of petroleum contaminated soils, a comprehensive search of the technical literature was performed to identify all available composition data for the most common petroleum-based fuels, crude oil and lubricating oils" (6, page 13).

TPH CWG conducted extensive literature and field research to derive representative fractions and the physical and chemical properties that best might characterize those fractions. TPH CWG's Table 8 summarizing key physical and chemical parameters describing the environmental dynamics of petroleum hydrocarbons is reproduced as an Exhibit on the following page. Note that the following definitions apply (also quoted from TPH CWG):

--BP	boiling point,
--EC	equivalent carbon number,
--MW	molecular weight,
--S	solubility (in water),
--VP	vapor pressure,
--H	Henry's Law constant, and
--log Koc	organic carbon partition coefficient.

Exhibit. TPH CWG Table 8:**Fraction-Specific Physical-Chemical Properties**

Fraction	BP (°C)	EC (...)	MW (g/mole)	S (mg/L)	VP (atm)	H^b (cm ³ /cm ³) ^b	log Koc (...)
aliphatics							
EC 5-6	5.1E+01	5.5E+00	8.1E+01	3.6E+01	3.5E-01	3.3E+01	2.9E+00
EC >6-8	9.6E+01	7.0E+00	1.0E+02	5.4E+00	6.3E-02	5.0E+01	3.6E+00
EC >8-10	1.5E+02	9.0E+00	1.3E+02	4.3E-01	6.3E-03	8.0E+01	4.5E+00
EC >10-12	2.0E+02	1.1E+01	1.6E+02	3.4E-02	6.3E-04	1.2E+02	5.4E+00
EC >12-16	2.6E+02	1.4E+01	2.0E+02	7.6E-04	4.8E-05	5.2E+02	6.7E+00
EC >16-21	3.2E+02	1.9E+01	2.7E+02	2.5E-06	1.1E-06	4.9E+03	8.8E+00
aromatics							
Benzene:							
(EC 5-7) ^a	8.0E+01	6.5E+00	7.8E+01	1.8E+03	1.3E-01	2.3E-01	1.9E+00
Toluene:							
(EC >7-8) ^a	1.1E+02	7.6E+00	9.2E+01	5.2E+02	3.8E-02	2.7E-01	2.4E+00
EC >8-10	1.5E+02	9.0E+00	1.2E+02	6.5E+01	6.3E-03	4.8E-01	3.2E+00
EC >10-12	2.0E+02	1.1E+01	1.3E+02	2.5E+01	6.3E-04	1.4E-01	3.4E+00
EC >12-16	2.6E+02	1.4E+01	1.5E+02	5.8E+00	4.8E-05	5.3E-02	3.7E+00
EC >16-21	3.2E+02	1.9E+01	1.9E+02	6.5E-01	1.1E-06	1.3E-02	4.2E+00
EC >21-35	3.4E+02	2.8E+01	2.4E+02	6.6E-03	4.4E-10	6.7E-04	5.1E+00

Notes:

a Actual values of benzene and toluene, not based on correlation.

b Calculated Henry's law constant based on vapor pressure, solubility, and molecular weight relationship.

Absorption, Distribution, Metabolism, and Excretion

Absorption, distribution, metabolism, and excretion comprise pharmacokinetics, which is the effect of the body on substances entering it. Petroleum hydrocarbon pharmacokinetics will be described in this HASP module via examples of petroleum hydrocarbon fractions defined by TPH CWG, including toluene, naphthalene, and PAHs. Further details on the pharmacokinetics of petroleum hydrocarbons as exemplified by these substances are provided in *Tech Support Appendices 1, 2, and 3*.

Toluene. Inhaled toluene is readily absorbed through both the upper and lower respiratory tract. Animal experiments suggest that, while gastrointestinal absorption of toluene may be slow relative to pulmonary absorption, it is, nonetheless, complete. Absorption of toluene vapor through the skin appears to be negligible. Liquid toluene has been reported to be absorbed through human skin slowly.

Following absorption, toluene, which is only slightly soluble in water, binds to plasma lipoproteins in the blood, and is then distributed rapidly throughout the body with the general circulation. Its pattern of distribution is similar following exposure via inhalation or ingestion. The highest concentrations occur in adipose (fat) tissue, bone marrow, kidneys, liver, and nervous tissue.

Toluene metabolism is mediated primarily by microsomal (liver) enzymes. Toluene is metabolized via three principal pathways, of which one yields hippuric acid and two yield cresol. The cresol pathways both involve formation of unstable intermediate arene oxides, which may be toxicologically significant insofar as these intermediates may bind with cellular macromolecules and thereby cause mutations and cancers. These pathways, however, otherwise account for a only relatively minor fraction of

total metabolism of toluene, which is regarded as being non-carcinogenic (see *Carcinogenicity* subsection).

The pattern of excretion of toluene and its metabolites by animals and humans is apparently not significantly affected by the exposure route from which toluene was initially absorbed. Some 20 percent of absorbed toluene is exhaled unchanged in expired air, whereas some 60-75 percent is eliminated as hippuric acid in the urine, and only a trace amount--some 0.06 percent--is excreted unchanged in the urine. Biliary excretion amounts to less than two percent, but such 'excretion' is not equivalent to elimination, inasmuch as a significant fraction thereof is reabsorbed from the intestine. The time course of toluene excretion suggests a three-compartment model, and most toluene inhaled or ingested by humans and absorbed is excreted within 12 hours following termination of exposure.

Naphthalene. Naphthalene is absorbed following inhalation and ingestion. This is known based upon reports of toxic effects arising from inhalation and from ingestion. Available data, however, preclude reliable estimation of the efficiency of its absorption following inhalation or ingestion. The efficiency with which naphthalene is absorbed following dermal exposure was reported to be 50 percent after a period of 2.1 hours.

Naphthalene was present in 40 percent of adipose (fat) tissue samples analyzed as part of the National Human Adipose Tissue Survey. The maximum concentration observed was 63 ng/g. Naphthalene was also detected in human milk (concentration not reported). Naphthalene also was reported to cross the human placenta in concentrations high enough to cause red cell hemolysis and lead to anemia in newborn infants of mothers who consumed naphthalene during pregnancy. Information about distribution of naphthalene in people following dermal absorption was unavailable.

Little information is available pertaining to naphthalene metabolism by humans. Naphthol (isomer unspecified) was found in the urine of patients four days after naphthalene ingestion; a smaller amount was detected one day later; and none was found in any specimens collected thereafter. In a different study, the urine of an 18-month-old child was found to contain 1-naphthol, 2-naphthol, 1,2-naphthoquinone, and 1,4-naphthoquinone, approximately nine days after exposure to naphthalene. The case appeared to involve ingestion, but the exposure route was not established conclusively. With the exception of the 1,4-naphthoquinone, these metabolites were still present on day 13 but absent on day 17.

According to ATSDR: "Little information is available pertaining to the excretion of inhaled naphthalene in humans. Individuals occupationally exposed to airborne naphthalene during distillation of naphthalene oil and at a coke plant exhibited peak levels of urinary 1-naphthol one hour after finishing a shift. Of three workers and a non-occupationally exposed group, naphthalene oil distribution plant workers had the highest concentrations of urinary 1-naphthol, with a mean excretion rate of 0.57% mg/hour. Investigators calculated the half-life for the urinary excretion of 1-naphthol as approximately four hours. Urinary excretion of metabolites appears to be prolonged following naphthalene ingestion. Information about excretion of naphthalene and/or its metabolites following dermal absorption was unavailable.

PAHs. PAHs tend to have low vapor pressure, so their absorption following inhalation typically would primarily involve particle-born PAHs. Absorption by all routes is likely to be significantly less efficient than 100 percent, especially with regard to such particle-born PAHs because of the tightness of their bonding to particles such as fly ash. Particle-born PAHs, therefore, may be to a large degree biologically unavailable. The efficiency of pulmonary absorption of inhaled PAHs depends upon particle size and deposition rate in the respiratory tract. In one study, only 15 percent of the benzo(a)pyrene (BAP) adsorbed to carrier particles was found to be

bioavailable. A reasonable assumption, therefore, is that either 100 percent of bioavailable particle-born PAHs may be absorbed via the lungs, or equivalently, that 15 percent of total particle-born PAHs may be absorbed. The high lipid (fat) solubility of PAHs facilitates their absorption via the intestinal tract and via the skin. The efficiency with which PAHs are absorbed following exposure via the ingestion route has been reported to equal >50 percent. Quantitative information about absorption efficiency following dermal contact was unavailable.

The principal tissues and organs to which PAHs are distributed following absorption have been reported to include fat, lungs, intestines, liver, and mammary glands. Metabolism of this large and diverse category of substances principally occurs in the liver by action of the microsomal mixed function oxidase system of enzymes, which includes the cytochrome P450 system. Metabolism produces a variety of intermediates, some of which are more toxic than the parent compounds. These intermediates are frequently metabolically activated to carcinogenic electrophilic epoxides. PAH metabolism specifically involves the P450 enzymes known as aryl hydrocarbon hydroxylases (AHH), whose increased synthesis in the liver may be induced by exposure to PAH, as well as epoxide hydrolases (EHs), which produce potentially carcinogenic vicinal glycols. PAHs may form conjugates with glutathione and glucuronic acid, as well as with proteins and nucleic acids, including both DNA and RNA.

PAH metabolism is dominated by the difficulty of opening saturated carbon bonds in the multiple PAH rings, which are relatively stable. However, enzymatic attack may alter PAH molecules to more soluble and excretable compounds, sequentially including formation of complex alcohols, ketones, aldehydes, and carboxylic acids. Metabolism also produces phenols and, following epoxide formation, dihydrodiols, which yield diol-epoxides via microsomal mono-oxygenase enzymes. Some protection of cellular macromolecules from the plethora of reactive intermediates attending PAH

metabolism is afforded by formation of excretable conjugates with glutathione and glucuronic acid, as well as tetrahydrotetrols.

Although differences among individual members of the diverse group of PAHs must be emphasized, generally the principal elimination routes are the bile and feces. When PAHs were administered intratracheally or injected subcutaneously or intravenously, the feces constituted the principal elimination pathway. Rapid elimination occurred initially (within ten minutes) following intravenous injection, but a slower phase ensued, lasting some six hours. Intragastric administration resulted in fecal elimination of 82 percent of the dose within 24 hours. When PAHs are absorbed from the lungs or through the skin they will not make a first-pass through the liver, which is the major metabolizing organ. Therefore, they do not undergo the types or degree of metabolic processing that biochemically prepares foreign (xenobiotic) substances for excretion. Rather, they would first arrive at potentially sensitive sites of action and binding within other organs, resulting in formation of new complexes exhibiting different clearance kinetics.

Acute Toxicity

Acute toxicity involves exposure for up to one day. Its evaluation for the complex mixture of petroleum hydrocarbons will be implemented in this HASP module via examples of petroleum hydrocarbon fractions defined by TPH CWG, including toluene, naphthalene, and PAHs. Further details on the acute toxicity of petroleum hydrocarbons as exemplified by these substances are provided in *Tech Support Appendices 1, 2, and 3*.

Toluene. Acute exposure to toluene may result in central nervous system (CNS) depression and membrane irritation. Sudden deaths due to toluene induction of cardiac arrhythmias have been reported in cases of toluene abuse (such as sniffing). In addition to CNS, membrane, and cardiac effects; effects upon the lungs, liver, and kidneys have been reported following acute inhalation exposures. In one study, the oral LD50 (dose that killed half of exposed animals) in rats was reported to be 7.0 g/kg. Further details on the acute toxicity of petroleum hydrocarbons as exemplified by toluene are provided in *Tech Support Appendix 1*.

Naphthalene. Inhalation. According to ATSDR: "*Two Greek infants died as a consequence of acute hemolysis that resulted from exposure to naphthalene-treated materials (clothing, diapers, blankets, rugs, etc.). Both infants exhibited a severe form of jaundice (kernicterus) which often causes brain damage.*" **Ingestion.** According to ATSDR: "Death has been documented in humans who intentionally ingested naphthalene. A 17-year-old male died 5 days after the ingestion of an unknown quantity of naphthalene mothballs. Death was preceded by vomiting, evidence of gastrointestinal bleeding, blood-tinged urine, and coma. A 30-year-old female died following similar sequelae five days after reporting that she had swallowed 40 mothballs (25 were recovered intact from the stomach upon autopsy). **Ocular Effects.** In two case studies occupationally exposed individuals experienced eye

irritation and conjunctivitis as a result of naphthalene exposure. In one case an individual accidentally got naphthalene powder in his left eye. In the second case, a man who worked in a storage area where naphthalene was used as a pesticide complained of ocular pain, conjunctivitis, and impaired vision. The subject most likely was exposed to naphthalene vapors. When examined by a doctor, the subject was found to have retinal bleeding and the beginning of a cataract. Further details on the acute toxicity of petroleum hydrocarbons as exemplified by naphthalene are provided in *Tech Support Appendix 2*.

PAHs. Acute toxic effects associated with most PAHs can occur in humans under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. However, acute poisonings with naphthalene in humans have occurred (see above), inasmuch as naphthalene is a commercially available substance. Direct contact with PAHs has elicited a dermatitis reaction characterized by symptoms of skin reddening, itching, and burning. PAHs have been shown to cause hyperkeratosis (overgrowth of the cornified layer of the skin), cytotoxicity, hyperplasia (excessive tissue growth), and loss of sebaceous glands in the skin. Further details on the acute toxicity of petroleum hydrocarbons as exemplified by PAHs are provided in *Tech Support Appendix 3*.

Cancer Causation

As indicated earlier, TPH CWG recommends against evaluating cancer risks potentially posed by petroleum hydrocarbons based upon fractions defined for non-cancer risk assessment. Accordingly, the RBCA-based HRA conducted in this HASP module assumes a cancer potency of zero for each defined hydrocarbon fraction. In reality, however, many petroleum hydrocarbons are carcinogenic, and some may be powerful human carcinogens. Benzene is a prime example, being associated with numerous human and animal cancers and with high potency at causing such cancers.

Many polycyclic aromatic hydrocarbons (PAHs) also are capable of producing tumors in skin and other epithelial tissues in numerous test species, following exposure via all routes. Benzo(a)pyrene (BAP) in particular has been extensively studied with regard to carcinogenicity in animals. In animal bioassays, BAP has produced tumor growth by all exposure routes in all or nearly all species tested. Tumors of the nasal cavity, larynx, trachea and pharynx have occurred in hamsters exposed to airborne concentrations of BAP as low as 9.5 mg/M³. Dermal application, as well as subcutaneous and intramuscular injection have resulted in local (contact site) tumor formation in mice, rats, guinea pigs, monkeys, and hamsters. BAP administered orally to mice has caused stomach tumors. The U. S. EPA has, accordingly, classified BAP in Group B₂ (probable human carcinogen) based upon multiple animal studies.

PAHs besides BAP have been extensively investigated to ascertain their carcinogenic potential and potency. The classical demonstration of PAH carcinogenicity in animals was made by skin-painting the compounds on mice. The most powerful PAH agents caused skin tumors following only a brief lag time. Potency of PAHs as carcinogens depends upon structure. Anthracene, which consists of three benzene rings in a straight line, has

been reported to exert no carcinogenic effects, whereas the angular arrangement of benzene rings of, for example, benz[a]anthracene produces weak carcinogenicity. Potency is further increased by addition of benzene rings in select positions, yielding such compounds as dibenz[a,h]anthracene and benzo[a]pyrene (BAP). Further potency is attained by methylation (adding a CH₃- group) at specific ring carbons, yielding such powerful carcinogens as 7, 12-dimethylbenz[a]anthracene (DMBA). In addition to skin-painting, exposure via inhalation and ingestion has yielded positive results in numerous carcinogenicity bioassays over many years.

PAHs have been associated with carcinogenicity to humans based upon epidemiological studies, mostly of occupationally exposed individuals. The numerous epidemiological investigations undertaken have established a firm association between cancer incidence and exposure to PAHs in soots, tars, and oils, among other substances, although not necessarily in pure compounds. For example, long-time coke plant employees have exhibited elevations of lung cancers, digestive tract cancers, and cancers of other sites, such as the pancreas and kidneys. The classical association between PAHs and human cancer was established by Percival Pott as early as 1775, when he noted elevations of scrotal cancers among chimney sweeps who experienced chronic occupational exposure to soot.

Chronic Toxicity

Chronic toxicity involves exposure for a period of months to years. Its evaluation for the complex mixture of petroleum hydrocarbons will be implemented in this HASP module via one of the petroleum hydrocarbon fractions defined by TPH CWG, specifically toluene, naphthalene, and PAHs. Further details on the chronic toxicity of petroleum hydrocarbons as exemplified by toluene, naphthalene, and PAHs are provided in *Tech Support Appendices 1, 2, and 3*. Toluene alone is represented in this main section because of the great detail in which its chronic toxic effects are known, and because the neurological effects of petroleum hydrocarbons generally are of primary concern with respect to toluene.

Dermal contact with toluene may cause skin damage because it removes skin oils. Individuals occupationally exposed to toluene in mixtures of solvents, of which toluene was generally the major component, reported problems with the skin of their hands. The specific symptoms associated with the reported skin abnormalities were not reported. Eye irritation in humans occupationally exposed to toluene vapors also has been reported.

Neurological effects following toluene inhalation. Occupational exposures to toluene at concentrations of 300 ppm have resulted in central nervous system (CNS) abnormalities. For example, female shoemakers exposed to toluene used as solvent exhibited abnormal tendon reflexes, reduced grasping power, and decreased finger agility. Car painters exhibited impaired concentration, reduced emotional reactivity, and reduced hand agility. Studies of habitual 'glue sniffers' abusing toluene-containing glues have exhibited symptoms consistent with those of occupationally exposed subjects. Associated neurological disorders have included cerebellar

degeneration, encephalopathy (brain degeneration), personality changes, slurred speech, clumsiness, and memory and concentration disturbances.

According to IRIS (4): "Toluene-induced neurotoxicity has been documented in humans over a broad spectrum of severity that correlates well with concentration. Numerous case studies on chronic toluene abusers [repeatedly exposed to greater than 30,000 ppm (113,000 mg/cu.m)] have demonstrated functional deficits of the CNS accompanied by abnormal morphology of cerebellar and cortical areas of the brain. Under acute exposure conditions [short exposures to greater than 10,000 ppm (37,690 mg/cu.m)], toluene produces CNS narcosis... Lower concentrations, i.e., 800-400 ppm (3015-1508 mg/cu.m), have been associated with worker complaints of CNS-related effects... Clinical studies using controlled exposure to toluene have demonstrated concentration-related occurrence of complaints such as drowsiness, ataxia, visual impairment, and headache. A number of occupational studies indicate that these same effects are present in exposed worker populations at concentrations lower than 400 ppm (1508 mg/cu.m) although deficiencies in most of these studies preclude confirming this finding unequivocally...

The preponderance of the literature showing CNS effects and the well-known proclivity for solvents to affect CNS processes in humans leave little doubt that the brain is a principal target organ for toluene toxicity in humans."

RBCA Risk Assessment

The RBCA risk assessment, implemented via ASTM's *RBCA Tool Kit* software package (1-3), was completed using as input data default assumptions described in the *Methods* section of this HASP module. Dose-response parameter values for petroleum hydrocarbons that might have been provided with the software were updated to confirm their currency. These values for petroleum hydrocarbons are reported in Table 3 (next page).

Input assumptions about the concentrations of petroleum hydrocarbons present in environmental media were selected arbitrarily, except that values were adjusted to produce output risks within maximum acceptable target risk levels selected as defaults within the software. Default values of acceptable risk benchmarks were one per million incremental cancer risk (one per hundred thousand for the construction worker scenario) and a hazard quotient of unity (one) for non-cancer effects. This means that petroleum hydrocarbon exposure levels were maintained below levels that would be expected to produce a clinically significant toxic effect, with an adequate margin of safety reflecting uncertainties and variability in susceptibility among people who might be exposed to petroleum hydrocarbons.

Results of the RBCA HRA are set forth in Table 4 (on the page after Table 3). They reveal that 1.0-mg/kg concentrations of petroleum hydrocarbons (in fractions exemplified by n-hexane, toluene, naphthalene, and PAHs) in surface and subsurface soils, and 1.0-mg/L concentrations in groundwater, produced cancer and non-cancer risks within the default values adopted as acceptable risk benchmarks. Note that Table 4 uses a scientific format for reporting numbers. This was necessary to express, within reasonable space, numbers spanning many orders of magnitude (powers of

10). To clarify, 1.0 mg/kg is expressed as 1.0 e+0 mg/kg in Table 4, where the e+0 means 10^0 , or 1.0. Accordingly, 1.0 e0 is 1.0 multiplied by 1.0, which remains 1.0. To avoid mixing formats, and to facilitate comparison of numbers with one another, all numbers were reported using this format, even though some numbers easily could have been expressed in a more familiar format.

Table 3. Dose-Response Parameters for Petroleum Hydrocarbons

petroleum hydrocarbon fraction, equivalent carbon range	example substance	cancer potency*			non-cancer potency**		
		inhalation slope factor		oral slope factor	inhalation risk reference concentration (RfC)	oral risk reference dose (RfD)	
		(risk per mg/M ³)	[risk per mg/(kg d)]		(mg/M ³)	[mg/(kg d)]	
C _{>7} - C ₈	toluene	0.00	0.00	0.00	0.40	0.11	0.20
C _{>8} - C ₁₆	naphthalene	0.00	0.00	0.00	0.20	0.06	0.04
C _{>16} - C ₃₅	pyrene	0.00	0.00	0.00	not applicable		0.03

*Cancer risks are estimated best based upon individual substances, because an assumed default composition of 'petroleum hydrocarbons' can result in their gross misestimation. Accordingly, cancer potencies of each petroleum hydrocarbon fraction are assumed here to be zero. When cancer risk is of potential concern, its analysis should be undertaken based upon site-specific sample analysis.

**Risk reference doses (RfDs) and risk reference concentrations (RfCs) pertain to the respective petroleum hydrocarbon fraction. The associated example substance might have different RfD and/or RfC values.

