915012

Engineering Report

REMEDIAL INVESTIGATION REPORT BUFFALO COLOR AREA "D" APPENDICES

buffalo
COLOR CORPORATION
Buffalo, New York

Allied Signal
Morristown, New Jersey

April 1989
Project: 1115-03-1

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

MALCOLM
PIRNIE

BUFFALO COLOR CORPORATION

REMEDIAL INVESTIGATION REPORT
BUFFALO COLOR AREA "D"

APPENDICES

APRIL 1989

MALCOLM PIRNIE, INC.

S-3515 Abbott Road
P.O. Box 1938
Buffalo, New York 14219

1115-03-1

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APPENDIX A.1

ORDER ON CONSENT

STATE OF NEW YORK: DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of a the Development
and Implementation of a Remedial Investigation
and Feasibility Study For Inactive
Hazardous Waste Disposal Sites Under
Article 27, Title 13, of the
Environmental Conservation Law of the
State of New York (the "ECL") by:

INTERIM
ORDER
ON
CONSENT

BUFFALO COLOR CORPORATION AND
ALLIED-SIGNAL ~~CORPORATION~~ INC. ov

Respondents

INDEX NO. B9-0014-84-01
SITE #915012

WHEREAS:

1. The New York State Department of Environmental Conservation (the "Department") is responsible for the enforcement of Article 27 Title 13 of the Environmental Conservation Law of the State of New York (the "ECL"), entitled "Inactive Hazardous Waste Disposal Sites".

2. Respondent Buffalo Color Corporation is a corporation organized and existing under the laws of the State of Delaware and owns property located at 100 Lee Street in the City of Buffalo, County of Erie, State of New York, where Respondent operates a dye and chemical manufacturing facility.

3. Respondent Allied-Signal ~~Corporation~~ INC. ov is a corporation organized and existing under the laws of the State of Delaware and is a successor in interest to Allied Chemical Corporation which had previously owned and operated the same facility at 340 Elk Street in Buffalo, New York.

4. During the course of operations at the facility certain areas within the property had been utilized for the storage and disposal of waste and excess material. These areas have been designated as hazardous waste disposal sites and listed in the New York State Inactive Hazardous Waste Site Registry. These listed sites are included in the area designated as the Plant D area as depicted in Appendix "A" hereto (the "Sites").

5. Respondent Buffalo Color Corporation has conducted a Field Investigation of the sites pursuant to an Order on Consent, Index #947T 032682 and has submitted a report of this Field Investigation to the Department for review.

6. The Department has determined that the Sites constitute a significant threat to the environment.

7. Pursuant to ECL Section 27-1313(3)(a), whenever the Commissioner of Environmental Conservation (the "Commissioner") "finds that hazardous wastes at an inactive hazardous waste disposal site constitute a significant threat to the environment, he may order the owner of such site and/or any person responsible for the disposal of hazardous wastes at such site (i) to develop an inactive hazardous waste disposal site remedial program subject to the approval of the Department, at such site, and (ii) to implement such program within reasonable time limits specified in the Order."

8. Respondents have developed and submitted to the Department for review a Remedial Investigation/Feasibility

Study Project Scope which appears to the Department to address the extent of services necessary to be rendered by a qualifying consultant in developing and implementing a Remedial Investigation/Feasibility Study for the Sites.

9. The Department and Respondents acknowledge that the goals of this Order shall be that Respondents shall implement a remedial investigation and conduct a feasibility study and submit a report containing the detailed results of the investigation and study, subject to the approval of the Department. The investigation and study shall be based upon the Project Scope previously reviewed by the Department.

10. Respondents, in a spirit of cooperation and as concerned and responsible corporate citizens, voluntarily consent to the issuance and entry of this Order, waive their right to a hearing herein as provided by law, and agree to be bound by the provisions, terms and conditions of this Order.

NOW, THEREFORE, having considered this matter and been duly advised, it is ORDERED THAT:

I ACOLME RANIE

I. Respondents shall retain a third-party professional consultant, contractor and/or laboratory to perform the technical, engineering and analytical obligations required by this Order. The qualifications and professional expertise of the third party so employed shall be subject to the approval of the Department.

II. Within forty-five (45) days after the effective date of this Order, Respondents shall submit to the Department a proposal (the "Proposal") to investigate the field environmental conditions on-Site and off-Site (the "Remedial Investigation") in accordance with the Project Scope which is attached hereto as Appendix "A".

The Proposal shall include, but not be limited to, specific details concerning the following:

a. The methods and procedures by which the types, quantities and the areal and vertical extent of hazardous and industrial wastes present and found during the site investigation shall be determined.

b. The methods by which the hydrogeological conditions at and in the vicinity of the Sites shall be determined to include but not be limited to:

1. Locations for the specified number of exploratory borings and groundwater monitoring wells;

2. Instrument surveys and geophysical methods;

3. Groundwater, surface water, soil, sediment, sludge, and waste sampling and analysis;

4. Procurement and review of historical data, including aerial photography, surface water flow records, precipitation and storm events;

5. Field hydrogeologic evaluations (aquifer pump tests, permeability assessments, etc.); and

6. Piezometric monitoring.

c. The methods which shall be utilized to determine the past, present and future release and migration of hazardous and industrial wastes from the Sites and from locations in the vicinity of the Sites, to include: the number, location and types of samples of surface water, groundwater, air, soil, sediment and biota to be collected and the specific analyses and analytical protocols to be performed and followed on each sample; any proposed modeling of air, surface water, or groundwater; and risk analyses to be performed based upon the data obtained;

d. The calculations which shall be utilized to predict the potential release and migration of hazardous and industrial wastes through surface water, groundwater, and air at the Sites to any other on-Site or off-Site area;

e. Procedures and protocols, including, but not limited to, quality control and quality assurance to be employed in establishing sampling stations, in obtaining samples and in analyzing such samples, and in gathering field data;

f. An identification of all households, persons, and industries within a radius of three miles of the Site who utilize private wells as a source of water for drinking, household, irrigation or other applications;

g. A time schedule for the initiation and completion of the Remedial Investigation and submission of a report to the Department; and

h. A health and safety plan for the protection of persons at and in the vicinity of the Site during the performance of the Remedial Investigation. Such plan shall include provisions for air monitoring at and in the vicinity of the Sites.

III. Within sixty (60) days after receipt of the Proposal, the Department shall provide written notification to Respondents of its approval or disapproval of the Proposal. If the Department approves the Proposal, Respondents shall perform the Remedial Investigation in accordance with the Proposal.

If the Department disapproves the Proposal, the Department shall notify Respondents in writing of the Department's objections. Within thirty (30) days after receipt of notice of disapproval, Respondents shall revise the Proposal in accordance with the terms, provisions and conditions of this Order and shall submit to the Department a Proposal which has been revised in accordance with the Department's objections (the "Revised Proposal").

Within thirty (30) days after receipt of the Revised Proposal, the Department shall provide written notification to Respondents of its approval or disapproval of the Revised Proposal. If the Department approves the Revised Proposal, Respondents shall perform the Remedial Investigation in accordance with the Revised Proposal.

If the Department disapproves the Revised Proposal, the Department shall modify the Revised Proposal to include such plans, specifications, procedures, protocols or other items as the Department deems appropriate, and which shall be binding on Respondents in carrying out the Remedial Investigation.

The approved Proposal or the approved Revised Proposal shall be attached hereto and shall be incorporated into this Order as Appendix "B". Such Proposal shall hereafter be referred to as the "Approved Proposal".

IV. Within ninety (90) days of the date specified for completion of the Remedial Investigation as provided pursuant to paragraph II(g) above, Respondents shall submit to the Department a Remedial Investigation Report (the "Report"), founded upon its performance of the Remedial Investigation in accordance with the Approved Proposal. The Report shall include a copy of the Approved Proposal and all data generated, and all other information obtained, during the Remedial Investigation and shall also include, but shall not be limited to, the following specific information with respect to the Site and areas affected by the disposal of hazardous and industrial wastes at the Sites:

a. A topographic survey and a resultant plot plan, including establishment of on-Site benchmarks;

b. A summary of all environmental conditions, including, but not limited to: annual and seasonal climatic conditions, Site drainage, Site water balance, stream flow data, wildlife habitats, land use, soil conditions, hydrogeologic characteristics, surface and groundwater quality, and air quality; said summary to include maps, tables, graphics, and any other appropriate means of presenting all information;

c. All data collected during the Remedial

Investigation and/or used in preparing the Report, including, but not limited to: soil boring logs, well data, and the results of chemical analyses performed on samples obtained during the Remedial Investigation; said data presented in tabulated and/or graphic form where appropriate;

d. A determination of the types and quantities of hazardous and industrial wastes present as well as the areal and vertical extent of such wastes, which determination shall result in the preparation of a waste location and concentration map and cross-sections of waste disposal areas;

e. A study and evaluation of the hydrogeologic conditions at and in the vicinity of the Sites;

f. Plotted results of all geophysical survey work conducted at the Sites;

g. A determination of the nature and extent of actual and potential release and migration of hazardous and industrial wastes from the Sites through surface water, groundwater, air, soil and sediment to areas at and in the vicinity of the Sites and further off-Site. The results of and calculations for mathematical modeling of the Sites shall be provided;

h. A determination of the areal and vertical extent to which both on-Site and off-Site surface water, ground water, air, soil, sediment and biota have been, are being or may be contaminated by hazardous or industrial wastes;

i. An assessment of the results of the Remedial

Investigation and a determination of the current or potential impacts of any identified threat to the environment which exists, or may exist in the future, at and in the vicinity of the Site and further off-Site, as a result of the hazardous and industrial wastes disposed of at the Site, and as a result of the determinations made pursuant to subparagraphs g. and h. above;

j. References to all scientific or technical literature used in the preparation of the Report; and

k. Names, titles and disciplines of all professionals engaged in the preparation of the Report.

V. The Department reserves the right to require a modification and/or amplification and expansion of the Remedial Investigation and Report by Respondents to address specific areas if the Department determines that further investigation is necessary, as a result of reviewing data generated by the Remedial Investigation or as a result of reviewing other data or facts, provided that such modification, amplification or expansion does not substantially alter the scope of the approved Work Plan.

VI. Within sixty (60) days after its receipt of the Report, the Department shall determine if the Remedial Investigation was conducted, and the Report prepared in accordance with the terms, provisions and conditions of this Order, and shall provide written notification to Respondents of its approval or disapproval of the Report.

If the Department disapproves the Report, the Department shall notify Respondents in writing of the Department's objections. Within thirty (30) days after its receipt of notice of disapproval, Respondents shall revise the Report and/or re-perform or supplement the Remedial Investigation in accordance with the terms, provisions and conditions of this Order and shall submit to the Department a Report which has been revised in accordance with the Department's objections (the "Revised Report").

Within thirty (30) days after its receipt of the Revised Report, the Department shall determine if the revised Report is in accordance with the terms, provisions and conditions of this Order and shall provide written notification to Respondents of its approval or disapproval of the Revised Report.

If the Department disapproves the Revised Report, the Respondents shall be in violation of this Order, not having submitted an approvable report and/or conducted a Remedial Investigation in accordance with the terms, provisions and conditions of this Order.

The Report or the Revised Report, whichever is approved by the Department, shall become incorporated in and made a part of this Order, and shall be attached hereto as Appendix "C". Such Report shall hereafter be referred to as the "Approved Report".

VII. Within ninety (90) days after receipt of the Department's approval of the Report, or within such greater period as the Department may allow for good cause shown, Respondents shall submit to the Department a feasibility study (the "Feasibility Study") evaluating on-Site and off-Site remedial actions to eliminate or mitigate the health and environmental hazards and potential hazards attributable to the Sites. The Feasibility Study shall be in accordance with the then existing National Contingency Plan and USEPA guidelines governing feasibility studies.

The Feasibility Study shall include, but not be limited to, the following:

a. A summary of the health and environmental hazards and potential hazards attributable to the Sites.

b. As to each such hazard or potential hazard, a statement of the remedial actions necessary to eliminate or mitigate the same, and a categorization into discrete elements of each such remedial action.

c. As to each such discrete element, a statement of the alternative technologies available to effectuate the same, and analyses thereof, including, but not limited to:

1. Unit Cost estimates.
2. Operation and maintenance requirements and cost estimates.
3. Long-term integrity.
4. Timeliness of implementation.
5. Conformity to applicable law.

d. As to each discrete element, the selection of one alternative technology to effectuate the same.

VIII. Within sixty (60) days after its receipt of the

Feasibility Study, the Department shall determine if the Feasibility Study was prepared in accordance with the terms, provisions and conditions of this Order, and shall provide written notification of its approval or disapproval.

If the Department disapproves the Feasibility Study, the Department shall notify Respondents in writing of the Department's objections. Within thirty (30) days after its receipt of notice of disapproval, Respondents shall revise the Feasibility Study and shall submit to the Department a Feasibility Study which has been revised in accordance with the Department's objections (the "Revised Feasibility Study").

Within fifteen (15) days after its receipt of the Revised Feasibility Study, the Department shall determine if the Revised Feasibility Study is in accordance with the terms, provisions, and conditions of this Order, and shall provide written notification to Respondents of its approval or disapproval of the Revised Feasibility Study.

If the Department disapproves the revised Feasibility Study, the Respondents shall be in violation of this Order, not having submitted an approvable Feasibility Study in accordance with the terms, provisions and conditions of this Order.

The Feasibility Study or the revised Feasibility Study, whichever is approved by the Department, shall be incorporated in and made a part of this Order, and shall be attached hereto as Appendix "D". Such Feasibility Study shall hereafter be referred to as the "Approved Feasibility Study".

IX. All investigations, proposals, reports, plans, remedial programs, and supplements and revisions thereto required by this Order shall address both on-Site and off-Site contamination caused by the disposal of hazardous and industrial wastes at the Sites, and shall be prepared, designed and executed in accordance with Requisite Technology. As used in this Order, Requisite Technology means engineering, scientific and construction principles and practices subject to the Department's approval, which (a) are technologically feasible, and (b) will effectively identify, mitigate and eliminate any present or potential future threat to the environment posed by the disposal of hazardous and industrial wastes at and in the vicinity of the Sites.

The failure of Respondents to submit or undertake a proposal, report, field investigation, construction program plan or any supplement or revision thereof, which is in accordance with Requisite Technology shall constitute a violation of this Order.

X. As used herein, "hazardous wastes" shall mean hazardous wastes, any hazardous constitutents thereof, and any toxic degradation products of such wastes and of such constituents.

XI. The Department shall have the right to obtain for the purpose of comparative analysis "split samples" or "duplicate samples", at the Department's option, of all substances and materials sampled by Respondents pursuant to this Order. As used herein: "split samples" shall mean whole samples divided into aliquots; "duplicate samples" shall mean multiple samples, collected at the same time from the same location, using the same sampling apparatus, collected into identical containers prepared identically, filled to the same volume, and thereafter identically handled and preserved.

XII. Respondents shall provide notice to the Department of any excavating, drilling or sampling to be conducted pursuant to the terms of this Order at least five (5) working days in advance of such activities.

XIII. Respondents shall permit any duly designated officer, employee, consultant, contractor or agent of the Department to enter upon the Sites or areas in the vicinity of the Sites which may be under the control of Respondents, and any areas necessary to gain access thereto, for inspection purposes and for the purpose of making or causing to be made such sampling and tests as the Department deems necessary, and for ascertaining Respondents' compliance with the provisions of this Order.

XIV. Respondents shall not suffer any penalty under any of the provisions, terms and conditions hereof, or be subject to any proceedings or actions for any remedy or relief, if it cannot comply with any requirements of the provisions hereof because of an act of God, war, riot or other condition as to which negligence or willful misconduct on the part of either Respondent was not the proximate cause, provided, however, that Respondents shall immediately notify the Department in writing when it obtains knowledge of any such condition and request an appropriate extension or modification of the provisions hereof.

XV. The failure of Respondents to comply with any provision of this Order shall constitute a default and a failure to perform an obligation under this Order and under the ECL.

XVI. Nothing contained in this Order shall be construed as barring, diminishing, adjudicating or in any way affecting (1) any legal or equitable rights or claims, actions, suits, causes of action or demands whatsoever that the Department may have against anyone other than Respondents, their directors, officers, employees, servants, agents, successors and assigns; (2) the Department's right to enforce, at law or in equity, the terms and conditions of this Order against Respondents, their directors, officers, employees, servants, agents, successors and assigns in the event that Respondents shall fail to fulfill any of the provisions hereof; and (3) the Department's right to bring any action, at law or in equity against Respondents, their directors, officers, employees, servants, agents, successors and assigns with respect to areas or resources that may have been affected or contaminated as a result of the release or migration of hazardous or industrial wastes from the Sites or from areas in the vicinity of the Sites. Nothing herein shall be construed as affecting the Department's right to commence any action or proceeding to which it may be entitled in connection with, relating to, or arising out of Respondents' disposal of hazardous or industrial wastes at the Sites.

XVII. The terms of this Order shall not be construed to prohibit the Commissioner or his duly authorized representative from exercising any summary abatement powers, either at common law or as granted pursuant to statute or regulation.

XVIII. Respondents shall obtain whatever permits, easements, rights-of-way, rights-of-entry, approvals or authorizations which are necessary in order to perform the Field Investigation and all of Respondents' other obligations pursuant to this Order.

XIX. Respondents shall indemnify and hold the Department, the State of New York, and their representatives and employees harmless for all claims, suits, actions, damages and costs of every name and description arising out of or resulting from the acts or omissions of Respondents in the fulfillment or attempted fulfillment of the provisions hereof by Respondents, their directors, officers, employees, servants, agents, successors or assigns.

XX. If there is a dispute between the Department and Respondents as to any of the terms, provisions, conditions or actions of the Department pursuant to paragraphs III, V, VI, or VIII hereunder, and if the parties are not able to resolve the dispute through negotiation and settlement, then the dispute may be resolved in accordance with the procedures set forth below. Nothing herein shall be construed as a limitation on, waiver of, or relinquishment of any rights, privileges, defenses, or causes of action otherwise available to any party except as specifically stated.

A. Either party, upon written notice to the others, may request the Commissioner of Environmental Conservation to appoint an administrative law judge (ALJ), and to hold a hearing, if appropriate, to settle the dispute. If the ALJ deems it necessary to convene a hearing, the taking of evidence shall be concluded within thirty (30) working days of the receipt of the written request to appoint an ALJ.

In any proceeding hereunder:

1. The parties shall be limited to Respondents and the Department.

2. The burden of persuasion shall be on the Respondent.

3. The ALJ shall have all powers conferred by 6 NYCRR Part 622.12.

4. All proceedings conducted pursuant to this paragraph shall be stenographically recorded. The ALJ shall arrange for an expedited stenographic transcript to be made within three (3) working days after conclusion of the proceeding, and for the original and two copies of the transcript to be delivered to the ALJ at the expense of the

Respondent.

B. The ALJ shall prepare a written summary of the documentation and testimony received during the proceedings and a recommended decision within ten (10) working days after the receipt of the written transcript of the hearing or close of record. The summary and recommendation shall be delivered to the Respondents and to the Department's representative at the proceeding by an expedited delivery.

C. The recommended decision of the ALJ shall become final and binding unless one of the parties objects in writing to the ALJ within seven (7) days of receipt of the recommended decision. Any objection shall be submitted in writing to the ALJ with copies to the other parties. Each party shall have the opportunity to submit a response to the objection within five (5) days of the date that the ALJ receives the objection.

D. Within fifteen (15) days of receipt of any objection, the ALJ shall forward the summary and recommendation and any objection and any response thereto to the Commissioner for final determination. The ALJ may propose any modifications to the recommended decision for consideration by the Commissioner.

E. The final determination of the Commissioner shall be made within ten (10) working days of receipt of the referral by the ALJ.

F. Any motion for judicial review pursuant to

Article Seventy-eight of the Civil Practice Laws and Rules of the State of New York shall be filed within thirty (30) days of the date the final determination is signed by the Commissioner. This time period shall be binding upon the parties hereto, any other time period otherwise available hereby being waived.

XXI. A. Upon execution of this Order by Respondents, Respondents shall pay to the Department the sum of Thirty-six Thousand Dollars ($36,000.00) which represents reimbursement to the Department for expenses including, but not limited to, direct labor, overhead, analytical costs, contractor costs, travel expenses and equipment heretofore incurred by the Department in evaluating conditions at the Sites. Such payment shall be to the Hazardous Waste Remedial Fund.

B. Within thirty (30) days of receipt of notice of the Department's approval of the Feasibility Study pursuant to paragraph VIII above, Respondents shall pay to the Department a sum of money which shall be determined by the Department and which shall represent reimbursement for the expenses including but not limited to: direct labor, overhead, analytical costs, contractor costs, travel and lodging expenses and equipment incurred by the State of New York for reviewing and oversight of the proposals and programs pursuant to this Order. Such payment shall be to the Hazardous Waste Remedial Fund. In no event shall the reimbursement for such expenses exceed Fifty Thousand

Dollars ($50,000.00).

C. In addition to subparagraph B above, Respondents shall be liable for any costs and expenses which may be incurred by the Department pursuant to the provisions for a proceeding contained in paragraph XX above. Such costs and expenses shall be separately set forth and submitted to Respondents.

XXII. The effective date of this Order shall be the date this Order is signed by the Commissioner or his designee.

XXIII. If, for any reason, Respondents desire that any provision of this Order be changed, Respondents shall make timely written application therefore to the Commissioner setting forth reasonable grounds for the relief sought.

XXIV. A. All communication required hereby to be made between the Department and Respondents shall be made in writing and transmitted by United States Postal Service return receipt requested, or hand delivered to the address as listed hereinunder. All reports and submissions herein required shall be submitted in duplicate to each of the following addresses:

B. Communication to be made from Respondents to the Department shall be made as follows:

Department of Environmental
Conservation
Division of Environmental Enforcement
600 Delaware Avenue
Buffalo, New York 14202-1073

Department of Environmental
Conservation
Division of Environmental Enforcement
Room 618
50 Wolf Road
Albany, New York 12233-5500

Department of Environmental
Conservation
Division of Solid and Hazardous Waste
Room 222
50 Wolf Road
Albany, New York 12233-5500
Attn: John Willson

C. Communication to be made from the Department to Respondents shall be made as follows:

Buffalo Color Corporation
Attn: Mr. David Sauer
P.O. Box 7027
Buffalo, New York 14240

Allied-Signal ~~Corporation~~ INC. OP
Attn: Mr. William E. Yanovitch
P.O. Box 1129 R
Morristown, New Jersey 07960

D. The Department and Respondents respectively reserve the right to designate other or different addresses on notice to the other.

XXV. The provisions of this Order shall be deemed to bind Respondents, their officers, directors, agents, servants, employees, successors and assigns.

XXVI. Nothing herein shall be construed to bind any entity not specifically bound by the terms of this Order.

XXVII. The provisions hereof shall constitute the complete and entire Order between Respondents and the

Department concerning the Sites. No terms, conditions, understandings or agreements purporting to modify or vary the terms hereof shall be binding unless made in writing and subscribed by the party to be bound. No informal advice, guidance, suggestions or comments by the Department regarding reports, proposals, plans, specifications, schedules or any other writing submitted by Respondents shall be construed as relieving Respondents of their obligations to obtain such formal approvals as may be required by this Order.

DATED:
Albany, New York

THOMAS C. JORLING
Commissioner
New York State Department of
Environmental Conservation

CONSENT BY RESPONDENT

Respondent hereby consents to the issuing and entering of the foregoing Order, waives its right to a hearing herein as provided by law, and agrees to be bound by the provisions, terms and conditions contained herein.

BUFFALO COLOR CORPORATION

BY: ____________________

TITLE: General Manager - Operations

DATE: December 2, 1987

State of New York)
County of Erie) s.s.:
)

On this 2nd day of December , 1987, before me personally came Thaddeus J. Wlodarczak to me known, who, being by me duly sworn, did depose and say that he resides in East Aurora, NY. ; that he is the General Manager-Operations of Buffalo Color Corporation, the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Mary Ann Kolodziej
NOTARY PUBLIC

Mary Ann Kolodziej
Notary Public, State of New York
Qualified in Erie County
My Commission Expires
April 30, 19 89

CONSENT BY RESPONDENT

Respondent hereby consents to the issuing and entering of the foregoing Order, waives its right to a hearing herein as provided by law, and agrees to be bound by the provisions, terms and conditions contained herein.

ALLIED-SIGNAL INC.

BY: A. Belzer

TITLE: Executive Vice President

DATE: November 24, 1987

BY: E.W. Callahan

TITLE: Vice President, Health Safety & Environmental Sciences

DATE: 11/24/87

State of ~~New York~~ New Jersey)
County of Morris) s.s.:
)

On this 24th day of November, 1987, before me personally came A. Belzer and E.W. Callahan to me known, who, being by me duly sworn, did depose and say that he resides in Morristown, NJ; that he is the Executive Vice President; and Vice President, Health Safety & Environmental Sciences, respectively of Allied-Signal Inc., the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

C. Nadine Ellerthorpe
NOTARY PUBLIC
C. NADINE ELLERTHORPE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Feb. 13, 1990

EXHIBIT A

ALLIED-SIGNAL CORPORATION
BUFFALO COLOR CORPORATION

AREA D

REMEDIAL INVESTIGATION
FEASIBILITY STUDY

PROJECT SCOPE

NOVEMBER 5, 1986

1. Criteria for Scoping

1.1 Hydrogeology

1.1.1 Should define the movement of water throughout Area D.

1.1.2 Should locate position and extent of migrating pollutant plumes.

1.1.3 Should ascertain the hydrogeological impact of river level changes.

1.2 Groundwater

1.2.1 Should determine the concentration of migrating pollutant plumes.

1.2.2 Should determine the rate of mass transfer of pollutants.

1.3 Soil

1.3.1 Should define underground conditions at areas of known past activity.

1.3.2 Should locate and identify additional sources of continuing releases.

1.3.3 Should search for probable pollutants.

1.4 River Bottoms

1.4.1 Should characterize pollutants in river bottoms near Area D.

1.5 River Water

1.5.1 Should characterize pollutants in river water upstream and downstream of Area D.

2. Scope of Work

2.1 Terrain Conductivity

2.1.1 Terrain conductivity readings will be taken at a grid size of 50 feet covering the entire Area D peninsula.

2.1.2 On the basis of information so obtained, the positions of wells, major soil borings, or piezometers may deviate slightly from the locations shown in Figure 1.

2.2 New Piezometers and Water Gauges

2.2.1 Four piezometers in saturated fill

2.2.1.1 NW end of Bldg. 432
2.2.1.2 SE end of Bldg. 432
2.2.1.3 NE of DL&W railroad tracks
2.2.1.4 N of Bldg. 447 and Buffalo Creek RR tracks

2.2.2 Two Water Level Gauges in Buffalo River

2.2.2.1 NE corner of Area D.
2.2.2.2 SW Corner of Area D.

2.2.3 In conjunction with new and existing wells this will give a definitive 3-dimensional picture of groundwater movement over the entire area.

2.2.4 Specifications

2.2.4.1 Piezometers will be constructed of two inch diameter PVC.

2.2.4.2 Caps and locks will be provided.

2.2.4.3 Contractor will provide specification in accord with standard practice.

2.3 New Groundwater Monitoring Wells

2.3.1 Screened in the natural alluvial soils at bedrock

2.3.1.1 Iron sludge lagoon
2.3.1.2 Weathering Area

2.3.2 Screened in saturated fill

2.3.2.1 SW of Weathering Area
2.3.2.2 Next to the pit S of Bldg. 432
2.3.2.3 S of Well Tank Park 10
2.3.2.4 W of Well Tank Park 10
2.3.2.5 N of Bldg. 447
2.3.2.6 Between Building 448 and Iron Lagoons
2.3.2.7 Between Bldg. 448 and shore
2.3.2.8 Between Bldg. 448 and the Weathering Area

2.3.3 Specifications

2.3.3.1 Monitoring wells will be constructed of two inch diameter steel.

2.3.3.2 Screens will be constructed of stainless steel and will typically be five feet in length. The screens in the natural alluvial soils in the iron lagoon are subject to field conditions as the wastes extend below river level at some locations.

2.3.3.3 Caps and locks will be provided.

2.3.3.4 The contractor will provide detailed specification in accord with standard practice.

2.4 Soil Borings

2.4.1 Deep soil borings will go to bedrock. There will be a total of 7 major borings.

2.4.1.1 Two borings near Well #8
2.4.1.2 Two borings near Bldg. 447
2.4.1.3 Two borings near Bldg. 448
2.4.1.4 One boring S of Bldg. 444

2.4.2 The samples collected from these deep borings, together with those collected from the installations of the piezometers and the sampling wells will be organized according to the following plan.

2.4.2.1 For each deep boring, a Composite A will be made of all of the apparently contaminated soil. The physical appearance of the soil (notably discoloration and odor) will be used to make this determination of how deep each Composite A is. Observations in the field may indicate the presence of gross differences in physical appearance within the Composite A stratum, which would require sampling and analyses of substrata within a Composite A. However, different colors or shades of color alone will not constitute grounds for subdividing. In some areas there may be no discoloration or odor at all and, hence, no first Composite, A. Composites A will vary in depth.

2.4.2.2 At each boring a Composite B will be made of the first complete 2 foot spoon sample of apparently uncontaminated soil. This will be in the next five feet of boring sample after Composite A.

2.4.2.3 A C-zone sample will be made of the 2 foot spoon sample starting 5 feet below the top of the composite B sample in the seven borings.

2.4.2.4 The deep soil boring locations are shown in Figure 1.

2.4.2.5 All soil samples will be archived for a period of five years.

2.4.2.6 In the installation of the groundwater monitoring wells and piezometers, C-zone samples will not be analyzed, but will be archived.

2.4.3 Shallow soil borings will be made with a hand auger to a depth of two feet. There will be up to twenty shallow borings with their locations and density determined by field observations.

2.5 River Bottom Sampling

Eight river bottom samples will be taken from the shore out to a river depth of ten feet. These will be collected near the Weathering Area and the Iron Sludge Lagoons.

2.6 Buffalo River Sampling

A total of four river water samples are to be collected, two upstream and two downstream of Area D. These will be collected in different seasons of the year.

2.7 Analytical Effort

2.7.1 Deep Soil Boring Analysis

All major soil boring samples will be analyzed for the following:

2.7.1.1 Priority metals found to be present in the Weathering Area and Iron Sludge Lagoons in previous studies.

2.7.1.2 Base/Neutral Priority Pollutants

2.7.1.3 Total Organic Halogen

2.7.1.4 Total Organic Carbon

2.7.2 Shallow Soil Borings Analysis

2.7.2.1 Samples will be analyzed for those parameters detected in significant concentration in the Composite A of the deep soil borings.

2.7.3 Other Soil Borings Analysis

2.7.3.1 Selected samples or composites of samples may be analyzed for determination of hazardous waste characteristics according to EPA's SW-846 manual.

2.7.3.2 Samples from selected locations may be analyzed for specific priority pollutants on the basis of probable cause.

2.7.4 Groundwater Analysis

Two rounds of ground water samples will be analyzed for the 126 priority pollutants.

2.7.5 River Bottom Analysis

The river bottoms samples will be analyzed for the same parameters as the soil samples.

2.7.6 Buffalo River Analysis

This work will parallel the monitoring well work and therefore will include two rounds of the 126 Priority Pollutants.

2.8 The contractor will provide a site specific health and safety plan.

3. <u>Matching of Scope With Criteria</u>

3.1 Hydrogeology

3.1.1 The use of the shallow aquifer piezometers achieves a multiple purpose.

3.1.1.1 Defines the gradient in the interior of the peninsula.

3.1.1.2 Explores shallow strata under two former operating buildings.

3.1.2 The two water level gauges in the Buffalo River will permit definition of the impact of river levels on the groundwater gradients.

3.2 Groundwater

3.2.1 The proposed new monitoring wells are positioned around the periphery of Area D to characterize the total movement, if any, of materials off site.

3.2.2 All of the four new piezometers, eight existing wells, and ten new wells, and the two new river water gauges will be used to define the movement of groundwater through the peninsula.

3.3 Soil Sampling

3.3.1 Each of the wells, piezometers, and borings will be done with a split spoon sampler to provide information on underground conditions.

3.3.2 The proposed distribution (See Figure 1) will provide deep reconnaissance for the peninsula as a whole while investigating probable sites of contamination.

3.3.2.1 Dowtherm unit N of Bldg. 447.
3.3.2.2 Dowtherm unit SW of Bldg. 444
3.3.2.3 Open buring area N of Bldg. 448
3.3.2.4 Tank Park areas NE and SW of Bldg. 447
3.3.2.5 Pit area SW of Bldg. 432

4. <u>Reporting of Results - Remedial Investigation</u>

4.1 The Remedial Investigation report will follow a format similar to that presented in Figure 3. The report contents will be adjusted based on the focus of the data collection and the analyses conducted.

4.2 The underground investigation (item 2.3 in Figure 3) will be based on plant records.

4.3 The biological data analysis (Item 4.0) will be based on a search of the literature and of local records.

4.4 The QC/QA Protocol (Item 8.B) will be the USEPA's Contract Laboratory Protocol (CLP).

4.5 The master drawing of the site (Item 8.E) on which all of the wells and borings will be shown will include at its periphery the Republic Steel shores of the Buffalo River and the railroad property north and west of Area D.

4.6 The Cross Sectional Diagrams of Area D (Item 8.F) will describe the underground conditions along the following axes.

4.6.1 Lateral Cross Sections

4.6.1.1 SW - NE through the Weathering Area
4.6.1.2 SW - NE through the pit
4.6.1.3 W - E through Well #8 and Bldg. 448.
4.6.1.4 W - E through Bldg. 447 and the Iron Sludge Lagoon

4.6.2 Longitudinal Cross Sections

4.6.2.1 From the deep piezometer at the tip of the point through the wells along the southern shore.

4.6.2.2 From the tip of the point, through the center of the peninsula to Well #8, then turning through Bldg. 447 to Well #6

4.6.2.3 From the Weathering Area through the wells and borings on the northern shore, through the Iron Sludge Lagoons.

4.6.3 An example of a cross section is presented as Figure 4.

5. Report Format - Feasibility Study

5.1 The Feasibility Study report will follow a format similar to that presented in Figure 5.

FIGURE 1

AREA D RI/FS

JOB SCOPING

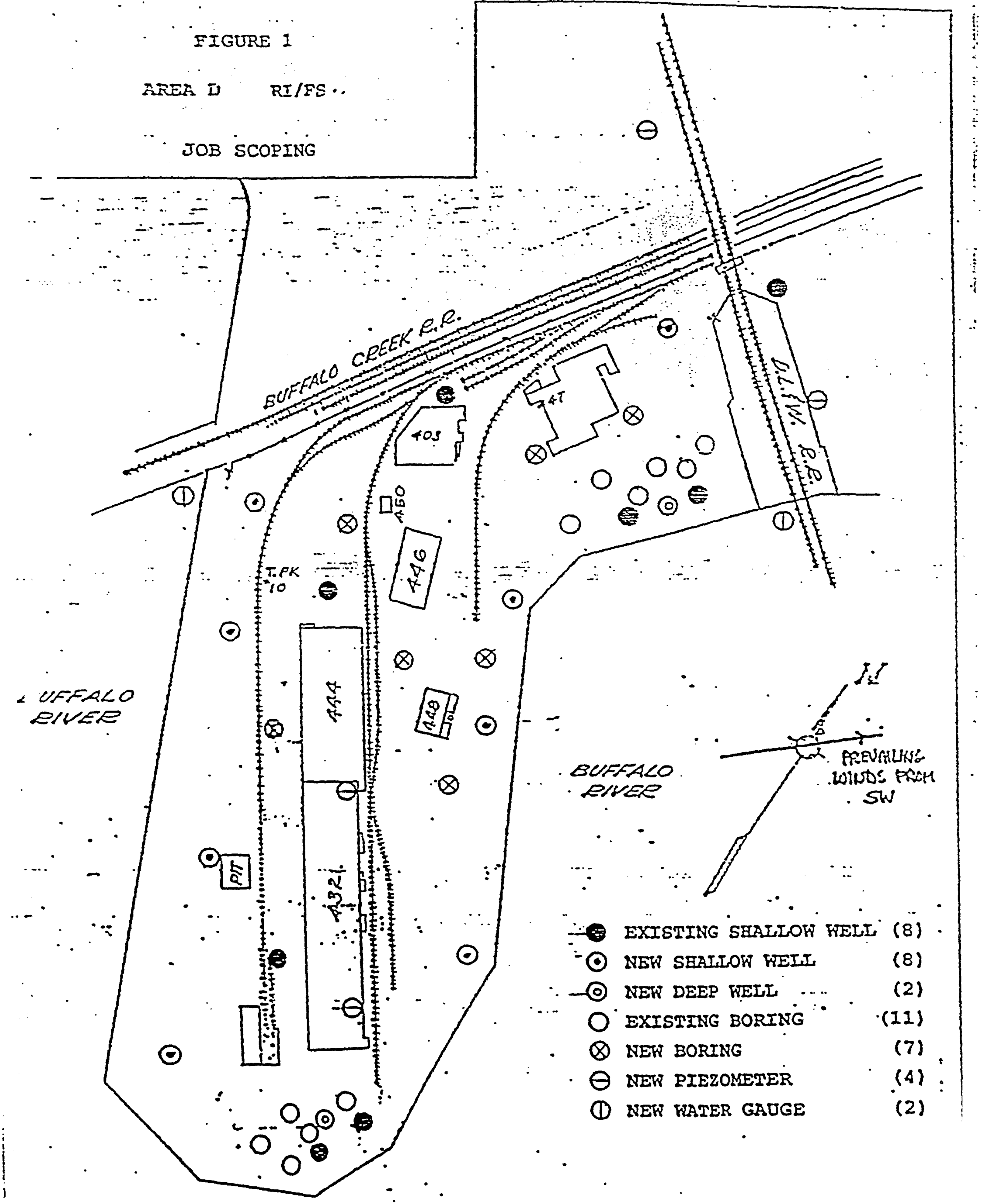
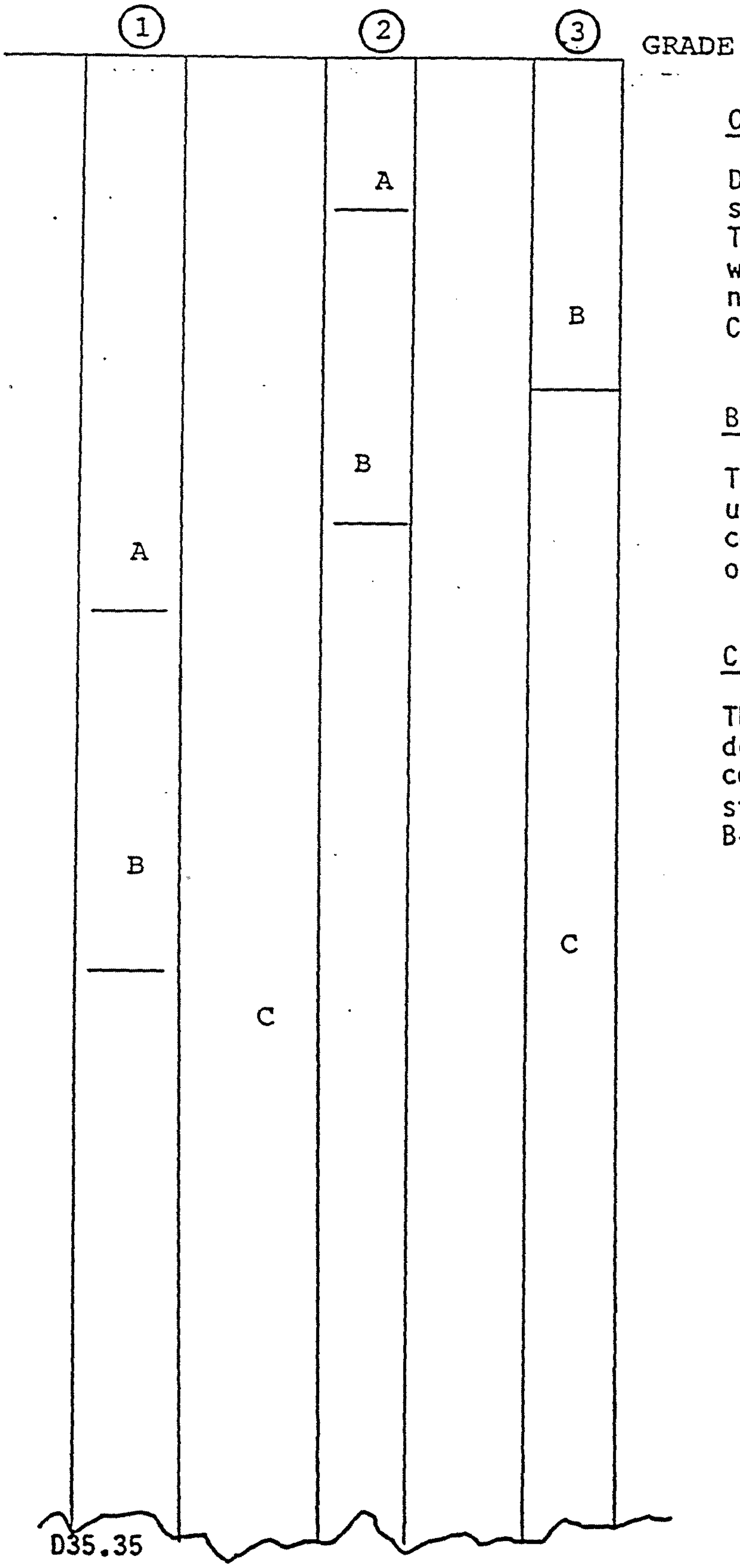


FIGURE 2

SOIL SAMPLING PLAN



Composite A

Discolored or odorous soil. These samples may be subdivided if necessary. The depth of discolored or odorous soil will vary. In some areas there will be none at all and thus there will be no Composite A (e.g. boring ③)

B-Zone Sample

The first five feet of apparently uncontaminated soil. Each sample will be composited from the first two foot spoon of completely uncontaminated soil.

C-Zone Sample

These will be collected from the seven deep borings only. Each sample will be composited from the two foot spoon sample starting five feet below the top of the B-zone sample.

D35.35

FIGURE 3

REMEDIAL INVESTIGATION REPORT

BUFFALO COLOR CORPORATION - AREA D

REPORT FORMAT

---

0. Executive Summary

1. Introduction

   1.1 Objective
   1.2 Site History
   1.3 Site Description

      1.3.1 Location and Boundaries
      1.3.2 Physiography
      1.3.3 River

2. Site Characterization

   2.1 Hydrogeology

      2.1.1 Aquifer Identification

         a) Locations and flow patterns
         b) Effects of river level

      2.1.2 Soil Characterization

         a) Soils analysis and description
         b) Ground water permeation
         c) Ground water runoff

   2.2 Contamination Characterization

      2.2.1 Location and identification

         a) Soil
         b) Aquifers
         c) Riverbed
         d) Surface water
         e) River water

      2.2.2 Characteristics and Behavior

   2.3 Underground Investigation

      2.3.1 Utilities
      2.3.2 Foundations
      2.3.3 Miscellaneous

FIGURE 4

SAMPLE CROSS SECTIONAL DRAWING

SW-NE Through Weathering Area

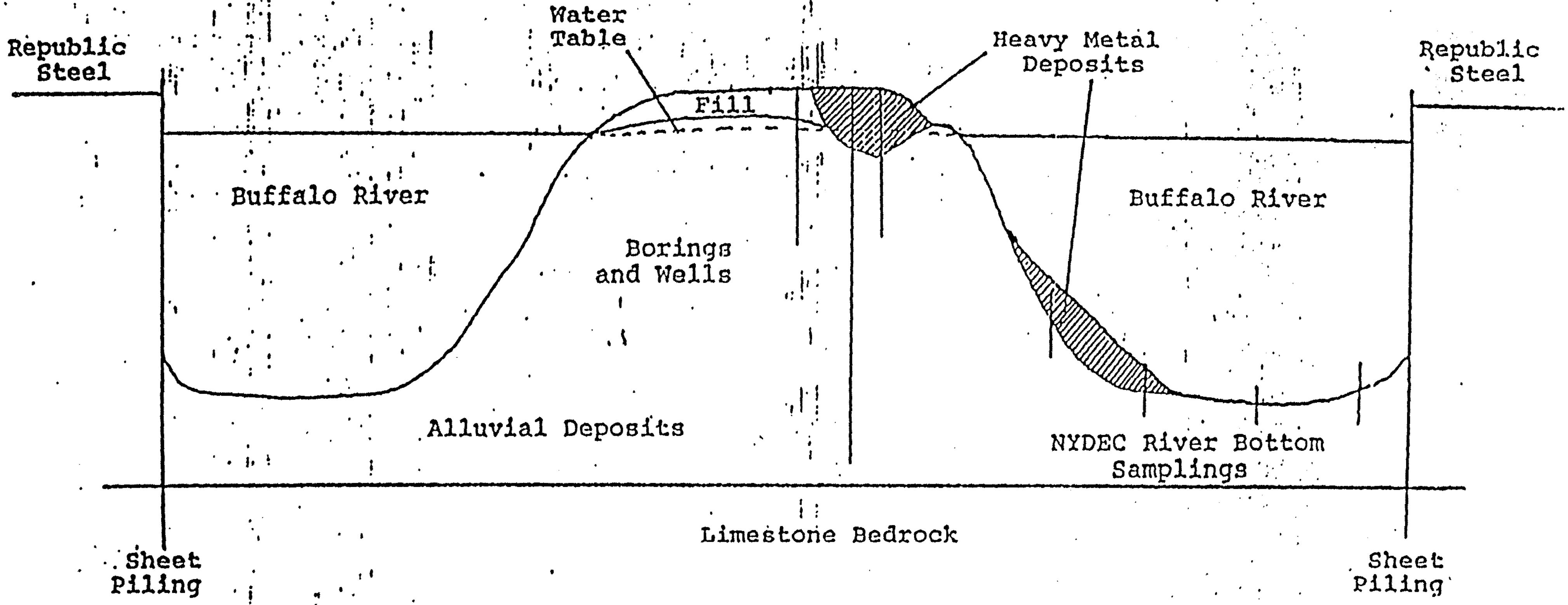


FIGURE 5

FEASIBILITY STUDY
BUFFALO COLOR CORPORATION - AREA D
REPORT FORMAT

---

0. Executive Summary

1. Introduction

   1.1 Objective
   1.2 Site background
   1.3 Remedial Investigation Summary
   1.4 Statement of Purpose

2. List of Remedial Technologies

   2.1 Technology #1
   2.2 Technology #2
   2.3 Etc.

3. Selection Criteria

   3.1 Environmental and Public Health Criteria
   3.2 Cost Criteria
   3.3 Other Criteria

4. Remedial Alternatives -- Site Specific

   4.1 Selection
   4.2 Screening

      4.2.1 Alternative #1 (No action)
      4.2.2 Alternative #2
      4.2.3 etc.

5. Evaluation of Alternatives

   5.1 Alternative #1

      5.1.1 Technical Analysis
      5.1.2 Environmental Analysis
      5.1.3 Public Health Analysis
      5.1.4 Cost Analysis

   5.2 Alternative #2 etc.

6. Cost / Benefit Evaluation of Potentially Acceptable Alternatives

7. Recommendations and Conclusions

8. Responsiveness Summary

9. Appendices

   A. Supporting Documentation: Technical
   B. Supporting Documentation: Environmental
   C. Supporting Documentation: Public Health
   D. Supporting Documentation: Cost

APPENDIX B

PLANNING DOCUMENTS

APPENDIX B.1

WORK PLAN/QUALITY ASSURANCE PLAN
FOR
BUFFALO COLOR CORPORATION
AREA "D" RI/FS

WORK PLAN/QUALITY ASSURANCE PLAN
FOR THE
BUFFALO COLOR CORPORATION
AREA "D"
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

FEBRUARY 1988
REVISED APRIL 1988

MALCOLM PIRNIE
MALCOLM PIRNIE, INC.
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PREFACE

This plan has been prepared by Malcolm Pirnie, Inc. in accordance with the terms and provisions of the Order on Consent between the State of New York Department of Environmental Conservation and Buffalo Color Corporation and Allied-Signal Inc. Maloclm Pirnie, Inc. is a consulting firm licensed to practice engineering in New York State.

AREA "D"
RI/FS WORK PLAN

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1.0 INTRODUCTION

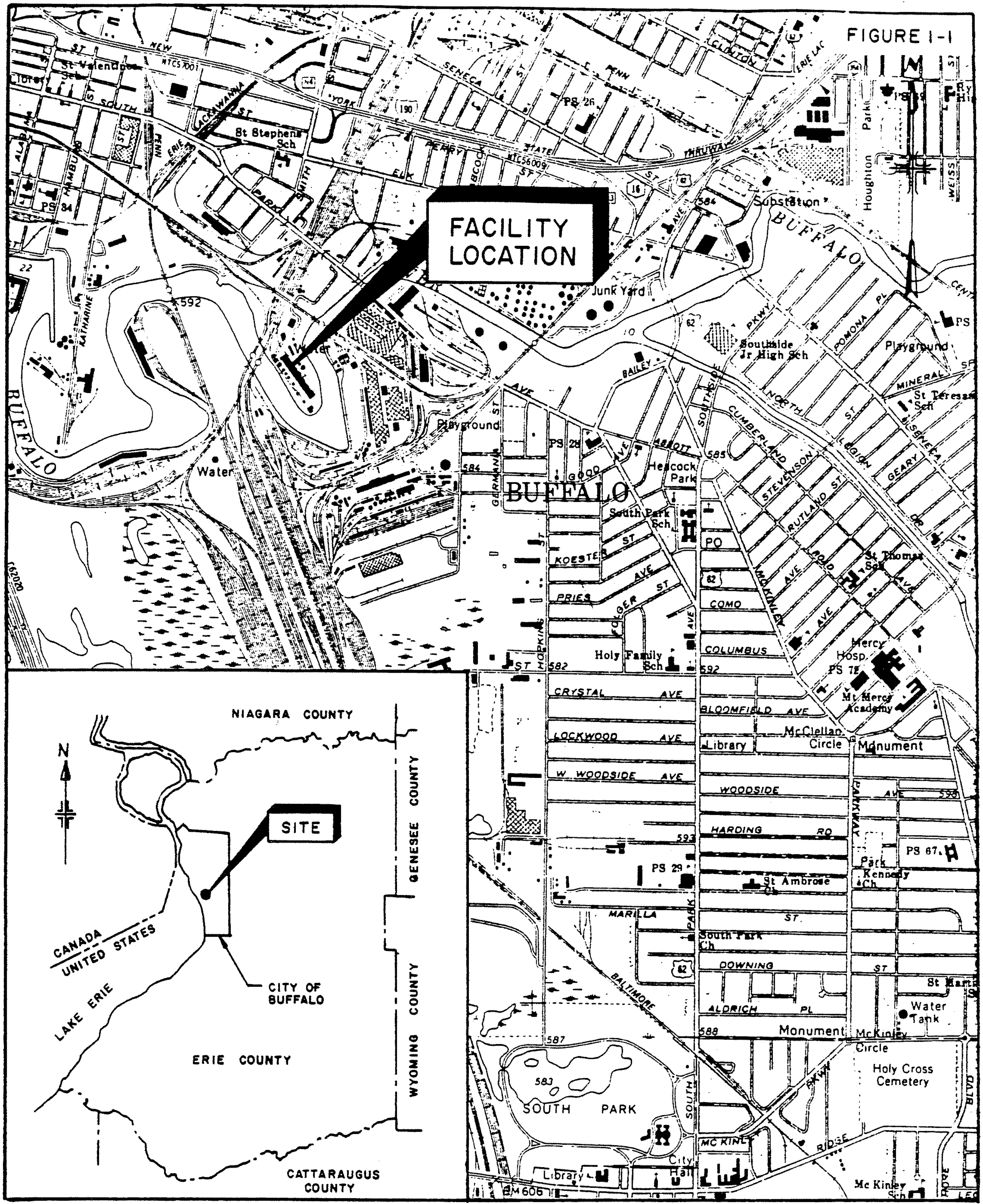
1.1 BACKGROUND

Buffalo Color Corporation's Area "D" is an inactive waste management site located off South Park Avenue in the City of Buffalo, Erie County, New York (Figure 1-1). This site, which comprises a 19-acre peninsula in the Buffalo River, is currently listed in the New York State Registry of Inactive Hazardous Water Disposal Sites (Site Nos. 915012a and 915012b). The site was operated by Allied Chemical Corporation for the manufacture of a variety of chemicals (principally household detergents) and as a temporary storage area for chemcial byproducts, that were subsequently recycled, from the manufacture of organic dyes and dye intermediates. Manufacturing and waste handling operations at the Area "D" ceased during the 1960s and early 1970s prior to the purchase of the property by Buffalo Color Corporation. The portions of Area "D" which are of concern include:

1) the "Weathering Area" located at the tip of the peninsula which was utilized for the storage of metal oxide sludges;
2) the two lagoons which were utilized for the disposal of iron oxide sludges;
3) a former tank farm area where fuel oil was bulk stored; and
4) the area formerly occupied by an incinerator and which was also used for open burning.