Table 4. Potential Health Risks Associated with Modeled Exposure Pathways

exposure pathways		conc. in source medium*	unit	health risk	
				cancer	non- cancer
air exposure pathways					
	--surface soil: inhalation of vapor and dust	1.0 e+0	mg/kg	0.0 e+0	1.6 e-4
	--subsurface soil: inhalation of vapor	1.0 e+0	mg/kg		
groundwater exposure pathways					
	source medium: groundwater	1.0 e+0	mg/L	0.0 e+0	8.6 e-1
	--soil leachiing to groundwater, ingestion	...	...		
	--groundwater, ingestion	...	...		
	--volatilization to outdoor air	...	...		
	--volatilization to indoor air	...	...		
soil exposure pathways					
	source medium: surface soil	1.0 e+0	mg/kg	0.0 e+0	8.2 e-4
	--leaching to groundwater	...	...		
	--ingestion, inhalation, dermal contact	...	...		
	--construction worker	...	...		
	source medium: subsurface soil	1.0 e+0	mg/kg		
	--leaching to groundwater	...	...		
	--ingestion, inhalation, dermal contact	...	...		
	site-specific target levels (SSTLs)		groundwater	surface soil	subsurface soil
			(mg/L)	(mg/kg)	(mg/kg)
	n-hexane		2.94 e-1	9.60 e-2	1.0 e-2
	naphthalene		2.94 e-1	9.60 e-2	1.0 e-2
	pyrene		2.94 e-1	6.60 e-1	1.0 e-2
	toluene		2.94 e-1	9.60 e-2	1.0 e-2
*Conc. in source medium: same for all substances: 1 mg/L in water, 1 mg/kg in surface and subsurface soils.					

CONCLUSIONS

Conclusions drawn based upon findings made in the *Findings* section above are, most generally, that petroleum hydrocarbons arose on the earth as products of the decay of prehistoric life. With the onset of the Industrial Revolution they became important as energy sources, including home heating with coal and, later, powering industrial machinery and eventually automobiles. These developments, and the emerging use by the chemical industry of petroleum hydrocarbons as feedstocks for the production of chemicals in commerce, such as plastics, together resulted in mining and extraction of petroleum hydrocarbons in coal seams, oil wells, and gas fields. Ultimately these activities have brought petroleum hydrocarbons (and products of their incomplete combustion) into intimate contact with the environment, including aerial, terrestrial, marine, and aquatic habitats. Most organisms, including humans, have had little time to evolve adaptations to such relatively new stressors in their environment (although some species of bacteria have evolved to require them).

Clearly, in these 'modern times', petroleum hydrocarbons often have entered occupational (and residential) environments at levels that can cause acute and/or chronic toxic effects. Environmental levels used as inputs to the RBCA HRA appear to be well within such toxic environmental levels, at least under the default scenario adopted by the ASTM *RBCA Tool Kit* software. Some assumptions (such as longer exposure time) can increase risks potentially posed by petroleum hydrocarbons, and other assumptions (such as wearing respiratory protection) can reduce those risks. The generic nature of this HASP module precludes resolution of this issue for specific workplaces, but the value of the HASP module is undiminished: it still allows the reader to understand better the dynamics of petroleum hydrocarbons in the environment, and to discern 'red flags' that should trigger concern. Such 'red flags' could include higher petroleum hydrocarbons concentrations than

those assumed in the RBCA HRA, or the applicability of significantly different exposure assumptions.

Individuals assigned to workplaces (such as fuel tank farms) at which petroleum hydrocarbons compounds are present at levels above natural background should be familiarized with this HASP module, and thereby enabled to manage effectively potential risks of exposure and health damage. As a final conclusion, this HASP module focuses on petroleum hydrocarbons in the context of occupational health and safety planning, but it is not a substitute for a HASP. This HASP module should be used in conjunction with a well-prepared HASP.

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TECH SUPPORT APPENDIX 1

Toxicological Profile:
TOLUENE
CAS No. 108-88-3

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Physical and Chemical Properties

Toluene (methyl benzene, formula $C_6H_5CH_3$) is a simple, single-ring organic compound of the type known as an aromatic hydrocarbon (4, 29):

It has been assigned CAS No. 108-88-3, and has a molecular weight of 92.13 daltons. Toluene exhibits a melting (freezing) point of $-95^{\circ}C$. At standard temperature and pressure (STP), toluene exists as a volatile, clear, colorless, flammable liquid having a density of 0.8669 (g/ml), measured at $20^{\circ}C$. At STP it exhibits a boiling point of $110.6^{\circ}C$. Toluene has been reported insoluble in water (29), but more recent investigation indicates that it is slightly soluble in water (23); its solubility has been reported to be 500 mg/L (4). The solubility of toluene is infinite in alcohols, ethers, and benzene, and slight in acetone (CH_3COCH_3 ; 29). In the absence of turbulent mixing, toluene which is undissolved in water floats on the surface, as indicated by the fact that its density is less than that of water (1.0 g/ml). Selected physical and chemical properties of toluene are set forth in Table 1.

Toluene is highly flammable, exhibiting lower to upper limits of flammability in air estimated at between 1.4 and 6.7 percent by volume (23). Its flashpoint is relatively low, at $4.4^{\circ}C$. The volatility of toluene is quantified by its vapor pressure which is 36.7 mm Hg at $30^{\circ}C$. Toluene vapors are 3.1 times as dense as air. In the absence of turbulent mixing, therefore, toluene may accumulate in the breathing zone within confined spaces into which it has been released. One ppm of toluene is equivalent to 3.77 mg/M³.

Toluene is commercially produced by the petrochemical industry. It is used in manufacturing dyes, saccharin, perfumes, caprolactam, pharmaceuticals, detergents, and trinitrotoluene (TNT; 11). It is also used as a solvent, and is a component of automobile and aviation fuel. Atmospheric concentrations of toluene have been repeatedly linked with automobile exhaust emissions. Toluene has also been identified in several surveys of raw and treated water in the U. S. usually at concentrations of lower than 1 μ g/L. Levels in surface waters have been reported to be generally less than 1 μ g/L, although higher concentrations have been detected, especially in groundwater samples.

Table 1. Selected Physical and Chemical Properties of Toluene

parameter	value	unit and/or note	source
Chemical Abstract Service (CAS) number	108-88-3	...	1, 6
color	colorless	...	6
refractive index	1.4961	at 20° C	8
physical state @ standard temperature, pressure	liquid	...	6
density of liquid, @ 4-20° C	0.8669	g/mL	8
formula	C ₆ H ₅ -CH ₃	...	1, 4, 6, 8
molecular weight	92.14	daltons	8
viscosity	0.590	cPascals @ 20° C	2, 8
melting/freezing point	-95 to -94.5	° C	6
boiling point	110.4	° C	6
latent heat of vaporization	155	BTU/lb	2
latent heat of vaporization	86.1	cal/g	2
latent heat of vaporization	3.61 E5	joules	2
evaporation rate	...	...	...
vapor pressure	22	torr @ 20° C	1
vapor pressure	36.7	torr @ 30° C	6
vapor density	3.14	air = 1	6
autoignition temperature	536	° C	6
flash point	4	° C, closed cup	6
flammability limits			
lower explosive limit (LEL)	1.27	percent	6
upper explosive limit (UEL)	7	percent	6
specific heat	...	...	...
heat of combustion	-17,430	BTU/lb	2
heat of combustion	-9,686	cal/g	2
heat of combustion	-405.5 E5	joules	2
heat of fusion	...	...	...
density/specific gravity	0.866	@ 20°/4° C	6
solubility in water	0.067	percent @ 23.5° C	4
solubility in absolute alcohol	miscible	...	4, 6, 8
solubility in ether	miscible	...	4, 6, 8
solubility in glacial acetic acid	miscible	...	4
solubility in carbon disulfide	miscible	...	4
solubility in acetone	soluble	...	4, 6, 8
solubility in chloroform	soluble/miscible	...	4, 6
solubility in benzene	soluble	...	8
dissociation constant (Ka)	...	...	...
Henry's Law constant	6.37 E-3	atm-cu M/mol	7
log of octanol/water partition coefficient (log Kow)	2.71	...	2, 7
organic carbon partition coefficient (Koc)	300	ml/g	7
odor	benzene-like	...	4
odor threshold in air	...	...	...
half-life in air (t1/2)	1.30	days	7
half-life in surface water (t1/2)	0.17	days	7
background air level(s)			
rural/remote: USA, 115 samples, range	0.057 to 30	ppb	2
rural/remote: USA, 115 samples, median	66	ppb	2
urban/suburban: USA, 3,195 samples, range	0 to 85	ppb	2
urban/suburban: USA, 3,195 samples, median	11	ppb	2
USA cities: range (mostly from automobiles)	0.8 to 37	ppb	2
USA cities: maximum (mostly from automobiles)	6.5 to 1,110	ppb	2
1. ACGIH. <i>Documentation of the Threshold Limit Values and Biological Exposure Indices</i>, 5th edition. Cincinnati, OH; American Conference of Governmental Industrial Hygienists, pp. 276-7, 1986; 2. HSDB. <i>Hazardous Substances Data Bank</i>, an on-line database. 3. IRIS. <i>Integrated Risk Information System</i>, an on-line database. 4. Merck. <i>The Merck Index</i>, 11th Edition. Rahway, NJ; Merck & Co.; 10,100 pp. plus appendices, 1989; 5. RTECS. <i>Registry of Toxic Effects of Chemical Substances</i>. On-line database, access date 12/12/93; 6. Sax, NI; and RJ Lewis, Sr. (Editors). <i>Dangerous Properties of Industrial Materials</i>, 7th Edition. New York City, Van Nostrand Reinhold, pp. 999-1,000, 1989; 7. US EPA. <i>Superfund Public Health Evaluation Manual</i>. Washington, DC, Office of Emergency and Remedial Response, EPA/540/1-86/060, OSWER Directive 9285.4-1, NTIS PB 87-183-125, 175 pp., October 1986. 8. Weast, RC; et al. (Editors). <i>Handbook of Chemistry and Physics</i>, 70th Ed. Boca Raton, Florida; CRC Press, i. p., 1989.			

Pharmacokinetics

Absorption

Inhalation. According to Anderson (1987; 4): *Toluene is readily absorbed through both the upper and lower respiratory tract (U. S. EPA 1983; [25]). Astrand (1975; [5]) found that alveolar and arterial concentrations reach a relatively constant value after 20 to 30 minutes in human subjects exposed to 375-750 mg/M3 of toluene. At the end of a thirty minute exposure to 375 mg/M3 of toluene, the concentration of toluene in the expired air was 18 percent of the inspired air concentration while the arterial concentration was 270 percent of the inspired air value. This corresponds to a blood/air partition coefficient of 15. Pulmonary uptake of toluene by human subjects under steady state conditions was determined to range from 40 to 60 percent (U. S. EPA, 1983 [25]; WHO, 1981 [30]). Initial uptake may be closer to 75 percent (Cohr and Stockholm, 1979 [10]; source document page 14).*

Ingestion. According to Anderson (1987; 4): *Data are unavailable on human gastrointestinal absorption of toluene (U. S. EPA, 1983 [25]). Experiments have been conducted on laboratory animals. The results of these experiments indicate that while gastrointestinal absorption of toluene may be slow relative to pulmonary absorption, it is, nonetheless, complete (U. S. EPA, 1983 [25], source document, pp. 15-16). Absorption of toluene bound to soil particles also occurs (6.5): "Binding to soil does not prevent absorption. The time course for absorption of toluene mixed with sandy soil or clay soil was increased when compared to the time course for pure toluene, but the total amount absorbed was the same based on the area under the blood toluene concentration curve (Turkall et al. 1991)."*

Dermal contact. According to Anderson (1987; 4): *In experiments with human subjects, Dutkiewicz and Tyras (cited in U. S. EPA, 1983; [25]) measured a flux of 14-20 mg/cm²/hr for liquid toluene across the skin of the human forearm. Absorption of toluene from aqueous solutions (180-600 mg/liter) ranged proportionally from 160 to 600 µg/cm²/hr when the subjects' hands were immersed in the solutions. The results of these experiments suggest that the relative absorption rates of toluene in aqueous solutions are higher than the absorption rate of the pure solvent. This interpretation, however, is inconsistent with other data which show a dose-related enhancement of skin permeability in response to concentrated toluene solutions (Barry, et al., 1985; [7]). Absorption of toluene vapor through the skin appears to be negligible (U. S. EPA, 1983 [25]; WHO, 1981 [30]; Barry, et al., 1985; [7]; source document, page 14).*

According to ATSDR (6.5): "Toluene is absorbed through human skin slowly (Dutkiewicz and Tyras 1968). The rate of absorption of toluene in

human forearm skin was found to range from 14 to 23 mg/cm²/hr. Exposure to toluene at concentrations of 0.005-0.5 mg/L in water while swimming or bathing would result in daily doses of 0.0001-0.036 mg/kg body weight (Brown et al. 1984). These estimated values were for adults and children, and also included the contribution of inadvertent toluene ingestion.

Soaking the skin of two volunteers with toluene for 5 minutes resulted in a maximum concentration of toluene in blood of 5.4 mmol/L (Aitio et al. 1984). Individual differences were marked, and dramatic changes in blood concentrations were observed over short periods of time. Similar individual differences and highly variable results were reported by Sato and Nakajima (1978) in a study using five volunteers."

Distribution

Following absorption, toluene--which is only slightly soluble in water (see discussion titled *Physical and Chemical Properties*, above)--binds to plasma lipoproteins in the blood, and is then rapidly distributed throughout the body with the general circulation (4, 10). Its pattern of distribution is similar following exposure via inhalation or ingestion (25). The highest concentrations occur in adipose (fat) tissue, bone marrow, kidneys, liver, and nervous tissue. Toluene exhibits relatively high tissue/blood partition coefficients in bone marrow and adipose tissue (25) and, accordingly, autoradiographical studies have revealed relatively long toluene retention in these tissues (4). Repeated occupational exposure to toluene at levels ranging from 130 to 1,325 mg/M³ over a five-day work week resulted in no accumulation of toluene in the blood of exposed employees (21). However, a weak trend of generally increasing toluene levels in blood of individuals occupationally exposed to air levels of toluene ranging from 750 to 1,125 mg/M³ was discernible despite great variability (15).

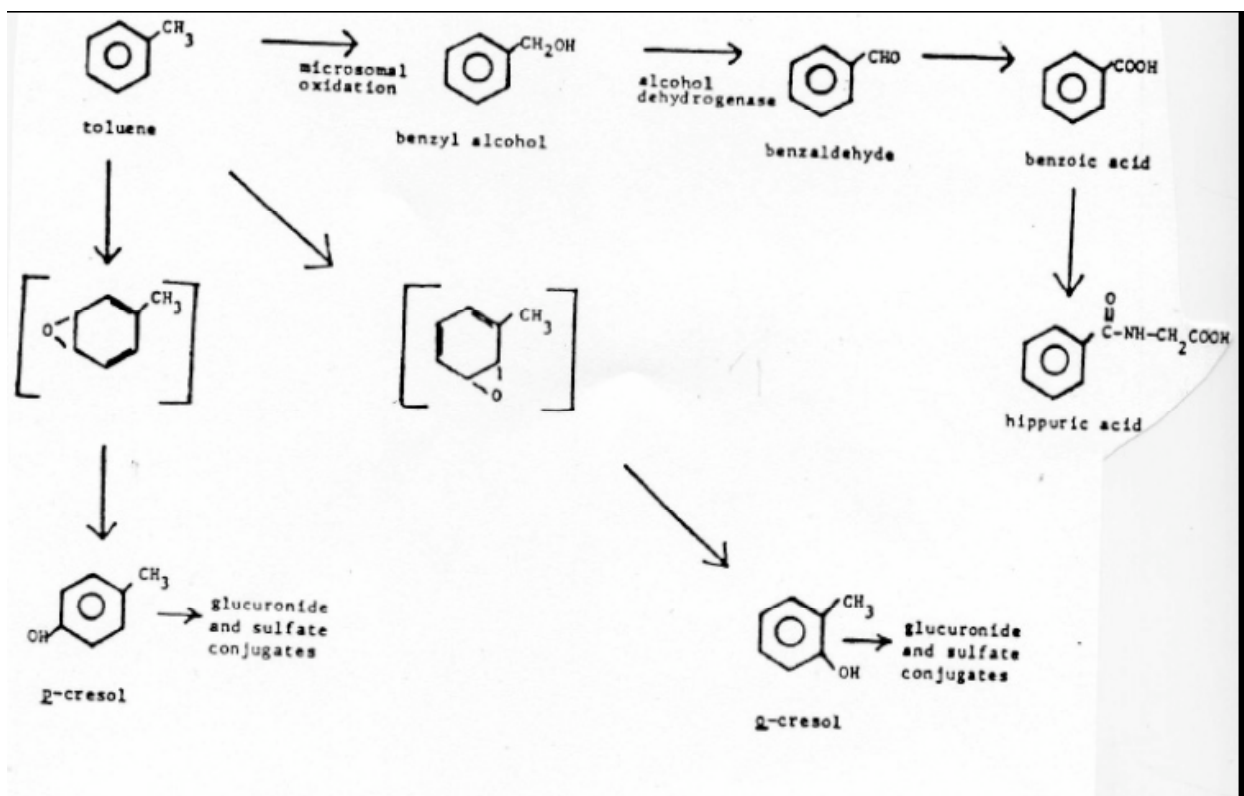
Metabolism

Toluene metabolism is primarily mediated by microsomal enzymes in the liver (4, 18, 24, 25). Toluene is metabolized via three principal pathways, of which one yields hippuric acid and two yield cresol (Fig. 1). The cresol pathways both involve formation of unstable intermediate arene oxides, which may be toxicologically significant insofar as these intermediates may bind with cellular macromolecules and thereby cause mutations and cancers. These pathways, however, otherwise account for a only relatively minor fraction of total metabolism of toluene (31), which is regarded as being non-carcinogenic (see *Carcinogenicity* subsection).

The major, hippuric acid pathway of toluene metabolism begins with oxidation of toluene to benzoic acid, and is followed by conjugation of the benzoic acid with the amino acid glycine, forming hippuric acid (4, 18, 24, 25). The rate-limiting step appears normally to be the oxidation to benzoic acid (22), although conjugation may be rate-limiting under conditions of glycine deficiency (4, citing Riihimaki, 1979; full citation not given). Saturation of the glycine conjugation pathway may activate an alternative conjugation pathway, namely glucuronide conjugation with benzoic acid (30), although this pathway is otherwise minor owing to the lower affinity of its enzymes (presumably for benzoic acid; 1).

Identification of the rate-limiting step in toluene metabolism has attained a (surprising) degree of importance, inasmuch as the efficiency of metabolic clearance of toluene under chronic environmental exposure conditions appears to depend upon it (4). N. T. Anderson (4) has drawn upon theoretical arguments evinced by M. E. Anderson (2, 3) and Astrand (6), as well as empirical data evinced by M. E. Anderson (2), Ogata (20), Pyykko (22), and Clayson, *et al.* (9) to show that the amount of toluene processed via the hippuric acid pathway is proportional to the concentration of toluene in ambient air. This is equivalent to flow limitation of metabolic clearance of toluene, as distinguished from capacity limitation. Under the flow limitation assumption, some 30 percent of absorbed toluene is metabolically cleared, and 70 percent is retained (4). Details of the pathways described above are depicted in Figure 1, which was copied from N. T. Anderson (4; original source, NRC; 18).

Figure 1. Toluene Metabolism in Humans and Animals*



*copied from:

Anderson, N. T. *Risk Assessment Document for Toluene. Final Report.* Augusta, State of Maine Bureau of Health, 57 pp., January 1987;

original source:

NRC. *The Alkyl Benzenes.* Washington, DC, National Research Council, National Academy of Sciences Press, 1981.

Excretion

The pattern of excretion of toluene and its metabolites by animals and humans is apparently not significantly affected by the exposure route from which toluene was initially absorbed (4, 25). Some 20 percent of absorbed toluene is exhaled unchanged in expired air, whereas some 60-75 percent is eliminated as hippuric acid in the urine (25), and only a trace amount--some 0.06 percent--is excreted unchanged in the urine (30). Biliary excretion amounts to less than two percent, but such 'excretion' is not equivalent to elimination, inasmuch as a significant fraction thereof is reabsorbed from the intestine (12). The time course of toluene excretion suggests a three-compartment model, and most toluene inhaled or ingested by humans and absorbed is excreted within 12 hours following termination of exposure (20).

Pharmacodynamics

Acute Toxicity

Acute exposure to toluene may result in central nervous system (CNS) depression and membrane irritation. Sudden deaths due to toluene induction of cardiac arrhythmias have been reported in cases of toluene abuse (such as sniffing; 11). In addition to CNS, membrane, and cardiac effects; effects upon the lungs, liver, and kidneys have been reported following acute inhalation exposures (14). In one study, the oral LD50 in rats was reported to equal 7.0 g/kg (11). Toluene acute inhalation toxicity reports are summarized in Table 2.

Mutagenicity

Chromosomal studies of individuals occupationally exposed to toluene have yielded equivocal results regarding its mutagenicity. In one study, individuals exposed for up to 15 years exhibited no statistically significant elevation in lymphocyte chromosomal aberrations. In contrast, a study of occupationally exposed individuals in chemical laboratories and in a rototyping factory revealed a significant elevation in the frequency of abnormal lymphocytes and chromosome breaks (11). Given limitations of these studies, however, ATSDR (6.5) concluded that: "[b]ased on the available in vivo data, studies of humans are inconclusive with regard to the genotoxicity of toluene. An in vivo rodent study indicated that toluene exposure does not cause dominant lethal effects in sperm."