During late 1982, a field investigation was initiated in compliance with a New York State Department of Environmental Conservation (NYSDEC) Order on Consent in an effort to determine what, if any, impact that Area "D" had on the environment in the vicinity of the site. Upon review of the investigation report by the NYSDEC, it was determined that Area "D" constituted a significant threat to the environment due to soil, ground water and surface water contamination. Subsequently, pursuant to New York State's Environmental Conservation Law Section 27-1313(3)(a), the Commissioner of the NYSDEC has ordered the responsible parties for Area "D" to develop and implement an inactive hazardous waste disposal site remedial program which is approvable by that department. The first step in the remediation process is the development of this Remedial Investigation/Feasibility (RI/FS) Study Work Plan.

FIGURE 1-1



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SOURCE: BUFFALO SE QUADRANGLE
N.Y.S.D.O.T. MAP
SCALE: 1:24000

AREA "D" RI/FS

VICINITY MAP

BUFFALO COLOR CORPORATION

JANUARY 1988

1.2 PURPOSE AND OBJECTIVES

This RI/FS Work Plan for Area "D" defines the level of effort and specific field activities for the Remedial Investigation, as well as the strategy for the Feasibility Study, as directed by Order on Consent B9-0014-84-01. The purpose of this Work Plan is to describe the proposed activities in sufficient detail to allow the NYSDEC to evaluate all aspects of the project, thereby ensuring the RI/FS is undertaken in accordance with their applicable guidelines.

The objectives of this Work Plan are to:

- identify the number and types of samples to be collected, as well as analytical procedures and other methodologies to be followed;
- provide a mechanism for planning and approving site activities;
- provide a basis for estimating the costs of field efforts and other associated RI/FS tasks; and
- focus the RI toward a feasible and supportable conceptual remedial approach.

1.3 SCOPE OF WORK

This Work Plan for the RI/FS to be carried out at Buffalo Color Corporation's Area "D" has been developed in accordance with the requirements of the United States Environmental Protection Agency's (USEPA) "Model Statement of Work for Conducting Remedial Investigations" and "Model Statement of Work for Conducting Feasibility Studies." Details are presented in this Work Plan concerning:

- methods and procedures for determining the types, quantities and areal and vertical extents of hazardous wastes present;
- methods for determining hydrogeologic conditions at, and in the vicinity of, the site;
- methods for estimating past, present and future releases and migration of hazardous wastes from the site;
- calculations used to predict the potential release and migration of hazardous wastes through surface water, ground water and air at the site;
- procedures for establishing sampling stations, obtaining samples, analyzing samples and gathering field data;

- time schedules for the initiation and completion of the Remedial Investigation and submission of the RI/FS report to the NYSDEC; and
- procedures to ensure the protection of people at, and in the vicinity of, the site during the performance of the Remedial Investigation.

In accordance with the above topics, the major elements of this document include:

- Remedial Investigation Plan which details all proposed field investigation activities, sampling procedures, analyses and quality assurance/quality control (QA/QC) procedures;
- Feasibility Study Plan which provides descriptions of the remedial strategy for the site, identification of applicable remedial technologies and details on the remedial alternative development and selection processes;
- Health and Safety Plan which addresses site-specific considerations for workers during the RI, including potential hazards on-site, decontamination areas and procedures and emergency procedures; and
- Project Schedule which identifies both the major milestones to be achieved in implementing the RI/FS and estimates of the time required to perform the project tasks.

2.0 REMEDIAL INVESTIGATION

2.1 SUMMARY OF BACKGROUND INFORMATION

Available background information pertinent to Area "D" will be assembled and summarized. This information will include a list of chemicals used at the site, characteristics of wastes disposed of in Area "D", local geology and hydrogeology, local ground water and surface water quality, land use, and location of sensitive environmental habitats, if any.

2.2 HEALTH AND SAFETY PLAN (HASP)

A HASP that addresses the specific conditions that exist at Area "D" has been prepared and is attached as Appendix A to this document. This HASP identifies the health and safety protocols that will be followed during all RI field activities.

2.3 SITE INVESTIGATION

2.3.1 Surveying and Mapping (Task 1)

Aerial photogrammetric mapping of Area "D" with surveyed ground control has been performed by McIntosh and McIntosh, Inc. to prepare a topographic base map for use during the site investigation and subsequent evaluation of remedial alternatives. This map is at a scale of one hundred feet to an inch and a contour interval of one foot.

Field surveys will also be performed during the site investigation to establish exact locations of soil borings and piezometer/well installations. The master drawing of the site on which all of the wells and borings will be shown will include, at its periphery, the Republic Steel shores of the Buffalo River and the railroad property north and west of Area "D".

2.3.2 Underground Facilities Investigation (Task 2)

An investigation of underground utilities, building foundations, etc. will be performed on the basis of plant records. This investigation will be supplemented in the field by a visual inspection of utility line (including sewer) manholes to observe any indication of contaminant deposition or migration.

2.3.3 Terrain Conductivity Survey (Task 3)

There are various known areas of concern on the site including the sludge ponds and the weathering area. An EM-terrain conductivity survey will be conducted in an attempt to locate contaminant plumes that may be emanating from these areas and to detect additional unknown plumes and their respective sources.

The EM-terrain conductivity survey will be performed using a Geonics Model EM34-3 terrain conductivity meter in the 10-meter spacing configuration. The depth of penetration of this configuration is approximately 20 feet, which should detect highly-conductive contaminant plumes within the entire thickness of saturated alluvial deposits beneath the site.

The survey will be conducted on a maximum of a 50-foot grid over the entire peninsula starting along pre-established base lines. A 10-meter grid spacing will be used when readings indicate that a contaminant plume is present. Conductivity readings will be recorded, graphically plotted to illustrate conditions at the baseline traverses, and contoured, if applicable, on a site map for analysis and interpretation. The underground utilities known to be present on-site may cause interference with the performance of the conductivity survey.

Subsequent to analysis and evaluation of the EM survey data, the positions of piezometers, ground water monitoring wells, and/or soil borings presented in this work plan may be revised.

2.3.4 Soil Borings (Task 4)

2.3.4.1 Drilling Method

Following the geophysical study, a total of seven (7) deep soil borings will be advanced to bedrock across the Area "D" Site. The locations of the borings are anticipated to be as follows:

- Two borings near Well No. 8.
- Two borings near Building No. 447.
- Two borings near Building No. 448.
- One boring south of Building No. 444.

The approximate locations are shown on Figure 2-1 The procedures for drilling the borehole will be as follows:

- A plastic sheet six-mils in thickness will be placed over the soil in the working area around each borehole to isolate the surface soil from the drill cuttings. A 12-inch diameter hole will be cut in the sheet to allow the auger to pass through it. Sheets of plywood will be used to provide a stable work surface.

- Augers will be checked for alignment after each five-foot section of auger flight has been advanced.

- A boring will be made through overburden materials (to bedrock) by advancing a nominal 4-1/4-inch I.D. continuous-flight, hollow-stem auger casing, producing a borehole with an outside diameter of eight inches.

- To define the geologic character of the encountered soils, continuous split-spoon soil samples will be collected from all borings using a 2-inch O.D., 27-inch long split-spoon sampler, and Standard Penetration Test Methods (ASTM D-1586). The split-spoon sampler will be thoroughly cleaned prior to obtaining a new sample at depth to avoid cross-contamination.

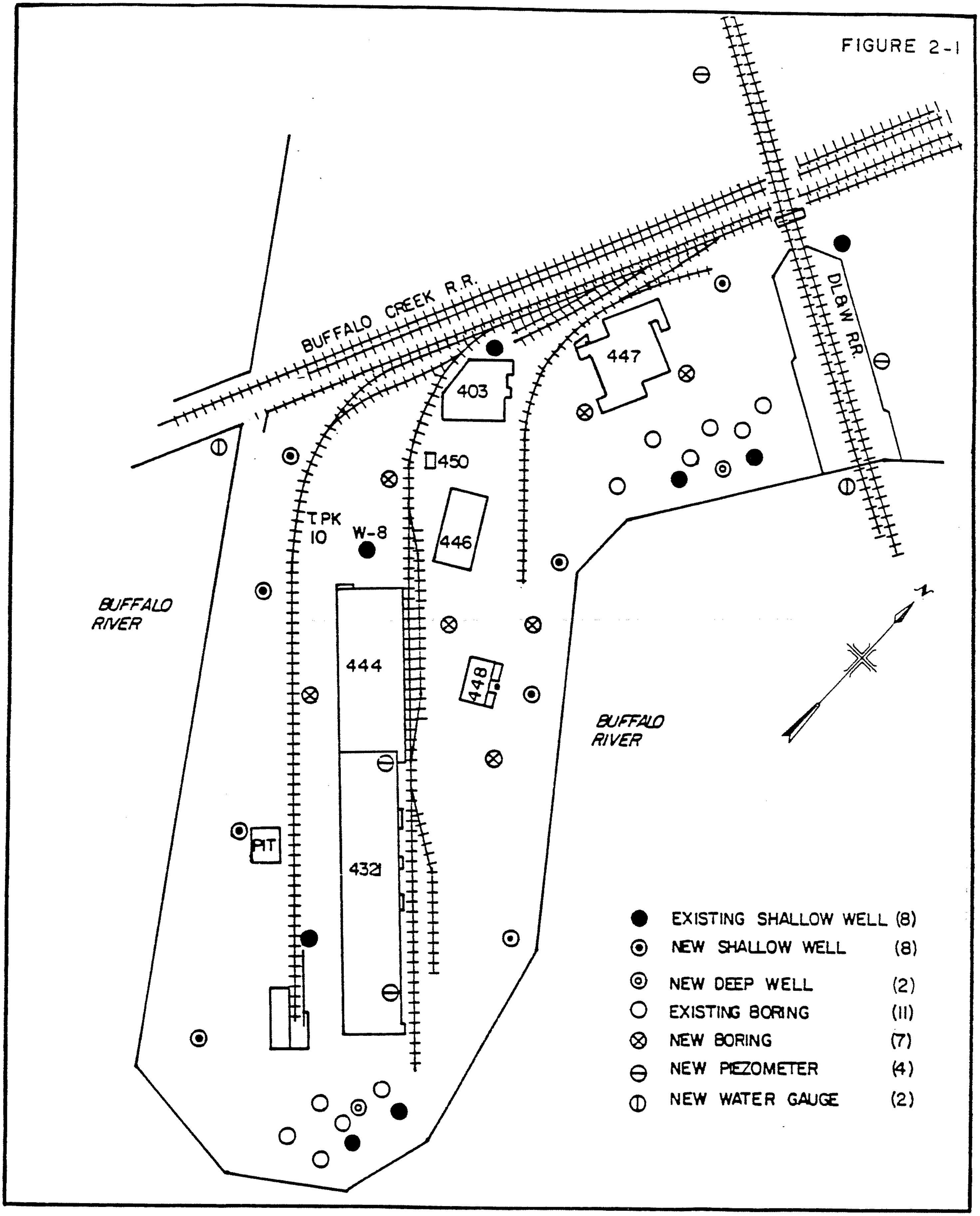
- An HNu photoionization analyzer will be used to scan each split-spoon sample as it is collected to detect the presence of hydrocarbon vapors. Air monitoring of the breathing zone will be performed, using the HNu, in accordance with the Health and Safety Plan (Appendix A). The auger and sampling equipment will be steam-cleaned between borings to prevent cross-contamination.

- Each boring will be logged by a Malcolm Pirnie geologist using the Unified Soil Classification System (SCS) or Burmister SCS. Descriptions of the consistency and color and field estimates of the moisture content, plasticity, and gradation (e.g. moist, wet, highly plastic, poorly graded) will be recorded in a log book in indelible ink.

- All samples obtained from each boring well will be placed in Teflon-lined screw-top bottles, cataloged and archived at the Malcolm Pirnie soils laboratory for future reference.

- All drilling spoils will be placed in drums stationed next to each boring location. The ultimate disposal of these spoils will be executed in accordance with NYS Department of Environmental Conservation regulations.

FIGURE 2-1



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AREA "D" RI/FS
SITE INVESTIGATION PLAN

BUFFALO COLOR CORPORATION
JANUARY 1988

- In the event that rotary drilling is necessary, all return water from drilling will be collected in drums. The water collected in drums will be disposed of according to NYS Department of Environmental regulations.

- Following the completion of all sampling, these boreholes will be backfilled with a cement/bentonite grout mixture using the procedure presented in Appendix K.

2.3.4.2 Boring Logs

The soil borings will be drilled under the supervision of a Malcolm Pirnie geologist who will log each boring. The boring logs will include the following at a minimum:

a. Top and bottom depths of material encountered and the type of material

b. Estimate of the moisture content of the material(s)

c. Drill fluid losses (top and bottom depths)

d. Changes in drill speed including areas of "chatter" or binding of the bit and time of drilling for landfill or bedrock zones

e. Depth at which water is encountered

f. Water levels at the beginning and end of each shift, and just prior to backfilling the hole

g. Top and bottom of casing as casing is advanced per shift

h. Type of drill, bit sizes, and changes of drill bits/sizes and reasons for changes

i. Name of geologist and driller

j. Date, boring number

k. Soil description

l. Standard penetration test blow counts

The field borehole log form that will be used for documentation purposes is presented in Appendix B.

2.3.4.3 Hand Augers

Up to 20 soil borings will be made to a depth of two feet, using a hand bucket auger. A composite sample will be collected at each boring location for subsequent chemical analysis (see Section 2.3.9). The location of each boring will be selected in the field on the basis of field observations and the results of the EM survey.

2.3.5 Piezometer/Ground Water Monitoring Well Installations (Task 5)

2.3.5.1 Monitor Locations

The approximate locations of all new piezometers and ground water monitoring wells that will be installed are depicted on Figure 2-1.

Four shallow piezometers will be installed in saturated fill material directly above the alluvial deposits at the following approximate locations:

- northeast end of Building No. 432;
- southeast end of Building No. 432;
- northeast of DL&W railroad tracks; and
- north of Building No. 447 and Buffalo Creek railroad tracks.

Two of the piezometers will define unconfirmed ground water conditions and gradients in the interior of the peninsula, while the remaining two will explore shallow strata under two former operating buildings.

Two deep monitoring wells will be screened in the natural alluvial soils directly above bedrock. One deep well will be located at the weathering area; the other at the sludge pond area. In addition, eight shallow monitoring wells will be screened in saturated fill material directly above the alluvial deposits at the following locations:

- southwest of the weathering area;
- next to the pit south of Building No. 432;
- south of Well Tank Park No. 10;
- west of Well Tank Park No. 10;
- north of Building No. 447;
- between Building No. 448 and iron lagoons;
- between Building No. 448 and shore; and
- between Building No. 448 and the weathering area.

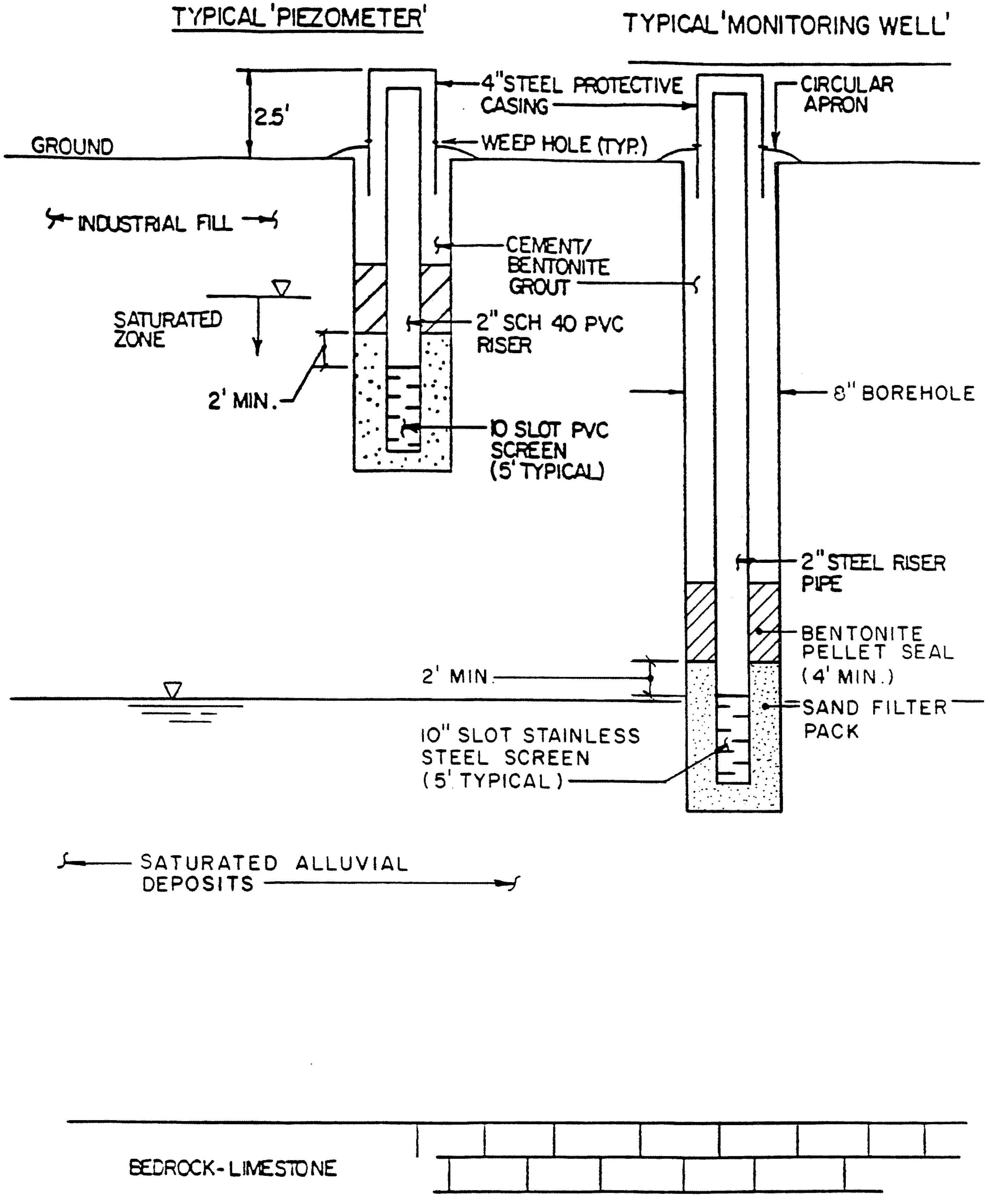
All new monitoring wells will be positioned around the periphery of Area "D" to monitor unconfined ground water conditions and characterize the total movement, if any, of contaminants off-site.

2.3.5.2 Monitor Design/Construction

All boreholes for piezometer and monitoring well installation will be drilled and logged in the manner described in Sections 2.3.4.1 and 2.3.4.2. The typical design of each monitor is shown schematically in Figure 2-2.

All piezometers will be constructed of two-inch ID Schedule 40 PVC riser pipe and screen (0.010-inch slot screen). Based on the subsurface lithology,

FIGURE 2-2



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AREA "D" RI/FS

GROUNDWATER MONITORING DETAILS

BUFFALO COLOR JANUARY 1988

screens five feet in length will be placed at the top of the uppermost permeable stratum encountered so that the screened zone intersects the water table. A one-foot deep, clean-washed silica sand booting will be installed at the bottom of each boring as a base for the well screen to prevent settling. Clean, washed (medium uniform, 0.010-0.020-inch or larger) sand will be backfilled into the annular space to a depth of two feet above the top of the screen, after which a minimum four-foot bentonite pellet seal will be installed. The remainder of the borehole will be cement-grouted to the ground surface. Backfilling with grout will be done with a tremie tube.

The top of the monitor riser will extend two feet above grade and be protected by a vented four-inch diameter steel casing anchored in cement to a depth of approximately 2.5 feet and extending 2.5 feet above grade. The protective casing will be fitted with a keyed-alike locking cap and will be labeled with permanent markings for identification purposes. A concrete surface collar will be constructed around the protective steel casing to stabilize the installation and prevent the infiltration of surface water. Each monitor location will be surveyed for vertical and horizontal location and recorded on the site map.

The top of casing and ground surface elevation will be used to reference lithologic contacts, ground water and well screen elevations. Installation details of all monitors will be graphically documented.

Monitoring wells will be constructed in a similar manner, as described previously for piezometer installations. Since these wells are to be used for ground water quality sampling, however, each well will be constructed using two-inch diameter stainless steel well screen with accompanying two-inch diameter plain steel riser pipe (see Figure 2-2). The screens will typically be five feet in length.

2.3.5.3 Monitor Development

All new piezometers and wells will be developed following installation. Each well will be allowed to stand a minimum of 48 hours and maximum of 96 hours after installation to insure that the non-shrink grout has set. Prior to development, the static water level and well bottom depths will be measured. Development will be relative to evacuated volume, visual clarity, character of the sediments removed and characteristics of the soil in the screened interval of each piezometer/well. Development will continue until the discharged water is relatively sediment-free and/or visual clarity has stabilized.

Development will be accomplished using either a suction-lift pump or bottom-discharge bailer. For those wells which have sustained water levels of 25 feet or less below the top of casing, it will be possible to develop the well using a powered (gasoline or battery) suction-lift pump and dedicated 1/2-inch I.D. polyethylene tubing. Bailers will be used to develop wells which have sustained water levels greater than 25 feet below the top of casing and may also be used for development of shallow wells. The up-and-down motion of bailing acts to surge the well and any suspended sediments collected on the bottom of the well, which facilitates well development by this method.

The eight (8) existing wells will be redeveloped using the procedure identified above. The functional status of each of these wells will be noted as will the presence of any nonaqueous phase liquid (NAPL) in any of these wells.

All ground water removed from each well/piezometer during development will be placed into 55-gallon D.O.T.-approved drums stationed next to each well/-piezometer. The means for ultimate disposal of this ground water will be determined on the basis of the analysis of ground water samples.

2.3.6 Water Gauge Installations (Task 6)

Two water level staff gauges will be placed in the Buffalo River along its banks at the following locations:

- northeast corner of Area "D"; and
- southwest corner of Area "D".

2.3.7 Hydraulic Testing (Task 7)

Testing that will be performed to determine ground water hydraulic characteristics at the site will include monitoring of water levels in all wells and piezometers (existing and new) to determine hydraulic gradients and performance of hydraulic conductivity tests as a part of the new well development process.

2.3.7.1 Water Level Monitoring

Ground water elevations will be measured in all previously existing and newly installed wells/piezometers from the top of casing using an electronic liquid level sensor. Initially, measurements will be taken at least once daily following well/piezometer development. After the first week, measurements will be made at a frequency of once per week until the completion of the RI field activities. Ground water elevation readings will also be made on each of the two occasions that ground water sampling is performed. Readings will also be taken at the two water level staff gauges at the same time as ground water elevation measurements.

2.3.7.2 Hydraulic Conductivity Testing

In-situ permeability of the strata screened by all new wells/piezometers will be determined using the variable-head test method ("rising head") developed by the U.S. Department of the Navy, Naval Facilities Engineering Command (Reference 1). The hydraulic conductivity tests to collect field data will be performed as follows:

- The static water level in the monitoring well to be tested will be determined and recorded.
- The well will be drawn down using a bottom-loading bailer.
- At frequent time intervals (1-5 minutes initially depending upon the rate of recovery) the water levels in the well and the respective elapsed time from the beginning of the test will be measured and recorded (see data recording forms in Appendix B).

As a secondary check on the hydraulic conductivities determined by the above method, the water level recovery data for each well/piezometer that will be collected following development (Section 2.3.7.1) will be analyzed using the methodology of Hvorslev (Reference 2).

2.3.8 Environmental Sampling Program (Task 8)

The environmental sampling program will include the collection and analysis of soil and ground water samples in "Area D" and surface water and bottom sediment samples from the Buffalo River in the immediate vicinity of "Area D".

Sampling locations and procedures are discussed in this section. Sample container requirements and sample handling, labeling and shipping procedures are presented in Section 2.3 and 2.4.

2.3.8.1 Soils

Soil samples collected from the deep borings, together with those collected from the installations of piezometers and monitoring wells, will be organized according to the following plan:

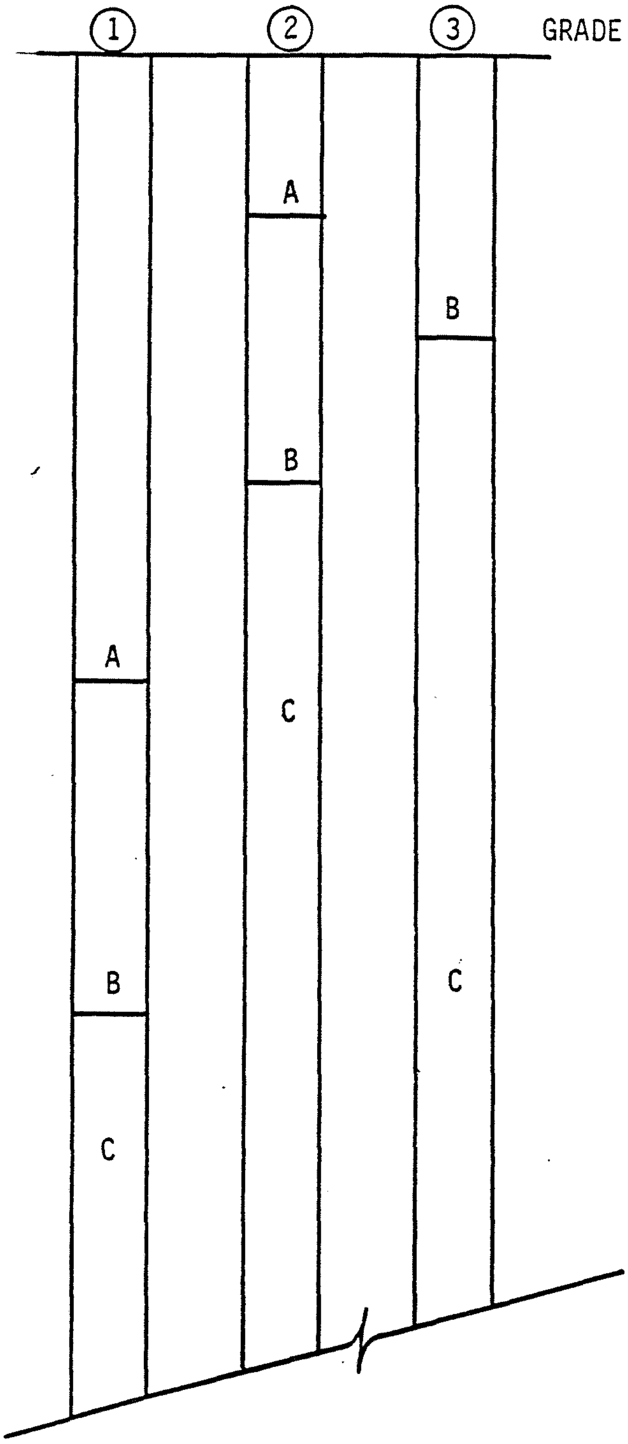
- For each deep boring, a Composite "A" sample will be made of all of the apparently contaminated soil. The physical appearance of the soil (notably discoloration and odor) will be used to make this determination. Observations in the field of gross differences in physical appearance within the Composite "A" stratum may require sampling and analyses of substrata within a Composite "A." However, different colors or shades of color alone will not constitute grounds for subdividing. In some areas, there may be no discoloration or odor at all and, hence, no Composite "A." Final determinations will be made by taking HNu or OVA total organic vapor meter readings. The Composite "A" zone will vary in depth between sampling locations.
- At each boring, a Composite "B" sample will be made of the first complete 2-foot spoon sample of apparently uncontaminated soil. This will be within the next five feet of boring sample after Composite "A."
- A "C"-zone sample will be made of the 2-foot spoon sample starting 5 feet below the top of the Composite "B" sample.
- The deep soil boring locations are shown in Figure 2-1. A hypothetical representation of the soil sampling plan is illustrated in Figure 2-3.
- All soil samples will be archived for a period of five (5) years.
- In the installation of subsequent ground water monitoring wells and piezometers, C-zone samples will not be chemically analyzed, but will be archived.

In addition to the above, shallow soil borings will be made with a hand auger to a depth of two (2) feet. There will be up to twenty (20) shallow borings across the site with their locations and density determined by field observations and the geophysical survey.

2.3.8.2 Ground Water

All of the existing and newly installed monitoring wells will be sampled on two (2) occasions, approximately three (3) to eight (8) weeks apart. The sampling dates will be selected to allow sample collection during the approximately highest and lowest ground water table elevation conditions that

FIGURE 2-3



COMPOSITE A

DISCOLORED OR ODOROUS SOIL. THESE SAMPLES MAY BE SUBDIVIDED IF NECESSARY. THE DEPTH OF DISCOLORED OR ODOROUS SOIL WILL VARY. IN SOME AREAS THERE WILL BE NONE AT ALL AND THUS THERE WILL BE NO COMPOSITE A (e.g. BORING③)

B-ZONE SAMPLE

THE FIRST FIVE FEET OF APPARENTLY UNCONTAMINATED SOIL. EACH SAMPLE WILL BE COMPOSITED FROM THE FIRST TWO FOOT SPOON OF COMPLETELY UNCONTAMINATED SOIL.

C-ZONE SAMPLE

THESE WILL BE COLLECTED FROM THE SEVEN DEEP BORINGS ONLY. EACH SAMPLE WILL BE COMPOSITED FROM THE TWO FOOT SPOON SAMPLE STARTING FIVE FEET BELOW THE TOP OF THE B-ZONE SAMPLE.

MALCOLM
PIRNIE

AREA "D" RI/FS

SOIL SAMPLING PLAN

BUFFALO COLOR
CORPORATION

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occur during the 3-8 week period. The exact sampling dates will be agreed upon by Buffalo Color and the NYS Department of Environmental Conservation. The locations of all wells are shown on Figure 2-1. Locations of the new wells may be modified from those shown, depending on the results of the EM terrain conductivity survey (Section 2.3.3).

The specific ground water monitoring well sampling procedures that will be used are presented in Appendix C. Ground water samples will not be filtered prior to analysis.

2.3.8.3 Surface Water

Surface water samples will be collected from the Buffalo River on each of the same two (2) occasions that ground water samples are collected. Sampling will be performed at two (2) stream monitoring stations: one (1) located immediately upstream of Area "D", and one (1) immediately downstream, as shown on Figure 2-4. The samples collected for chemical analysis at each station will consist of composites of four (4) samples taken at mid-depth at equally-spaced points across the width of the river. Specific sample collection procedures are presented in Appendix D.

2.3.8.4 Stream Sediments

A total of eight (8) river-bottom sediment samples will be collected at two (2) locations in the Buffalo River as shown on Figure 2-4. These locations are centered on sounding lines 735+00 and 747+00 on the U.S. Army Corps of Engineers Buffalo Harbor drawing No. 795-BFR-1/5. Four (4) samples will be collected near the "Area D" Weathering Area and four (4) near the Iron Sludge Lagoons. The samples will be core samples collected through the entire depth of deposit into compacted bottom material or to a maximum depth of 24 inches. The samples will be collected roughly parallel to shore, spaced at equal distances from each other in a water depth of ten (10) feet or less.

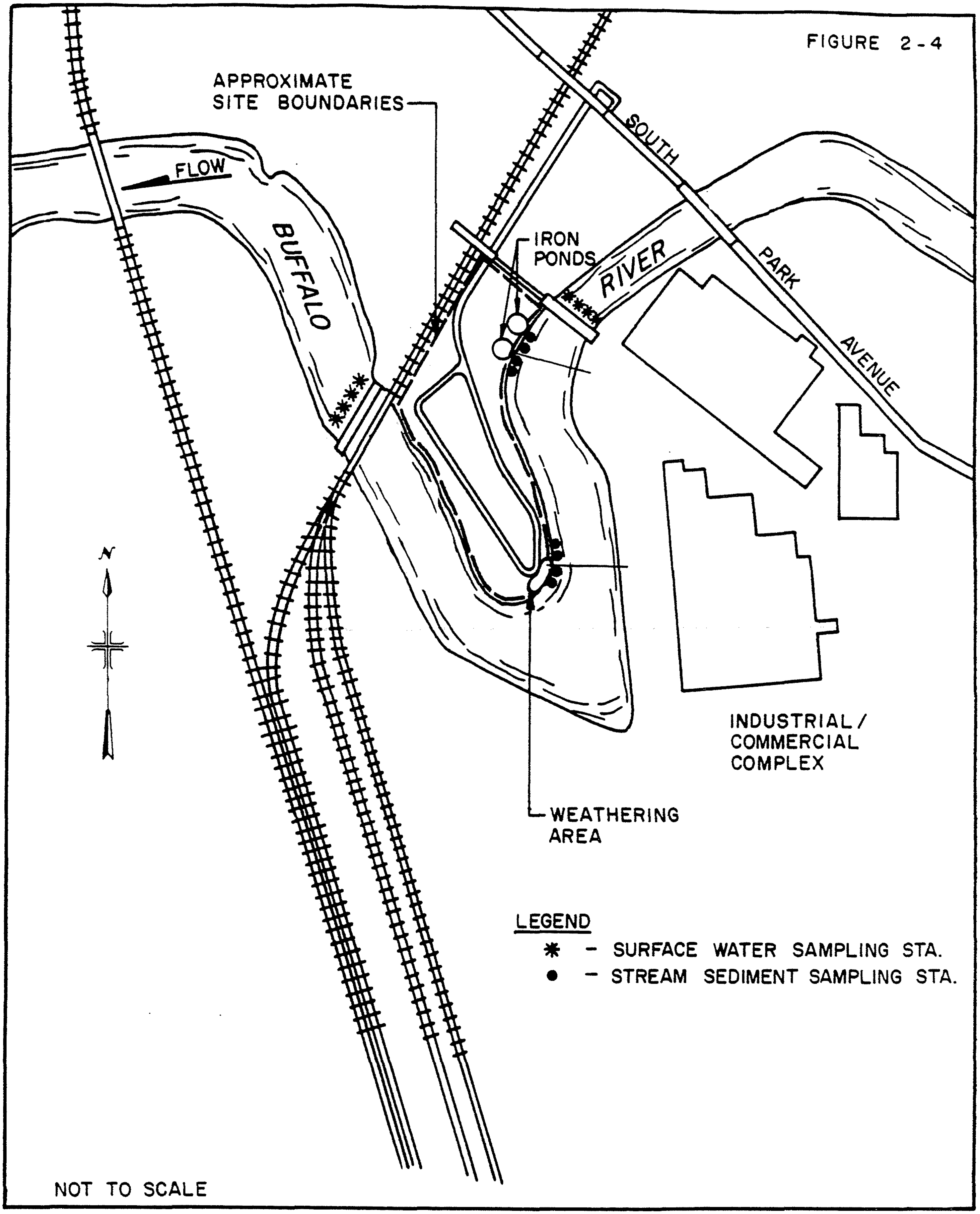
The procedure to be used to collect stream bottom sediments is presented in Appendix E.

2.3.9 Sample Analytical Program (Task 9)

2.3.9.1 Parameters for Physical/Chemical Analysis

The environmental samples collected during this program will be analyzed for the physical/chemical parameters identified in Table 2-1.

FIGURE 2-4



MALCOLM PIRNIE

AREA "D" RI / FS

WATER / SEDIMENT / FISH SAMPLING LOCATIONS

BUFFALO COLOR CORPORATION

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TABLE 2-1

PARAMETERS FOR PHYSICAL/CHEMICAL ANALYSIS

I. SOIL SAMPLES

  A. Summary of Samples

    1. Seven (7) deep soil borings to bedrock
    2. Ten (10) monitoring well installations
    3. Four (4) piezometer installations
    4. Up to twenty (20) shallow (2-feet) hand augers.
    5. Composite samples will be collected from three (3) depth intervals at each boring

  B. ANALYTICAL PARAMETERS

    1. Deep Soil Borings (Item A - 1,2,3)
      a. EPA Priority Pollutant Metals
      b. EPA Base/Neutral Priority Pollutants
      c. Total Organic Halogen

    2. Shallow Soil Borings
      a. EPA Priority Pollutant Metals
      b. EPA Base/Neutral Priority Pollutants
      c. Total Organic Halogen

II. GROUND WATER SAMPLES

  A. Summary of Samples

    1. Eight (8) existing monitoring wells
    2. Ten (10) new wells to be installed during this project
    3. All wells will be sampled on two (2) occasions

  B. Analytical Parameters

    1. EPA Priority Pollutant Volatiles
    2. EPA Priority Pollutant Acid Extractables
    3. EPA Priority Pollutant Base/Neutral Extractables
    4. 1-napthylamine
    5. EPA Priority Pollutant Pesticides
    6. EPA Priority Pollutant Metals
    7. Total Cyanide
    8. Hexavalent Chromium (Cr^{+6})
    9. pH
    10. Specific Conductivity

TABLE 2-1 (Continued)

III. SURFACE WATER

A. Summary of Samples

1. One (1) sample from each of two (2) sample stations on the Buffalo River on each of two (2) sample collection events.

B. Analytical Parameters

1. Same as Item II.B

IV. STREAM SEDIMENTS

A. Summary of Samples

1. Eight (8) stream sediment core samples

B. Analytical Parameters

1. Same as in Item I.B.1

NOTE:

1. The specific priority pollutant metals, Volatiles, Acid Extractables, Base/Neutrals, and Pesticides/PCBs are listed in Tables 2-2, 2-3, 2-4, 2-5, and 2-6, respectively.

TABLE 2-2

PRIORITY POLLUTANT METALS

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

TABLE 2-3

PRIORITY POLLUTANT VOLATILES

Acrolein
Acrylonitrile
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Chloromethane
Dibromochloromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
trans-1,2-Dichloroethylene
1,2-Dichloropropane
cis-1,3-Dichloropropane
trans-1,3-Dichloropropane
Ethylbenzene
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Vinyl chloride

TABLE 2-4

PRIORITY POLLUTANT ACID EXTRACTABLES

4-Chloro-3-methylphenol
2-Chlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2-Methyl-4,6-dinitrophenol
2-Nitrophenol
4-Nitrophenol
Pentachlorophenol
Phenol
2,4,6-Trichlorophenol

TABLE 2-5

PRIORITY POLLUTANT BASE/NEUTRAL EXTRACTABLES

Acenaphthene
Acenaphthylene
Anthracene
Benzidine
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Benzo(g,h,i)perylene
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
4-Bromophenylphenylether
Butyl benzyl phthalate
2-Chloronaphthalene
4-Chlorophenylphenylether
Chrysene
Dibenzo(a,h)anthracene
Di-n-butyl phthalate
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
Diethylphthalate
Dimethylphthalate
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-nitrosodi-n-propylamine
Phenanthrene
Pyrene
1,2,4-Trichlorobenzene

TABLE 2-6

PRIORITY POLLUTANT PESTICIDES/PCBs

Aldrin
Alpha-BHC
Beta-BHC
Delta-BHC
Gamma-BHC
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Toxaphene
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

2.3.9.2 Analytical Methodology/Protocols

The methods which will be used for chemical analysis of all surface and ground water, soil and stream sediment samples collected during this investigation are presented in Table 2-7. The method detection limits and ancillary sample volume, handling, and holding time requirements are also presented.

2.4 SITE ASSESSMENT (TASK 10)

2.4.1 Biological Data Review

A biological data analysis will be based on a search of the literature and of local records.

2.4.2 Ground Water Transport Assessment

Due to the anticipated complex interaction of the Buffalo River with site ground water characteristics and the relatively limited amount of data which will be collected during this remedial investigation, analytical models in lieu of computer models will be used to assess ground water flow and solute transport characteristics of Area "D". Computer models require extensive amounts of data, definition of boundary conditions and verification over extended periods of time with actual seasonal data. The proposed analytical modeling will provide simplified estimates of solute transport for use in completing the risk assessment and identifying required remedial actions.

The following data, some of which is presently available and some of which will be acquired during the course of the remedial investigation, will be used as necessary to perform the analytical evaluation:

- Geometry of the system: average thickness and depth of the ground water system(s), permeability, sources of contamination and means of ground water discharge;
- Direction and magnitude of average regional fluid velocity in the vicinity of "Area D";
- Concentration of different solute species and the rate of leaching, as well as the history of operation at the site;
- Approximations of longitudinal and traverse dispensivity (obtained from previous literature for similar geologic materials); and
- Retardation factor or distribution coefficient for solutes which can be absorbed onto the media (obtained from literature).

TABLE 2-7

ANALYTICAL METHODS/PROTOCOLS FOR SURFACE AND GROUND WATER, SOILS AND STREAM SEDIMENTS

PARAMETER	METHOD	METHOD REFERENCE	HOLDING TIME	PRESERVATIVE (Note 4)	CONTAINER (Note 3)
EPA Priority Pollutant Volatiles	CLP Protocol based on GC/MS Method 624	1	Note 1	Cool to 4°C	2-40 ml glass VOA bottles with Teflon septums
EPA Priority Pollutant Acid Extractables	CLP Protocol based on GC/MS Method 625	1	Note 1	Cool to 4°C	3-1000 ml glass bottles with Teflon-lined cap
EPA Priority Pollutant Base/Neutral Extractables	CLP Protocol based on GC/MS Method 625	1	Note 1	Cool to 4°C	
EPA Priority Pollutant Pesticides/PCBs	CLP Protocol based on GC/MS Method 608	1	Note 1	Cool to 4°C	1000 ml glass bottle with Teflon-lined cap
EPA Priority Pollutant Metals (Total)	CLP Protocol using ICP or AA	2	Note 2	Water: HNO_3 to pH<2 Soil: Cool to 4°C	1000 ml polyethylene bottle with polyethylene cap
Total Cyanide	CLP Protocol based on Method 335.2	2	14 days	Water: NaOH to pH>12 Soil: Cool to 4°C	1000 ml polyethylene bottle with polyethylene cap
Total Organic Halogen (Soils Only)	See Appendix I			Cool to 4°C	
Total Organic Carbon (Leachate) (Soils Only)	90	4		Cool to 4°C	
pH (Water only)	9040	3	Note 3	N/A	N/A
Specific Conductivity (Water only)	9050	3	Note 3	N/A	N/A

TABLE 2-7 (Continued)

ANALYTICAL METHODS/PROTOCOLS FOR SURFACE AND GROUND WATER, SOILS AND STREAM SEDIMENTS

NOTES:

1) All field samples will be delivered to the lab within one (1) day of their collection. The lab shall adhere to CLP contract-required holding times. VOA analysis of water samples must be completed within 7 days of VTSR (Validated Time of Sample Receipt). VOA analysis of soil samples must be completed within 10 days of VTSR. If separatory funnel or sonication procedures are employed for extractions for semivolatile and pesticide analyses, extraction of water samples shall be completed within 5 days of VTSR, and extraction of soil samples shall be completed within 10 days of VTSR. If continuous liquid-liquid extraction procedures are employed, the extraction of water samples shall be started within 5 days of VTSR.

   The VTSR shall be the date on which a sample is received at the Laboratory, as recorded on the Chain-of-Custody form and the lab's central sample log.

2) Analysis of water and soil/sediment samples for all metals (other than Mercury) must be completed within 180 days of the VSTR. Analysis of mercury must be completed within 26 days.

3) Analyze in field immediately upon collection of sample.

4) Preservatives will be added to the sample bottles in the field immediately after the sample has been collected. Ice will be used to cool samples in the field and in transit to the laboratory.

5) Containers shown are those necessary to satisfy volume requirements for water analysis. The mass of soil needed for analysis of all parameters, except volatiles will be satisfied by filling one liter wide-mouth amber glass jar fitted with a Teflon-lined cap. Analysis of volatiles in soil will require two 40 ml VOA glass vials with Teflon septums.

REFERENCES

1) USEPA Contract Laboratory Program, Statement of Work for Work for Organic Analysis, Multi-Media, Multi-Concentration. October 1986, Revised 1/87, 2/87, 7/87.

2) USEPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration.

3) Test Methods for Evaluating Solid Waste, USEPA Office of Solid Waste and Emergency Response. SW846, third edition. November 1986.

Simple mathematical formulas and/or complex partial differential equations are typically used for analytical modeling depending on specific data requirements. In addition, matrix tables (developed for the U.S. EPA and Department of Energy) which consist of dimensionless concentrations versus hydraulic parameters can be used to approximate one or two dimensional contaminant transport in aquifers having one or two dimensional uniform flow (References 3 and 4).

Where appropriate, isoconcentration maps and/or flow nets will be prepared to depict or clarify the magnitude and extent of contaminant migration and ground water flow characteristics.

2.4.3 Site Water Balance

The water balance method will be utilized to estimate the amount of precipitation which is infiltrating Area "D" and potentially resulting in leachate generation. The water balance method assumes the infiltration fraction of precipitation is the principal contributor to leachate generation from a given waste disposal area. Other potential contributors include the water of decomposition, the initial moisture content of the waste, and infiltration of ground water. All of these factors are assumed negligible relative to the infiltration fraction of precipitation.

The water balance, as developed in the soil and water conservation literature, is based upon the relationship between precipitation, evapotranspiration, surface runoff, and soil moisture storage. Precipitation represents that amount of water added. Evapotranspiration, the combined evaporation from the plant and soil surfaces and transpiration from plants, represents the transport of water from the earth back to the atmosphere, the reverse of precipitation. Surface runoff represents water which can be held in the soil. Each of the parameters used in the water balance is described in detail as follows:

- Potential Evapotranspiration (PET) - Mean monthly (PET) values will be obtained from the National Climatic Center.

- Precipitation (P) - Mean monthly P values will be obtained from the U.S. Weather Bureau for the Buffalo area.

- Surface Runoff (R) - Represents the amount of precipitation that runs off the land surface before it can infiltrate into the fill materials. The amount of runoff (R) is determined by applying a runoff coefficient (C) to the monthly precipitation.

- Infiltration (I) - represents the amount of precipitation that enters the surface of the cover material. It is simply the difference between precipitation (P) and surface runoff (R).

- I-PET - to determine period of moisture excess and deficiency in the soil, it is necessary to obtain the difference between infiltration and potential evapotranspiration. A negative value of I-PE indicates the amount by which the infiltration fails to supply the potential evaporation. A positive value of I-PE indicates the amount of excess water which is available during certain periods of the year for soil moisture recharge and percolation.

- Accumulated Potential Water Loss (NEG) - equals the summation of the negative I-PE values.

- Soil Moisture Storage (ST) - represents the soil moisture retained in the soil after a given amount of accumulated potential water loss or gain has occurred.

- Change in Soil Storage (ΔST) - represents the change in soil moisture from month to month.

- Actual Evapotranspiration (AET) - represents the actual amount of water loss during a given month. As soil moisture is depleted, the rate of evapotranspiration decreases below its potential rate, thereby resulting in an AET value less than the corresponding PET value. For those months when I-PET is positive, the rate of evapotranspiration is not limited to moisture availability, and AET is equal to PET. For those months where I-PET is negative, the rate of evapotranspiration is limited by soil moisture availability, and $AET=PET + (I-PET) - \Delta ST$.

- Percolation (PERC) - after the soil moisture storage reaches the maximum water-holding capacity of the soil, any excess infiltration percolates through the cover material and into the underlying fill area. Percolation escaping the fill is called leachate. Basic equation is: $PERC=P-R - \Delta ST-AET$.

Consideration will also be given to using the Hydrologic Evaluation of Landfill Performance (HELP) Model for predicting the amount of leachate being generated by Area "D" (Reference 5). The HELP computer program is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of waste areas. The model accepts climatologic, soil and design data and utilizes a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, evapotranspiration, soil moisture storage, and lateral drainage. Waste disposal areas, including various combinations of vegetation, cover soils, and relatively impermeable confining layers, may be modeled. The program was developed to facilitate rapid estimation of the amounts of runoff, drainage, and leachate that may be expected to result from a waste disposal area.

2.4.4 Mathematical Load Calculations

The nature and extent of the known actual and potential release and migration of hazardous and industrial wastes from the site via ground water to the Buffalo River and further downstream will be determined. This task, which will be interrelated with the analytical modeling, will include mathematical modeling of such releases to the Buffalo River via the ground water pathway using a modification of Darcy's Law and the Continuity Equations.

Darcy's Law: $V = \frac{K\ I}{\theta}$ Continuity Equation: $Q = VA\ \theta$

where:

V = seepage velocity (vertical or horizontal)

K = hydraulic conductivity (vertical of horizontal component

I = vertical or horizontal gradient

θ = effective porosity

Q = Volumetric flow rate

A = Estimated cross-sectional area through which the ground water is assumed to flow.