Table 2. Toluene Acute Inhalation Toxicity Reports*

species	study type	dose	duration	dose x duration	effect	source
...	...	(mg/M ³)	(min)	(mg min/M ³)	...	...
lethality						
rat	LC50	49,000	240	11,760,000	Details not reported	Gig Tr Prof Zabol, vol 32(10), pg 23, 1988
mouse	LC50	1,507	1,440	2,170,425	Details not reported	Neurotoxicology, vol 2, pg 567, 1981
rabbit	LCLO	207,245	40	8,289,816	Details not reported	J Ind Hyg Toxicol, vol 26, pg 69, 1944
4-h lethality benchm		24,829	240	5,958,894	based upon geometric mean of dose x time	
guinea pig	LCLO	6,029	...	...	BEHAVIORAL (General anesthetic; Somnolence; Irritability)	J Ind Hyg, vol 10, pg 261, 1928
mammal	LC50	30,000	...	...	Details not reported	Gig Tr Prof Zabol, vol 32(10), pg 25, 1988
non-lethal effects						
human	TCLO	377	...	...	BEHAVIORAL (Hallucinations, distorted perceptions; Change in motor activity; Change in psycho-physiological tests)	Work Environ Health, vol 9, pg 131, 1972
human	TCLO	754	...	...	BRAIN AND COVERINGS (Recordings from specific areas of CNS)	JAMA, 123:1106, 1943
human	TCLO	754	...	...	BEHAVIORAL (Antipsychotic)	JAMA, 123:1106, 1943
human	TCLO	754	...	...	BLOOD (Changes in bone marrow not included in above)	JAMA, 123:1106, 1943
*RTECS. Registry of Toxic Effects of Chemical Substances. Access date 1997/10/17. **Dose x time relationship (Haber's rule) is approximate, as is use of the geometric mean to determine a single lethality benchmark. Therefore, the lethality benchmark is also only approximate. Further, greater accuracy might be achieved in two ways: 1. by determining human equivalent concentrations (HECs) for each non-human species, if known, and 2. differentiating between LC_{LO} and LC₅₀ studies, if possible.						

Carcinogenicity

No significant increases in tumor incidence was found in a two-year inhalation study of 120 rats exposed to 0, 30, 100, or 300 ppm of toluene for six hours per day, five days per week. Likewise, toluene applied to the skin of mice three times per week over their entire lifetime produced no carcinogenic effects (11). Based upon the inadequacy of evidence derived from animal bioassays and the absence of epidemiological data, the U. S. EPA's Carcinogen Assessment Group (CAG) has designated toluene in Group D (not classifiable as to human carcinogenicity; 14).

Despite the generally negative findings regarding toluene carcinogenicity, it is important to note that positive results have been reported by Maltoni, *et al.* (16, 17). These investigators, though primarily investigating benzene carcinogenicity, also reported probable carcinogenic potency of toluene administered by stomach tube to Sprague-Dawley rats. Experimental methods were reported in detail in Maltoni, *et al.* (16). The results indicate that rats administered toluene at a level of 500 mg/kg d exhibited hemolymphoreticular neoplasias occurring with an incidence of 8.1 percent in males (3 of 37 animals) and 17.5 percent in females (7 of 40 animals), compared with rates of 6.7 and 2.0 percent, respectively, among controls. A statistical analysis of these data were not presented, and the findings may be most appropriately regarded as being cautionary rather than definitive, pending further investigation.

Teratogenicity

Several investigations have revealed toluene induction of teratogenic effects. Increased embryo mortality was evident in pregnant mice administered toluene via gavage on days 6-15 of gestation at doses of 0.3, 0.5 or 1.0 mL/kg (0.26, 0.43, or 0.87 mg/kg; 11). Decreased fetal weight was also noted among mice administered 0.5 mL/kg and 1.0 mL/kg, and a significantly increased incidence of cleft palate was found at the highest dose (11). Other results have been summarized by N. T. Anderson (4). For example, Anderson's description of one study follows:

Hudak and Ungvary (1978) exposed rats and mice to toluene during various stages of gestation..... They found no increases in skeletal malformations in the fetuses when pregnant rats were exposed to 1,000 mg/M3 and 1,500 mg/M3 of toluene or when pregnant mice were exposed to 500 mg/M3 of toluene. They did observe, however, a significant increase in skeletal anomalies (fused sternbrae, extra ribs) in rats exposed continuously to 1,500 mg/M3 of toluene during days 9-

14 of gestation. two of the twenty-one rats in this exposure group died. In the surviving mothers, however, body weight gain, fetal loss and the mean fetal and placental weights did not differ from controls. Skeletal retardation signs (poorly ossified vertebrae, bipartite vertebra centra, and shortened 13th ribs) were significantly increased over controls in the fetuses of ten rats exposed to 1,000 mg/M3 of toluene, 8 hours per day, for days 1 through 21 of pregnancy. An increased number of eight retarded fetuses was also noted. This exposure regimen produced no overt signs of maternal toxicity. Low fetal weights were observed in the offspring of rats exposed continuously to 1,500 mg/M3 of toluene during days 1-8 of pregnancy and of mice exposed continuously to 500 mg/M3 of toluene during days 6-13 of pregnancy (source document, page 30).

Reproductive Effects

Inhalation. According to ATSDR (6.5): "[d]ata are available on the reproductive effects of toluene following inhalation exposure. For the most part, these effects have been associated with an increased incidence of spontaneous abortions among 55 women occupationally exposed to an average of 88 ppm toluene (Ng et al. 1992b). The authors reported that almost all the women were of the same socioeconomic status, were nonsmokers, and did not drink, thereby limiting some of the possible confounding variables that could have influenced the results. The incidence of spontaneous abortions exceeded population norms among five female workers (Lindbohm et al. 1992) and among the wives of 28 or 48 male workers (Lindbohm et al. 1992; Taskinen et al. 1989) exposed to toluene; however, exposure levels were not reported. These studies are further limited because of the small number of cases evaluated, the failure to account for confounding factors (smoking, alcohol consumption) and the large number of confounding variables.

When 231 female production workers were exposed to 25-150 ppm (mean of 88 ppm) toluene, there were no cycle irregularities and the extent of uterine bleeding and occurrence of dysmenorrhea were comparable to control females (Ng et al. 1992a). Testicular atrophy was observed in one case involving chronic solvent abuse (Suzuki et al. 1983). Because only one individual was examined, no conclusions can be derived from this study.

Changes in gonadotropic hormone levels have been associated with toluene exposure. Exposure to increasing concentrations of toluene (8 - <111 ppm) was associated with decreased plasma levels of the luteinizing hormone, follicular stimulating hormone and testosterone levels in 20 or 47 males occupationally exposed to toluene (Svensson et al. 1992a, 1992b). It is not clear how changes of this sort would affect reproductive success. Interpretation of these data is complicated by the lack of data on male

reproductive function and the absence of effects on menstrual functions in females (Ng et al. 1992b). It is generally considered that effects of this sort may be the result of effects of toluene on the catecholamine hormones of the hypothalamus or a consequence of toluene or a metabolite having a dopamine-like activity. Thus, it appears that any potential toluene-induced hormonal effects on reproductive success which may occur would be secondary to effects on the central nervous system... The effects of toluene on reproductive performance have also been evaluated in animals, but adverse effects have not been detected...."

Ingestion. According to ATSDR (6.5): "[n]o studies were located regarding reproductive effects in humans after oral exposure to toluene. There was no effect on the number of mice producing viable litters following oral administration of 2,350 mg/kg on gestational days 7-14 (Smith 1983)."

Other Chronic Effects

Hematological. In a two-year study of rats exposed to toluene at 30, 100, or 300 ppm, a dose-related reduction in hematocrit values (packed cell volume) was observed in females, but not in males (14). According to ATSDR (6.5): "No studies were located regarding hematological effects in humans after oral exposure to toluene. There were no changes in total erythrocytes in male mice administered 5-105 mg/kg/day toluene in their drinking water for 28 days, although there was a nonsignificant decrease in the concentrations of leukocytes, lymphocytes, and neutrophils (Hsieh et al. 1989). Neither rats nor mice given doses of 0-2,500 mg/kg/day for 13 weeks displayed any compound-related differences in hematological parameters (NTP 1990b)."

Renal. Rodents exposed to toluene at 12,000 ppm in three-hour cycles five times per week for eight weeks exhibited no kidney damage (11). According to ATSDR (6.5): "Data in humans are limited to one case report noting acute tubular necrosis after exposure to 625 mg/kg. This dose was also lethal (Ameno et al. 1989). There were no changes in kidney weight for male mice administered doses from 5 to 105 mg/kg/day in drinking water for 28 days (Hsieh et al. 1989), or in female mice given doses of 312-2,500 mg/kg/day by gavage for 13 weeks (NTP 1990b). There was a significant decrease in the absolute kidney weight for male mice administered 2,500 mg/kg/day for 13 weeks but no change in the relative kidney weight

(NTP 1990b). There were significant increases in the relative kidney weights in male rats administered toluene doses of 625 mg/kg/day or greater by gavage for 13 weeks and in females administered doses of 1,250

mg/kg/day or greater (NTP 1990b). In addition, lethal exposures of the rats to 5,000 mg/kg/day resulted in hemorrhages of the urinary bladder."

Dermal. "In humans, dermal contact with toluene may cause skin damage because it removes skin oils (EPA 1983a). Workers exposed to mixtures of solvents, of which toluene was generally the major component, reported problems with the skin of their hands (Winchester and Madjar 1986). The specific symptoms associated with the reported skin abnormalities were not reported. Eye irritation in humans occupationally exposed to toluene vapors has also been reported (Meulenbult et al. 1990).

Repeated application of undiluted toluene to the rabbit ear or shaved skin produced slight to moderate irritation (Wolf et al. 1956). In guinea pigs, continuous contact with toluene resulted in karyopyknosis, karyolysis, spongiosis, and cellular infiltration of the dermis (Kronevi et al. 1979). These data suggest that toluene is slightly to moderately irritating to the skin.

Slight irritation of the conjunctival membranes, but no corneal injury, was observed in rabbit eyes following direct application of toluene (Hazleton Laboratories 1962). Moderately severe injury to the eyes of rabbits following direct application of toluene has also been reported (Carpenter and Smyth 1946). These data suggest that toluene is slightly to moderately irritating to the eyes" (6.5).

Respiratory. Inhalation. Rodents exposed to toluene at 12,000 ppm in three-hour cycles five times per week for eight weeks exhibited no lung damage (11). "In humans, respiratory tract irritation is the only observed effect of chronically inhaled toluene. In an intermediate-duration study of rats, irritation was observed at moderate doses of toluene and pulmonary lesions were observed at high doses. In a chronic study in rats exposed at moderate concentrations (600-1,200 ppm), inflammation and degeneration of the nasal and respiratory epithelium were reported. However, no respiratory effects were observed in other studies of rats and mice exposed to lower concentrations (300 ppm)...

Rats exposed to 600 ppm of toluene for 5 weeks (7 hours/day) had irritated tissue in the upper airway and rats exposed to 2,500 and 5,000 ppm had pulmonary lesions (von Oettingen et al. 1942). No signs of respiratory distress or histological abnormalities were observed in the lungs of rats or mice exposed to 4,000 ppm (3 hours/day) of toluene for 8 weeks or 12,000 ppm for 7, 10 minute periods per day separated by 20 minute recovery period (Bruckner and Peterson 1981b). The different results reported by von Oettingen et al. (1942) and Bruckner and Peterson (1981b) may be explained by differences in the daily exposure duration with the shorter duration causing the less severe effects. Significantly increased relative lung weights were reported in rats exposed to 2,500 and 3,000 ppm for 15 weeks (NTP 1990b).

Exposures lasted for 6.5 hours each day and were conducted 5 days/week. Irritation of respiratory tissue was not noted.

Inflammation of the nasal mucosa, erosion and metaplasia of the olfactory epithelium, and degeneration of the respiratory epithelium were reported in rats exposed to toluene at 600-1,200 ppm for 2 years (6.5 hours/day, 5 days/week) (NTP 1990b). These effects were not observed in mice with exposure to the same concentrations. In rats exposed chronically (24 months) to lower doses of toluene (300 ppm), no histopathological lung lesions attributable to toluene exposure were observed (CIIT 1980)" (6.5).

Ingestion. "Except for lung congestion and hemorrhage in one case report involving lethality (Ameno et al. 1989), no studies were located regarding respiratory effects in humans after oral exposure to toluene. No respiratory effects were reported in mice or rats after oral exposure to toluene at dosage levels up to 2,500 mg/kg/day for 13 weeks (NTP 1990b)" (6.5).

Neurological effects following inhalation. Occupational exposures to toluene at concentrations of 300 ppm have resulted in CNS abnormalities (11). For example, female shoemakers exposed to toluene used as solvent exhibited abnormal tendon reflexes, reduced grasping power, and decreased finger agility. Car painters exhibited impaired concentration, reduced emotional reactivity, and reduced hand agility. Studies of habitual 'glue sniffers' abusing toluene-containing glues have revealed symptoms consistent with those of occupationally exposed subjects and experimental animals. Associated neurological disorders have included cerebellar degeneration, encephalopathy (brain degeneration), personality changes, slurred speech, clumsiness, and memory and concentration disturbances.

According to IRIS (14): "Toluene-induced neurotoxicity has been documented in humans over a broad spectrum of severity that correlates well with concentration. Numerous case studies on chronic toluene abusers [repeatedly exposed to greater than 30,000 ppm (113,000 mg/cu.m)] have demonstrated functional deficits of the CNS accompanied by abnormal morphology of cerebellar and cortical areas of the brain. Under acute exposure conditions [short exposures to greater than 10,000 ppm (37,690 mg/cu.m)], toluene produces CNS narcosis [American Conference of Governmental Industrial Hygienists (ACGIH), 1991]. Lower concentrations, i.e., 800-400 ppm (3015-1508 mg/cu.m), have been associated with worker complaints of CNS-related effects (ACGIH, 1991). Clinical studies using controlled exposure to toluene have demonstrated concentration-related occurrence of complaints such as drowsiness, ataxia, visual impairment, and headache. A number of occupational studies indicate that these same effects are present in exposed worker populations at concentrations lower than 400 ppm (1508 mg/cu.m) although deficiencies in most of these studies preclude confirming this finding unequivocally. Descriptions of a number of these studies follow.

The preponderance of the literature showing CNS effects and the well-known proclivity for solvents to affect CNS processes in humans leave little doubt that the brain is a principal target organ for toluene toxicity in humans."

According to ATSDR (6.5): "Dysfunction of the central nervous system is the primary human health concern following inhalation exposure to toluene. The major effects in humans following acute exposure to high concentrations of toluene (typical of glue sniffing, solvent abuse, or industrial accidents) are central nervous system dysfunction and narcosis. At the low to moderate concentrations found in occupational settings, impaired cognitive, auditory, and neuromuscular function are observed. In well-conducted animal studies, toluene causes subtle behavioral effects, ototoxicity, alterations in brain neurochemistry, and electrophysiological effects.

Experimental studies in volunteers show that acute exposure to low concentrations of toluene results in few, if any, observable effects. For example, exposure to 40 ppm of toluene for 6 hours did not produce statistically significant differences in the results of tests measuring nasal mucus flow, lung function, psychometric performance, and subjective evaluations of air quality and well-being when compared to controls (Andersen et al. 1983). On the other hand, 6-6.5-hour exposures to 100 ppm toluene caused fatigue, sleepiness, headaches, nausea, decreased manual dexterity, decreased color discrimination, decreased accuracy in visual perception, and decreased accuracy in multiplication tests (Andersson et al. 1983; Baelum et al. 1985). An acute inhalation MRL of 3 ppm was calculated as described in the footnote in Table 2-1 based on the LOAEL (100 ppm) from the study by Baelum et al. 1985.

Exposure of students to 75 or 150 ppm toluene for 7 hours caused a dose-related impairment of function on digit span, pattern recognition, the one hole test, and pattern memory (Echeverria et al. 1991). There was an effect on the results of the symbol digit test but the effect was not dose related. Subjects served as their own controls. The differences between the exposed and control groups were smaller than the differences between subjects within the same exposure group. There were no differences in the results on simple reaction time, POMS mood scale, visual memory, hand-eye coordination, Sternberg test, finger tapping, reaction time, continuous performance test, and critical tracking test. These data provide support for the MRL.

At moderate concentrations (200-800 ppm), toluene exposures initially resulted in excitatory effects such as exhilaration and lightheadedness. These effects were followed by the development of narcosis, characterized by impaired intellectual, psychomotor, and

neuromuscular effects with increased duration of exposure (EPA 1985c; von Oettingen et al. 1942).

Humans exposed to high levels of toluene as a result of solvent abuse or industrial accidents displayed serious central nervous system dysfunction. In some cases, the degree of central nervous system depression was sufficient to result in death. Prolonged abuse has been reported to cause permanent damage resulting in abnormal electroencephalogram (EEG) activity, ataxia, tremors, temporal lobe epilepsy, paranoid psychosis, hallucinations, nystagmus (involuntary eye movement), cerebral atrophy, and impaired speech, hearing, and vision (Abbate et al. 1993; Byrne et al. 1991; Devathanan et al. 1984; King et al. 1981; Maas et al. 1991; Meulenbelt et al. 1990; Suzuki et al. 1983). In two hospitalized patients with a history of solvent abuse, there was a decrease in intelligence quotient when the results of tests administered before solvent abuse began were compared to those measured during hospitalization for long-term abuse (Byrne et al. 1991).

Magnetic resonance imaging (MRI) and brainstem auditory evoked response (BAER) evaluations of the brains of chronic toluene abusers indicate that there were permanent changes in brain structure which correlated with the degree of brain dysfunction. Results from MRI tests reveal an increase in the white matter signal and a loss of gray and white matter differentiation in the brains of neuropsychologically impaired toluene abusers (Filley et al. 1990; Ikeda and Tsukagoshi 1990; Rosenberg et al. 1988a). Cerebral, cerebellar, and brainstem atrophy were also present (Rosenberg et al. 1988b). In two separate studies, independent analysis of MRI results correctly identified 8 of 9 patients who had been classified as severely dysfunctional among a group of 25 solvent abusers. Eleven of the 25 patients were also evaluated with the BAER test. Three of the four severely dysfunctional patients had abnormal BAER results. Two patients with abnormal BAER test results had not been classified as neurologically impaired (Rosenberg et al. 1988b). The abnormalities in MRI and BAER results were present even though the subjects had refrained from toluene exposure for 2-9 months. These results suggest that some of the neurological symptoms associated with toluene abuse may be the result of permanent structural changes in the brain.

A group of 95-104 workers exposed to TWA of 41-46 ppm toluene during shoemaking, printing, and audio equipment production were evaluated for symptoms and signs of exposure when compared to 130 control subjects. The incidence of health-related complaints among the toluene exposed workers was two to three times that of the controls. Dizziness was reported by about two-thirds of the toluene exposed respondents. These subjects also complained of headaches, sore throats, eye irritation, and difficulty with sleep. When the exposed subjects were divided into two groups, one with TWA exposures of less than 40 ppm and the other with exposures greater than or equal to 40 ppm, the incidence of

headache and sore throat, but not dizziness, showed a dose-response pattern (Yin et al. 1987).

A group of 30 rotogravure printers with 4-43 years of experience completed a questionnaire designed to record their neurasthenic complaints and were given a series of tests designed to evaluate psychometric function (Orbaek and Nise 1989). The cohort was divided into 3 groups of 72 controls, 19 workers exposed to TWA toluene levels of 11.6 ppm, and 11 workers exposed to 42.4 ppm. There was a negative correlation between the complaints and the performance on the tests of psychometric function; spatial test results were positively correlated with blood toluene levels. The results from this study were used to derive a chronic-duration MRL of 1 ppm as described in the footnote to Table 2-1. A stronger correlation between neurobehavioral test results and toluene exposure was seen in 30 female workers exposed to 88 ppm toluene as compared to 30 workers in the same facility exposed to only 13 ppm (Foo et al. 1990). The higher exposure group received poorer test scores in tests of visual retention, visual reproduction, trail making, grooved peg board, digit span, and digit symbol, but not on tests of simple reaction time and finger tapping.

Low level occupational exposure to 97 ppm for 12-14 years toluene had an apparent effect on hearing in 40 rotogravure workers when brainstem auditory evoked potential (BAEP) results were compared to a group of 40 workers who were of comparable age but were not exposed to toluene (Abbate et al. 1993). Workers were carefully screened to eliminate even slight hearing abnormalities or exposure to other chemicals. Two series of stimuli were used, one with 11 repetitions/second and one with 90 repetitions/second. In both cases the intensity was 80 dB/nHL. Mean latencies were significantly higher for the exposed group than the control group for each BAEP wave evaluated (I, III, and V). Discernment mean values for the exposed and control groups were distributed homogeneously with very little overlap of exposed and control responses for both the 11 repetition and 90 repetition cycles. Wave I showed the most pronounced increase in latency. According to the authors, the effects on Wave I could be due to either a change in the membrane of the peripheral receptor, a modification of the structure of the junction, or a change in the stimulus transduction mechanism.

Chronic exposure to mixtures of solvents containing predominantly toluene may cause impaired performance on psychometric, motor, and muscular function tests. Iregren (1986) studied 26 painters exposed for 1-35 years to toluene and other chemicals. In a battery of tests administered after experimental exposure of painters to 80 ppm of toluene in a controlled environment, the performance of the painters was similar to that of the nonexposed controls. However, in another study, 100 painters exposed to toluene and other solvents for 1-40 years had poorer performance on the block design of visual cognitive ability (Hanninen et al. 1976). An analysis of subgroups showed that alcohol consumption did not influence the results. In

both cases subjects had been exposed to a variety of solvents, thus limiting the conclusions that can be drawn from the results."

One of two principle studies (13) forms the basis for derivation of a U. S. EPA chronic inhalation risk reference concentration for toluene is described in IRIS (14) as follows: "Foo *et al.* (1990) conducted a cross-sectional study involving 30 exposed female workers employed at an electronic assembly plant where toluene was emitted from glue. Toluene levels reported in the study were from personal sample monitoring and reported as an 8-hour TWA, although the number of samples taken and the actual sampling period were not given. No historical exposure values were given. Co-exposure to other solvents was not addressed in the study. The exposed and control cohorts were matched for age, ethnicity, and use of medications. Members of these cohorts did not use alcohol and were nonsmokers. Medical histories were taken to eliminate any histories of central or peripheral nervous system disorders. The average number of years (+/- SD) worked by the exposed population was 5.7 +/- 3.2 and by the controls was 2.5 +/- 2.7. Exposed workers breathed toluene air levels of 88 ppm (332 mg/cu.m) as a TWA and control workers 13 ppm (49 mg/cu.m) (TWA); both of which are averages of the individual personal samples. A battery of eight neurobehavioral tests were administered to all exposed and control workers. The tests were performed midweek, before the workers reported to their stations for the day. Group means revealed statistically significant differences in 6/8 tests; all tests showed that the exposed workers performed poorly compared with the control cohort. When individual test results were linearly regressed against personal exposure concentrations, poor concentration-response relationships resulted for the six tests, with correlation coefficients ranging from 0.44 to 0.30. Irritation effects were not evaluated in this study, and no clinical signs or symptoms were reported. The paucity of exposure information, coupled with the small size of the cohort, limits the interpretation of this study, although the results were essentially confirmed in a clinical study in which the toluene concentrations were carefully controlled (Echeverria *et al.*, 1989) at levels bracketing 88 ppm. Although the data in Echeverria *et al.* (1989) were generated from short-term exposures (3-7 hours over a period of 142 days), the results may be considered relevant to longer-term exposures as several studies indicate the absence of a duration-response relationship in toluene-induced symptomatology. Fornazzari *et al.* (1983) noted the absence of a duration-effect relationship among toluene abusers when they were segregated into neurologically impaired vs. unimpaired ($p = 0.65$). The human studies of Iregren (1982), Cherry *et al.* (1985), Baelum *et al.* (1985), and the principal study of Foo *et al.* (1990) all report this lack of a duration-response relationship and confirm the occurrence of CNS effects. Foo *et al.* (1990) indicate a LOAEL of 88 ppm toluene (332 mg/cu.m) for neurobehavioral changes from chronic exposure to toluene."