This task will also include an estimate of the amount of waste which has or continues to enter the Buffalo River via erosion. Such calculations will involve comparing the existing areal extent and topography of the site as determined by 1987 areal photography with previous areal and topographic surveys.

2.5 RI REPORT (TASK 11)

After all RI field activities have been completed and the results of all sample analysis has been received from the laboratory, a report will be prepared describing the results of the Remedial Investigation. The outline for this report will be approximately as shown in Table 2-8.

TABLE 2-8

RI REPORT OUTLINE

EXECUTIVE SUMMARY

- 1.0 INTRODUCTION
  - 1.1 Objective
  - 1.2 Site History
  - 1.3 Site Description
    - 1.3.1 Location and Boundaries
    - 1.3.2 Physiography
    - 1.3.3 River

- 2.0 SITE CHARACTERIZATION
  - 2.1 Hydrogeology
    - 2.1.1 Aquifer Identification
      - a) Locations and Flow Patterns
      - b) Effects of River Level
    - 2.1.2 Soil Characterization
      - a) Soils Analysis and Description
      - b) Ground Water Permeation
      - c) Ground Water runoff
  - 2.2 Contamination Characterization
    - 2.2.1 Location and Identification
      - a) Soil
      - b) Aquifers
      - c) Riverbed
      - d) Surface Water
      - e) River Water
    - 2.2.2 Characteristics and Behavior
  - 2.3 Underground Investigation
    - 2.3.1 Utilities
    - 2.3.2 Foundations
    - 2.3.3 Miscellaneous

- 3.0 CONTAMINATION MIGRATION
  - 3.1 Riverbed Erosion
  - 3.2 Sludge Ponds
  - 3.3 Incinerator
  - 3.4 Weathering Area
  - 3.5 Kerosene Well #8
  - 3.6 Balance
  - 3.7 Summary

- 4.0 BIOLOGICAL DATA ANALYSIS

TABLE 2-8 (Continued)

RI REPORT OUTLINE

5.0 PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS
  5.1 Potential Receptors
  5.2 Public Health Impacts
  5.3 Environmental Impacts
6.0 SUMMARY

APPENDICES

A. Sampling Protocol

B. QC/QA Protocol

C. Sampling Program Data and Results
  1. Soil
  2. Ground Water
  3. River
  4. River Bottoms

D. Logs: Wells, Deep Borings and Hand Augers

E. Grid Map of Area "D"

F. Cross-Sectional Diagrams of Area "D"
  1. Lateral Cross Sections
    a) SW - NE through the Weathering Area
    b) SW - NE through the pit
    c) W - E through Well #8 and Bldg. 448.
    d) W - E through Bldg. 447 and the Iron Sludge Lagoon
  2. Longitudinal Cross Sections
    a) From the deep piezometer at the tip of the point through the wells along the southern shore.
    b) From the tip of the point, through the center of the peninsula to Well #8, then turning through Bldg. 447 to Well #6
    c) From the Weathering Area through the wells and borings on the northern shore, through through the Iron Sludge Lagoons.

3.0 FEASIBILITY STUDY PLAN

3.1 FEASIBILITY STUDY GUIDANCE

The enactment of the Superfund Amendments and Reauthorization Act (SARA) during 1986 has resulted in changes in the general approach to the development of hazardous waste site remedial plans. In conjunction with the enactment of SARA, the National Contingency Plan (NCP) is currently being revised. The NCP is the vehicle by which the response powers of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and SARA are effectuated. This revision process has not been completed as of the time of this submission; however, a draft of the proposed changes has been developed which provides some guidance to future requirements. With regard to this Feasibility Study Plan for Buffalo Color Corporation's Area "D", specific updated guidance has been incorporated concerning the development, initial screening and detailed analysis of remedial alternatives, and the subsequent selection of a remedy. This Plan has been designed to be responsive to both the existing and future aspects of the NCP which affect the remediation of the site.

3.2 DEVELOPMENT OF PROPOSED RESPONSE (TASK 12)

The Feasibility Study process for Area "D" will utilize data obtained during the Remedial Investigation as the basis for identifying, selecting and evaluating remedial action alternatives for implementation at this site. Potential site contaminant sources and contaminant migration pathways which were identified during previous investigations or are defined during the proposed field activities will be categorized as follows:

- Air and airborne dust;
- Surface water infiltration or contamination;
- Ground water contamination;
- Wastes present in drums, piles, etc.; and/or
- Soil and sediment contamination.

Subsequently, as information regarding site conditions and characteristics becomes available during the RI, General Response Actions will be identified which appear to address the site problems listed. These General Response Actions which are considered will include the "no action" measure as a baseline against which other remedial measures can be compared. Some examples of General Response Actions which at present address known site problems and contaminant migration pathways are listed in Table 3-1.

To prepare the site-specific Remedial Investigation Plan, a preliminary conceptual response will be developed for the site based upon available site information. As discussed in Section 1 of this Work Plan, portions of Area "D" were used to dispose of wastes from past manufacturing processes. In addition, contaminants suspected to be present in the vicinity of the former incinerator and/or tank farm may have been the result of chemical spillage during on-site activities. Since the potential exists to manage this remediation as several areas with different physical, chemical and environmental characteristics and concerns, the investigation activities will be geared toward this approach. Any contamination of off-site environmental media by hazardous constituents will be addressed by management of migration response actions. If information becomes available during the RI that indicates a removal action may be necessary, this situation will be identified during the development of the proposed response for the site.

3.3 REMEDIAL TECHNOLOGY IDENTIFICATION AND SCREENING (TASK 13)

As the development of the proposed remedial response for Area "D" progresses, a master list of potentially feasible remedial technologies will be developed concurrently. For each General Response Action identified under Task 12, specific technologies will be identified. This identification process will be revised and updated simultaneously with the completion of field investigation and data assessment tasks to ensure that all data required to define these technologies are available for the FS process. This approach will allow further investigative activities to be carried out in a cost-effective and timely manner, if they are deemed necessary. In general, technologies which present permanent solutions to reducing unacceptable contaminant source volumes, toxicity or mobility will be considered. Wherever possible, proven alternative and innovative technologies will be included in the master list.

TABLE 3-1

GENERAL RESPONSE ACTIONS IDENTIFIED FOR AREA "D"

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGIES
1. No Action	None
2. Minimal Action	Site monitoring.
3. Removal	Excavation/dredging of all or some of the wastes and contaminated soils and sediments related to the site which present a significant public health or environmental threat.
4. Disposal	Disposal of contaminated wastes in an off-site secure landfill.
5. Containment	Capping and/or barrier walls to prevent or minimize contaminant migration off-site.
6. Diversion	Site grading and/or construction of diversion ditches and terraces or benches to control surface water and groundwater contact with contaminants.
7. Collection	Leachate collection drains or ditches and groundwater pumping to collect contaminated leachate and/or groundwater for treatment.
8. In-Situ Treatment	Biodegradation, soil flushing or aeration and VOC vacuum wells to treat contaminants without soil or waste disturbance.
9. Direct Treatment	Physical/Chemical treatment processes which may include biological processes, granular activated carbon treatment and VOC air stripping to remediate contaminated groundwater and/or leachate for discharge from the site.

The technologies which are identified as potentially applicable for remediation of the site will then undergo a preliminary screening process based upon site conditions, waste characteristics and technical requirements. Specific considerations which will form the basis of this screening process will include the following:

- Technologies that would be extremely difficult to implement, that will not achieve remedial goals within a reasonable time frame, or that rely upon unproven technology will be eliminated from consideration;
- Technologies which are obviously limited by adverse waste characteristics (e.g., solubility, persistence, toxicity, material incompatibility) or adverse site conditions (e.g., high water table, slope) will be eliminated from consideration;
- Technologies for which performance records or inherent construction, operational or maintenance constraints are deemed unacceptable will be modified or eliminated from consideration; and
- Technologies that may influence the feasibility or effectiveness of other technologies will be modified or eliminated from consideration;

Wherever necessary, modifications to a specific technology will be considered before it is eliminated from consideration altogether. Adequate justification will be provided whenever a technology is eliminated by the screening process.

3.4 DEVELOPMENT OF REMEDIAL ALTERNATIVES (TASK 14)

The initial emphasis of this task will be to establish site-specific response goals which reflect both public health and environmental concerns and applicable regulatory environmental criteria (standards, guidance and advisories). Goals for source control measures will ensure the minimization of contaminant migration from the site, while the goals for migration management measures will ensure that the impact of contaminants that have migrated from the site are minimized or eliminated. This task will focus on cost effective remedial measures which utilize, to the maximum extent practicable, permanent solutions and alternative treatment technologies aimed at significantly reducing the volume, toxicity and/or mobility of on-site hazardous constituents.

After certain conceptual technologies have passed the preliminary screening process (Task 12), a limited number of remedial alternatives which appear to both adequately address site problems and achieve response goals (as described above) will be developed. Each alternative may consist of one or more technologies which are combined to effectively address response criteria. In general, each alternative will be classified as either a source control and/or a migration management remedy. It must be noted that the dynamic relationship between these two aspects may require that alternatives incorporate both to ensure a comprehensive site response involving complimentary actions. A reasonable attempt will be made to develop at least one alternative within each of the following categories:

- Alternatives for source control actions will be developed ranging from an alternative that minimizes the need for long-term management (including monitoring) at the site, to an alternative using treatment to reduce the toxicity, mobility, or volume of site wastes. Any alternative involving treatment as a principal element must rely primarily on treatment technologies to reduce the major threats posed by the site. These alternatives will vary primarily in terms of the amount of waste that must be managed following implementation of the remedial action and the degree of threat posed by that waste.

- Alternatives for ground water response actions developed to be within a performance range that is defined in terms of varying remediation levels and different rates of restoration.

- Alternatives that involve the containment of wastes with little or no treatment, but provide protection of human health and the environment primarily by either preventing exposure or reducing the mobility of the waste.

- A no-action alternative.

In the case that technologies which passed the preliminary screening procedure are not used in the alternative development process or that one (or more) of the alternative categories described above is not addressed, adequate justification of the situation will be provided.

3.5 SCREENING OF ALTERNATIVES (TASK 15)

The alternatives identified in Task 14 will be screened to eliminate those that are clearly inappropriate for Area "D", thereby narrowing the list of potential alternatives for the detailed analysis. The screening should preserve the most promising alternatives as determined by their likely effectiveness and implementability. Three broad criteria will be used in the initial screening of alternatives, including:

- Effectiveness. Alternatives will be evaluated as to the degree of protection to human health and the environment they afford; how significantly and permanently they reduce the toxicity, mobility, or volume of hazardous constituents; or how they are effective in other respects;
- Implementability. Alternatives will be evaluated as to the technical feasibility and availability of the technologies each alternative would employ; the technical and institutional ability to monitor, maintain, and replace technologies over time; and the administrative feasibility of implementing the alternative; and
- Cost. The costs of construction and any long-term costs to operate and maintain the alternatives will be evaluated.

In addition, the following considerations will apply:

- Innovative alternative technologies will be carried through the screening process if there is a reasonable belief that they will offer the potential for better treatment performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies; and
- At least one containment alternative and the no action alternative will be carried through the initial screening process to the detailed analysis.

At the completion of Task 15, the NYSDEC will be notified of the alternatives which pass through the initial screening procedure. The performance of the screening process will then be summarized and presented to NYSDEC for review and comment prior to Task 16 being initiated.

3.6 DETAILED ANALYSIS OF ALTERNATIVES (TASK 16)

Each remedial alternative which passes the preliminary screening process will be evaluated in detail regarding its technical, environmental, institutional, public health and cost-related merits. The detailed evaluation will be conducted on the limited number of alternatives that remain after the completion of Task 15. Each alternative will be evaluated with respect to Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) and other criteria, advisories and guidance related to the proposed actions. The detailed analysis begins with an examination of each alternative against the broad factors of effectiveness, implementability and cost. Each of these factors addresses specific response goals as indicated below:

- Effectiveness. Measures of effectiveness include (but are not limited to) the degree of protection afforded to human health and the environment by each alternative and the extent that waste toxicity, mobility and volume reduction are achieved.

- Implementability. Measures of this factor include (but are not limited to) the technical feasibility regarding short term reliability, compatibility with other remedial actions and ability to attain ARARs; the administrative feasibility regarding public response and agency approvals; and the availability of necessary equipment and specialists.

- Cost. Component measures include short-term construction and operating costs prior to complete remediation; long-term O&M costs; present worth of the entire remedial project; and replacement costs for unsatisfactory remedial actions.

Once all of the alternatives are evaluated according to the factors listed above, each alternative will be compared to the others using the above-listed factors and any other factors deemed appropriate for the site. Among the key comparisons will be an evaluation of the relationship between the degree of protection achieved and the estimated costs.

3.7 PRELIMINARY REPORT (TASK 17)

A preliminary report will be prepared which presents the results of Tasks 1 through 16. Table 3-2 identifies the recommended format for this Remedial Investigation/Feasibility Study Report.

TABLE 3-2

FEASIBILITY STUDY REPORT OUTLINE

EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 Site Background Information
- 1.2 Nature and Extent of Problems
- 1.3 Objectives of Remedial Action

2.0 SITE FEATURES INVESTIGATION

- 2.1 Demography
- 2.2 Land Use
- 2.3 Natural Resources
- 2.4 Climatology

3.0 HAZARDOUS SUBSTANCES INVESTIGATION

- 3.1 Waste Types
- 3.2 Waste Component Characteristics and Behavior

4.0 HYDROGEOLOGIC INVESTIGATION

- 4.1 Soils
- 4.2 Geology
- 4.3 Groundwater

5.0 SURFACE WATER INVESTIGATION

- 5.1 Surface Water
- 5.2 Sediments
- 5.3 Flood Potential
- 5.4 Drainage

6.0 AIR INVESTIGATION

7.0 PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

- 7.1 Potential Receptors
- 7.2 Public Health Impacts
- 7.3 Environmental Impacts

Table 3-2 (continued)

8.0 SCREENING OF REMEDIAL ACTION TECHNOLOGIES

- 8.1 Technical criteria
- 8.2 Remedial Action Alternatives Developed
- 8.3 Environmental and Public Health Criteria
- 8.4 Other Screening Criteria
- 8.5 Cost Criteria

9.0 REMEDIAL ACTION ALTERNATIVES

- 9.1 Alternative 1 (No Action)
- 9.2 Alternative 2
- ⋮
- 9.N Alternative N

10.0 ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

- 10.1 Non-cost Criteria Analysis
  - 10.1.1 Technical Feasibility
  - 10.1.2 Environmental Evaluation
  - 10.1.3 Institutional Requirements
  - 10.1.4 Public Health Evaluation
- 10.2 Cost Analysis

11.0 SUMMARY OF ALTERNATIVES

REFERENCES

APPENDICES

3.8 FINAL REPORT (TASK 18)

A final report will be prepared which presents the results of Tasks 1 through 17, including technical considerations and comments presented by the NYSDEC.

4.0 QUALITY ASSURANCE PLAN

This Quality Assurance (QA) Plan presents, in specific terms, the policies, organizations, objectives, functional activities, and specific QA and quality control (QC) activities designed to achieve the data quality goals of the "Area D" RI/FS. This plan describes the 16 elements that are considered to be an essential part of a QA Plan as defined by the USEPA Office of Research and Development (Reference 6). These elements and their location in this document are summarized in Table 4-1.

The QA applicable to both the field sampling activities and the laboratory analysis of these samples is addressed in this document. Most of the laboratory analyses and QA/QC procedures will be in accordance with the USEPA Contract Lab Program (CLP). The analytical laboratory, RECRA Environmental, Inc., that will be employed to analyze the field samples collected during the RI is a CLP approved lab. RECRA's CLP Statements of Work (SOW) for performance of inorganic and organic parameter analyses requires adherence to rigorous QA/QC procedures that are specifically defined in the SOWs. These QA/QC procedures are incorporated by reference into this QA Plan (see References 7 and 8). The CLP SOWs also require the CLP lab to have a formally written QA/QC standard operating procedure (SOP) which describes the in-house procedures employed to guarantee, to the extent possible, the quality of all analysis activities. The Quality Assurance/Quality Control Plan that RECRA has written to satisfy this requirement is attached as Appendix J.

4.1 Quality Assurance Objectives

The QA sample collection and analysis objectives are stated in terms of precision, accuracy, completeness, representativeness, and comparability.

4.1.1 Accuracy and Precision

The QA objective for the accuracy and precision of laboratory analytical data is compliance with the specific requirements for these criteria defined in the CLP SOWs. Accuracy will be determined on the basis of blank sample analysis and surrogate recoveries from spiked samples. Precision will be determined in terms of the coefficient of variance based on duplicate sample analysis. The procedures for these determinations are specified in the CLP SOWs.

TABLE 4-1

QUALITY ASSURANCE PLAN CHECKLIST

	QA Plan Element	Location
(1)	Title page with provision for approval signatures	Front Sheet
(2)	Table of contents	Table of Contents
(3)	Project description	Section 2.0
(4)	Project organization and responsiblity	Section 6.0
(5)	QA objectives for measurement data in terms of precision, accuracy, completeness, representativeness and comparibility	Section 4.1
(6)	Sampling procedures	Section 4.2, 2.0
(7)	Sample custody	Section 4.3
(8)	Calibration procedures and frequency	Section 4.4
(9)	Analytical procedures	Section 4.5, 2.3.8
(10)	Data reduction, validation and reporting	Section 4.6
(11)	Internal quality control checks and frequency	Section 4.7
(12)	Performance and system audits and frequency	Section 4.8
(13)	Preventive maintenance procedures and schedules	Section 4.9
(14)	Specific routine procedures to be used to assess data precision, accuracy and completeness of specific measurement parameters involved	Section 4.10
(15)	Corrective action	Section 4.11
(16)	Quality assurance reports to management	Section 4.12

4.1.2 Completeness

The QA objective for completeness is to collect and analyze all environmental samples in a manner such that valid data is obtained from 100% of the samples. Achievement of this objective will rely on the use of strict sample identification and custody procedures, use of standard reference materials, proper instrument calibration and maintenance, analysis of quality control samples, performance audits, and corrective action anytime QC acceptance criteria are exceeded.

4.1.3 Representativeness

An objective of the RI sampling program is the collection of samples that are representative of the matrix (i.e., ground water, surface water, soil, etc.) from which they were collected. Achievement of this objective will rely on the use sampling procedures, as described in Section 2.0, that have been designed with the goal of obtaining representative samples.

4.1.4 Comparability

The QA objective for comparability is the generation of site characterization data that can be used to make valid comparisons with other data that may be generated in the future at this or other sites. This objective also involves the analysis of the environmental samples collected during the RI in manner that produces results comparable to the results that would be obtained by another laboratory using the same analytical procedure. This objective is achieved by the use of standard materials traceable to the National Bureau of Standards; the use of standardly accepted procedures for well/piezometer installation, sample collection and analysis, etc.; and analysis of quality control samples to validate the analytical results.

4.2 Sampling Procedures

The procedures that will be used for the collection, handling, preservation and analysis of samples are presented in Section 2.0 of this document.

4.3 Sample Custody

Immediately following sample collection, each sample container will be marked with the following information:

- Sample Code
- Project number (Malcolm Pirnie No.)

- Date/Time
- Sample Type
- Samplers Initials

The sample code will indicate the site location, media sampled, and sample station.

After all sample identification information has been recorded, each sample label will be covered with waterproof clear plastic tape to preserve its integrity. All samples will be recorded and tracked under strict chain-of-custody protocols. In the field, each sample will be sealed and checked for proper labeling. The samples will then be packed into coolers with either blue-ice freeze packs or ice and transported by automobile to the laboratory. A chain-of-custody form (Figure 4-1) will be completed for each cooler. The form will be signed and dated by the person who collected the samples, the person the samples were relinquished to for transport to the laboratory, and the laboratory sample controller/custodian who receives the samples.

The sample chain-of-custody procedures that will be followed, once the samples are at the laboratory, are described in the laboratories QA/QC Plan (see Section 2.3 of Appendix J).

4.4 Calibration Procedures and Frequency

The field instruments that will be used to make measurements in the field during the RI are the following:

- Portable field pH meter
- Portable field conductivity meter
- Explosimeter
- HNu photoionization analyzer

The procedures that will be used to calibrate and maintain these instruments are presented in Appendix F.

Instrument calibration requirements for CLP analyses are specifically defined in Exhibit E of the CLP SOWs, (References 7 and 8).

4.5 Analytical Procedures

The procedures that will be used for chemical analysis of the environmental samples collected during the RI are presented in Section 2.3.8 of this document. CLP required quantitation limits are presented in Exhibit C of the CLP SOWs (Reference 7 and 8).

FIGURE 4-1

MALCOLM PIRNIE

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME:

SAMPLERS (SIGNATURE):

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS								REMARKS

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS:	

Distribution: Original accompanies shipment; copy to coordinator field files

4.6 Data Reduction, Validation, and Reporting

4.6.1 Field Activities

The results of all field measurements and associated calculations will be recorded on standard forms. Examples of these forms are presented in Appendix B.

Separate field logs will also be maintained for each of the following activities:

- Geophysical survey
- Soil borings and well/piezometer installation
- Collection of environmental samples (i.e., ground water, surface water, stream sediments, etc.)

During all activities, the following general information will be recorded in each log book:

1. Date
2. Crew members
3. Meterological conditions
4. Brief description of field activities planned for date indicated
5. Location where work is performed
6. Problems encountered and corrective actions taken
7. All field measurements or descriptions made
8. Any modifications made to work plan

The following additional information will be recorded by the supervising geologist during drilling activities:

1. Drill rig type
2. Documentation of types and quantities of materials used
3. Record of downtime and the periods of time that work is performed at the various levels of personnel protection (i.e., level B, C or D)
4. Description of soil or rock strata encountered
5. Diagram of well or piezometer construction

The following information will be recorded by the sampling team leader and/or field technicians during the collection of all environmental samples:

1. Sample locations and summary of the samples collected
2. Completeness of the sampling effort (e.g., were all the samples collected that were intended to be collected and if not, what were the reasons?)
3. Chain-of-custody information
4. Results of all field measurements
5. Results of field instrument calibrations

All original forms and field notebooks will be placed in the project record file that will be maintained at Malcolm Pirnie's office in Buffalo, New York.

Data validation will be facilitated by adherence to Standard Operating Procedures (SOPs) identified for the performance of all field activities (see Section 2.0), calibration checks on all field instruments at the beginning and end of each day of use, and manual checks of field calculations.

4.6.2 Laboratory Analyses

The laboratory procedures for data reduction, validation and reporting for all chemical parameters included on the EPA CLP target compound list (TCL) will be in accordance with the specific requirements identified in Exhibit B of the CLP SOWs (References 7 and 8). Procedures for non-TCL parameters will be as described in the laboratory's QA/QC Plan (see Section 2.5 of Appendix J).

4.7 Internal Quality Control Checks and Frequency

Quality control sample analyses that will be performed during this project to document the acceptability of the data will include the following:

- Trip blank
- Matrix spike
- Matrix spike duplicate
- Method blank

The frequency of QC sample analysis for all analyses will be in accordance with the EPA CLP requirements as summarized below.

The laboratory will prepare trip blanks that will accompany sample bottles into the field and be returned to the lab with the samples collected. One (1) trip blank will be collected and analyzed for volatile organics each day that samples to be analyzed for volatiles are collected in the field. Preparation of trip blanks will involve the placement of distilled laboratory water into appropriate precleaned sample bottles.

The laboratory will perform one (1) spiked analysis (matrix spike) and one duplicate spike sample analysis (matrix spike duplicate) for each group of samples of a similar matrix (e.g., water, soil) and concentration level (for soil samples only), once:

- each case of field samples received, or
- each 20 field samples in a case, or
- each 14 calendar period during which field samples in a case were received (said period beginning with the receipt of the first sample in that Sample Delivery Group),

whichever is most frequent. Matrix spikes and matrix spike duplicates will be carried through the entire analytical process from initial sample preparation to final analyses.

The laboratory will prepare and analyze one (1) laboratory reagent blank (method blank) for each group of samples of similar matrix (e.g., water, soil), processed by a similar method (e.g., separatory funnel or continuous liquid-liquid extraction, acid digestion, etc.), and a similar concentration level (for soil samples only), once:

- each case of field samples received, or
- each 20 field samples in a case, or
- each 14 calendar day period during which field samples in a case were received, or
- whenever samples are processed (i.e., extracted, digested, etc.),

All quality control sample analytical results will be reported on standard forms in conjunction with data acceptance criteria. Most of the acceptance criteria applicable to this project are specified by the EPA CLP SOWs (References 7 and 8).

4.8 Performance and System Audits

Performance and system audits routinely conducted at RECRA Environmental, Inc. to ascertain the potential of all analytical measurements systems to generate data that are representative, valid, and meet completeness requirements are described in the labs QA/QC Plan (see Section 2.7 of Appendix J).

4.9 Preventative Maintenance Procedures and Schedules

4.9.1 Field Equipment

Maintenance procedures that will be employed to assure the proper operation of all field equipment is presented in Appendix F.

4.9.2 Laboratory Equipment

Preventative maintenance performed on critical laboratory instruments at RECRA Environmental, Inc. is described in the labs QA/QC Plan (see Section 2.8 of Appendix J).

4.10 Quality Control of Data

A number of general and specific measures will be employed to ensure that the analytical data produced during this project are generated within known and acceptable limits of accuracy and precision. General control measures will include the following:

- Proper cleaning of sample containers
- Use of formal written sample labeling, logging and chain-of-custody
- Use of standardly accepted USEPA methods for sample preservation
- Use of laboratory reagents that meet or exceed American Chemical Society "Analytical Reagent Grade" quality standards
- Use of laboratory water that meets or exceeds quality standards for Type I water as described in Reference 9
- Use of pesticide grade solvents for all sample extractions
- Use of high purity or ultra high purity gases for all gas chromatographic procedures
- Proper cleaning of laboratory glassware

These measures are addressed in the laboratory's QA/QC Plan (see Section 2.6 of Appendix J).

Specific QC measures will involve the analysis of QC samples and reporting of results in conjunction with applicable acceptance criteria. The QC sample analyses that will be performed are discussed in Section 4.7.

4.11 Corrective Action

Whenever calibration checks of field or laboratory instruments fail to compare with initial calibrations and/or laboratory data precision and/or accuracy acceptance limits are exceeded, corrective actions will be implemented. These actions will include:

- Recalibration or standardization of instruments
- Acquiring new standards
- Repairing instrumentation
- Replacing instruments that cannot be repaired
- Reanalyzing samples for which unacceptable or suspect analytical results were obtained

If problems are encountered which require corrective action, these problems will be addressed and resolved before additional samples are analyzed in order to minimize the quantity of reanalyses required.

4.12 Quality Assurance Reports to Management

Periodically during the performance of this investigation, field and laboratory personnel will be required to report the performance of all measurement systems to management. Field personnel will report to the Malcolm Pirnie QA/QC Officer. Laboratory personnel reporting requirements are defined in the lab's QA/QC Plan (see Section 2.9.3 of Appendix J).

The frequency of reporting will be daily or weekly as appropriate during the period of time that measurements are being made in the field and/or laboratory. Reporting of measurement system performance will generally be verbal. However, if a problem requiring corrective action is encountered, a formal written report will be prepared. If a QC problem arises in the laboratory, the laboratory operation manager at RECRA Environmental, Inc. will immediately contact the Malcolm Pirnie QA/QC Officer to discuss an appropriate corrective action. Final approval of the corrective action to be implemented will be made by the Malcolm Pirnie QA/QC Officer.

5.0 PROJECT SCHEDULE

The estimated schedule for the Remedial Investigation and Feasibility Study is presented in Figure 5-1. This schedule indicates that the RI will require approximately 11 months to complete. This estimate reflects the initiation of field activities early enough during the 1988 construction season to avoid the continuation of these efforts into the Winter season. It is further estimated that the FS will require an additional 6 months to complete. The entire RI/FS program may take as long as 23 months to complete, depending on the length of time the NYSDEC requires to review project submittals.