Hepatic. Rodents exposed to toluene at 12,000 ppm in three-hour cycles five times per week for eight weeks exhibited no liver damage (11).

"The liver of an adult male who died from toluene ingestion (625 mg/kg) was found to be enlarged on autopsy (Ameno et al. 1989). In mice, there was a significant increase in liver weight after 28 days of ingestion of 105 mg/kg/day toluene in drinking water, but not at doses of 22 mg/kg/day or lower (Hsieh et al. 1989). Relative liver weights increased significantly over control levels in mice administered toluene by gavage for 13 weeks with doses of 312 mg/kg/day and greater in females and 1,250 mg/kg/day and greater in males (NTP 1990b). In female rats, the liver weights were increased by exposure to doses of 1,250 mg/kg/day or greater and in male rats by exposure to doses of 625 mg/kg/day or greater. No treatment-related gross or histopathological lesions of the liver were reported (NTP 1990b). When rats were exposed for a longer duration, liver weights were not affected and there were no treatment-related lesions in rats that received 590 mg/kg/day toluene by gavage for 6 months (Wolf et al. 1956)" (6.5).

Immunological. "No studies were located regarding immunological effects in humans after oral exposure to toluene. Thymus weights, mixed lymphocyte culture responses, and antibody plaque-forming cell responses were decreased in male mice administered doses of 105 mg/kg/day in their drinking water for 28 days (Hsieh et al. 1989). Mitogen-stimulated lymphocyte proliferation and interleukin-2 immunity were depressed by doses of 22 and 105 mg/kg/day. A dose of 5 mg/kg/day had no effect upon any of these indicators of immune system function" (6.5).

Sensitive Subpopulations

An on-line search of computerized databases, as well as an examination of standard toxicology references, has revealed no data identifying subpopulations exhibiting greater sensitivity to toluene than the general population following exposure via the inhalation, ingestion, or dermal routes.

Sensitization to toluene. Evidence that exposure to toluene may cause sensitization and subsequent hypersensitivity on re-exposure was not found in the available literature. Such evidence was sought via an on-line search of the Medline database conducted by RAM TRAC on 25 June 1992. Between 1989 and 1992, Medline cites 23,998 English-language articles about "*sensitization*" or "*hypersensitivity, immunologic.*" Although many of these citations contained the word "*toluene*" in the title, all referred to toluene diisocyanate, not to toluene.

Chemical Interactions

An on-line search of computerized databases, as well as an examination of standard toxicology references, has revealed no data regarding chemical interactions of toluene with other substances to which reference individuals might be simultaneously or sequentially exposed.

Dose-Response Parameter Estimation

Cancer. Insufficient evidence exists to classify toluene as a carcinogen.

Non-Cancer Effects. Inhalation RfC. According to IRIS (14):

REFERENCE DOSE FOR INHALATION EXPOSURE

o INHALATION RFD SUMMARY :

Critical Effect Exposures*		UF	MF	RfC
Neurological effects	NOAEL: None	300	1	4E-1 mg/cu.m
Occupational Study Foo et al., 1990	LOAEL: 332 mg/cu.m (88 ppm) LOAEL(ADJ): 119 mg/cu.m LOAEL(HEC): 119 mg/cu.m			
Degeneration of nasal epithelium 2-Year Rat Chronic Inhalation Study NTP, 1990	NOAEL: None LOAEL: 2261 mg/cu.m (600 ppm) LOAEL(ADJ): 437 mg/cu.m LOAEL(HEC): 79 mg/cu.m			

*Conversion Factors: MW = 92.15.

Foo et al., 1990: Assuming 25 C and 760 mmHg, LOAEL (mg/cu.m) = 88 ppm x 92.15/24.45 = 332 mg/cu.m. This is an extrarespiratory effect of a soluble vapor. The LOAEL is based on an 8-hour TWA occupational exposure. MVho = 10 cu.m/day, MVh = 20 cu.m/day. LOAEL(HEC) = LOAEL(ADJ) = 332 x MVho/MVh x 5 days/7 days = 119 mg/cu.m.

NTP, 1990: Assuming 25 C and 760 mmHg, LOAEL (mg/cu.m) = 600 ppm x 92.15/24.45 = 2261 mg/cu.m. LOAEL(ADJ) = LOAEL (mg/cu.m) x 6.5 hours/24 hour x 5 days/7 days = 437 mg/cu.m. The LOAEL(HEC) was calculated for a gas:respiratory effect in the extrathoracic region. MVa = 0.24 cu.m/day, MVh = 20 cu.m/day, Sa (ET) = 11.6 sq.cm, Sh (ET) = 177 sq.cm. RGDR = (MVa/Sa) / (MVh/Sh) = 0.18. LOAEL(HEC) = 437 x RGDR = 79 mg/cu.m.

Inhalation. Acute exposure, lethality, occupational. Table 2 sets forth a four-hour inhalation lethality benchmark concentration of 24,829 mg/M3 based upon the geometric mean of several bioassays. Although this value will be only approximate with respect to toluene lethality to humans, it is likely to be sufficiently accurate to justify deriving a lethality RfC, which should overcome uncertainties by applying two safety/uncertainty factors of 10 to extrapolate from an effect level to a lethality NOAEL (LC0), and from animals to humans. This yields 4-h RfC = 248 mg/M3, equivalent to 8-h RfC = 124 mg/M3, assuming validity of Haber's rule (concentration x exposure duration = constant) for this substance over this exposure duration range. This value may be compared with the *Short-Term Exposure Limit* (STEL) of 150 ppm-v (565 mg/M3) promulgated by NIOSH, the Ceiling Limit of 300 ppm-v (1,131 mg/M3) promulgated by OSHA, and the peak limit of 500 ppm-v (1,884 mg/M3) for 10-minute exposure also promulgated by OSHA.

Inhalation. Chronic occupational. An occupational RfC for chronic inhalation of airborne toluene may be derived based upon existing standards and/or guidelines. Eight-hour time-weighted average (TWA) exposure limits have been promulgated, as follows: 188 mg/M3 (50 ppm-v) recommended by ACGIH (to protect against effects of airborne toluene on unprotected skin), 200 ppm-v (754 mg/M3) required by OSHA, and 375 mg/M3 required by MSHA. A 10-hour TWA of 100 ppm-v (377 mg/M3) has been promulgated by NIOSH, equivalent to 471 mg/M3 for eight hours.

Inhalation. Chronic, occupational, neurological effects.

Neurological. The neurological effects inhalation RfC may be derived based upon the U. S. EPA's inhalation RfC value of 0.4 mg/M3. This value was derived based upon bioassay and occupational studies in which neurological effects were reported. The occupational RfC may be upwardly adjusted by multiplying it by 24/8 h/h and 7/5 d/d to reflect shorter-term exposure in the workplace, and by a factor of 10 to reflect relatively healthy individuals in the workplace. This yields RfC = 17 mg/M3.

Ingestion. According to IRIS (14):

REFERENCE DOSE FOR ORAL EXPOSURE

o ORAL RFD SUMMARY :

Critical Effect	Experimental Doses*	UF	MF	RfD
-----	-----	-----	---	---
Changes in liver and kidney weights	NOAEL: 312 mg/kg converted to 223 mg/kg/day	1000	1	2E-1 mg/kg/day
13-Week Rat Gavage Study	LOAEL: 625 mg/kg			

converted to 446 mg/kg/day

NTP, 1989

*Conversion Factors: Dose adjusted for gavage schedule of 5 days/week.

o ORAL RfD STUDIES :

NTP (National Toxicology Program). 1989. Toxicology and Carcinogenesis Studies of toluene in F344/N rats and B6C3F1 mice. Technical Report Series No. 371. Research Triangle Park, NC.

Teratogenic. An oral teratogen RfD may be derived based upon increased incidence of cleft palate in offspring of mice exposed during gestation days 6-15 to toluene at 0.87 mg/kg/d, as reported earlier. A NOAEL for this effect appears to be 0.43 mg/kg/d. Two safety/uncertainty factors of 10 may be applied to extrapolate from mice to humans, and from humans to potentially sensitive human subpopulations. This yields an oral teratogen RfD value of 4.3×10^{-3} mg/kg/d.

Reproductive. An inhalation reproductive effects RfD may be derived based upon changes in hormone levels induced by airborne toluene at 8 to <111 ppm-v (geometric mean 30 ppm-v), as reported earlier. Two safety/uncertainty factors of 10 may be applied to the geometric mean to extrapolate from a LOAEL to a NOAEL, and from humans to potentially sensitive human subpopulations. This yields an inhalation reproductive effects RfC value of 0.3 ppm-v ($1.13 \text{ mg/M}^3 = 0.3 \times 92.14/24.45$). This is equivalent to an RfD value of 3.23×10^{-1} mg/kg d.

Hematological. Inhalation. An inhalation hematological effects RfD may be derived based upon a dose-related reduction in hematocrit observed in rats exposed to toluene at 30, 100, or 300 ppm-v for two years; as reported earlier. The geometric mean (96.5 ppm-v) may be taken as a LOAEL. Three safety/uncertainty factors of 10 may be applied to the geometric mean to extrapolate from a LOAEL to a NOAEL, from rats to humans, and from humans to potentially sensitive human subpopulations. This yields an inhalation hematological effects RfC value of 9.65×10^{-2} ppm-v ($3.64 \times 10^{-1} \text{ mg/M}^3$). The equivalent RfD for person breathing an RfC of $3.64 \times 10^{-1} \text{ mg/M}^3$ is $1.04 \times 10^{-1} \text{ mg/kg d}$ (calculation $3.64 \times 10^{-1} \text{ mg/M}^3 \times 20 \text{ M}^3/\text{d} \times 1/70 \text{ kg}$).

Ingestion. A lower limit may be placed upon the hematological effects oral RfD based upon a NOAEL of 2,500 mg/kg d in mice and rats exposed to toluene in their drinking water for 13 weeks, as reported earlier. Two safety/uncertainty factors of 10 may be applied to extrapolate from a subchronic to a chronic exposure regimen, from mice to humans, and from humans to potentially sensitive human subpopulations. This yields an ingestion hematological effects RfD value of 25 mg/kg/d.

Renal. The renal effects oral RfD equals the U. S. EPA oral RfD of 0.2 mg/kg d, which was based upon changes in kidney (and liver) weights in rats exposed to toluene via gavage.

Dermal. A dermal effects oral RfD cannot be derived based upon available data.

Respiratory. Inhalation. A lower limit may be placed upon the respiratory effects inhalation RfD based upon a NOAEL in rats exposed to toluene at 12,000 ppm-v, as reported earlier. Two safety/uncertainty factors of 10 may be applied to extrapolate from rodents to humans, and from humans to potentially sensitive human subpopulations. This yields an inhalation respiratory effects RfC value of 120 ppm-v (452 mg/M³). The equivalent RfD for person breathing an RfC of 452 mg/M³ is 129 mg/kg d (calculation $452 \text{ mg/M}^3 \times 20 \text{ M}^3/\text{d} \times 1/70 \text{ kg}$).

Ingestion. A lower limit may be placed upon the respiratory effects oral RfD based upon a NOAEL of 2,500 mg/kg d in mice and rats exposed to toluene in their drinking water for 13 weeks, as reported earlier. Two safety/uncertainty factors of 10 may be applied to extrapolate from a subchronic to a chronic exposure regimen, from mice to humans, and from humans to potentially sensitive human subpopulations. This yields an ingestion hematological effects RfD value of 25 mg/kg/d.

Hepatic. The hepatic effects oral RfD equals the U. S. EPA oral RfD of 0.2 mg/kg d, which was based upon changes in liver (and kidney) weights in rats exposed to toluene via gavage.

Immunological. An immunological effects oral RfD may be derived based upon a LOAEL of 22 mg/kg d with respect to depression of mitogen-stimulated lymphocyte proliferation in mice, as reported earlier. An immune system function NOAEL was reported to be 5 mg/kg d. Two safety/uncertainty factors of 10 may be applied to extrapolate from mice to humans and from humans to potentially sensitive human subpopulations. This yields an immunological effects oral RfD value of 5×10^{-3} mg/kg d.

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TECH SUPPORT APPENDIX 2

Toxicological Profile: **NAPHTHALENE** **CAS No. 91-20-3**

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Physical and Chemical Properties

Based upon examination of standard sources (1-12), selected physical and chemical properties of naphthalene (Chemical Abstract Service number 91-20-3) are set forth in Table 1. The structural formula of naphthalene is depicted below (Fig. 1).

Figure 1. Structural Formula of Naphthalene

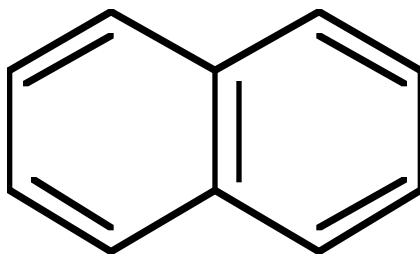


Table 1. Selected Physical and Chemical Properties of Naphthalene

parameter	value	unit and/or note	source
Chemical Abstract Service (CAS) number	91-20-3	...	1
chemical formula	C ₁₀ H ₈	...	1
synonym	tar camphor	...	1
synonym	albocarbon	...	1
synonym	naphthene	...	1
molecular weight	128.19	daltons	1
color	white	...	1
color	colorless to brown	...	2
physical state	solid	...	1
physical state	crystalline flakes; white scales, balls, powder or cakes	...	2
melting point	80.5	° C	1
boiling point	217.9	° C	2
density	1.145	g/cm ³ , at 20° C	1
odor	strong (tar or mothballs)	...	1
odor threshold in water	0.021	mg/L	1
odor threshold in air	0.4	mg/M ³	1
solubility:			1
<i>water</i>	31.7	mg/L @ 20° C	1
<i>acetate</i>	soluble	...	2
<i>acetone</i>	soluble	...	1
<i>alcohol</i>	soluble	...	1
<i>benzene</i>	soluble	...	1
<i>ether</i>	soluble	...	1
partition coefficients:			1
<i>log octanol/water</i>	3.29	...	1
<i>log K_{oc}</i>	2.97	...	1
vapor pressure	0.087	mm Hg, @ 25° C	1
vapor density	4.42	air = 1	2
Henry's law constant	4.6 x 10 ⁻⁴	atm M ³ /mole	1
autoignition temperature	526	° C	1
flashpoint	80	° C	1
flammability limits	0.9 to 5.9	%	1
heat of combustion	-16,720	BTU/lb	2
heat of combustion	-9,287	cal/g	2
heat of combustion	-388.8 x 10 ⁵	joules/kg	2
heat of vaporization	43.5	kJ/mole	2
surface tension of liquid	31.8	dyne/cm @ 100° C	2
surface tension of liquid	0.0318	Newtons/M @ 100° C	2
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Pharmacokinetics

Absorption

Inhalation. The efficiency with which naphthalene is absorbed following inhalation was unquantifiable based upon available data. According to ATSDR (2): "Clinical reports suggest that prolonged exposure to naphthalene vapors, can cause adverse health effects in humans (Harden and Baetjer 1978; Valaes *et al.* 1963; Linick 1983). Unfortunately, the rate and extent of naphthalene absorption were not determined in these studies. Presumably naphthalene moves across the alveolar membrane by passive diffusion through the lipophilic matrix.

No animal data that documented the absorption of naphthalene after inhalation were located. The only data observed in animal studies involved localized effects in the lungs and nasal passages. Thus, it is not possible to conclude that they were the consequence of absorbed naphthalene. However, absorption can be presumed to occur based on the human data.

Ingestion. The efficiency with which naphthalene is absorbed following ingestion was unquantifiable based upon available data. According to ATSDR (2): "Several case reports indicate that naphthalene ingested by humans can be absorbed in quantities sufficient to elicit toxicity (Bregman 1954; Chusid and Fried 1955; Gidron and Leurer 1956; Gupta *et al.* 1979; Haggerty 1956; Kurz 1987; MacGregor 1954; Mackell *et al.* 1951; Ojwang *et al.* 1985; Santhanakrishnan *et al.* 1973; Shannon and Buchanan 1982; Zuelzer and Apt 1949). However, no studies have been located that report the rate or extent of absorption. Absorption of naphthalene presumably occurs by passive diffusion through the lipophilic matrix of the intestinal membrane.

In one patient who died as a result of naphthalene ingestion, 25 mothballs were found in the stomach 5 days after her death (Kurz 1987). A single naphthalene mothball reportedly weighs between 0.5 and 5 g depending on its size (Ambre *et al.* 1986; Siegel and Wason 1986). The gastric contents of a person who mistakenly ingested naphthalene flakes still smelled strongly of naphthalene at least 2 days following ingestion (Ojwang *et al.* 1985). These findings suggest that dissolved naphthalene is transported slowly into the intestines. Uptake from the intestines is governed by the partition coefficient between the materials in the intestinal lumen and the membrane lipids. Ingestion of mothballs or other forms of particulate naphthalene will lead to continued absorption over a period of several days as the solid dissolves. Unfortunately none of the human data permit a quantitative evaluation of absorption coefficients or rates.

No information that documented the absorption of naphthalene after oral administration to animals has been located. The occurrence of systemic effects in dogs, mice, rats, and rabbits indicates that gastrointestinal absorption does occur. Toxicological evidence also suggests that absorption is facilitated when naphthalene is dissolved in a lipophilic medium such as corn oil (Plasterer et al. 1985).

Dermal contact. The efficiency with which naphthalene is absorbed following dermal exposure was reported to be 50 percent after a period of 2.1 hours (ATSDR 1997; 2). According to ATSDR: "Several cases of naphthalene toxicity in neonates have been reported in which the proposed route of exposure was dermal (Dawson *et al.* 1958; Schafer 1951). Each case involved the use of diapers which had been stored in contact with naphthalene (mothballs or naphthalene flakes). The authors proposed that the naphthalene was absorbed through the skin, causing hemolytic anemia. It was suggested that this absorption may have been enhanced by the presence of oils which had been applied to the babies' skin (Schafer 1951). Inhalation of vapors from the treated diapers probably contributed to the total exposure.

Naphthalene was rapidly absorbed when the neat material was applied for a 48-hour period under a sealed glass cap to shaved patches of rat skin. Half of the sample (3.3 mg/cm³) was absorbed in 2.1 hours (Turkall *et al.* 1994). When the naphthalene was mixed with either a sandy soil or a clay soil prior to contact with the skin, the presence of the soil slowed the absorption (Turkall *et al.* 1994). The absorption half-time from the clay and sandy soil samples were 2.8 and 4.6 hours, respectively. The rate of absorption did not influence the total amount of naphthalene absorbed in 48 hours since the areas under the plasma concentration curve did not differ significantly with any of the three exposure scenarios (0.42-0.63%/mL hour). The authors proposed that naphthalene was absorbed more slowly from the sandy soil than the clay soil because the sandy soil had a higher organic carbon content (Turkall *et al.* 1994). The sandy soil contained 4.4% organic matter and the clay soil 1.6% organic matter.

Distribution

Inhalation. Little information was located that documented the distribution of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene by humans or animals after inhalation exposure. According to ATSDR (2): "There are limited data concerning the distribution of naphthalene in human tissues. Naphthalene was present in 40% of the adipose tissue samples that were analyzed as part of the National Human Adipose Tissue Survey (Stanley 1986). The maximum concentration observed was 63 ng/g. Naphthalene was also detected in human milk (concentration not reported) (Pellizzari *et al.* 1982). The source term that accounted for the presence of naphthalene in milk and body fat is not known with certainty. The use of cigarettes or wood-burning fuel sources are two possibilities.

Ingestion. According to ATSDR (2): "Naphthalene can cross the human placenta in concentrations high enough to cause red cell hemolysis and lead to anemia in newborn infants of mothers who consumed naphthalene during pregnancy (Anziulewicz *et al.* 1959; Zinkham and Childs 1957, 1958).

The distribution of naphthalene and its metabolites in young pigs given a single dose of 0.123 mg/kg (4.8 Ci/kg) ^{14}C -labeled naphthalene was monitored at 24 and 72 hours (Eisele 1985). At 24 hours, the highest percentage of the label (3.48 $\pm$ 0.16% dose/mg tissue) was in the adipose tissue. The kidneys had the next highest concentration of label (0.96% dose/mg tissue), followed by the liver (0.26 $\pm$ 0.06% dose/mg tissue) and lungs (0.16% dose/mg tissue). The heart contained 0.09 $\pm$ 0.04% dose/mg tissue and the spleen contained 0.07 $\pm$ 0.01% dose/mg tissue. At 72 hours, the amount of label in the fat had fallen to 2.18 $\pm$ 0.16% dose/mg tissue, that in the liver to 0.34 $\pm$ 0.24% dose/mg tissue, and the kidneys and lungs contained the same concentration (0.26% dose/mg tissue).

Pigs were also given oral doses of 0.006 mg/kg/day (0.22 Ci/kg/day) ^{14}C -labeled naphthalene for 31 days (Eisele 1985). With repeated administration of the radiolabel, the tissue distribution differed considerably from that observed with a single dose of the compound. The highest concentration of label was in the lungs (0.15% dose/mg tissue), followed by the liver and heart (0.11% dose/mg tissue). There was very little label in the fat tissue (0.03% dose/mg tissue). The spleen had 0.09 $\pm$ 0.05% dose/mg tissue and the kidney had 0.09% dose/mg tissue.