FIGURE 5-1

```
                                                     PROJECT SCHEDULE
                                                      AREA "D" RI/FS
                                          BUFFALO COLOR CORP. & ALLIED SIGNAL CORP.


                              Dec 1        Apr 1           Aug 1           Dec 1           Apr 1           Aug 1         Dec 1
                              1987         1988            1988            1988            1989            1989          1989
             TASK             |              |               |               |               |               |               |
------------------------------------------------------------------------------------------------------------------------------
                              .              .               .               .               .               .               .
CONSENT ORDER SIGNED          . @            .               .               .               .               .               .
                              .              .               .               .               .               .               .
WORK PLAN                     .              .               .               .               .               .               .
--PREPARATION                 . ======       .               .               .               .               .               .
--NYSDEC REVIEW OF DRAFT      .       ///////.               .               .               .               .               .
--REVISION OF WORK PLAN       .              ====            .               .               .               .               .
--NYSDEC REVIEW AND APPROVAL  .              .   ////        .               .               .               .               .
                              .              .               .               .               .               .               .
REMEDIAL INVESTIGATION        .              .               .               .               .               .               .
--FIELD ACTIVITIES            .              .       ==============          .               .               .               .
--SAMPLE ANALYSIS             .              .               ============    .               .               .               .
                              .              .               .               .               .               .               .
REMEDIAL INVESTIGATION REPORT .              .               .               .               .               .               .
--PREPARATION OF DRAFT        .              .               .       ============            .               .               .
--NYSDEC REVIEW OF DRAFT      .              .               .               .   ////////    .               .               .
--REVISION OF DRAFT RI        .              .               .               .           ====.               .               .
--NYSDEC REVIEW AND APPROVAL  .              .               .               .               ////            .               .
                              .              .               .               .               .               .               .
FEASIBILITY STUDY REPORT      .              .               .               .               .               .               .
--PREPARATION OF DRAFT        .              .               .               .               .   ============.               .
--NYSDEC REVIEW OF DRAFT      .              .               .               .               .               ////////        .
--REVISION OF DRAFT RI        .              .               .               .               .               .       ====    .
--NYSDEC REVIEW AND APPROVAL  .              .               .               .               .               .           //  .
                              .              .               .               .               .               .               .
------------------------------------------------------------------------------------------------------------------------------

LEGEND:

===:   Malcolm Pirnie, Inc.
///:   New York State Department of Environmental Conservation (NYSDEC)
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6.0 PROJECT ORGANIZATION

The organization of this project and channels of communication are shown schematically in Figure 6-1. Functional responsibilities of key Malcolm Pirnie personnel are discussed below.

6.1 Key Project Staff

PAUL H. WERTHMAN, P.E. - as Project Manager, will be responsible for the coordination and manpower scheduling and for overall technical, subcontractor and client contact responsibility. Mr. Werthman has diversified experience in the design, evaluation and closure of sixteen (16) municipal and hazardous waste disposal facilities, fifteen (15) hydrogeologic investigations and twenty (20) Federal and NYS Superfund projects.

KENT L. BAINBRIDGE - as Project Engineer, will have day-to-day technical, subcontractor and client contact responsibility. He has fourteen (14) years of experience including the performance of Superfund preliminary assessments, remedial investigation/feasibility studies, and remedial designs. Mr. Bainbridge will also serve as the QA/QC Officer.

DAVID L. ALOYSIUS - will serve as the Task Leader for the RI Field Investigation. Mr. Aloysius will be responsible for supervision of on-site activities. He has over six (6) years experience in subsurface investigations for both industrial and governmental clients. As a specialist in quantitative hydrogeology, he has assessed: the nature and extent of soils and ground water contamination; soil, rock, and aquifer characteristics; and, subsurface contaminant transport. He has managed field investigations including exploratory borings, monitoring and production well installations, ground water sampling, geologic mapping, stratigraphic and aquifer studies, geophysical investigations and structural evaluations.

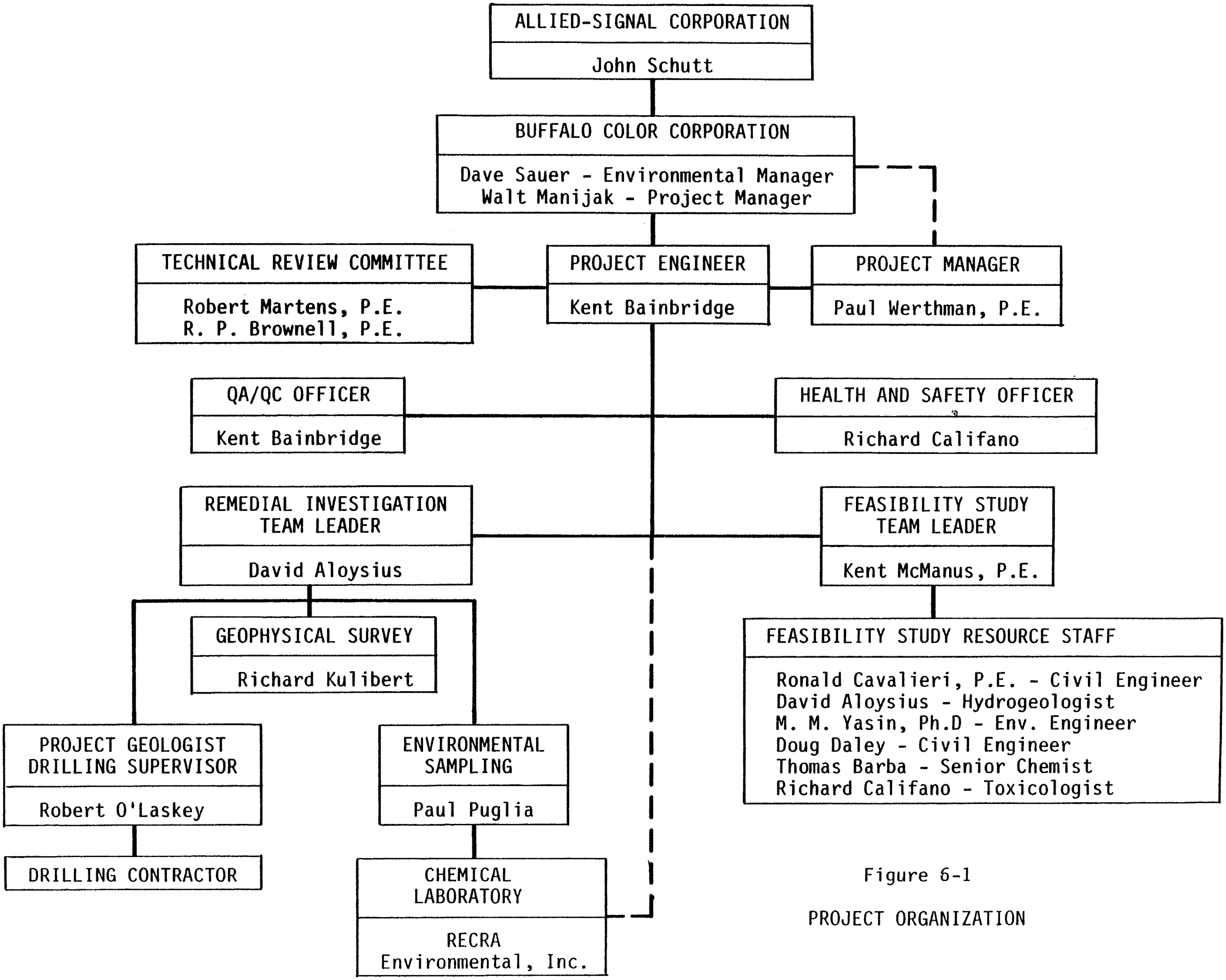

Figure 6-1

PROJECT ORGANIZATION

KENT McMANUS, P.E. - will serve as Task Leader for the Feasibility Study. Mr. McManus has over seven (7) years of progressively responsible experience with Malcolm Pirnie in industrial wastewater treatment and solid and hazardous waste management. He has prepared numerous NYSDEC Part 360 landfill designs and closures, RECRA Part B permits, hazardous waste facility closures, performed over a dozen hydrogeologic investigations, designed encapsulated landfills and performed process designs for industrial and hazardous wastewater treatment facilities.

7.0 REFERENCES

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APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR THE
AREA "D"
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

JANUARY 1988

MALCOLM PIRNIE, INC.
S3515 Abbott Road
P. O. Box 1938
Buffalo, New York 14219

MALCOLM
PIRNIE

TABLE OF CONTENTS

HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

In accordance with Malcolm Pirnie, Inc.'s corporate policies, this Health and Safety Plan was prepared to address the specific safety needs of Buffalo Color Corporation's Area "D", in the City of Buffalo, Erie County, New York (Figure A-1). The Plan presents information and procedures for employees and subcontractors involved with field activities at this uncontrolled hazardous waste disposal site, including the assignment of responsibilities, personnel protection requirements, work practices and emergency response procedures. The basis for this document includes both available historical information and potential health hazards. Environmental monitoring will be performed as necessary during the course of field activities to determine personnel exposures, enabling the refinement of the Plan to address specific conditions and present corrective procedures.

All Malcolm Pirnie personnel and subcontractors involved with Area "D" will be required to familiarize themselves and abide by this Health and Safety Plan. Compliance with this Plan is mandatory for all workers. Enforcement and adherence to the Health and Safety Plan will help prevent the loss of life, injury or health hazards to the field investigators and the public. The Pirnie Project Manager, the Health and Safety Manager and the Site Health and Safety Officer identified below will determine and enforce compliance.

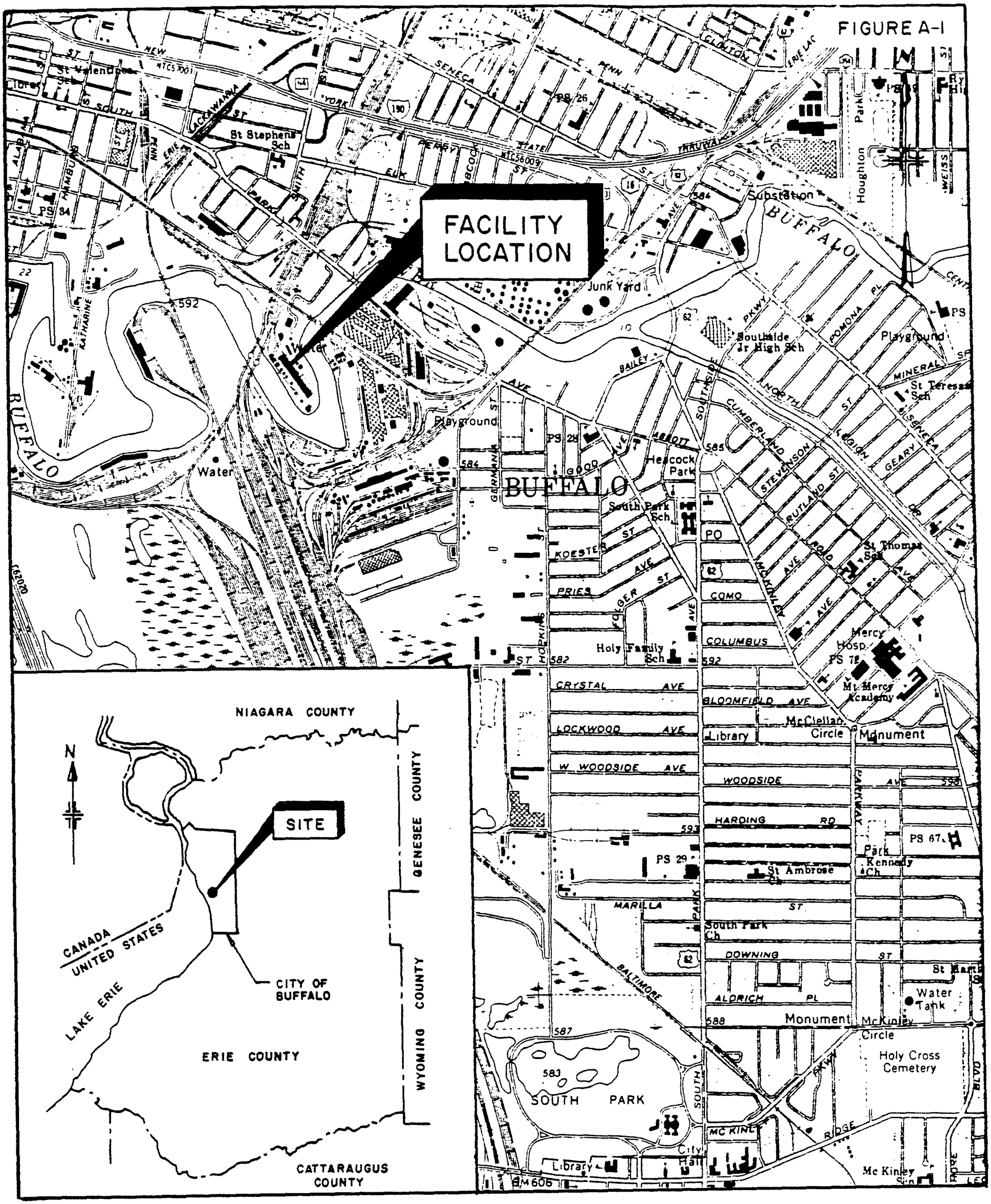
- PROJECT MANAGER

Name:	Paul H. Werthman	
Telephone:	Office	(716) 828-1300
	Home	(716) 627-9377

- HEALTH AND SAFETY MANAGER

Name:	Richard J. Califano	
Telephone:	Office	(914) 694-2100
	Home	(914) 964-9372

FIGURE A-1



SOURCE: BUFFALO SE QUADRANGLE
N.Y.S.D.O.T. MAP
SCALE: 1:24000

MALCOLM PIRNIE

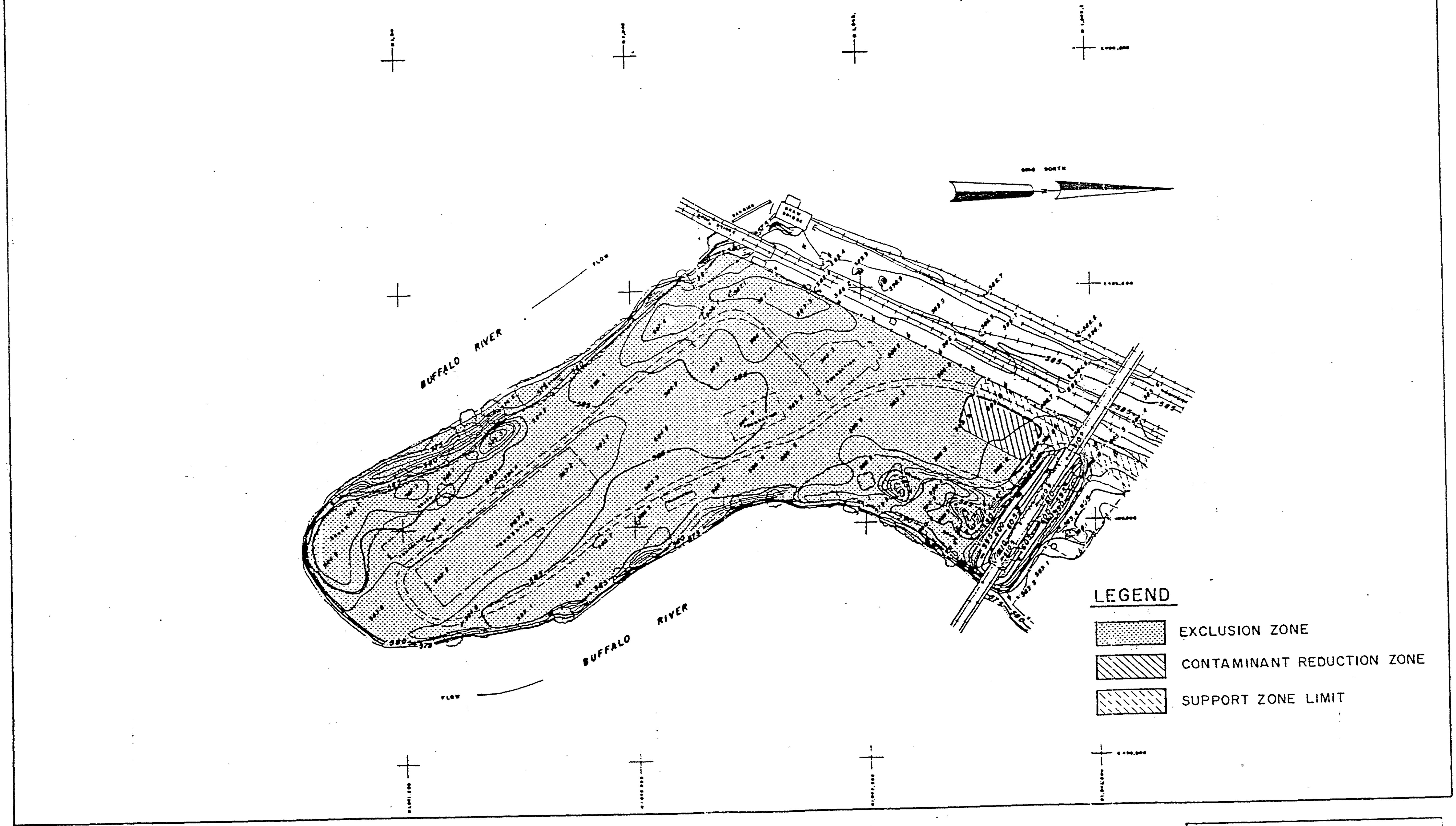
AREA "D" RI/FS

VICINITY MAP

BUFFALO COLOR CORPORATION

JANUARY 1988

FIGURE A-2



AREA "D" RI/FS
WORK ZONES

BUFFALO COLOR

JANUARY 1988

MALCOLM PIRNIE

- SITE HEALTH AND SAFETY OFFICER

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This Plan addresses the requirements outlined in the following documents:

- Standard Operating Safety Guides, USEPA Emergency Response Team; November 1984;
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities; NIOSH, OSHA, USCG, USEPA; October 1985; and
- OSHA Health and Safety regulations contained in 29CFR 1910 and 1926.

Further, it reflects the requirements of the Superfund Amendments and Reauthorization Act of 1986 including the interim final rules contained in 29 CFR 1910,.120.

2.0 CONTAMINANT CHARACTERISTICS AND TOXICOLOGY

2.1 Hazardous Substances On-Site

Area "D" consists of an approximately 19-acre peninsula which projects into the Buffalo River. Waste handling activities conducted during the history of the site include the use of two iron oxide sludge settling lagoons, an incinerator (demolished in 1984), an open burning area, a sludge storage/weathering area and a tank farm. Previous field investigations at Area "D" performed during 1979 and 1982 have provided information concerning the types of contaminants which are likely to be encountered during the RI. Based upon the results of these soil, ground water and surface water sampling and analysis programs completed at the site, contaminants identified include primarily heavy metals and organic compounds in the class polynuclear aromatic hydrocarbons (PAHs). Principal compounds of concern are identified in Table 1. Brief descriptions of the toxicology of these materials and related health and safety guidance and criteria are provided below.

TABLE 1

CONTAMINANTS OF CONCERN AT AREA "D"

HEAVY METALS:

- Arsenic
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Zinc

ORGANICS:

- Anthracene
- Benzidine
- Benzo (b) fluoranthene
- Chrysene
- Fluoranthene
- 1-Naphthylamine
- Pyrene

- Arsenic compounds are capable of causing acute or chronic poisoning, marked by disturbances of the digestive system. A characteristic of arsenic poisoning is the great variety of symptoms that can be produced, including shock, cramps, jaundice and skin abnormalities. Arsenicals are considered potential human carcinogens (USEPA Class "A" weight of evidence). The inorganic forms are generally more toxic than the organics forms. The OSHA time weighted average concentration standard for arsenic compounds is 10 ug/m^3.

- Chromium salts have a corrosive action on the skin and mucous membranes of the nasal cavity. Lesions may form on exposed parts. These compounds may produce lung and nasal cancer (USEPA Class "A" weight of evidence). Hexavalent chromium compounds are more toxic than trivalent compounds.

- Copper compounds can cause irritations of the eyes, skin and upper respiratory tract upon exposure. Ingestion of large amounts of copper salts can induce cramps, vomiting, dizziness and exhaustion. Target organs for these compounds include the lungs, liver and kidneys.

- Lead compounds are cumulative. The major routes of lead absorption are the gastrointestinal tract and the respiratory system. Small amounts of lead may also be absorbed from intact or abraded skin when applied in high concentration. The four major target systems consist of the central nervous system, the peripheral nerves, the kidney, and the blood-forming system.

- Mercury and its compounds are general cellular poisons. Routes of entry include ingestion, inhalation and dermal contact. After absorption, this metal circulates in the blood and is stored in the liver, kidneys, spleen and bone. Dermatitis may develop from dermal contact. Chronic exposure has been known to result in psychic and emotional disturbance.

- Nickel may cause dermatitis in sensitive individuals upon direct contact with the skin. Ingestion of soluble nickel salts induces nausea, vomiting and diarrhea, while inhalation can lead to an allergic asthma. Nickel is considered carcinogenic.

- Zinc is a skin and pulmonary irritant. Pure zinc powder is relatively non-toxic to humans following ingestion. Most symptoms result from the inhalation of zinc compounds, and include cough, chills, tight or painful chest, blurred vision and nausea.

- Numerous compounds falling into classification of PAHs were identified in the soils at Area "D". PAHs are high-molecular-weight chemical compounds that are formed from the destructive distillation of coal and petroleum refining operations as a result of the combustion of many organic materials. They also occur naturally in the environment.

  The major route of exposure to PAHs will be from the inhalation of airborne contaminated particulate matter and through direct skin contact with contaminated materials on the site.

  The contaminants are not generally considered to present an acute hazard in circumstances similar to those anticipated at the site. The predominant health impact associated with exposure to PAHs is the potential for carcinogenic effects from chronic exposure. PAHs are suspected human carcinogens.

2.2 Summary of Projected Risks

Due to the chemical use activities, disposal practices and the variety of potential contaminants at Area "D", the potential exists that during field activities workers will be exposed to hazardous substances. In addition, the use of heavy equipment on-site (e.g., drill rigs, backhoes, etc.) also presents conditions for physical injury to workers. Further, the fact that the Remedial Investigation may be carried out during the Summer makes heat stress for workers wearing protective equipment and clothing a distinct possibility.

Although no work at a site containing chemical contamination can be considered completely risk-free, logical and reasonable precautions can be implemented to provide an adequate level of protection for workers. The integration of medical evaluations, worker training relative to chemical hazards, safe work practices, proper personal protection, environmental monitoring, work zones and site control, appropriate decontamination procedures and contingency planning into the project approach minimizes the chances for unnecessary exposures and physical injuries, thereby ensuring the health and welfare of on-site workers.

3.0 RESPONSIBILITIES OF SAFETY PERSONNEL

The following roles have been identified for the project personnel:

Project Manager - The Project Manager has full responsibility for implementing and executing an effective program of employee protection and accident prevention. He may delegate authority to expedite and facilitate any application of the program.

<u>Health and Safety Manager</u> - The Health and Safety Manager serves as the administrator of the corporation's health and safety program. He is responsible for ensuring that Pirnie field personnel are properly trained, that they have obtained medical clearance to wear respiratory protection (per 29 CFR Part 1910.134(b)(10)), and that they are properly trained in the selection, use and maintenance of personal protective equipment, including qualitative respirator fit testing.

The Health and Safety Manager will also serve as scientific advisor for the duration of the project, providing guidance on data interpretation and the determination of appropriate levels of worker protection.

<u>Site Health and Safety Officer</u> - The Site Health and Safety Officer is knowledgeable in safety and worker protection techniques as they relate to the project. Responsibilities include ensuring the day to day compliance of work to this Health and Safety Plan, balanced by his ability to adapt quickly to needed changes or additions to the plan. This individual will provide technical assistance to project management on problems relating to industrial hygiene and work site safety.

In addition to the initial mandatory training, regular health and safety briefings will be conducted by the Site Health and Safety Officer. Examples of briefings might include accident prevention, respirator refresher courses or current issues. The frequency of safety briefings will be based upon the potential hazards specific to the designated work tasks.

The Site Health and Safety Officer will also be responsible for monitoring the personal exposures of workers to chemical toxicants contained in air, soil or water. This will consist of performing workplace air sampling such as organic vapor monitoring, as well as the interpretation and documentation of all generated data. As data are received and evaluated, the Site Health and Safety Officer will adapt this Health and Safety Plan to fit the current worker protection needs at the site. Employees will be informed of the air sampling results.

The Site Health and Safety Officer is responsible for the development and set up of emergency procedures and personal decontamination procedures. He will complete a daily diary of activities with health and safety relevance.

At any time unsafe work conditions are determined, the Site Health and Safety Officer is authorized to stop work. Resolution of all on-site health and safety problems will be coordinated through the Project Manager with assistance from the Health and Safety Manager.

4.0 MEDICAL SURVEILLANCE

Medical surveillance is as integral a part of a health and safety program as safety equipment, protective clothing, respiratory protection and training programs. The establishment and use of a medical surveillance program in conjunction with personal monitoring is essential to assess and monitor workers' health and fitness both prior to field activities and during the course of work.

Medical monitoring, including initial employment, annual and employment termination examinations will be provided to Pirnie employees whose work may result in potential chemical exposure or present unusual physical demands. Medical evaluations will be performed by an occupational physician designated by Malcolm Pirnie, Inc. The medical evaluations will be conducted according to the Malcolm Pirnie, Inc. Medical Monitoring Program and include an evaluation of the workers' ability to use respirator protective equipment (as per 29CFR 1910). The examination will include:

- Occupational history;
- Medical history;
- Medical review;
- Medical surveillance examination with emphasis on organ systems potentially affected by toxic substances identified in the work environment;
- Medical certification of physical requirements (sight, hearing, musculoskeletal, cardiovascular) for safe job performance; and
- Laboratory testing to include a complete blood count, white cell differential count, serum multiphasic screening and urinalysis.

The purposes of the medical evaluation are to: (1) determine fitness for duty on hazardous waste sites (such an evaluation is based upon the employee's occupational and medical history, a comprehensive physical examination and an evaluation of the ability to work while wearing protective equipment); and (2) establish baseline medical data.

Supplemental examinations may be performed whenever there is an actual or suspected excessive exposure to chemical contaminants or upon experience of exposure symptoms, or following injuries or temperature stresses.

In conformance with OSHA regulations, Malcolm Pirnie will maintain and preserve medical records for a period of 30 years following termination of employment. Employees have access to the results of medical testing and to full medical records and analyses.

Subcontractors must supply medical certification for all employees who will work at Buffalo Color Corporation's Area "D". All subcontractor personnel involved in site activities will undergo a baseline medical examination at the expense of the subcontractor. Contents of the examination must be determined by the subcontractor's medical consultants, who will have been provided with adequate information on the site hazards contained in this Health and Safety Plan to enable an evaluation of fitness to be made. The examination must include an OSHA-type evaluation of the workers' ability to use respiratory protective equipment. A medical approval is required prior to the start of work from the subcontractor's medical consultant to the Project Manager certifying the medical fitness of each person to perform his duties and to wear a respirator.

5.0 EMPLOYEE TRAINING PROGRAM

Prior to any site activities, the field investigation team (including subcontractor personnel) will participate in a site-specific health and safety orientation program developed by Malcolm Pirnie's Health and Safety Manager. At a minimum, the training will cover:

- Emergency and routine communications;
- First aid (recognition of conditions requiring emergency or medical care and simple steps to take until help arrives);
- Rescue operations;
- Decontamination procedures;
- Special chemical and physical hazards and potential health effects;
- Personnel protective equipment use, maintenance, fit and limitations;
- Site evaluation;
- Sample identification, packaging, storage, transport and chain of custody procedures;
- Laboratory procedures; and
- Work zone designations.

All Malcolm Pirnie personnel and performance subcontractors assigned to a field investigation team will undergo the safety indoctrination program to:

- Ensure that regard for the health and safety of fellow employees, the public and the environment is maximized;
- Comply with all laws, rules and regulations to safeguard the health and safety of all employees, the public, and the environment;
- Increase the ability of employees to react responsibly and to handle emergency situations in a safe manner under normal conditions and when physiological and psychological stresses occur; and
- Educate the field investigation team of potential hazards at sample sites, adverse effects and the importance of safety and industrial hygiene practices.

Periodic health and safety briefings will be conducted by the Site Health and Safety Officer for project employees and performance contract personnel on an as-needed basis. Problems relative to respiratory protection, inclement weather, heat stress or the interpretation of newly-available environmental monitoring data are examples of topics which might be covered during these briefings.

6.0 SAFE WORK PRACTICES

The understanding of basic, precautionary concepts regarding personal health and safety is essential for workers assigned to sites where chemical contamination is known or suspected to be present and deserves emphasis here:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice which increases the probability of hand-to-mouth transfer of contaminated material is strictly prohibited;
- The hands and face must be thoroughly washed upon leaving the work area and prior to engaging in any activity indicated above. Each individual must shower as soon as possible after the removal of protective clothing and equipment after the completion of the daily field activities;

- Any required respiratory protective equipment and clothing must be worn by all personnel going on-site. Excessive facial hair (i.e., beards, long mustaches or sideburns), which interferes with the satisfactory respirator-to-face seal is prohibited;
- When it is necessary for a visitor to observe the field work, that person will be issued appropriate personal protective equipment, briefed on potential hazards, safety practices, decontamination procedures and site communications. Respiratory equipment and proof of training/fit testing must be provided by all site visitors to the Site Health and Safety Officer prior to gaining access to the site;
- Contact with surfaces/materials either suspected or known to be contaminated will be avoided to minimize the potential for transfer to personnel, the cross-contamination and need for decontamination;
- Medicine and alcohol can potentiate the effects of exposure to toxic chemicals. Due to possible contra-indications, use of prescribed drugs should be reviewed with the Pirnie occupational physician. Alcoholic beverage and illegal drug intake are strictly forbidden during site work activities;
- All personnel shall be familiar with standard operating safety procedures and additional instructions contained in this Health and Safety Plan;
- On-site personnel shall use the "buddy" system. No one may work alone, i.e., out of earshot or visual contact with other workers;
- Personnel and equipment in the contaminated area shall be minimized, consistent with effective site operations;
- All employees have the obligation to correct or report unsafe work conditions; and
- Use of contact lenses on-site will not be permitted. Spectacle kits for insertion into full-face respirators will be provided for MPI employees, as required.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Protection Levels

Personnel must wear protective equipment when work activities involve known or suspected atmospheric contamination;

when vapors, gases, or particulates may be generated; or when direct contact with dermally active substances may occur. Respirators can protect the lungs, the gastro-intestinal tract and the eyes against air toxicants. Chemical-resistant clothing can protect the skin from contact with skin-destructive and skin-absorbable chemicals. Good personal hygiene and appropriate work practices limit or prevent the ingestion of materials.

Equipment designed to protect the body against contact with known or anticipated chemical hazards have been divided into four categories according to the degree of protection afforded:

- Level A: Should be selected when the highest level of respiratory, skin and eye protection is needed;
- Level B: Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required; Level B protection is the minimum level recommended on initial site entries until the hazards have been further defined by on-site studies;
- Level C: Should be selected when the types of airborne substances are known, the concentrations have been measured and the criteria for using air-purifying respirators are met. In atmospheres where no airborne contaminants are present, Level C provides dermal protection only.
- Level D: Should not be worn on any site with respiratory or skin hazards. This is primarily a work uniform providing minimal protection.

The level of protection selected is based primarily on:

- Types and measured concentrations of the chemical substances in the ambient atmosphere and their associated toxicity; and
- Potential or measured exposure to substances in air, splashes of liquids or other indirect contact with material due to the task being performed.

In situations where the types of chemicals, concentrations, and possibilities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgement until the hazards may be further characterized. The individual components of clothing and equipment must be assembled into a full protective ensemble to protect the worker from site-specific hazards, while at the same time minimizing hazards and drawbacks of the personal protective gear itself. Ensemble components based on the widely used USEPA Levels of Protection are detailed below for levels B, C, and D protection.

7.2 Level B Protection Ensemble

Recommended

- Pressure-demand, full-facepiece self-contained breathing apparatus (MSHA/NIOSH approved) or pressure-demand supplied-air respirator with escape SCBA;
- Chemical-resistant clothing (overalls and long-sleeved jacket; hooded one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit);
- Inner and outer chemical resistant gloves;
- Chemical-resistant safety boots/shoes; and
- Hard hat.

Optional

- Coveralls
- Disposable boot covers
- Face shield
- Long cotton underwear

Meeting any one of the following criteria warrants the use of Level B protection:

The types and atmospheric concentrations of toxic substances have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:

- with concentrations Immediately Dangerous to Life and Health (IDLH);
- exceeding limits of protection afforded by a full-face air-purifying mask;
- containing substances for which air-purifying canisters do not exist or have low removal efficiency;
- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard;
- containing less than 19.5% oxygen; or
- with evidence of incompletely identified vapors or gases as indicated by direct reading organic vapor detection instrument, but those vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

Level B equipment provides a high level of protection to the respiratory tract, but a somewhat lower level of protection to skin. The chemical-resistant clothing required in Level B is available in a wide variety of styles, materials, construction detail and permeability. These factors all affect the degree of protection afforded. Therefore, a specialist should select the most effective, chemical-resistant clothing based on the known or anticipated hazards and task. Level B skin protection is selected by:

- Comparing the concentrations of identified substances in the air with skin toxicity data;
- Assessing the effect of the substance (at its measured air concentrations or splash potential) on the small area of the head and neck unprotected by chemical-resistant clothing.

7.3 Level C Protection Ensemble

Recommended

- Full-facepiece, air-purifying respirator equipped with MSHA and NIOSH approved organic vapor/acid gas/dust/-

mist combination cartridges or as designated by the Health and Safety Manager;

- Chemical-resistant clothing (overalls and long-sleeved jacket, hooded, one- or two-piece chemical splash suit or disposable chemical-resistant one-piece suit);
- Inner and outer chemical-resistant gloves;
- Chemical-resistant safety boots/shoes; and
- Hardhat.

Optional

- Coveralls
- Disposal boot covers
- Face shield
- Escape mask
- Long cotton underwear

The use of Level C protection is permissible upon satisfaction of these criteria:

- Measured air concentrations of identified substances will be reduced by the respirator to below the substance's permissible exposure limit (PEL), threshold limit value (TLV), and/or the concentration is within the service limit of the cartridge;
- Atmospheric contaminant concentrations do not exceed IDLH levels; and
- Atmospheric contaminants, liquid splashes or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing an air-purifying device. The device (when required) must be an air purifying respirator (MSHA/NIOSH approved) equipped with filter cartridges. Cartridges must be able to remove the substances encountered. Respiratory protection will be used only with proper fitting, training and the approval of a qualified individual. In addition, an air-purifying respirator can be used only if:

- Oxygen content of the atmosphere is at least 19.5% in volume;
- Substances are identified and concentrations measured;
- Substance have adequate warning properties;
- Individual passes a qualitative fit-test for the mask; and
- Appropriate cartridge/canister is used, and its service limit concentration is not exceeded.

An air monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators. Continual surveillance using direct-reading instruments is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

7.4 Level D Protection Ensemble

Recommended

- Coveralls
- Safety boots/shoes
- Safety glasses or chemical splash goggles
- Hardhat

Optional

- Gloves
- Escape mask
- Face shield

The use of Level D protection is permissible upon satisfaction of these criteria:

- No hazardous air pollutants have been measured; and
- Work functions preclude splashes, immersion or the potential for unexpected inhalation of any chemicals.

Level D protection is primarily a work uniform. It can be worn in areas where only boots can be contaminated, or where there are no inhalable toxic substances.

7.5 Recommended Levels of Protection

Based upon current information regarding both the contaminants suspected to be present at Area "D" and the various tasks that are included in the Remedial Investigation, the following Levels of Protection are recommended:

RECOMMENDED LEVELS OF PROTECTION: GEOPHYSICAL STUDIES

	Respiratory*	Clothing	Gloves	Boots	Other; Modifications
Field Management	D			L	
Health & Safety Surveillance	D			L	
Geophysical Testing	D	T	L/N	L	Safety Glasses
Decontamination	D	T	L/N	L	Goggles

* Level of protection based on air monitoring in the breathing zone. The Level C requirement is an air purifying cartridge respirator equipped with Organic Compound/Acid Gases/Dust cartridges.

T = Tyvek
L = Latex
N = Nitrile

RECOMMENDED LEVELS OF PROTECTION: BORING INSTALLATION

	Respiratory*	Clothing	Gloves	Boots	Other; Modifications
Field Management	D			L	
Health & Safety Surveillance	D			L	
Boring Installation	D/C	T	L/N	L	Goggles, hardhat
Sample Collection	D/C	T	L/N	L	Goggles
Decontamination	D/C	T	L/N	L	Goggles

* Level of protection based on air monitoring in the breathing zone. The Level C requirement is an air purifying cartridge respirator equipped with Organic Compound/Acid Gases/Dust cartridges.

T = Tyvek
L = Latex
N = Nitrile

RECOMMENDED LEVELS OF PROTECTION: ENVIRONMENTAL SAMPLING

	Respiratory*	Clothing	Gloves	Boots	Other; Modifications
Field Management	D			L	
Health & Safety Surveillance	D			L	
Sample Collection	D/C	T	L/N	L	Goggles
Decontamination	D/C	T	L/N	L	Goggles

* Level of protection based on air monitoring in the breathing zone. The Level C requirement is an air purifying cartridge respirator equipped with Organic Compound/Acid Gases/Dust cartridges.

T = Tyvek
L = Latex
N = Nitrile

7.6 HEAT STRESS

Personal protective equipment may place a worker at considerable risk of developing heat stress, probably one of the most common (and potentially serious) illnesses encountered at hazardous waste disposal sites. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning and age. Personal protective equipment may severely reduce the body's normal ability to maintain equilibrium (via evaporation, convection and radiation), and by its bulk and weight increases energy expenditure. Therefore, in the selection of outer protective clothing, the intent of protecting against chemical splashes or other potential skin exposure must be carefully weighed against the added heat stress that may be associated with the impermeability of the suit.