In one dairy cow, naphthalene distributed to milk with both single and repeated doses of ^{14}C -labeled naphthalene. The label was distributed between the milk and the milk fat (Eisele 1985). When the cow was given naphthalene for a 31-day period, the amount of label found in the milk remained relatively constant throughout the exposure period. The amount in

the milk fat was lower for the first 7 days than it was for the remainder of the exposure.

Dermal. According to ATSDR (2): "No information was located that documented the distribution of naphthalene, 1-methylnaphthalene, or 2-methyl-naphthalene in humans after dermal exposure.

In rats, radiolabel from naphthalene distributed to the ileum, duodenum, and kidney (0.01-0.02% of initial dose) when tissues were analyzed 48 hours after naphthalene contact with the skin (Turkall *et al.* 1994). The largest concentration was found at the site of application (0.56% of initial dose). A total of 20 tissues were evaluated; the percentage of label in all other tissues was minimal.

Metabolism

According to ATSDR (2): "The metabolism of naphthalene is complex. Up to 21 various metabolites (oxidized derivatives and conjugates) have been identified in the urine of animal species (Horning *et al.* 1980; Kanekal *et al.* 1990; Wells *et al.* 1989). Figure 2-3 illustrates the early steps of naphthalene metabolism. The initial metabolic reaction is the microsomal production of an epoxide intermediate. Many of the derivatives illustrated in Figure 2-3 undergo subsequent oxidation reactions to form trihydroxylated and tetrahydroxylated compounds (Horning *et al.* 1980). Some metabolites are conjugated with glutathione, glucuronic acid, or sulfate. The glutathione conjugates undergo additional reactions with loss of the glutamyl and glycyl groupings to form a variety of cysteine derivatives (thioethers). There are differences in naphthalene metabolism between tissues and between species.

Little information is available pertaining to the metabolism of naphthalene by humans. Naphthol (isomer not specified) was found in the urine of patients 4 days after naphthalene ingestion; a smaller amount was detected 1 day later; and none was found in any specimens collected thereafter (Zuelzer and Apt 1949). In a different study, the urine of an 18-month-old child was found to contain 1-naphthol, 2-naphthol, 1,2-naphthoquinone, and 1,4-naphthoquinone, approximately 9 days after exposure (Mackell *et al.* 1951). Although the case appeared to involve oral ingestion, the route of exposure could not be established conclusively. With the exception of the 1,4-naphthoquinone, these metabolites were still present on day 13 but not on day 17.

Microsomes isolated from human lung tissue metabolize naphthalene to dihydro-1,2-naphthalenediol and three different glutathione adducts (Buckpitt and Richieri 1984; Buckpitt and Bahnson 1986). Among the specimens tested (from two men and one woman, ages 60-77), considerable variability was noted regarding the amounts of each metabolite generated.

Microsomes isolated from six histologically normal human livers produced 1,2-dihydro-1,2-naphthalenediol as the principle stable metabolite and 1-naphthol as a minor metabolite (Tingle *et al.* 1993). The ratio of these two metabolites was 8.6:1. Production of 1,2-dihydro-1,2-naphthalenediol occurred as the result of epoxide hydrolase activity on 1,2-naphthaleneoxide. Several cytochrome P-450 participate in naphthalene epoxidation. Epoxide hydrolase inhibition increases the amount of 1-naphthol formed by liver microsomes.

The urinary metabolites of naphthalene were evaluated following oral (rats and rabbits) and intraperitoneal (mice, rats, and guinea pigs) administration (Corner and Young 1954). All tested species excreted 1- and

2-naphthol, 1,2-dihydro-1,2-naphthalenediol, 1-naphthylsulfate, and with the exception of guinea pigs, 1-naphthylglucuronic acid. A probable, but not clearly confirmed metabolite was a glucuronic acid conjugate of 1,2-naphthalenediol which was also present in all species. 1,2-Dihydro-2-hydroxy-1-naphthyl glucuronic acid was found in rats and rabbits, while guinea pigs alone were found to excrete unconjugated 1,2-naphthalenediol.

The glucuronic acid conjugate of dihydronaphthalenediol was also present in the urine of calves (Bakke *et al.* 1990). A slightly larger portion of the dose was excreted as dihydro-1-hydroxy-2- cysteine derivative. These two metabolites accounted for 81% of the dose. 2-Naphthylsulfate and 2-naphthylglucuronic acid could not be detected in rats, rabbits, and guinea pigs (Corner and Young 1954). There were no differences in the metabolites found after oral and intraperitoneal administrations in the rat (the only species tested by both routes).

Intraperitoneal administration of naphthalene to male rats resulted in the urinary excretion of 80-95% of the administered dose as conjugated metabolites including glucuronides, sulfates, and thioethers (Horning *et al.* 1980). The major metabolites were identified as 1-naphthol, 2-naphthol, 1,2-naphthalenediol, 1,2-dihydro-1,2-naphthalenediol (cis and trans), 1,4-dihydro-1,4- naphthalenediol-, (cis and trans) and 1,1-, 2,7-, and 2,6-naphthalenediol. In a similar study, intraperitoneal administration of naphthalene to male mice resulted in urinary excretion of 96% of the administered dose as conjugated metabolites. The major naphthalene metabolites were 1-naphthol, trans-1-hydroxy-2-methylthio-1,2-dihydronaphthalene, trans-1,2-dihydro-1,2-naphthalenediol, methylthionaphthalene, and 2-naphthol. The major sulfur-containing derivative from the seven identified was N-acetyl-S-(1-hydroxy-1,2-dihydro-2-naphthenyl) cysteine (Stillwell *et al.* 1982). The sulfur metabolites are produced by conjugation with glutathione followed by removal of the glycyl and glutamyl moieties and modification of the cysteine. The metabolites identified in both of these studies support the hypothesis that epoxide intermediates play a key role in the metabolism of naphthalene.

A dose-dependent increase in urinary mercapturic acid excretion was observed following gavage doses of naphthalene to rats (Summer *et al.* 1979). No corresponding increase in thioether excretion was seen in chimpanzees. On the basis of data from 2 animals, glucuronic acid and sulfate conjugates account for the bulk of the conjugated naphthalene in chimpanzees (Summer *et al.* 1979). Rhesus monkeys also did not demonstrate any increase in urinary excretion of thioethers or depletion of hepatic glutathione following oral doses of up to 200 mg/kg/day (Rozman *et al.* 1982).

Evidence that intestinal microflora are involved in the production of 1,2-dihydro-1-hydroxymethyl-thionaphthalene glucuronide, naphthols, and naphthol conjugates from premercapturic acid was demonstrated in a study

in which radiolabeled naphthalene was administered to bile-cannulated, noncannulated, and germ-free rats. Urinary naphthols, naphthol glucuronides, and methylthioglucuronides were identified in control rats. Bile and urine from cannulated rats and urine from germ-free rats contained no labeled methylthioglucuronide metabolite and only trace amounts of labeled naphthols and naphthol glucuronide conjugates (Bakke *et al.* 1985). The 1,2-dihydro-1-hydroxy-2-S-(N-acetyl) cysteinyl naphthalene conjugate was excreted in urine as 14.4% of the administered dose in bile-cannulated rats within 24 hours and 89% of the dose in germ-free rats. Noncannulated rats excreted 38.1% of the dose in urine as this N-acetyl cysteinyl conjugate.

Excretion

Inhalation. According to ATSDR (2): "Little information is available pertaining to the excretion of naphthalene in humans after inhalation exposure to naphthalene. Workers employed in the distillation of naphthalene oil and at a coke plant had peak levels of urinary 1-naphthol 1 hour after finishing a shift. Of three workers and a nonoccupationally exposed group, naphthalene oil distribution plant workers had the highest concentrations of urinary 1-naphthol, with a mean excretion rate of 0.57% mg/hour. Investigators calculated the half-life for the urinary excretion of 1-naphthol as approximately 4 hours (Bieniek 1994). This urinary metabolite may indicate both exposure to naphthalene and low concentrations of 1-naphthol during naphthalene oil distillation (Bieniek 1994). No studies were located that documented excretion in humans after inhalation exposure to 1-methylnaphthalene, or 2-methylnaphthalene... No studies were located that documented excretion in animals after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene."

Ingestion. According to ATSDR (2): "Little information is available pertaining to the excretion of orally ingested naphthalene by humans. The urine of one patient was tested for naphthalene and its derivatives. Naphthol was found at the time of hospital admission (4 days post-ingestion). Smaller quantities were present 1 day later, but naphthalene was not detected in later specimens (Zuelzer and Apt 1949). In another instance, the urine of an 18-month-old child was found to contain 1-naphthol, 2-naphthol, 1,2-naphthoquinone, and 1,4-naphthoquinone (but no naphthalene) 9 days after exposure (Mackell *et al.* 1951). With the exception of the 1,4-naphthoquinone, these metabolites were still detectable on day 13, but not on day 17. These data indicate that urinary excretion of metabolites may be prolonged following exposure. It is important to note, however, that delayed dissolution and absorption from the gastrointestinal tract may also be a contributing factor. Unabsorbed naphthalene was visible in the fecal matter after ingestion of naphthalene flakes or mothballs in several individuals (Zuelzer and Apt 1949).

In nonhuman primate studies, *Rhesus* monkeys given naphthalene at oral doses up to 200 mg/kg did not excrete naphthalene as thioethers in urine or feces (Rozman *et al.* 1982). In a similar study, chimpanzees orally administered naphthalene at 200 mg/kg did not excrete naphthalene as thioethers in urine (Summer *et al.* 1979). These data suggest that glutathione conjugation of naphthalene may not occur to any great extent in nonhuman primates. Data from two chimpanzees indicate that most of the naphthalene excreted in this species is excreted as glucuronic acid and sulfate conjugates (Summer *et al.* 1979).

In rats administered radiolabeled naphthalene, the amount of label

recovered in 24 hours was 77-93% in urine and 6-7% in feces (Bakke *et al.* 1985). There was a dose-dependent increase in urinary thioether excretion following gavage doses of naphthalene at 30, 75, and 200 mg/kg within 24 hours (Summer *et al.* 1979). The levels of thioethers excreted accounted for approximately 39, 32, and 26% of the three dose levels tested.

Dermal. According to ATSDR (2): "No reports have been located which discuss the excretion of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene in humans following dermal exposure... The dermal exposure of rats to radiolabeled naphthalene was evaluated over a 48-hour period (Turkall *et al.* 1994). Naphthalene samples were applied to shaved areas on the skin under a sealed plastic cap. Neat naphthalene or naphthalene adsorbed to the surface of sandy soil or clay soil was tested. In all three cases, excretion of the label was primarily through the urine (70-87%). With the pure naphthalene and naphthalene adsorbed to clay soil, the exhaled air accounted for 6-14% of the administered label. Exhaled air contained only 0.9% of the label in the sandy soil group. This finding was presumably related to the slower adsorption of naphthalene from the sandy soil and its more rapid metabolism to nonvolatile metabolites. Less than 0.02% of the label was exhaled as carbon dioxide in all groups. The feces contained 2-4% of the label.

The primary metabolites in the urine after dermal application of naphthalene were 2,7-dihydroxynaphthalene, 1,2-dihydroxynaphthalene, and 1,2-naphthoquinone (Turkall *et al.* 1994). The ratio of these metabolites for pure naphthalene and naphthalene adsorbed to clay soil were roughly 3:2:1. For the sandy soil, the corresponding ratio was 3:2:1.5. Small amounts of 1-naphthol and 2-naphthol were also excreted. In all cases, the amount of urinary free naphthalene was less than 0.4% of the administered label... No studies were located that documented excretion in animals after dermal exposure to 1-methylnaphthalene or 2-methylnaphthalene."

Other Exposure Routes. According to ATSDR (2): "In mouse studies using the intraperitoneal or subcutaneous exposure routes, several naphthalene metabolites were excreted in the urine. After intraperitoneal administration of naphthalene, conjugates accounted for 80-95% of the urinary metabolites (Horning *et al.* 1980; Stillwell *et al.* 1982). Much of the conjugated material was present as thioethers (glutathione conjugates and their derivatives). The major oxidation products of naphthalene metabolism were 1-naphthol and trans-1,2-dihydro-1,2-naphthalene diol.

Pharmacodynamics

Acute Toxicity

Inhalation. Reports of lethality following naphthalene inhalation are set forth in Table 2. According to ATSDR (2): "Two Greek infants died as a consequence of acute hemolysis that resulted from exposure to naphthalene-treated materials (clothing, diapers, blankets, rugs, etc.). Both infants exhibited a severe form of jaundice (kernicterus) which often causes brain damage (Valaes *et al.* 1963). One infant suffered from a glucose-6-phosphate dehydrogenase (G6PD) deficiency. The other infant was apparently heterozygous for this trait. Individuals with a G6PD genetic defect are prone to hemolysis after exposure to a variety of chemical oxidizing agents including nitrates, nitrites, aniline, phenols (Dean *et al.* 1992), and naphthalene...

Exposure to 78 ppm naphthalene for 4 hours did not cause any deaths in rats. In addition, no definitive adverse clinical signs were observed during the 14 days after exposure, and no gross pathologic lesions were observed at necropsy (Fait and Nachreiner 1985)...

2.2.1.2 Systemic Effects

No studies were located that documented dermal effects in humans or animals after inhalation exposure to naphthalene. Most of the data on humans come from occupational and domestic settings where mothballs were the source of the naphthalene vapors...

Respiratory Effects. No studies were located that documented respiratory effects in humans after inhalation exposure to naphthalene... A change to mouth breathing occurred in rats during exposure to 78 ppm naphthalene but no other effects on respiration were noted (Fait and Nachreiner 1985).

Cardiovascular Effects. No studies were located that documented cardiovascular effects in humans after inhalation exposure to naphthalene... No histological changes were seen in the hearts of mice that were exposed to naphthalene (30 ppm) for 2 years (NTP 1992a).

Table 2. Naphthalene Acute Inhalation Toxicity Reports*

species	study type	conc.	duration	conc. x duration	effect	source
...	...	(mg/M ³)	(min)	(mg min/M ³)	...	...
lethality						
rat	LC ₅₀	>340	60	>20,400	SENSE ORGANS AND SPECIAL SENSES (Lacrimation)	BIOFAX Ind Bio-Test Lab[16-4/1970
rat	LC ₅₀	>340	60	>20,400	BEHAVIORAL (Somnolence)	BIOFAX Ind Bio-Test Lab[16-4/1970
4-h lethality benchn		>85	240	>20,400	based upon geometric mean of conc. x duration	

***RTECS.** Registry of Toxic Effects of Chemical Substances. Access date 1997/10/17.

**Concentration x time relationship (Haber's rule) is approximate, as is use of the geometric mean to determine a single lethality benchmark. Therefore, the lethality benchmark is only approximate. Further, greater accuracy might be achieved in two ways: 1. by determining human equivalent concentrations (HECs) for each non-human species, if known, and 2. differentiating between LCLO and LC50 studies, if possible.

Ingestion. According to ATSDR (2): "Death has been documented in humans who intentionally ingested naphthalene. A 17-year-old male died 5 days after the ingestion of an unknown quantity of naphthalene mothballs. Death was preceded by vomiting, evidence of gastrointestinal bleeding, blood-tinged urine, and coma (Gupta *et al.* 1979). A 30-year-old female died following similar sequelae 5 days after reportedly swallowing 40 mothballs (25 were recovered intact from the stomach upon autopsy) (Kurz 1987)..."

Several animal studies have been conducted to estimate lethal doses of naphthalene. Mice appear to be more sensitive than rats or rabbits. The LD₅₀ values in male and female mice were 533 and 710 mg/kg, respectively (Shopp *et al.* 1984). An LD₅₀ of 354 mg/kg was estimated in female mice treated with naphthalene once daily by gavage for 8 consecutive days (Plasterer *et al.* 1985). The dose response curve appeared to be very steep because no deaths occurred at 250 mg/kg/day, but all animals died with a dose of 500 mg/kg/day. At the 300 mg/kg/day dose, mortality was approximately 15%. In a different study with a 14 day dosing period, 10% of the males and 5% of the females died at a dose of 267 mg/kg/day, but none were affected by doses of 27 and 53 mg/kg/day (Shopp *et al.* 1984).

The oral LD₅₀ values in male and female rats were 2,200 and 2,400 mg/kg, respectively in one study (Gaines 1969), and 2,600 in a second study that did not differentiate by sex (Papciak and Mallory 1990). Male rats tolerated daily doses of 1,000 mg/kg without lethality, even after 18 days of administration (Yamauchi *et al.* 1986). In an increasing dose study, Germansky and Jamall (1988) treated male rats with naphthalene at doses beginning at 100 mg/kg/day and raised the dose weekly to a final level of 750 mg/kg/day over 6 weeks. Doses were then kept constant for an additional 3 weeks. The animals tolerated 750 mg/kg/day with no mortalities. No increase in mortality was observed in rats administered naphthalene at 41 mg/kg/day in a 2-year feeding study (Schmahl 1955).

Although few data are available, rabbits appear to tolerate naphthalene in doses similar to those administered to rats. Two different rabbit strains were administered 1,000 mg/kg twice per week for 12 weeks without lethality (Rossa and Pau 1988)."

Dermal. According to ATSDR (2): "No studies were located that documented dermal effects in humans after dermal exposure to naphthalene... A study in rabbits has shown that naphthalene is a mild dermal irritant, causing erythema and fissuring, when directly applied to the shaved, abraded or nonabraded skin under a dressing; healing occurred within 6-7 days (Papciak and Mallory 1990; PRI 1985a)..."

Ocular Effects. Two case studies were reported in which humans experienced eye irritation and conjunctivitis as a result of naphthalene exposure (van der Hoeve 1906). In one case a worker accidentally got naphthalene powder in his left eye. The exact amount was unknown but

described by the worker as large. Despite immediate cleansing of the eye, the subject experienced conjunctivitis and pain shortly after exposure. Symptoms of irritation subsided but then reappeared 6 weeks later. At that time the subject noticed decreased vision in his left eye. When examined by a doctor, the eye had retinal lesions (one fresh and others seemingly older); the entire retina appeared clouded. The subject's vision in his left eye was poorer than that in the right. Five years earlier, vision in both eyes was the same.

In the second case study, an adult male who worked in a storage area where naphthalene was used as a pesticide complained of ocular pain, conjunctivitis, and impaired vision (van der Hoeve 1906). Neither the duration nor the mode of exposure were described. The subject most likely was exposed to naphthalene vapors. When examined by a doctor, the subject was found to have retinal bleeding and the beginning of a cataract.

Mild ocular irritation was observed in the nonrinsed eyes of rabbits after instillation of naphthalene at 0.1 mg/eye (Papciak and Mallory 1990; PRI 1985b). Observed effects were reversible within 7 days after exposure. When the eyes were rinsed with water immediately after exposure, there were no signs of irritation (Papciak and Mallory 1990).

Immunological and Lymphoreticular Effects. No studies were located that documented immunological or lymphoreticular effects in humans after dermal exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene. An enlarged spleen was noted in two human subjects dermally exposed to naphthalene (Dawson *et al.* 1958; Schafer 1951). However, spleen enlargement is a result of hemolysis rather than a direct effect of naphthalene on the spleen...

Mutagenicity

Inhalation. According to ATSDR (2): "No studies were located that documented genotoxic effects in humans or animals after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene."

Carcinogenicity

According to ATSDR (2): "No studies were located that documented carcinogenic effects in humans after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene."

In animals, there was a statistically significant increase in the number of tumors per tumor-bearing mouse, but not in the number of mice with pulmonary adenomas after exposure to 10 or 30 ppm naphthalene vapors for 6 months (Adkins *et al.* 1986). However, the incidence of adenomas in the control group for this experiment was significantly lower than the pooled incidence observed in the control groups of eight concurrently conducted 6-month studies, and the difference in tumor incidence was not significantly greater than that of the historic controls.

In a 2-year bioassay (NTP 1992a), female (but not male) B6C3F 1 mice showed a significantly increased incidence in pulmonary alveolar/bronchiolar adenomas after a lifetime exposure to 30 ppm naphthalene vapors when compared to untreated controls. The incidence of tumors in the low dose group (10 ppm) was less than the control level. On the basis of these data NTP (1992) determined that there was some evidence of naphthalene carcinogenicity in female mice."

Teratogenicity

According to ATSDR (2): "No studies were located that documented developmental effects in humans or animals after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene."

Reproductive Effects

According to ATSDR (2): "No studies were located that documented reproductive effects in humans after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene... In animals, histological examination did not reveal damage to male or female reproductive organs in mice exposed to 30 ppm naphthalene for 2 years (NTP 1992a)..."

Other Chronic Effects

According to ATSDR (2): "Exposure to 78 ppm naphthalene for 4 hours did not cause any deaths in rats. In addition, no definitive adverse clinical signs were observed during the 14 days after exposure, and no gross pathologic lesions were observed at necropsy (Fait and Nachreiner 1985). A high background mortality in the male control group precluded drawing conclusions regarding the effects of lifetime exposures to 10 and 30 ppm naphthalene (6 hours/day, 5 days/week) on lifetime mortality; no apparent effects on mortality occurred in the females (NTP 1992a)."

Mice of both sexes showed chronic inflammation and metaplasia of the olfactory epithelium after inhalation of naphthalene vapors (10 and 30 ppm) for 2 years (NTP 1992a). Hyperplasia of the respiratory epithelium was also present in nearly all exposed mice and there was a dose-related increase in inflammatory lesions of the lungs. These data were used to calculate a chronic duration inhalation MRL for naphthalene as discussed in Table 2-1 and shown in Figure 2-1. Other nonneoplastic lesions of the lungs were increased as compared to the controls, but no dose-related trend was noted.

According to recent guidance (EPA 1990b), a Human Equivalent Concentration (HEC) can be used to calculate MRLs for contaminants that are either reactive or soluble. In the mouse study used for MRL derivation, naphthalene exposure resulted in olfactory epithelial inflammation and metaplasia, respiratory epithelial hyperplasia, and granulomatous inflammation generally characterized as mild to moderate in severity. Because the authors considered the effects a generalized inflammation and repair process, naphthalene was not especially reactive in this study. Furthermore, with a water solubility of 31.7 mg/L at 20° C, naphthalene cannot be considered particularly soluble. Consequently, the HEC methodology specified in EPA (1990b) cannot be applied. However, it should be noted that the end point of greatest concern in humans (Chematological dysfunction) may not have been adequately addressed in the NTP (1992a) study.

Gastrointestinal Effects. Nausea, vomiting, and abdominal pain were reported in 8 adults and 1 child exposed to naphthalene vapors from large numbers of mothballs (300-500) scattered throughout their homes for odor and pest control (Linick 1983). Air samples collected in one home contained naphthalene at 20 parts per billion (ppb); concentrations could have been higher when the mothballs were fresh. Gastrointestinal symptoms disappeared after the mothballs were removed. Few location-specific background data to support this air concentration were reported... There were no histopathological changes in the stomach or intestines of mice exposed to naphthalene (30 ppm) for 2 years (NTP 1992a).

Hematological Effects. Hemolytic anemia is the most frequent manifestation of naphthalene exposure in humans. Acute hemolytic anemia was observed in 21 infants exposed to naphthalene via mothball-treated blankets, woolen clothes, or materials in the infants' rooms (Valaes *et al.* 1963). Ten of these children had a G6PD genetic defect that increased their sensitivity to hemolysis from a variety of chemicals, including naphthalene. Clinical observations included high serum bilirubin values, methemoglobin, Heinz bodies, and fragmented red blood cells. Inhalation appeared to be the primary route of exposure because in all children but two, the naphthalene-treated material was not worn next to the skin. One of the exceptions was an infant who wore diapers that had been stored in naphthalene.

Anemia was reported in 9 individuals exposed to large numbers of mothballs distributed throughout their homes (Linick 1983). The nature of the anemia and specific levels of naphthalene exposure were not identified. In one home, the naphthalene concentration was determined to be 20 ppb at the time of testing, but could have been higher when the mothballs were first distributed.

In another study, a woman who was exposed to reportedly high (but unmeasured) concentrations of a combination of naphthalene and paradichlorobenzene for several weeks in a hot, poorly ventilated work area developed aplastic anemia (Harden and Baetjer 1978). It is difficult to determine the contribution of naphthalene to the aplastic anemia since there was simultaneous exposure to paradichlorobenzene.

In animals, no treatment-related effects on hematologic parameters (hematocrit, hemoglobin concentration, erythrocyte counts, mean cell volume, reticulocytes, and leucocytes) were observed among mice exposed to 10 and 30 ppm naphthalene for 14 days (NTP 1992a). Due to high mortality in the control males, hematology measurements were not continued beyond 14 days.

Musculoskeletal Effects. No studies were located that documented musculoskeletal effects in humans after inhalation exposure to naphthalene... Histological examination of the femur did not reveal compound-related effects in mice exposed to naphthalene at a concentration of 30 ppm for 2 years (NTP 1992a).

Hepatic Effects. Jaundice has been reported in infants and adults after exposure to naphthalene (Linick 1983; Valaes *et al.* 1963). However, the jaundice is a consequence of hemolysis rather than a direct effect of naphthalene on the liver. Infant exposures lasted 1-7 days (Valaes *et al.* 1963); adult exposure durations were not provided (Linick 1983). Dose was not determined in either instance, although a concentration of 20 ppb was measured in the home of one affected individual (Linick 1983).

In animals, no treatment related gross or histopathological lesions of the liver were reported in mice exposed to 30 ppm naphthalene for 2 years (NTP 1992a).

Renal Effects. Renal disease was reported in 9 individuals (details not specified) exposed to large numbers of mothballs in their homes, but symptoms were not described and dose could not be determined (Linick 1983).

In animals, no treatment-related gross histopathological lesions of the kidneys were observed in mice exposed to 30 ppm naphthalene for 2 years (NTP 1992a).

Ocular Effects. Twenty-one workers exposed to naphthalene for up to 5 years in a plant that manufactured dye intermediates were examined for eye problems (Ghetti and Mariani 1956). During the period of exposure, plant conditions were primitive, involving heating of naphthalene in open vats and considerable worker contact with the naphthalene. Eight of the 21 workers developed multiple pin-point lens opacities which had no correlation with the age of the workers. These effects were not overtly noticeable and apparently had no effect on vision. They were judged to be a consequence of naphthalene exposure on the basis of their location in the crystalline lens and the fact that occurrence did not correlate with age. Exposure involved long-term inhalation of vapors and direct contact of vapors with the eyes and skin.

Retinal bleeding and the beginnings of a cataract were identified in a worker from a naphthalene storage area who was most likely exposed to naphthalene through inhalation and dermal/ocular contact (van der Hoeve 1906). The duration of exposure prior to seeking medical attention for eye irritation and problems with vision was not identified.

In animals, no treatment-related ocular lesions were observed in mice exposed to naphthalene at concentrations up to 30 ppm for 2 years (NTP 1992a). However, during a 4-hour exposure of rats to a concentration of 78 ppm, irritation to the eyes was evidenced through lacrimation.

Immunological and Lymphoreticular Effects. No studies were located that documented immunological or lymphoreticular effects in humans or animals after inhalation exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Neurological Effects. Infants are prone to permanent neurological damage (kernicterus) as a consequence of the jaundice that results from naphthalene-induced hemolysis. Bilirubin is absorbed by vulnerable brain cells and this leads to convulsions and sometimes death. Survivors often suffer from motor disturbances and mental retardation (McMurray 1977). Kernicterus was diagnosed in 8 of 21 Greek infants that experienced

hemolysis as a result of naphthalene exposure (Valaes *et al.* 1963). Two of the eight died. One of the infants that died had no G6PD enzyme activity and the other had intermediate activity. Two of the infants were normal with regard to the G6PD trait. Of the remaining infants, three had no G6PD activity and the fourth had intermediate activity. Brain damage seldom occurs in adults as a consequence of jaundice (McMurray 1977).

Nausea, headache, malaise, and confusion were reported in several individuals (children and adults) exposed to large numbers of mothballs in their homes (Linick 1983). Actual levels and duration of exposure were unknown, although a concentration of 20 ppb was measured in one of the affected residences.

No treatment-related histopathological lesions of the brain were reported in mice exposed to 30 ppm naphthalene for 2 years (NTP 1992a)."

Dermal. According to ATSDR (2): "Death: Two cases of hemolytic anemia were observed in infants exposed to naphthalene-treated diapers (Schafer 1951; Valaes *et al.* 1963). One case was fatal. Jaundice, methemoglobinemia, hemolysis, and cyanosis were noted. In the fatal case the symptoms persisted, even after the naphthalene-containing diapers were no longer used (Schafer 1951). The author suggested that use of baby oil on the infant's skin might have facilitated the naphthalene absorption.

No treatment-related deaths occurred within the 14-day observation period when naphthalene was applied at 2,500 mg/kg to the skin of male and female rats or when doses of up to 1,000 mg/kg/day were applied to the skin for 6 hours/day, 5 days/week for 13 weeks (Gaines 1969; Frantz *et al.* 1986). There were also no deaths in New Zealand White rabbits after application of 2,000 mg/kg naphthalene to intact and abraded shaved areas of skin in an LD50 study (Papciak and Mallory 1990)...

2.2.3.2 Systemic Effects

No studies were located that documented musculoskeletal effects in humans or animals after dermal exposure to naphthalene...

Respiratory Effects. No studies were located that documented respiratory effects in humans after dermal exposure to naphthalene... No histological changes of the lungs were noted in rats dermally treated with doses of up to 1,000 mg/kg/day naphthalene (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986).

Cardiovascular Effects. No studies were located that documented cardiovascular effects in humans after dermal exposure to naphthalene... No differences in organ weight or histological changes of the heart were noted in rats dermally treated with 1,000 mg/kg/day naphthalene (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986).

Gastrointestinal Effects. No studies were located that documented gastrointestinal effects in humans after dermal exposure to naphthalene... No histological changes of the esophagus, stomach, or intestines were noted in rats dermally treated with 1,000 mg/kg/day naphthalene (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986).

Hematological Effects. Hemolytic anemia was reported in infants dermally exposed to diapers or other clothing treated with naphthalene mothballs (Dawson *et al.* 1958; Schafer 1951; Valaes *et al.* 1963). Jaundice, fragmentation of erythrocytes, Heinz bodies, methemoglobinemia, and reticulocytosis were observed. Several of the infants had G6PD deficiencies. Individuals with this genetic disorder are particularly susceptible to hemolysis from chemical agents. The application of oil to the skin was assumed to aid the absorption of naphthalene, as shown by the increasing severity of symptoms (jaundice and cyanosis) even after the use of the naphthalene-containing diapers ceased (Schafer 1951).

There were no changes in hemoglobin, hematocrit, red blood cell count, leukocyte count, or platelet count at 4 and 13 weeks in rats treated with doses of up to 1,000 mg/kg/day applied to the skin (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986).

Hepatic Effects. The liver was enlarged in two infants who experienced acute hemolysis after dermal exposure to naphthalene (Dawson *et al.* 1958; Schafer 1951). The relationship between liver enlargement and potential naphthalene-induced hemolysis is unknown. There were no differences in liver weights or histological damage to the liver in rats dermally treated with doses of up to 1,000 mg/kg/day naphthalene (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986). In addition, the levels of aspartate amino transferase, alanine amino transferase, urea nitrogen, and bilirubin were not elevated in the exposed rats as compared to the controls.

Renal Effects. No studies were located that documented renal effects in humans after dermal exposure to naphthalene... There were no differences in kidney weights or histological damage to the liver in rats dermally treated with doses of up to 1,000 mg/kg/day naphthalene (6 hours/day, 5 days/week) for 13 weeks (Frantz *et al.* 1986). In addition, the results of urinalysis conducted at 4 and 13 weeks on the treated rats were not different from the control results, indicating that there was no impairment of kidney function.

Immunological and Lymphoreticular Effects. No studies were located that documented immunological or lymphoreticular effects in humans after dermal exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene. An enlarged spleen was noted in two human subjects dermally exposed to naphthalene (Dawson *et al.* 1958; Schafer 1951). However, spleen enlargement is a result of hemolysis rather than a direct effect of naphthalene on the spleen... In animals, dermal application of

pure naphthalene once per week for 3 weeks did not result in delayed hypersensitivity reactions in guinea pigs (Papciak and Mallory 1990; PRI 1985c)."

Sensitive Subpopulations

According to ATSDR (2): "A susceptible population will exhibit a different or enhanced response to naphthalene than will most persons exposed to the same level of naphthalene in the environment. Reasons include genetic make-up, developmental stage, age, health and nutritional status (including dietary habits that may increase susceptibility, such as inconsistent diets or nutritional deficiencies), and substance exposure history (including smoking). These parameters result in decreased function of the detoxification and excretory processes (mainly hepatic, renal, and respiratory) or the pre-existing compromised function of target organs (including effects on clearance rates and any resulting end-product metabolites). For these reasons we expect the elderly with declining organ function and the youngest of the population with immature and developing organs will generally be more vulnerable to toxic substances than healthy adults. Populations who are at greater risk due to their unusually high exposure are discussed in Section 5.6, "Populations With Potentially High Exposure."

The hemolytic response to naphthalene is enhanced by the presence of inherited erythrocyte G6PD deficiency. Although any human may experience acute hemolysis if exposed to a sufficiently high dose of naphthalene, this enzyme deficiency may cause some persons to be unusually sensitive. The incidence of the deficiency among Caucasians of European origin is relatively low, while there is a higher incidence among certain groups of Asians and Middle Eastern populations. A study of hemolytic anemia in African-American children with G6PD deficiency by Shannon and Buchanan (1982) suggests that this is a population that may be susceptible to the hemolytic effects of naphthalene exposure. It was also reported that 16% of African-American males are G6PD-deficient (Calabrese 1986). According to Shannon and Buchanan (1982), a syndrome of acute severe hemolysis following exposure to oxidative stress is associated with the Mediterranean variant of the deficiency, whereas the hemolytic anemia seen in African-Americans is generally mild.

Infants also appear to be more sensitive to the effects of naphthalene than adult humans. It is believed that the less-developed metabolic conjugation pathways of the infant may contribute to its sensitivity to naphthalene. The limited mobility of infants when they are wearing naphthalene-treated clothing or when they are near other naphthalene-treated articles may maximize exposure due to the development of a microenvironment with a high level of naphthalene vapor in the space around the infant. The tendency for infants and small children to place small objects, such as mothballs, in their mouths also increases their risk..."

Chemical Interactions

According to ATSDR (2): "When either naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene was applied dermally in combination with benzo[a]pyrene (BaP), there was an inhibitory effect on the induction of skin tumors in female mice (Schmeltz *et al.* 1978). These investigators also reported that a mixture containing naphthalene (0.02%), 2-methylnaphthalene (0.02%) and 10 other methylated and ethylated naphthalenes (each at 0.02%) also appeared to inhibit the development of BaP-induced skin tumors. The authors suggested that it is likely that certain naphthalenes compete with BaP for the same enzyme sites, resulting in alteration of the BaP metabolic pathway and decreased production of the active BaP metabolite. This hypothesis is consistent with the observation that benzo(a)pyrene hydroxylase is inhibited by naphthalene (Shopp *et al.* 1984). Dermal application of the naphthalene mixture did not induce tumors in the absence of BaP. The results of these studies were not analyzed statistically.

Several studies have been conducted to assess factors which influence the toxicity of naphthalene. For the most part, these studies have evaluated the effects of mixed function oxidase activity (MFO) and alterations in glutathione levels on pulmonary and ocular toxicities. The effects of cyclooxygenase activity, antioxidants, and epoxide hydrolase inhibitors on the cataractogenic effect of naphthalene have also been evaluated. The administration of MFO inhibitors (SKF-525A, metyrapone) and antioxidants (caffeic acid and vitamin E) decreased ocular toxicity in mice (Wells *et al.* 1989). Use of ALO1576, an inhibitor of the enzyme aldose reductase, prevented cataract formation in both *in vivo* and *in vitro* studies (Xu *et al.* 1992a, 1992b). On the other hand, naphthalene-induced cataracts were enhanced by pretreatment with a MFO inducer (phenobarbital) and a glutathione depletor (diethyl maleate) (Wells *et al.* 1989). Pulmonary damage was decreased by prior treatment with a MFO inhibitor (piperonyl butoxide), but enhanced by prior treatment with a glutathione depletor (diethyl maleate) (Warren *et al.* 1982). For the most part, these studies support the role for mixed function oxidase activity and glutathione conjugation in naphthalene-induced pulmonary and ocular lesions.

Mixed function oxidase inducers also affect the metabolism of 2-methylnaphthalene. Inducers that influence cytochrome P-450 increase the oxidation of the side chain and the concentration of one dihydrodiol. Induction of cytochrome P-450 increased the production of two other dihydrodiols (Melancon *et al.* 1985). The production of naphthoic acid in preference to the diols may explain why 2-methylnaphthalene is less toxic to Clara cells than naphthalene.

In general, interactions with environmental contaminants, such as polycyclic aromatic hydrocarbons, should be expected at hazardous waste sites. Most hazardous waste sites (with the notable exception of certain pharmaceutical sites) would not be expected to contain substantial volumes of certain types of contaminants, such as antioxidants or cytochrome P-450 inhibitors."

Dose-Response Parameter Estimation

CANCER. The U. S. EPA's *Integrated Risk Information System* (IRIS) database indicates that naphthalene is not be classified as a human carcinogen based upon available data:

"EVIDENCE FOR HUMAN CARCINOGENICITY

o CLASSIFICATION : D; not classifiable as to human carcinogenicity

o BASIS FOR CLASSIFICATION : Based on no human data and inadequate data from animal bioassays. NOTE ADDED IN JULY 1995: Subsequent to the verification of this cancer assessment in 1990, the National Toxicology Program completed a two-year cancer bioassay (1991); its results suggest that naphthalene may be more appropriately classified as a possible human carcinogen (Group C under current EPA guidelines). The NTP concluded, "Under the conditions of these 2-year studies, there was no evidence of carcinogenic activity of naphthalene in male B6C3F1 mice exposed by inhalation to concentrations of 10 or 30 ppm for 6 hours daily, 5 days per week, for 103 weeks. There was some evidence of carcinogenic activity of naphthalene in female B6C3F1 mice, as indicated by the increased incidences of pulmonary alveolar/bronchiolar adenomas."

NON-CANCER EFFECTS. **Acute Exposure, Lethality.** Table 2 in the *Acute Toxicity* section, above, reports a 4-h lethality benchmark of $>85 \text{ mg/M}^3$ in rats, based upon which the acute lethality RfC might be derived. However, this derivation is unsatisfactory because values preceded by the $>$ symbol may be of indeterminate magnitude. In this case, data pertaining to oral exposure and to inhalation of structurally related compounds suggest a lethality benchmark orders of magnitude higher than that reported in Table 2. The RfC alternatively might be derived from a 4-h LC_0 of 78 ppm (408.95 mg/M^3) in rats also reported in *Acute Toxicity*. The RfC is derived by applying a safety/uncertainty factor of 10 to extrapolate from animals to humans, yielding 4-h $\text{RfC} = 41 \text{ mg/M}^3$, equivalent to 8-h $\text{RfC} = 21 \text{ mg/M}^3$. However, this study likewise seems too low, and failed to report a level which was lethal to any animals. The inhalation RfC, therefore, may be derived by extrapolating from an oral lethality benchmark, such as 2,200 mg/kg in rats (which are often used for extrapolation to humans), as reported in *Acute Toxicity*. This is equivalent to $7,700 \text{ mg/M}^3$ (calculation: $2,200 \text{ mg/kg} \times 70 \text{ kg} \div 20 \text{ M}^3/\text{d} = 7,700 \text{ mg/M}^3$). The RfC may be derived from this lethality benchmark value by applying two safety/uncertainty factors to extrapolate from an effect level to a NOAEL (LC_0) and from animals to humans. This yields $\text{RfC} = 77 \text{ mg/M}^3$. The applicable exposure duration is uncertain, but may be assumed applicable to an eight-hour

workshift.

Chronic exposure, occupational. A chronic inhalation RfC for occupational exposure to naphthalene may be derived based upon existing occupational standards and guidelines for occupational exposure to naphthalene. According to RTECS (9), an eight-hour time-weighted average (TWA) Permissible Exposure Limit (PEL) of 10 ppm (50 mg/M³) has been established by both U. S. Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA), and the American Conference of Governmental Industrial Hygienists (ACGIH). ACGIH indicates that this value is established to prevent ocular effects (eye irritation), *"but possibly not blood changes in hypersusceptibles"* (1). The 10-ppm (50-mg/M³) value has been adopted in other nations. It is appropriate as an acceptable exposure benchmark in the context of occupational inhalation exposure to airborne naphthalene vapors.

Occupational exposure, neurological effects. Neurological effects; including headache, malaise, and confusion; were reported among individuals exposed to mothballs in their homes, as indicated in *Acute Toxicity*, above. Although concentrations and exposure duration data were not provided, one home was reported to exhibit an airborne naphthalene level of 20 ppb-v (0.02 ppm-v). A higher concentration (30 ppm-v) was reported to have produced no histopathological lesions in the brains of mice exposed for two years. One procedure for deriving the RfC is to apply a safety/uncertainty factor to 30 ppm as an animal NOAEL, to extrapolate to humans. This yields an inhalation neurological effects RfC value of 3 ppm-v (15 mg/M³). An alternative approach is to apply a safety/uncertainty factor to 20 ppb-v as a LOAEL for a clinically less-serious effect to extrapolate to a NOAEL. If a value of three for the safety/uncertainty factor is selected, the RfC would be 6.67 ppb-v (33.3 µg/M³). A factor discouraging use of the latter approach is uncertainty about the 20-ppb-v value on which it is based. Thus, the neurological RfC for the occupational setting may be set higher, at 3 ppm-v (15 mg/M³).

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TECH SUPPORT APPENDIX 3

Toxicological Profile:

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

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Physical and Chemical Properties

Polycyclic aromatic hydrocarbons (PAHs) are comprised of a large group of organic substances whose structures include multiple rings. Several hundred PAHs have been associated with pyrolysis or incomplete combustion of organic materials (26), such as foods, tobacco, municipal refuse, industrial organic chemicals, and fossil fuels. Although PAHs may constitute a significant *chemical* result of incomplete combustion of organics, a significant *physical* result is frequently formation of particles (such as fly ash) containing or consisting of condensed organic matter. Such organic matter, which includes PAHs, has been assigned the acronym POM, for particulate organic matter.

The term POMs came into wide use in the early 1970s, primarily to denote the polycyclic component of fossil fuel combustion residues. Both POM and PAHs include pure (homocyclic) polycyclic aromatic compounds, whereas POMs also include polycyclic heterocyclic compounds, such as carbazole and pyridine derivatives, as well as some nitro- derivatives of these heterocyclic compounds and other hydrocarbons.

In the environment, the hydrocarbon fraction tends to predominate, with the heterocycles and nitro- compounds constituting only a small fraction of total polycyclics, both with regard to the mass of material present, and the number of compounds detected. This profile will emphasize the polycyclic hydrocarbons, and the term "PAHs" will be used to denote all of the polycyclic organic products of partial combustion emitted by the planned Quonset Point facility.

PAHs are generated not only by human technology, but by natural processes. They are widely distributed in the environment, in plants and animal tissues, and adsorb strongly to particulate matter. Man-generated sources of PAHs in air include automobile and aircraft emissions, power plants burning fossil fuels, refuse incinerators, and other industrial facilities (24). PAH concentrations in air have been reported to vary from about 0.001 ng/M³ to 20 ng/M³ in rural areas, to approximately 0.1 ng/M³ to 60 ng/M³ in urban areas (32). PAHs have been detected in some foods, depending upon the method of cooking, presentation, and storage. Exposure to PAHs has been reported to occur principally via direct inhalation of tobacco smoke or other polluted air, and via dermal contact with tars, oils, and soot (8). Some of the more completely characterized PAHs include the following (20):

anthracene	fluoranthene
benz[a]anthracene	fluorene
benzo[a]pyrene	3-methyl cholanthrene
benzo[b]fluoranthene	naphthalene
chrysene	phenanthrene
dibenzocarbazole*	pyrene
dibenzo[e]pyrene	
*a heterocyclic compound	

Of all the PAH compounds investigated, benzo[a]pyrene (BAP) is the most common and thoroughly studied (20). Useful physical-chemical properties of several PAHs--all exhibiting between two and six aromatic rings--are set forth in Table 1.

Table 1. Physical-Chemical Properties of Selected Polycyclic Aromatic Hydrocarbons (PAHs)*

compound	CAS No.	molecular weight (daltons)	vapor pressure (mm Hg)	water solubility (mg/100 ml)	log K _{ow}
naphthalene	91-20-3	128.16	8.2 x 10 ⁻² @ 25°C	3.17	3.37
phenanthrene	85-01-8	178.22	6.8 x 10 ⁻⁴ @ 20°C	0.1	4.46
anthracene	120-12-7	178.22	1.95 x 10 ⁻⁴ @ 20°C	0.00446	4.45
fluoranthene	206-44-0	202.24	5.0 x 10 ⁻⁶ @ 25°C	0.0206	4.90
pyrene	129-00-0	202.24	2.5 x 10 ⁻⁶ @ 25°C	0.0132	4.88
benz[a]anthracene	56-55-3	228.20	1.01 x 10 ⁻⁵ @ 20°C	0.00094	5.61
chrysene	218-01-9	228.20	6.3 x 10 ⁻⁹ @ 25°C	0.000018	5.61
benzo[a]pyrene	50-32-8	252.30	5.6 x 10 ⁻⁹ @ 25°C	0.000012	6.06
benzo[g,h,i]perylene	191-24-2	276.30	1.03 x 10 ⁻³⁰ @ 25°C	0.00007	6.51

*Adapted from: **U. S. EPA.** *Health Assessment for Polycyclic Aromatic Hydrocarbons (PAHs).* Cincinnati, Environmental Criteria and Assessment Office; and Washington, DC, Office of Solid Waste and Emergency Response; EPA/540/1-86/013, 49 pp., September 1984.

water solubility: reported at 25° C

log K_{ow}: octanol/water partition coefficient

Pharmacokinetics

Absorption

Absorption by all routes is likely to be significantly less efficient than 100 percent, particularly with regard to PAHs which may be tightly bound to particles, such as fly ash, and may therefore be to a large degree biologically unavailable.

Inhalation. The efficiency of pulmonary absorption of PAHs depends upon particle size and deposition rate in the respiratory tract. In one study, only 15 percent of the benzo(a)pyrene (BAP) adsorbed to carrier particles was found to be bioavailable for reaction with respiratory tissue. It is, therefore, reasonable to assume either that 100 percent of bioavailable PAHs may be absorbed via the lungs, or equivalently, that 15 percent of total PAHs may be absorbed.

Ingestion. The high lipid (fat) solubility of PAHs facilitates their absorption via the intestinal tract. The efficiency with which PAHs are absorbed following exposure via the ingestion route has been reported to equal >50 percent (26, 27). PAH absorption efficiencies were studied in 250-gram subadult rainbow trout fed PAHs over a period of five days (33; Table 2). As indicated by the table, gastrointestinal absorption efficiencies varied from 1 to 32 percent.

Dermal contact. The high lipid solubility of PAHs facilitates their absorption via the skin. More specific, quantitative information about absorption efficiency following dermal contact is apparently absent from the available literature.

Distribution

The principal tissues and organs to which PAHs are distributed following absorption have been reported to include fat, lungs, intestines, liver, and mammary glands (24, 26, 27).

Table 2. Absorption and Elimination of Polycyclic Aromatic Hydrocarbons By Rainbow Trout*

substance	dose (mg/kg/5d)	half-time ($t_{1/2}$; days)	absorption efficiency (percent)
phenyl naphthalene	40.8	25	15
acenaphthalene	40.0	1	32
2-methyl anthracene	40.0	2	14
triphenylene	38.4	2	4
9-methyl anthracene	40.0	4	1
perylene	40.0	2	2

*Adapted from:

Niimi, A. J., and G. P. Dookhran. *Dietary absorption efficiencies and elimination rates of polycyclic aromatic hydrocarbons (PAHs) in rainbow trout (*Salmo gairdneri*)*. Environmental Toxicology and Chemistry, 8:719-22, 1989.

Metabolism

PAHs are typically complex polycyclic aromatic hydrocarbons principally formed by incomplete combustion or pyrolysis (heat breakdown in an oxygen-starved atmosphere) of organic compounds, such as paper, wood, and rubber. Atmospheric PAHs may be exemplified by naphthalene, phenanthrene, anthracene, fluoranthene, and pyrene, which are principally gases; and benz-a-anthracene, chrysene, benzo[ghi]perylene, and benzo-a-pyrene (BAP), which are predominately particulate (26). Metabolism of this large and diverse category of substances principally occurs in the liver by action of the microsomal mixed function oxidase system of enzymes (27), which includes the cytochrome P450 system. Metabolism produces a variety of intermediates, some of which are more toxic than the parent compounds. These intermediates are frequently metabolically activated to carcinogenic electrophilic epoxides (24). PAH metabolism specifically involves the P450 enzymes known as aryl hydrocarbon hydroxylases (AHH), whose increased synthesis in the liver may be induced by exposure to PAH, as well as epoxide hydrolases (EH), which produce potentially carcinogenic vicinal glycols. PAHs may form conjugates with glutathione and glucuronic acid, as well as with proteins and nucleic acids, including both DNA and RNA.

PAH metabolism is dominated by the difficulty of opening saturated carbon bonds in the multiple PAH rings, which are relatively stable (24). However, enzymatic attack may alter PAH molecules to more soluble and excretable compounds, sequentially including formation of complex alcohols, ketones, aldehydes, and carboxylic acids. Metabolism also produces phenols and, following epoxide formation, dihydrodiols, which yield diol-epoxides via microsomal mono-oxygenase enzymes. Some protection of cellular macromolecules from the plethora of reactive intermediates attending PAH metabolism is afforded by formation of excretable conjugates with glutathione and glucuronic acid, as well as tetrahydrotetrols.

Excretion

Although differences among individual members of the diverse group of PAHs must be emphasized, generally the principal elimination routes are the bile and feces (24). When PAHs were administered intratracheally or injected subcutaneously or intravenously, the feces constituted the principal elimination pathway. Rapid elimination occurred initially (within ten minutes) following intravenous injection, but a slower phase ensued, lasting some six hours. Intra gastric administration resulted in fecal elimination of 82 percent of the dose within 24 hours. However, following intraperitoneal injection, only 30 percent of the dose appeared in the feces after three days. In rainbow trout, elimination half-times varied from 1 to 25 days, depending primarily upon the PAH which was administered (orally; 33; also see Table 2, above).

The kinetics of clearance behavior may differ depending upon organism and exposure route. When PAHs are absorbed from the lungs or through the skin, for example, they will not make a first-pass through the liver, which is the major metabolizing organ. Therefore, they will not undergo the types or degree of metabolic processing which biochemically prepares foreign (xenobiotic) substances for excretion. Rather, they would first arrive at potentially sensitive sites of action and binding within other organs, resulting in formation of new complexes exhibiting different clearance kinetics.

Pharmacodynamics

Acute Toxicity

Acute exposure to polycyclic aromatic hydrocarbons elicits a wide variety of adverse health conditions, in accordance with the broad distribution of PAHs within the body (24). These conditions, observed in rodents, include damage to the hematopoietic and lymphoid systems, thymus gland degeneration, reduction in the weights of spleen and mesenteric lymph nodes, bone marrow retardation, and wasting disease, all associated with methylcholanthrene. Dimethylbenz(a)anthracene (DMBA) has been associated with adverse effects upon bone marrow and lymphoid tissue; single doses of 112-133 mg/kg in the diets of female rats severely depressed hematopoietic and lymphoid precursors, causing pancytopenia (reduction in counts of circulating red and white blood cells and platelets). Interaction with DNA may explain some toxic properties of PAHs. An LD₅₀ of 250 mg/kg has been reported in mice administered BAP by intraperitoneal injection (16), whereas an oral LD₅₀ in rats has been reported to range from 1.8 to 2.4 g/kg (4).

Acute toxic effects associated with most PAHs can occur in humans under unusual, and unusually intense, exposure scenarios, such as in intentional or accidental poisoning. However, acute poisonings with naphthalene in humans have occurred, inasmuch as naphthalene is a commercially available substance. Acute poisonings with it have been associated with gastrointestinal and neurological disturbances, delayed hemolytic anemia (anemic condition resulting from rupture of red blood cells), kidney effects and, in severe cases, toxic effects to the eye (4). Direct contact with PAHs has elicited a dermatitis reaction characterized by symptoms of skin reddening, itching, and burning (4). PAHs have been shown to cause hyperkeratosis (overgrowth of the cornified layer of the skin), cytotoxicity, hyperplasia (excessive tissue growth), and loss of sebaceous glands in the skin (32). Overt signs of toxicity associated with BAP exposure have been reported to be usually non-evident, except at doses high enough to produce tumors (1, 32).

Mutagenicity

Numerous investigations have contributed to the conclusion that many PAHs are genotoxic, and that their genotoxic potential may be related to their metabolism to such highly electrophilic reactive metabolites as epoxides (24, 32; see *Metabolism* subsection). These reactive metabolites have been shown to bind to DNA and other critical cellular macromolecules, cause DNA damage, and induce gene mutations in microbial systems, such as the Ames assay. Cultured mammalian cells challenged with PAHs have also revealed their potency as gene mutagens. Mammalian chromosomes, including human chromosomes, exhibited variations in number and structure following exposure to various PAHs, and sister chromatid exchanges were induced by the PAH benzo(a)pyrene (BAP) in cultured human lymphocytes (24, 32).

BAP has been extensively studied with respect to genotoxicity in a variety of bacterial and mammalian test systems, both *in vivo* and *in vitro*, with positive results. Positive results have also been obtained with BAP with respect to the following mutagenic end-points in various *in vitro* test systems: bacterial DNA repair, bacterial point and multiple loci mutations, sister chromatid exchange, and chromosomal aberrations in cultured mammalian cells (29, 30). Mutagenicity tests of BAP *in vivo* have also yielded positive results for sister chromatid exchange, chromosomal aberrations, and sperm abnormalities in experimental animals (8, 9). In the case of naphthalene, however, bacterial mutagenic studies have apparently yielded only negative results (4).

Although *in vivo* studies have revealed induction of chromosome abnormalities in the presence of neoplastic transformation, evidence appears to be lacking that somatic mutations are produced by PAHs in the absence of neoplasia (24). However, an inconsistent positive result was obtained in dominant lethal assays in mice exposed to high doses of BAP, and abnormalities in sperm morphology have been observed, possibly suggesting mutagenic damage to primary spermatocytes and spermatogonia in mice (24).

Carcinogenicity

Many PAHs are capable of producing tumors in skin and other epithelial tissues in numerous test species, following exposure via all routes (32). BAP in particular has been extensively studied with regard to carcinogenicity in animals. In animal bioassays, BAP has produced tumor growth by all exposure routes in all species tested (29, 30). Tumors of the nasal cavity, larynx, trachea and pharynx have occurred in hamsters exposed to airborne concentrations of BAP as low as 9.5 mg/M³ (23). Dermal application, as well as subcutaneous and intramuscular injection have resulted in local tumor (contact site) formation in mice, rats, guinea pigs, monkeys, and hamsters (8). BAP administered orally to mice has caused stomach tumors (14). The U. S. EPA has, accordingly, classified BAP in Group B₂ (probable human carcinogen) based upon multiple animal studies (29, 30).

PAHs besides BAP have been extensively investigated to ascertain their carcinogenic potential and potency (10, 26, 27). The classical demonstration of PAH carcinogenicity in animals was made by skin-painting the compounds on mice (10). The most powerful PAH agents caused skin tumors following only a brief lag time. Potency of PAHs as carcinogens depends upon structure. Anthracene, which consists of three benzene rings in a straight line, has been reported to exert no carcinogenic effects, whereas the angular arrangement of benzene rings of, for example, benz[a]anthracene produces weak carcinogenicity. Potency is further increased by addition of benzene rings in select positions, yielding such compounds as dibenz[a,h]anthracene and benzo[a]pyrene (BAP). Further potency is attained by methylation at specific ring carbons, yielding such powerful carcinogens as 7, 12-dimethylbenz[a]anthracene (DMBA; 10). In addition to skin-painting, exposure via inhalation and ingestion has yielded positive results in numerous carcinogenicity bioassays over many years (26).

PAHs have been associated with carcinogenicity to humans based upon epidemiological studies, mostly of occupationally exposed individuals (26). The numerous epidemiological investigations undertaken have established a firm association between cancer incidence and exposure to PAHs in soots, tars, and oils, among other substances, although not necessarily in pure compounds. For example, long-time coke plant employees have exhibited elevations of lung cancers, digestive tract cancers, and cancers of other sites, such as the pancreas and kidneys (24). The classical association between PAHs and human cancer was established by Percival Pott as early as 1775, when he noted elevations of scrotal cancers among chimney sweeps who were exposed to soot.

Quantification of carcinogenic potency. The basis selected for quantifying the carcinogenic potency of PAH is the U. S. EPA's *Health Effects Assessment Document for Benzo(a)pyrene* (27). The U. S. EPA document developed two relative potency index values, one for inhalation, and one for ingestion of BAP. The inhalation value is $6.11 \text{ (mg/kg/d)}^{-1}$ for humans, and the ingestion value is $11.53 \text{ (mg/kg/d)}^{-1}$. On a per-mole basis, the potency values are determined by multiplying by the molecular weight of BAP (MW = 252), resulting in relative potency index values of 1.54×10^3 and $2.91 \times 10^3 \text{ (mMol/kg/d)}^{-1}$, respectively.

The U. S. EPA's basis for deriving the relative potency index for ingestion was a long-term study of dietary exposure of CFW mice to 1 to 250 ppm of BAP (14). The end point used for potency determination was incidence of stomach tumors, mostly of the squamous cell variety. EPA's basis for deriving the relative potency index for inhalation was a long-term study of inhalation exposure of Syrian golden hamsters to BAP at air levels of 0, 2.2, 9.5, or 46.5 mg/M^3 for 10-96 weeks (23). The end point used for potency determination was respiratory tumor incidence. The human relative potency index value assumes that 100 percent of inhaled BAP dose is absorbed into the hamster or human body.

Although EPA did not calculate unit risk values for each relative potency index value, data are available for making these calculations. For the inhalation value, the unit risk value is derived based upon an assumed respiratory volume of $20 \text{ M}^3/\text{d}$ by a 70 kg individual:

$$\begin{aligned} \text{Unit risk value } (\mu\text{g/M}^3)^{-1} &\times 1 \text{ day}/20\text{M}^3 \times 1 \mu\text{g}/10^{-3} \text{ mg} \times 70 \text{ kg} \\ &= 6.11 \text{ (mg/kg/d)}^{-1}. \end{aligned}$$

It follows algebraically that the unit risk value for inhalation equals 1.75×10^{-3} . Parallel calculations using the relative potency index value for ingestion (= 11.53) result in a unit risk value for ingestion of 3.30×10^{-3} .

Teratogenicity

BAP has been shown to cross the mammalian (rat) placenta (18, 24), and naphthalene has been shown to cross the human placenta (4). No data relating to teratogenicity following PAH inhalation appears to be available, and several studies of PAH teratogenicity following oral exposure were negative (26, 27). Malformations were produced by direct injection of 0.01 ml of a 0.025 percent solution of methylcholanthrene into embryonic fluids of mice (24). Dimethylbenz[a]anthracene (DMBA) and its hydroxymethyl derivatives exhibited potent teratogenicity. Sprague-Dawley rats intravenously injected with a single dose of about 5.5-7 mg of 7-hydroxymethyl-12-benz[a]anthracene on day 12-14 of gestation produced malformations in 100 percent of surviving fetuses, including stunting, lordosis (curvature) of cervical and upper thoracic parts of the vertebral column, encephalocele (gap in the skull, usually with herniation of brain substance), and spina bifida (spinal column defect in which vertebral arches are missing and spinal cord membranes and tissues may protrude). Likewise, DMBA produced teratogenic effects when administered on day 13 of gestation.

Reproductive Effects

Reported reproductive effects associated with BAP have included reduced gonadal weight, reduced fertility (13), stillbirths, fetal resorptions (19), reduced fetal weight, malformations, and fetal deaths (7, 19). Adverse reproductive and developmental effects observed in experimental animals may be attributable to BAP itself (as opposed to a metabolite; 11). Transplacental carcinogenesis has been reported in mice administered large doses of BAP (24). BAP fed to rats at a dose of 1.0 mg/g of food exhibited no disturbances of ovarian cycle, ovulation, fertilization, or implantation, although a few fetal resorptions were reported. Male mice also appeared to be unaffected. Studies involving the feeding of BAP to cockroaches, chickens, ducks, mice, rats, and dogs revealed a brief period of infertility occurring in the chicken, and fetal resorptions in the rat (24). Naphthalene administered orally to mice (300 mg/kg) on gestational days 7-14 was nearly lethal to the adult mothers and resulted in a significant reduction in live births (4).

Other Chronic Effects

PAHs, such as the benz[a]anthracene derivatives dibenzo[a,h]anthracene (DBaH_A), benz[a]anthracene, and anthracene, injected repeatedly into mice and rats were reported to alter lymphoid tissue (24). Each of three PAHs were administered to 19 - 38 mice weekly for 40 weeks by subcutaneous injection, such that each mouse received a dose of 10 mg. Principal effects included increased numbers of reticulum (stem) cells in lymph glands, iron accumulation, reduced numbers of lymphoid cells, and lymphoid sinus dilation. DBaH_A significantly reduced spleen weights of treated mice.

DBaH_A, a carcinogen, caused normal lymph nodes of male rats to undergo hemolymphatic (blood and lymph) changes, such as appearance of extravascular red blood cells in lymph spaces and appearance of large pigmented cells. A non-carcinogenic PAH (anthracene) did not induce these changes. Doses eliciting the observed effects were not reported (24).

Carcinogenic PAHs contacting the tracheobronchial mucosa of test animals have been commonly associated with of epithelial proliferation, cell hyperplasia in the absence of necrosis (cell death) and/or marked inflammation (24). For example, hamsters administered 100 µg of dimethylbenzanthracene (DMBA) or BaP intratracheally over a period of 4 - 16 months developed preneoplastic lesions, among other symptoms (acute pneumonia, chronic pneumonitis), eventually leading to death (60 percent) and lung tumors (percent not reported; 24). Recognition of such preneoplastic lesions is of obvious value. Chronic pneumonitis was characterized by proliferation of large squamoid alveolar cells occasionally forming tissue masses which filled air spaces. This proliferating alveolar epithelial tissue eventually began to invade and destroy neighboring cells, and was then classified as malignant. Tracheal damage occurred, consisting of mucosal and submucosal chronic exudative inflammation, ulceration, reserve cell hyperplasia (cell number increase), squamous metaplasia (transformation of glandular or mucosal epithelium into stratified squamous epithelium), and squamous cell carcinoma (24).

PAHs have also been shown to suppress the cell-mediated and humoral immune systems. Potency of PAHs as immunosuppressive agents appears to be correlated with carcinogenic potency, and PAHs such as anthracene and benzo[e]pyrene which have exhibited no carcinogenic potency have also exhibited no immunosuppressive potency (24). Mice administered 1 mg of DMBA by a single intramuscular injection exhibited a deficiency of bone-marrow-derived lymphocytes, and transient immunosuppression. Likewise, no *sustained* immunosuppression was observed in guinea pigs receiving 4 mg of MCA every four weeks for 6 - 9 months. The transient nature of the immunosuppression rendered

questionable its significance in neoplastic induction, although more toxicologically potent PAHs capable of destroying thymus-derived lymphocytes might produce sustained immunosuppression favorable to neoplastic induction.

PAHs have caused skin disorders, damage to the bronchial epithelium (1), and immunosuppression (1, 22). Widespread cytotoxicity and tissue damage following administration of various PAHs has occurred (25). In a subchronic study, various PAHs applied to the skin of mice suppressed sebaceous gland secretions (2). BAP has been reported to elicit various alveolar macrophage responses in hamsters (6). In a subchronic bioassay involving mice, oral administration of BAP damaged the hematopoietic (blood forming) system, leading to aplastic anemia and death (15). A significant strain difference in BAP sensitivity was observed and was attributed to genetic variations at a specific gene locus that altered the ability to metabolize BAP (8).

Individuals occupationally exposed to naphthalene exhibited dermal and ophthalmological changes (17). Early animal studies reported anemia and cataracts in rabbits and mice exposed to naphthalene, whereas a recent study revealed decreased spleen weights and lowered liver enzyme levels (aryl hydrocarbon hydroxylase activity) in mice administered doses up to 133 mg/kg/day of naphthalene for 90 days (4).

Sensitive Subpopulations

The group at highest risk of cancer from exposure to BAP are those who work in industries with elevated BAP concentrations (for example, active and passive smokers (1). Within exposed groups, variations in susceptibilities is likely. Genetic variation in levels of the metabolizing enzyme arylhydrocarbon hydroxylase (AHH; which metabolizes BAP to its reactive intermediate) may be one mechanism involved in determining individual sensitivities (specifically, individuals exhibiting high levels of AHH may potentially be more susceptible to lung cancer; 25). However, epidemiological evidence supporting this hypothesis appears to be presently unavailable, and reliable identification of groups exhibiting low levels of AHH is not yet feasible.

Chemical Interactions

Interactions within mixtures of PAHs are likely to occur. BAP and other PAHs may compete for the same metabolizing enzymes. This phenomenon has been shown to either reduce the carcinogenicity of BAP (12) or result in additive or even synergistic effects (5). For example, naphthalene has been reported to inhibit induction of skin tumors by BAP in mice (4). Naturally occurring compounds can induce metabolizing enzymes which also may alter BAP toxicity (1).

Dose-Response Parameter Estimation

As discussed previously, BAP and naphthalene have been chosen to serve as toxicologic indicator compounds for carcinogenic and non-carcinogenic PAHs, respectively. Therefore, in this assessment the carcinogenic dose-response parameter for PAHs (the under potency slope factor) will be derived based upon toxicologic studies of BAP, whereas the non-cancer dose-response parameter (the RfD) will be derived based upon studies of naphthalene.

Cancer. CAG has apparently not developed a cancer potency estimate for BAP; however, the Environmental Criteria and Assessment Office of the U. S. EPA has derived an oral cancer potency estimate of $11.5 \text{ (mg/kg/day)}^{-1}$ (28) based upon the incidence of forestomach tumors in mice orally administered BAP (14). An inhalation cancer potency estimate of $6.1 \text{ (mg/kg/day)}^{-1}$ was also derived based upon induction of respiratory tract tumors in hamsters exposed to 2.2-9.5 mg/M^3 of benzo[a]pyrene (23):

Ingestion cancer potency estimate: $11.5 \text{ (mg/kg/day)}^{-1}$ (28);

Inhalation cancer potency estimate: $6.1 \text{ (mg/kg/day)}^{-1}$ (28).

Non-cancer effects. The U. S. EPA Office of Health and Environmental Assessment has derived a chronic ingestion RfD of $4 \times 10^{-2} \text{ mg/kg/day}$ for naphthalene (30) based upon identification of a NOAEL of 4 mg/kg/day in rats fed naphthalene for 700 days. An uncertainty factor of 100 was applied to account for uncertainties in extrapolating animal data to humans (factor of 10) and to protect possibly-sensitive human subpopulations (factor of 10). An inhalation RfD is apparently unavailable at present. The ingestion value will, therefore, be used to evaluate inhalation exposures, in accordance with U. S. EPA guidance (29, 31):

Ingestion RfD: $4 \times 10^{-2} \text{ mg/kg/day}$ (30);

Inhalation RfD: $4 \times 10^{-2} \text{ mg/kg/day}$ (29, 31).

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TECH SUPPORT APPENDIX 4

Selected Health Risk Assessment Model Input and Output Screens

REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA

(Complete the following table)

CONSTITUENT	Representative COC Concentration					
	in Groundwater		in Surface Soil		in Subsurface Soil	
	value (mg/L)	note	value (mg/kg)	note	value (mg/kg)	note
Hexane, n-	1.0E+0		1.0E+0		1.0E+0	
Naphthalene	1.0E+0		1.0E+0		1.0E+0	
Pyrene	1.0E+0		1.0E+0		1.0E+0	
Toluene	1.0E+0		1.0E+0		1.0E+0	

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: HASP Module: Petroleum Hydrocarbons
Site Location: Generic

Completed By: Dr. Robert A. Michaels
Date Completed: 7/18/2005

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN			Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	Representative Concentration (mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)	(mg/L)	"  " If yes	Only if "yes" left
110-54-3	Hexane, n-	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!		#DIV/0!
91-20-3	Naphthalene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!		#DIV/0!
129-00-0	Pyrene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!		#DIV/0!
108-88-3	Toluene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	NA	#DIV/0!	#DIV/0!		#DIV/0!

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.1

Site Name: HASP Module: Petroleum Hydrocarbons

Completed By: Dr. Robert A. Michaels

Site Location: Generic

Date Completed: 7/18/2005

1 OF 1

SURFACE SOIL SSTL VALUES (< 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN			Soil Leaching to Groundwater			Ingestion, Inhalation and Dermal Contact		Construction Worker	Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	Representative Concentration (mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)	(mg/kg)	"  If yes	Only if "yes" left
110-54-3	Hexane, n-	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!
91-20-3	Naphthalene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!
129-00-0	Pyrene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!
108-88-3	Toluene	1.0E+0	NA	#DIV/0!	NA	NA	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!

Site Name: HASP Module: Petroleum Hyd Job Identification: CT Male

Site Location: Generic

Date Completed: 7/18/2005

SUMMARY CALCULATIONS - SSTL BY CUMULATIVE RISK

CAS No.	Constituent	Representative Concentration Groundwater (mg/L)	Representative Concentration Surface Soil (mg/kg)	Representative Concentration Subsurface Soil (mg/kg)	SSTL exceeded?			Relevant SSTL		
					Groundwater	Surface Soil	Subsurface Soil	Groundwater (mg/L)	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)
110-54-3	Hexane, n-	1.0E+0	1.0E+0	1.0E+0	n	n	o	2.9E-1	9.6E-2	> >Res
91-20-3	Naphthalene	1.0E+0	1.0E+0	1.0E+0	n	n	o	2.9E-1	9.6E-2	> 1.0E+2
129-00-0	Pyrene	1.0E+0	1.0E+0	1.0E+0	o	n	o	>Sol	< 6.6E-1	> >Res
108-88-3	Toluene	1.0E+0	1.0E+0	1.0E+0	n	n	o	2.9E-1	9.6E-2	> 1.0E+2

Completed By: Dr. Robert A. Michaels

Cumulative Target Risk: 0.0E+0

Target Hazard Index: 0.0E+0

Software: GSI RBCA Spreadsheet

Version: v 1.0

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Serial: 0

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.1

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

1 OF 6

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION
AIR EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS: VAPOR AND

DUST INHALATION

Exposure Concentration
Constituents of Concern

	1) Source Medium	2) NAF Value (m ³ /kg) Receptor	3) Exposure Medium Air: POE Conc. (mg/m ³) (1) / (2)	4) Exposure Multiplier (IRxETxEFxED)/(BWxAT) (m ³ /kg-day)	5) Average Daily Intake Rate (mg/kg-day) (3) X (4)
	Surface Soil Conc. (mg/kg)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Hexane, n-	1.0E+0	1.4E+5	7.2E-6	7.0E-2	5.0E-7
Naphthalene	1.0E+0	1.4E+5	7.2E-6	7.0E-2	5.0E-7
Pyrene	1.0E+0	3.9E+7	2.6E-8	7.0E-2	1.8E-9
Toluene	1.0E+0	1.4E+5	7.2E-6	7.0E-2	5.0E-7

 NOTE: ABS = Dermal absorption factor (dim)
 AF = Adherence factor
 AT = Averaging time (days)

 BW = Body Weight (kg)
 CF = Units conversion factor
 ED = Exp. duration (yrs)

 EF = Exposure frequency (days/yr)
 ET = Exposure time (hrs/day)
 IR = Intake rate (L/day or mg/day)

 POE = Point of exposure
 SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

AIR EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS: VAPOR

Exposure Concentration

TOTAL PATHWAY INTAKE (mg/kg-day)

INHALATION

Constituents of Concern

	1) Source Medium	2) NAF Value (m ³ /kg) Receptor		3) Exposure Medium Air: POE Conc. (mg/m ³) (1) / (2)		4) Exposure Multiplier (IRxETxEFxED)/(BWxAT) (m ³ /kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)		(Sum intake values from surface & subsurface routes.)	
	Subsurface Soil Conc. (mg/kg)	On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial	
Hexane, n-	1.0E+0	7.0E+4		1.4E-5		7.0E-2		1.0E-6		1.5E-6	
Naphthalene	1.0E+0	1.4E+5		7.1E-6		7.0E-2		4.9E-7		1.0E-6	
Pyrene	1.0E+0	2.6E+10		3.8E-11		7.0E-2		2.7E-12		1.8E-9	
Toluene	1.0E+0	7.0E+4		1.4E-5		7.0E-2		1.0E-6		1.5E-6	

NOTE: ABS = Dermal absorption factor (dim)
AF = Adherence factor
AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure
SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.2

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 PATHWAY RISK CALCULATION

AIR EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAYS ARE ACTIVE)

CARCINOGENIC RISK

TOXIC EFFECTS

Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial	(3) Inhalation Slope Factor (mg/kg-day) ⁻¹	(4) Individual COC Risk (2) x (3) On-Site Commercial		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
Hexane, n-	D	1.5E-6	0.0E+0	0.0E+0		4.2E-6		5.7E-2	7.4E-5	
Naphthalene	D	1.0E-6	0.0E+0	0.0E+0		2.8E-6		6.0E-2	4.7E-5	
Pyrene	D	1.8E-9	0.0E+0	0.0E+0						
Toluene	D	1.5E-6	0.0E+0	0.0E+0		4.2E-6		1.1E-1	3.7E-5	

Total Pathway Carcinogenic Risk = 0.0E+0 0.0E+0

Total Pathway Hazard Index = 1.6E-4 0.0E+0

Site Name: HASP Module: Petroleum I Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

DERMAL CONTACT

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

 $(SA \times AF \times ABS \times CF \times EF \times ED) / (BW \times AT)$ (1/day)

5) Average Daily Intake Rate

(mg/kg-day)

Constituents of Concern

	Surface Soil Conc. (mg/kg)	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial
Hexane, n-	1.0E+0		1.0E-5		1.0E-5
Naphthalene	1.0E+0		1.0E-6		1.0E-6
Pyrene	1.0E+0		1.0E-6		1.0E-6
Toluene	1.0E+0		1.0E-5		1.0E-5

NOTE: ABS = Dermal absorption factor (dim)
AF = Adherence factor
AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
ET = Exposure time (hrs/day)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure
SA = Skin surface area (cm²)

Site Name: HASP Module: Petroleum Site Location: Generic

Completed By: Dr. Robert A. Micr Date Completed: 7/18/2005

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TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

SOIL EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:

INGESTION

Exposure Concentration

1) Source Medium

4) Exposure Multiplier

(IRxCxExED)/(BWxAT) (1/day)

5) Average Daily Intake Rate

(mg/kg-day)

TOTAL PATHWAY INTAKE (mg/kg-day)

(Sum intake values from
dermal & ingestion routes.)

Constituents of Concern

Surface Soil Conc. (mg/kg)

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

On-Site Residential

On-Site Commercial

Hexane, n-

1.0E+0

1.7E-7

1.7E-7

Naphthalene

1.0E+0

1.7E-7

1.7E-7

Pyrene

1.0E+0

1.7E-7

1.7E-7

Toluene

1.0E+0

1.7E-7

1.7E-7

1.0E-5

1.2E-6

1.2E-6

1.0E-5

NOTE:

ABS = Dermal absorption factor (dim)

AF = Adherence factor

AT = Averaging time (days)

BW = Body Weight (kg)

CF = Units conversion factor

ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)

ET = Exposure time (hrs/day)

IR = Intake rate (L/day or mg/day)

POE = Point of exposure

SA = Skin surface area (cm²)

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 PATHWAY RISK CALCULATION
SOIL EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK				TOXIC EFFECTS					
		(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)	
		On-Site Residential	On-Site Commercial	(mg/kg-day) ⁻¹	On-Site Residential	On-Site Commercial	On-Site Residential	On-Site Commercial	(mg/kg-day)	On-Site Residential	On-Site Commercial
Hexane, n-	D		1.0E-5	0.0E+0		0.0E+0		2.9E-5	6.0E-2		4.8E-4
Naphthalene	D		1.2E-6	0.0E+0		0.0E+0		3.3E-6	4.0E-2		8.3E-5
Pyrene	D		1.2E-6	0.0E+0		0.0E+0		3.3E-6	3.0E-2		1.1E-4
Toluene	D		1.0E-5	0.0E+0		0.0E+0		2.9E-5	2.0E-1		1.4E-4

Total Pathway Carcinogenic Risk =
0.0E+0
0.0E+0
Total Pathway Hazard Index =
0.0E+0
8.2E-4

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

GROUNDWATER EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

SOIL: LEACHING TO GROUNDWATER/

INGESTION

Exposure Concentration

	1) <u>Source Medium</u>	2) <u>NAF Value (L/kg)</u> Receptor	3) <u>Exposure Medium</u> Groundwater (mg/L), (1)/(2)	4) <u>Exposure Multiplier</u> (IRxEFxED)/(BWxAT) (L/kg-day)	5) Average Daily Intake Rate (mg/kg-day)
Constituents of Concern	Soil Concentration (mg/kg)	On-Site Commercial	On-Site Commercial	On-Site Commercial	On-Site Commercial
Hexane, n-	1.0E+0	5.6E+0	1.8E-1	3.5E-3	6.2E-4
Naphthalene	1.0E+0	1.3E+1	7.7E-2	3.5E-3	2.7E-4
Pyrene	1.0E+0	3.8E+2	2.6E-3	3.5E-3	9.2E-6
Toluene	1.0E+0	1.5E+0	6.9E-1	3.5E-3	2.4E-3

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)

EF = Exposure frequency (days/yr)
IR = Intake rate (L/day)

POE = Point of exposure

RBCA SITE ASSESSMENT

Tier 2 Worksheet 8.1

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

GROUNDWATER EXPOSURE PATHWAYS

☒ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER: INGESTION

Exposure Concentration

MAX. PATHWAY INTAKE (mg/kg-day)

Constituents of Concern	1) Source Medium	2) NAF Value (dim) Receptor		3) Exposure Medium Groundwater: POE Conc. (mg/L) (1)/(2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (L/kg-day)		5) Average Daily Intake Rate (mg/kg-day)		(Maximum intake of active pathways soil leaching & groundwater routes.)	
	Groundwater Concentration (mg/L)	On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial	
Hexane, n-	1.0E+0	1.0E+0		1.0E+0		3.5E-3		3.5E-3		3.5E-3	
Naphthalene	1.0E+0	1.0E+0		1.0E+0		3.5E-3		3.5E-3		3.5E-3	
Pyrene	1.0E+0	1.0E+0		1.0E+0		3.5E-3		3.5E-3		3.5E-3	
Toluene	1.0E+0	1.0E+0		1.0E+0		3.5E-3		3.5E-3		3.5E-3	

NOTE: AT = Averaging time (days)

BW = Body Weight (kg)
CF = Units conversion factor
ED = Exp. duration (yrs)EF = Exposure frequency (days/yr)
IR = Intake rate (L/day or mg/day)

POE = Point of exposure

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.2

Site Name: HASP Module: Petroleum Hydrocarbons

Site Location: Generic

Completed By: Dr. Robert A. Michaels

Date Completed: 7/18/2005

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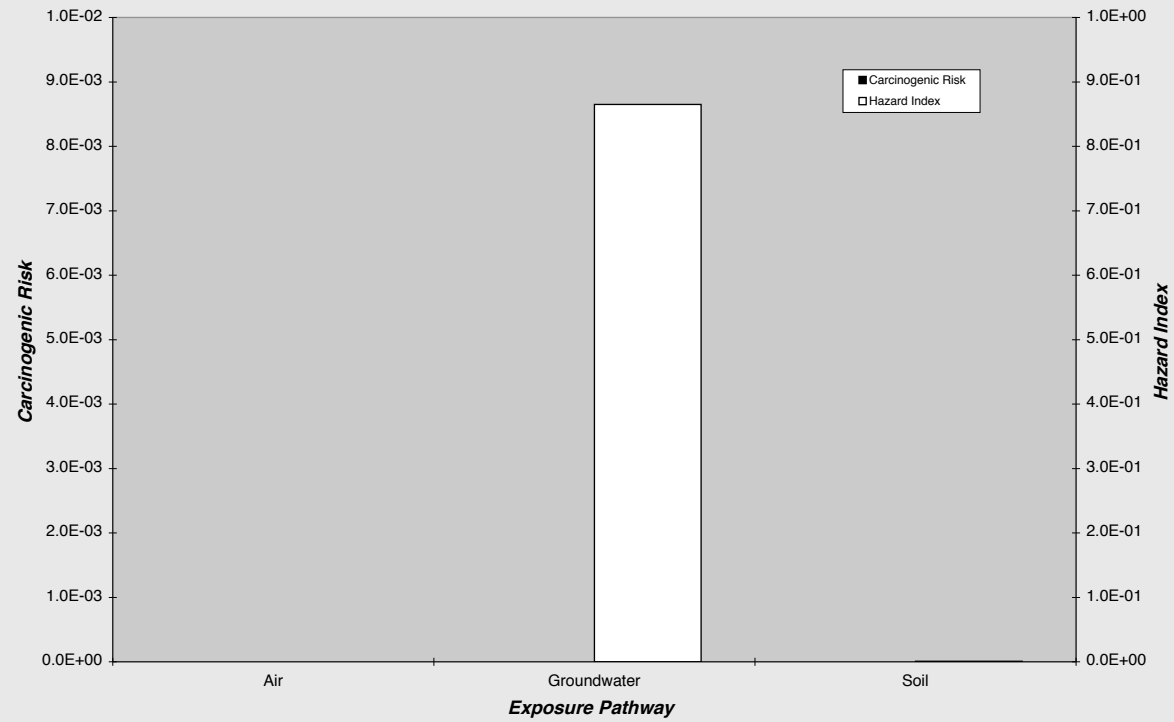
TIER 2 PATHWAY RISK CALCULATION
GROUNDWATER EXPOSURE PATHWAYS
☒ (CHECKED IF PATHWAYS ARE ACTIVE)

Constituents of Concern	(1) EPA Carcinogenic Classification	CARCINOGENIC RISK			TOXIC EFFECTS		
		(2) Total Carcinogenic Intake Rate (mg/kg/day)	(3) Oral Slope Factor	(4) Individual COC Risk (2) x (3)	(5) Total Toxicant Intake Rate (mg/kg/day)	(6) Oral Reference Dose	(7) Individual COC Hazard Quotient (5) / (6)
		On-Site Commercial	(mg/kg-day) ⁻¹	On-Site Commercial	On-Site Commercial	(mg/kg-day)	On-Site Commercial
Hexane, n-	D	3.5E-3	0.0E+0	0.0E+0	1.2E-2	6.0E-2	1.9E-1
Naphthalene	D	3.5E-3	0.0E+0	0.0E+0	1.1E-2	4.0E-2	2.6E-1
Pyrene	D	3.5E-3	0.0E+0	0.0E+0	9.8E-3	3.0E-2	3.3E-1
Toluene	D	3.5E-3	0.0E+0	0.0E+0	1.6E-2	2.0E-1	8.2E-2

Total Pathway Carcinogenic Risk = 0.0E+0 0.0E+0

Total Pathway Hazard Index = 8.6E-1 0.0E+0

Total Risk for Each Pathway



Site Name: HASP Module: Petroleum Hydrocarbons
 Site Location: Generic

Completed By: Dr. Robert A. Michaels
 Date Completed: 7/18/2005

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TIER 2 BASELINE RISK SUMMARY TABLE

EXPOSURE PATHWAY	BASELINE CARCINOGENIC RISK				BASELINE TOXIC EFFECTS					
	Individual COC Risk		Cumulative COC Risk		Risk Limit(s) Exceeded?	Hazard Quotient		Hazard Index		Toxicity Limit(s) Exceeded?
	Maximum Value	Target Risk	Total Value	Target Risk		Maximum Value	Applicable Limit	Total Value	Applicable Limit	
AIR EXPOSURE PATHWAYS										
Complete:	0.0E+0	1.0E-6	0.0E+0	N/A		7.4E-5	1.0E+0	1.6E-4	N/A	
GROUNDWATER EXPOSURE PATHWAYS										
Complete:	0.0E+0	1.0E-6	0.0E+0	N/A		3.3E-1	1.0E+0	8.6E-1	N/A	
SOIL EXPOSURE PATHWAYS										
Complete:	0.0E+0	1.0E-6	0.0E+0	N/A		4.8E-4	1.0E+0	8.2E-4	N/A	
CRITICAL EXPOSURE PATHWAY (Select Maximum Values From Complete Pathways)										
	0.0E+0	1.0E-6	0.0E+0	N/A		3.3E-1	1.0E+0	8.6E-1	N/A	

RBCA CHEMICAL DATABASE

Physical Property Data

		Vapor																
		Molecular Weight			Diffusion Coefficients				log (Koc) or log(Kd)		Henry's Law Constant		Pressure		Solubility		acid	
		(g/mole)			in air	in water			(@ 20 - 25 C)		(@ 20 - 25 C)		(@ 20 - 25 C)		(@ 20 - 25 C)		pKa	pKb
CAS Number	Constituent	type	MW	ref	Dair	ref	Dwat	ref	Koc	ref	mol	ref	Pure Component	ref	Pure Component	ref		
110-54-3	Hexane, n-	O	86.2	5	2.00E-01	4	7.77E-06	4	2.68	4	1.22E-01	5.07E+00	4	1.50E+02	4	1.30E+01	5	
91-20-3	Naphthalene	PAH	128.2	4	7.20E-02	A	9.40E-06	A	3.11	A	1.18E-03	4.90E-02	A	2.30E-01	4	3.29E+01	4	
129-00-0	Pyrene	PAH	202.3	4	2.72E-02	4	7.24E-06	4	4.58	4	7.00E-09	2.91E-07	4	4.20E-08	4	1.60E-01	5	
108-88-3	Toluene	A	92.4	5	8.50E-02	A	9.40E-06	A	2.13	A	6.25E-03	2.60E-01	A	3.00E+01	4	5.15E+02	29	

Site Name: HASP Module: Petr Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/18/2005

Software version: v 1.0

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RBCA CHEMICAL DATABASE

Toxicity Data

CAS Number	Constituent	Reference Dose (mg/kg/day)				Slope Factors 1/(mg/kg/day)				EPA Weight of Evidence	Is Constituent Carcinogenic ?
		Oral RfD_oral	ref	Inhalation RfD_inhal	ref	Oral SF_oral	ref	Inhalation SF_inhal	ref		
110-54-3	Hexane, n-	6.00E-02	A	5.71E-02	R	0.00E+00	R	0.00E+00	R	D	FALSE
91-20-3	Naphthalene	4.00E-02	A	6.00E-02	A	0.00E+00	R	0.00E+00	R	D	FALSE
129-00-0	Pyrene	3.00E-02	R		R	0.00E+00	R	0.00E+00	R	D	FALSE
108-88-3	Toluene	2.00E-01	A,R	1.14E-01	A,F	0.00E+00	R	0.00E+00	R	D	FALSE

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Michael Date Completed: 7/18/2005

Software version: v 1.0

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RBCA CHEMICAL DATABASE

Miscellaneous Chemical Data

CAS Number	Constituent	Maximum Contaminant Level		Permissible Exposure Limit PEL/TLV		Relative Absorption Factors		Detection Limits				Half Life (First-Order Decay) (days)		ref
		MCL (mg/L)	reference	(mg/m3)	ref	Oral	Dermal	Groundwater (mg/L)	ref	Soil (mg/kg)	ref	Saturated	Unsaturated	
110-54-3	Hexane, n-					1	0.5							
91-20-3	Naphthalene			5.00E+01	OSHA	1	0.05	0.01	C	0.01	S	258	258	H
129-00-0	Pyrene					1	0.05	0.01	C	0.66	S	3800	3800	H
108-88-3	Toluene	1.00E+00	56 FR 3526 (30 Jan 91	1.47E+02	ACGIH	1	0.5	0.002	C	0.005	S	28	28	H

Site Name: HASP Module:Site Location: Generic

Completed By: Dr. Robert A. Mir Date Completed: 7/18/2005

Software version: v 1.0

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