No material protects against all chemicals and combinations of chemicals. No currently available material is an effective barrier to prolonged chemical exposure. For work at this location, Tyvek suits will be worn. Because heat stress may be a serious concern for work at this site, and the potential for immersion or chemical splashing is minor and can be minimized through the institution of proper operating procedures, Tyvek is the material of choice. Although Tyvek offers little or no protection against hazardous liquid or vapor contaminants, it does protect against particulate contaminants and other nuisances and limits the amount of direct contamination of inner garments. Soiled Tyvek is to be immediately discarded and replaced.

8.0 ENVIRONMENTAL MONITORING

8.1 General Approach

Whenever feasible, the level of protection established for workers will be based upon qualitative and quantitative determinations of the chemical agents present in the work environment. Documentation of the chemicals suspected at

Area "D" will be used to determine appropriate levels of personal protection. Based upon the existing data base, minor concentrations of organic vapors are anticipated. Levels are anticipated to be below the permissible exposure limits (PEL) established by OSHA for the individual compounds. Respiratory and dermal protection may be modified (upgraded or downgraded) based upon the field monitoring data.

Contaminated soil layers are most likely to be encountered in known disposal areas. The monitoring program will indicate the potential for the volatilization of significant levels of contaminants when the soil is physically disturbed by drilling and sampling equipment. The necessary level of respiratory protection will be based upon these sampling results.

A combustible gas and oxygen meter will be utilized during the field activities. Monitoring instruments will be protected from surface contamination during use to allow for easy decontamination. Additional monitoring instruments may be added if the situations or conditions change.

Prior to surface penetration during auger drilling and soil sampling activities, background instrumentation measurements will be established and recorded with all support equipment engines turned off to eliminate the interfering effect of exhaust. All field measurements of this nature will be obtained and documented on the appropriate forms by the Site Health and Safety Officer. In addition, all values generated are subjected to immediate interpretation as a means of ensuring the effectiveness of the existing level of protection.

During drilling operations, the boreholes will be monitored continuously using a Photovac TIP or similar organic vapor monitoring device. Observed values will then be recorded and maintained as part of the permanent field record. Breathing zone monitoring will be performed at one-hour intervals at a minimum. The actual frequency of breathing zone monitoring will be dependent primarily upon values generated by the cuttings and the proximity of the worker's breathing zones to the source of contamination. Contaminant values which are in excess of established action levels appropriate for the prescribed level of protection will be immediately addressed. These action levels are described below.

The ends of the core samples will be surveyed with the Photovac TIP (or similar equipment) as each sample is retrieved. These values will be recorded with the respective sample number and will be used to determine the adequacy of employee personal protection equipment.

Atmospheric conditions will be monitored prior to the geophysical survey, field survey of sampling locations, and collection of ground water samples. Specific procedures to be followed during sampling of ground water monitoring wells are given in Appendix C.

8.2 Monitoring Action Levels

General guidelines associated with readings obtained with organic vapor analyzers must be considered with regard to other site conditions as follows:

- Level B - Total atmospheric concentrations of unidentified vapors or gases ranging from 5 to 50 ppm on the instrument (vapors not suspected of containing high levels of chemicals toxic to the skin);

- Level C - Total vapor readings register between background and 5 ppm above background on monitoring instruments; and

- Level D - No detectable inhalable toxic substances.

The explosimeter will be used to monitor levels of both combustible gases and oxygen during drilling activities. The results from this instrument may be interpreted as follows:

- Less than 10% LEL - Continue operations with caution;

- 10-25% LEL - Continuous monitoring with extreme caution;

- Greater than 25% LEL - Explosion hazard, shut-down operations and evaluate source;

- Less than 19.5% oxygen - wear SCBA;

- 19.5-25% oxygen - Continue investigation with caution; and
- Greater than 25% oxygen - Discontinue operations, fire hazard potential.

Readings with the explosimeter and organic vapor analyzers will be recorded and documented. All instruments will be calibrated before use and the procedure will be documented.

9.0 HEAT STRESS MONITORING

Since some of the field activity at Area "D" may be scheduled for the summer months, measures will be taken to minimize heat stress to workers. The Site Health and Safety Officer will be cognizant of the symptoms of heat stress and will be responsible for monitoring worker exposure and working conditions. The signs and symptoms of heat stress are as follows:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet and abdomen
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting

- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:
    - red, hot, usually dry skin
    - lack of or reduced perspiration
    - nausea
    - dizziness and confusion
    - strong, rapid pulse
    - coma

The monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism.

- Heart rate may be measured by the radial pulse for 30 seconds as early as possible in the resting period. The rate at the beginning of the rest period should not exceed 110 beats per minute. If the rate is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%.

- Body temperature may be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99.6 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.6 degrees Fahrenheit at the beginning of the next period, the following work cycle may be further shortened by 33%. Oral temperature should be measured again at the end of the rest period to make sure that it has dropped below 99.6 degrees Fahrenheit. No worker may be permitted to continue wearing semipermeable or impermeable garments when his/her oral temperature exceeds 100.6° Fahrenheit.

10.0 WORK ZONES AND SITE CONTROL

Work zones around the areas designated for drilling or sampling will be established and communicated to all employees and other site users (i.e., fireman and police) by the Site Health and Safety Officer (Figure A-2). The zones include:

- Exclusion Zone ("Hot Zone") - the area where contamination may be present and disturbance of the soil will occur. All personnel entering the Exclusion Zone must wear the prescribed level of personal protective equipment;
- Support Zone - outermost part of the site which is considered non-contaminated or "clean". This area will be located upwind from the Hot Zones with regard to prevailing winds. Support equipment will be located in this zone, and personnel may wear normal work clothes within this zone. Any potentially contaminated clothing, equipment and samples must remain in the Contamination Reduction Zone until decontaminated;
- Contamination Reduction Zone - the transition zone between the Exclusion and Support Zones. The zone where decontamination of personnel and equipment takes place.

The Exclusion Zone will be conspicuously identified through the use of ropes or colored tape. The decontamination of personnel and equipment will be performed as described before the Support Zone is entered. Access of non-essential personnel to the Exclusion and Contamination Reduction Zones will be strictly controlled. Only personnel who are essential to the completion of the task will be allowed access to these areas and only if they are wearing the prescribed level of protection. Entrance of non-Pirnie personnel or its performance contractor's personnel must be approved by the Site Health and Safety Officer.

A log containing the names of employees and their level of protection will be maintained.

11.0 DECONTAMINATION PROCEDURES

11.1 Personal Decontamination

The degree of decontamination required is a function of both a particular task and the physical environment within which it takes place. The following decontamination procedure, although somewhat specific to the tasks described herein, will remain flexible, thereby allowing the decontamination crew to respond appropriately to the changing environmental and sampling conditions which may arise at the sampling site.

Upon leaving the exclusion zone for lunch or at the end of the day, personnel will be required to remove all contaminated protective clothing/equipment. Upon completion of field activities, the work crew will proceed towards the contamination reduction corridor. Field equipment (i.e, shovels, tools, etc.) will remain in the Exclusion Zone. Boot covers and outer gloves will be washed with a soap and water solution, rinsed with fresh water, and removed within the Exclusion Zone.

The workers will then enter the Contamination Reduction Zone. Personal protection equipment will be washed with a soap and water solution and rinsed with fresh water. Respirator cartridges and other personal protective equipment can be replaced or removed in the corridor.

Following the removal of all personal protective equipment, workers will enter the Support Zone. Contaminated personal protective equipment (i.e., suits, inner gloves, respirator cartridges, etc.) will be considered contaminated and placed into barrels and prepared for disposal.

11.2 Decontamination for Medical Emergencies

In the event of a minor, non-life threatening injury, personnel should follow the decontamination procedures as defined, and then administer first-aid.

In the event of a major injury or other serious medical concern (i.e., heat stroke), immediate first-aid is to be administered in lieu of further decontamination efforts unless the environmental conditions would be considered "Immediately Dangerous to Life or Health."

11.3 Decontamination of Field Equipment

Decontamination efforts will be conducted in the Contamination Reduction Zone. Soap and water and mechanical cleaning with a brush will be used to remove all obvious contamination from the tools. The tools will then be rinsed with water. This procedure will be repeated twice.

It is expected that all tools will be constructed of non-porous, non-absorbent materials (i.e., metal) which will aid in the decontamination effort. Any tool or part of a tool which is made of porous, absorbent material (i.e., wood) will be placed into barrels and prepared for disposal.

The decontamination of heavy equipment will be undertaken when all on-site activities have been completed. A high temperature, high pressure water spray device will be used to wash the potentially contaminated areas of the equipment. This will continue until there are no visible signs of contamination.

12.0 FIRE PREVENTION AND PROTECTION

12.1 General Approach

Recommended practices and standards of the National Fire Protection Association (NFPA) and other applicable regulations will be followed in the development and application of Project Fire Protection Programs. When required by the client or regulatory authorities, the project management will prepare and submit a Fire Protection Plan for the approval of the contracting officers, authorized representative or other designated official. Essential considerations for the Fire Protection Plan will include:

- Proper site preparation and safe storage of combustible and flammable materials;
- Availability of coordination with private and public fire authorities;
- Adequate job-site fire protection and inspections for fire prevention; and
- Adequate indoctrination and training of employees.

12.2 Equipment and Requirements

- Fire extinguishers will be provided by the excavators and drillers;
- Fire extinguishers will be inspected, serviced, and maintained in accordance with the manufacturer's instructions. As a minimum, all extinguishers shall be checked monthly and weighed semi-annually, and recharged if necessary; and
- Immediately after each use, fire extinguishers will be either recharged or replaced.

12.3 Flammable and Combustible Substances

- All storage, handling or use of flammable and combustible substances will be under the supervision of qualified persons; and
- All tanks, containers and pumping equipment, whether portable or stationary, which are used for the storage and handling of flammable and combustible liquids, will meet the recommendations of the National Fire Protection Association.

13.0 EMERGENCY INFORMATION

13.1 Personnel Exposure

- Skin contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 minutes. Decontaminate and provide medical attention. Eyewash stations will be provided on site. If necessary, transport to Mercy Hospital.

- Inhalation: Move to fresh air and, if necessary, transport to Mercy Hospital.
- Ingestion: Decontaminate and transport to Mercy Hospital.

13.2 Personal Injury

Emergency first-aid will be applied on-site as deemed necessary. Several individuals trained in first-aid should be on-site during all work activities. Decontaminate and transport the individual to Mercy Hospital if needed. The On-site Health and Safety Officer will supply available chemical-specific information to appropriate medical personnel as requested.

First Aid kits will conform to Red Cross and other applicable good health standards, and shall consist of a weatherproof container with individually-sealed packages for each type of item. First aid kits will be fully equipped before being sent out on each job and will be checked weekly by the On-Site Health and Safety Officer to ensure that the expended items are replaced.

13.3 Adverse Weather Conditions

In the event of adverse weather conditions, the Site Health and Safety Officer will determine if work can continue without sacrificing the health and safety of Pirnie and performance contractor workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress;
- Inclement weather - related working conditions;
- Limited visibility; and
- Potential for electrical storms.

13.4 Emergency Telephone Numbers

PIRNIE PROJECT MANAGER:

Paul H. Werthman	(716) 828-1300 (W) (716) 627-9377 (H)

ALTERNATE:

Kent L. Bainbridge	(716) 828-1300 (W) (716) 652-8204 (H)

PIRNIE HEALTH AND SAFETY MANAGER:

Richard J. Califano	(914) 694-2100 (W) (914) 964-9372 (H)

PIRNIE SITE HEALTH AND SAFETY OFFICER:

____________________	____________________ ____________________

MERCY HOSPITAL	(716) 827-2205
FIRE	911
AMBULANCE	911
POLICE	911

13.5 Directions to Hospital

The following directions describe the best route to Mercy Hospital (see Figure A-3):

1) From the Plant driveway, turn right onto Park Avenue and proceed to intersection with Abbott Road.

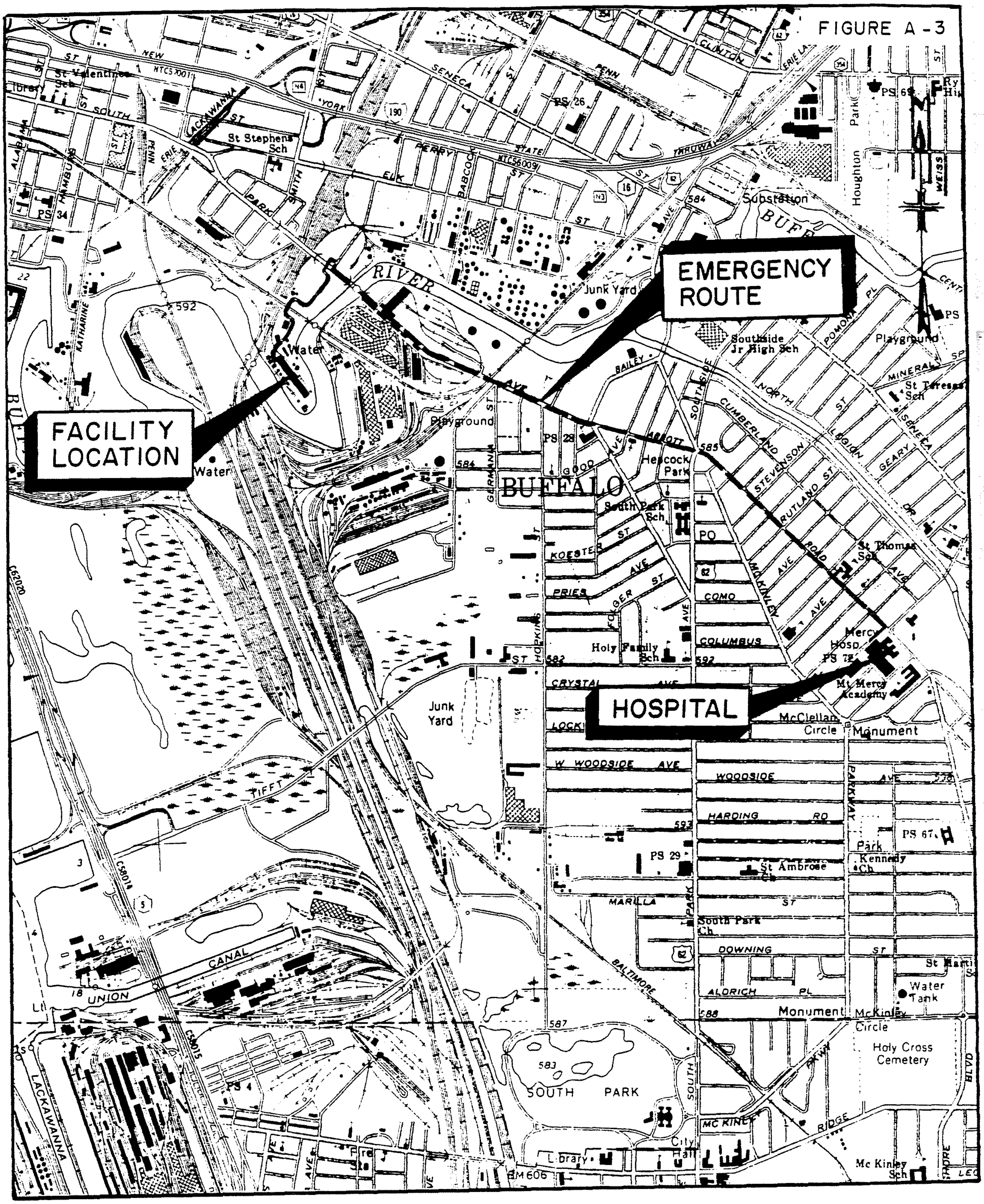
2) Turn right on Abbott Road and proceed to Mercy Hospital located at 565 Abbott Road.

3) Follow signs to Emergency Room.

13.5 Records and Reporting

It shall be the responsibility of the project management to establish and assure adequate records of all:

FIGURE A-3



SOURCE: BUFFALO SE QUADRANGLE
N.Y.S.D.O.T. MAP
SCALE: 1:24000

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AREA "D" RI/FS
HOSPITAL ROUTE

BUFFALO COLOR CORPORATION

JANUARY 1988

- Occupational injuries and illnesses;
- Accident investigations;
- Reports to insurance carrier or State compensation agencies;
- Reports required by client;
- Records and reports required by local, state, federal and/or international agencies;
- Property or equipment damage;
- Third party injury or damage claims;
- Environmental testing logs;
- Explosive and hazardous substances inventories and records;
- Records of inspections and citations;
- Related correspondence; and
- Safety training.

APPENDIX B

FIELD FORMS FOR DATA RECORDING

DESCRIPTION OF PROJECT FORMS

Throughout the duration of the Remedial Investigation, a variety of environmental samples and related data will be obtained that must be maintained in an organized fashion. In addition, the handling of the samples must also be carefully tracked. To facilitate this data management process, the following field logs and data sheets will be utilized:

1. Air Monitoring Data Log - The record of daily monitoring data both at the perimeter of the site and in the vicinity of on-site activities.

2. Field Borehole Log - Used during the installation of soil borings to record a variety of information concerning on-site subsurface conditions and characteristics.

3. Ground Water Elevations Log - Documentation of the well casing and ground water elevations for each monitoring will sampled during the Remedial Investigation.

4. In-situ Hydraulic Conductivity Test Field Data Sheet - Used to record field data during the performance of this test procedure.

5. Variable Head Permeability Test Record - The form on which the formal results of this testing data will be presented.

6. Field Investigation Report - Documentation of the general field activities carried out on a daily basis during the Remedial Investigation.

7. Water Quality Sampling Field Data Sheet - The record of ground water monitoring well sampling data.

8. Lab Analyses Request/Report Form - Used to both identify analytical procedures to be performed on samples submitted and report the results following analysis.

9. Chain-of-Custody Form - Documentation of the sample-tracking procedures and sample-custody information from the time each sample is collected until it is in the custody of the analytical laboratory. The sample tapes which accompany this form indicate the sample numbers which will be assigned.

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AIR MONITORING DATA

Site Sketch

Site Name ______________

Client Name ______________

Project No. ______________

Sampler's Name ______________

Weather & Notes ______________

Date	Time	Wind Direction	Wind Speed	Location	Span Setting	Concen-tration

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Field Borehole Log

CLIENT ____________________ JOB NO. ______ HOLE NO. ______ SHEET NO. ____ OF ____

PROJECT ____________________ WEATHER ____________ INSPECTOR ____________

SITE ____________________ TEMP. ______ °F STARTED ______ .M ________ 19____

LOCATION ____________________ DIP ______ ° FINISHED ______ .M ________ 19____

CONTRACTOR ____________________ ELEVATIONS: DATUM ____________

METHOD OF BORING: SOIL ____________________ CASING DIAM. ____________

ROCK ____________________ ____________ GROUND SURFACE ____________

CORE DIAM. ____________ WATER LEVELS ____________

LOG LEGEND
- ▥ - SILT
- ▒ - SAND
- ▨ - CLAY
- ▓ - GRAVEL

***SAMPLE CONDITION**
- ▦ - GOOD
- ☒ - DISTURBED
- ☰ - FAIR
- ■ - LOST

****SAMPLING METHOD**
- A - SPLIT TUBE
- B - THIN WALL TUBE
- C - PISTON SAMPLER
- D - CORE BARREL
- E - AUGER
- F - WASH
- K - SLOTTED SAMPLER

****SHIPPING CONTAINER**
- N - INSERT
- O - TUBE
- P - WATER CONTENT TIN
- Q - GLASS JAR
- R - CLOTH BAG
- S - PLIOFILM BAG
- Y - CORE BOX
- Z - DISCARDED

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE					BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
			*	** TYPE	NO.	SIZE (IN.)	RET'D (IN.)		

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Field Borehole Log

JOB NO.________ HOLE NO.________ SHEET NO.____ OF ____

PROJECT # ______________________ DATE ______________

PROJECT NAME ______________________ SAMPLERS ______________

SITE LOCATION ______________________ ______________

GROUND WATER ELEVATIONS

WELL #	ELEVATION TOP OF RISER (FT)	WATER DEPTH BELOW TOP OF RISER (FT)	WATER ELEVATION (FT)

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FIELD
DATA SHEET

IN-SITU HYDRAULIC
CONDUCTIVITY TEST

PROJECT NUMBER/AND CLIENT NAME	LOCATION	DATE OF TEST	WELL NUMBER
TEST TYPE	TEST METHOD (EQUIP)	SCREENED INTERVAL	TEST BY:

CLOCK TIME	ELAPSED TIME (MIN)	WATER LEVEL BELOW REF.* (FEET)	HEAD AT TIME t Ht (FEET)	HEAD RATIO ht/ho	REMARKS

* IN REMARKS COLUMN PLACE DETAILED DESCRIPTION OF REFERENCE POINT. ESPECIALLY IF DIFFERENT FROM RECORDED T.O.C.

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VARIABLE HEAD PERMEABILITY TEST

PIEZOMETER No.

PROJECT:

CLIENT:

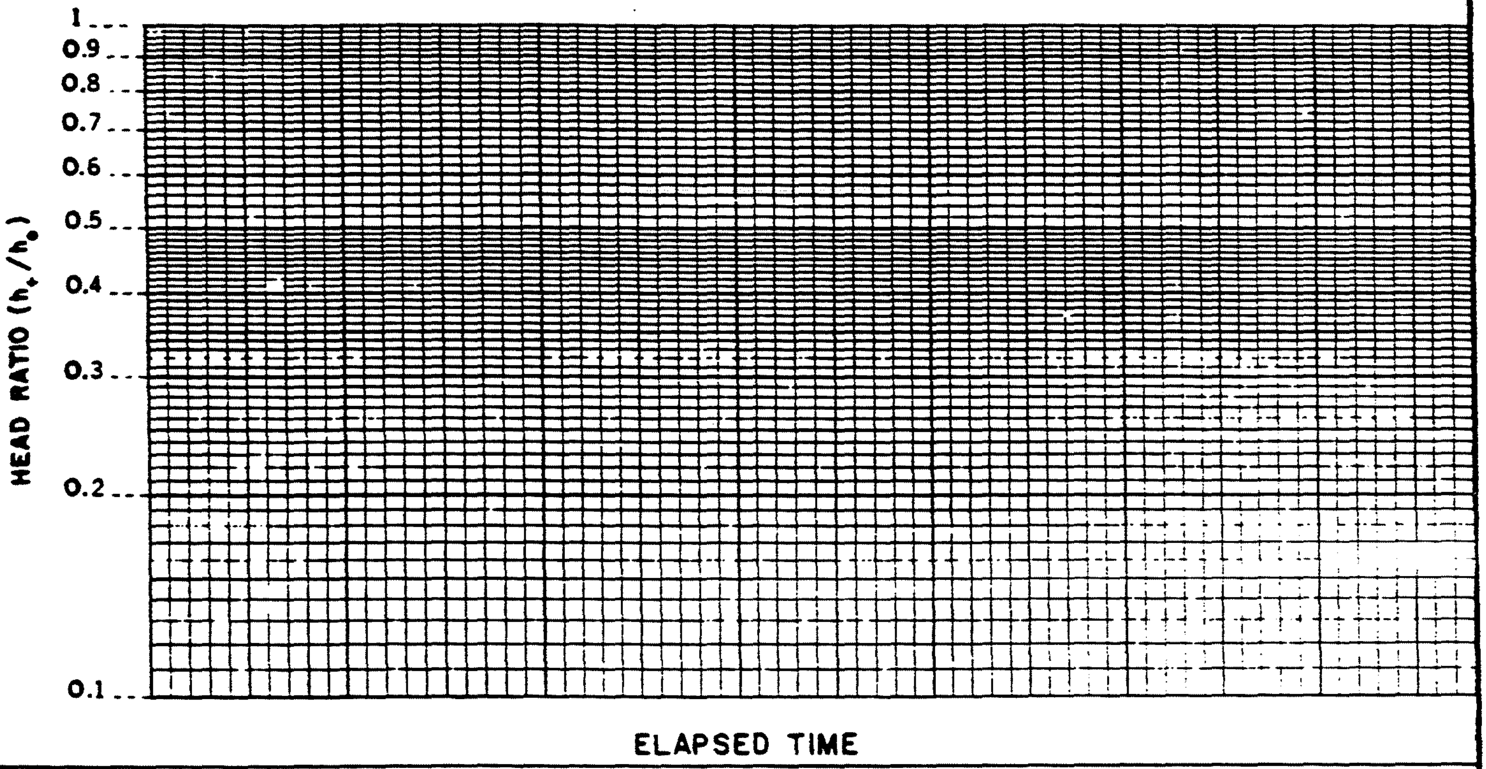
JOB NO:

DATE OF TEST:

SCREENED INTERVAL:

METHOD:

TEST DATA	
ELAPSED TIME	HEAD RATIO (h_t / h_o)



CALCULATIONS:

FIELD INVESTIGATION REPORT

DATE ____________

DAY	S	M	T	W	TH	F	S

Project ____________ No. ________

Contractor ____________

Subject ____________

To ____________

WEATHER	Brite Sun	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No	
HUMIDITY	Dry	Moder	Humid		

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Owner

Signature ____________ Title ____________

Wiley-Fisk Form 8-3

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WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: ____________________

LAB SAMPLE No.: ____________________

PROJECT: ____________________

CLIENT: ____________________

JOB No: ____________________

SAMPLER: ____________________

DATE: ____________ TIME: ____________

WEATHER CONDITIONS: ____________________

AIR TEMPERATURE: ____________________

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: __________ ☐ PVC ☐ STEEL ☐ OTHER: __________.

SCREEN DIAMETER: __________ ☐ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: ____________________ BOTTOM DEPTH: ____________________

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER: __________

GROUND SURFACE TO DATUM: ____________________ WATER VOLUME IN WELL: ____________________

CONDITION OF WELL: ____________________

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER

☐ OTHER: ____________________

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: __________ ELAPSED TIME: __________ VOLUME PUMPED: __________

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: __________

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ BAILER

☐ OTHER: ____________________

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

DEPTH OF SAMPLE: __________

CONTAINERS: NUMBER / TYPE: ____________________

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: __________ ☐ CONTAINS SEDIMENT: __________

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER: ____________________

ODOR: ☐ YES: ____________________ ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: __________ Ph: __________ SPEC. COND: __________

OTHER: ____________________ ____________________

REMARKS:

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FIGURE A-8

Sheet No. ___of___

ENVIRONMENTAL LABORATORY

LAB ANALYSES REQUEST/REPORT

A Date of request:__________ Requested by:__________ Ext:______
Date results needed:__________ Job Number:__________
Client/Project:__________
Client address:__________ Client contact (optional):__________
Total No. of sample containers:__________

B

For Lab Use			For Lab Use		
Sample ID No.	Sample description	Analyses required	Bottle	Preserv.	Stor.

C Sample(s) collected by:__________ Date:______ Time:______
Sample method (optional):__________
Sample(s) rec'd by:__________ Date:______ Time:______
Sample(s) rec'd by:__________ Date:______ Time:______
Sample(s) disposed by:__________ Date:______ Time:______

Remarks:__________

D

RESULTS	PARAMETER
Sample ID No.	
Date of Analysis	

Remarks:__________ Date completed:__________
Date Submitted:__________
Submitted by:__________

Chain of Custody Tapes

RECRA ENVIRONMENTAL, INC.
SAMPLE 2901

RECRA ENVIRONMENTAL, INC.
SAMPLE 2902

RECRA ENVIRONMENTAL, INC.
SAMPLE 2903

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CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME:

SAMPLERS (SIGNATURE):

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS							REMARKS

RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS:	

Distribution: Original accompanies shipment, copy to coordinator field files

APPENDIX C

GROUND WATER MONITORING WELL SAMPLE COLLECTION PROCEDURE

GROUND WATER MONITORING WELL SAMPLE COLLECTION PROCEDURE

1.0 GENERAL

This procedure is for the collection of ground water samples at known or suspected hazardous waste sites. Consequently, the water in a well to be sampled may contain hazardous waste constituents that may be dissolved or suspended, or that may be nonaqueous phase liquids having a density that is less than or greater than water. Constituents having densities greater or less than water may be present as separate layers beneath or floating on top of the water column in a well. This situation must be properly assessed to insure that a representative sample will be collected from a monitoring well.

Generally, the collection of representative ground water samples requires that ground water wells must be adequately purged prior to sampling. Principal considerations are the rate of purging and volume of water purged. Wells that are screened within a strata containing very fine-grained silts, etc. should be purged at a slow rate to minimize the extent to which these small particles are washed into the well. Purging will require the removal of three (3) to five (5) volumes of standing water in rapidly recharging wells and at least one (1) volume in slowly recharging wells. Shallow wells in which the screen straddles the water table should require a minimum amount of purging since the ground water will be flowing through the well screen and will not be entrapped in the casing. Deeper wells should be purged more thoroughly since they may be located in confined ground water and water may rise into the casing creating a stagnant condition. A thorough purging will require the removal of several volumes (i.e., 3-5) of this trapped water to ensure that representative ground water is brought into the casing for sampling. Sampling should commence as soon as adequate recharge has occurred.

2.0 DETERMINATION OF HEALTH/SAFETY REQUIREMENTS

The site-specific Health and Safety Plan must be consulted before ground water sampling is initiated to insure that the requirements for personnel protection are met. The following procedures will also be employed:

1. Upon arrival at the site, inspect the well to insure that it is not damaged.

2. Unlock and carefully remove the well cover to avoid having any foreign matter fall into the well.

3. Insert the intake probe of an explosimeter approximately one (1) foot into the interior of the riser pipe and monitor for an explosive atmosphere. If a reading of 25% or greater of the lower explosive limit (L.E.L.) is recorded, allow the well to vent until levels are below 25% L.E.L. before well purging is commenced.

4. Insert the intake probe of a total organic vapor monitoring instrument (i.e., HNu, Photovac TIP or OVA) approximately one (1) foot into the interior of the riser to determine the concentration of vapors present. Refer to the Health and Safety Plan to determine the need for respiratory protection and appropriate sample handling procedure based on the concentration of vapors present.

3.0 NON-AQUEOUS PHASE LIQUID DETECTION

Detection of Non-aqueous Phase Liquid (NAPL) in ground water monitoring wells may be accomplished by the following procedure:

1. Lower the probe of an electronic water level indicator down the well until the water level indicator sounds. Record this measurement. With the instrument still sounding, lower the probe through the water column to the well bottom. If the indicator sounding does not stop during the descent, it is probable that a non-aqueous phase liquid heavier than water is not present in the well.

2. Lower a lightweight bailer down the well (preferably Teflon) until the check valve on the bottom of the bailer pops, indicating the presence of a fluid phase. Mark the line used to lower the bailer down the well at the same reference point at which the ground water

elevation was taken. Retrieve the bailer from the well and measure the distance from the mark on the bailer line to the bottom of the bailer.

3. Subtract the measured distance from the bailer line from the recorded distance obtained from the water level indicator. The difference in these measurements is the thickness of a less dense than water (i.e. floating) non-aqueous phase liquid present in the well.

4. Record the presence of any non-aqueous phase liquid observed in the well in the field notebook.

4.0 NON-AQUEOUS PHASE LIQUID SAMPLING

If NAPL is determined to be present, as indicated in the above procedure, a discrete sample from this phase must be obtained prior to purging. Sampling NAPL heavier than water may be accomplished by the following procedure:

1. Slowly lower a double check valve bailer (i.e. a bailer with a ball valve on top and bottom of the bailer) down the well until it reaches the bottom of the well.

2. Slowly raise and lower the bailer in a controlled manner to collect the dense NAPL layer in the lower portion of the well.

3. Slowly remove the bailer from the well, being sure not to agitate the sample. Allow the bailer to stand for a few minutes so that the immiscible phases will separate.

4. Carefully attach threaded stopcock to the bottom of the bailer and discharge the dense immiscible layer through the stopcock into the proper sampling containers.

If NAPL is detected floating on the water surface in the well, sampling may be accomplished by the following procedure:

1. Slowly lower a single check valve bailer (i.e. a bailer with a ball valve on the bottom) down the well into the immiscible layer of NAPL. Care should be taken to lower the bailer just through the NAPL layer, but not significantly down into the underlying ground water.

2. Remove the bailer from the well, while being sure not to agitate the sample. Allow the bailer to stand for a few minutes so that the immiscible phases will separate.

3. Decant the denser ground water portion of the bailer into a wastewater barrel through the stopcock on the bottom of the bailer. The less dense immiscible NAPL layer may be emptied into the proper sampling containers by the same method.

5.0 NON-AQUEOUS PHASE LIQUID ANALYSIS

Any NAPL samples collected during the investigation will be chemically identified and analyzed for the list of ground water parameters presented in Table 2-1.

6.0 WELL PURGING PROCEDURE

Where Non-aqueous Phase Liquids (NAPL) are not detected, well purging will precede sample collection. The purging procedure to be used is described below.

1. Measure the distance from the top of the casing to the water surface using an electronic water level indicator. Accuracy will be to 0.01 feet. Make duplicate water level measurements at every fifth well. Between wells, wash the end of the water level indicator probe with soap and water and rinse with deionized water to avoid cross-contamination of wells.

2. Measure the distance to the bottom of the well using a graduated measuring tape with a weight attached.

3. Calculate the volume of water in the well.

4. At wells having water levels that remain 25 feet or less below the top of casing, use a suction-lift pump to remove three (3) to five (5) well volumes. (A well volume is the volume of water standing inside the casing prior to evacuation.) Dedicated new polyethylene discharge and intake tubing (3/8" I.D. low density polyethylene) will be used at each well.

   During excavation of the well, position the intake end of the tubing just below the surface of the well water. If the water level drops, lower the tubing as needed to maintain flow. Pumping from the top of the water column will insure proper flushing of the well.

   If the well purges to dryness and recharges rapidly (within 15 minutes), continue to purge water from the well until 3-5 volumes have been removed. If the well purges to dryness and is slow to recharge, terminate purging.

5. At wells having water levels that are initially 25 feet below the top of casing, or that draw down to this level because of a slow recharge rate, use a dedicated 1-1/2-inch PVC bailer, five (5) feet in length, to evacuate the well. The line for this bailer will be dedicated new 1/4-inch nylon. Prior to its use in the field, clean the dedicated purging bailer in accordance with the procedure given in Appendix G.

7.0 DISPOSAL OF PURGE WATER

In all cases, purge water from sampling procedures will be collected in drums and disposed of according to NYS Department of Environmental Conservation regulations.

8.0 WELL SAMPLE COLLECTION PROCEDURE

After ground water well purging has been completed, ground water samples may be collected as soon as the well has recharged sufficiently. However, all sample collection should be completed within 24 hours after well evacuation. The well sampling procedure that will be used is described below.

1. Use the electronic liquid level indicator to measure the distance from the top of casing to the water surface in the well. After the measurement is completed, clean the probe, as described previously, before use at the next well.

2. Collect ground water samples at each well using a dedicated 1-1/2-inch stainless steel bailer. The bailer will have a five-foot monofilament polypropylene leader. Attach a dedicated 1/4-inch nylon rope to the leader to lower the bailer into the well. Lower the bailer below the surface of the water to the extent that only the leader, and not the nylon rope, makes contact with the water. Prior to its use in the field, clean the stainless steel bailer and leader in accordance with the cleaning procedure given in Appendix G.

3. Place all samples into appropriate precleaned sample containers. Place small aliquots (approximately 200 mls) from the first and last bailer samples withdrawn from the well into separate plastic beakers or bottles and immediately measure the ground water pH, conductivity, and temperature, using portable field pH and conductivity meters.

9.0 SAMPLE HANDLING/PRESERVATION

Place all samples into precleaned sample containers supplied by the analytical laboratory. Sample containers used, preservation methods, and maximum sample holding time must be in accordance with mandatory EPA methods as shown in Table 2-7 of the Work Plan. Sample bottle cleaning protocol will be as presented in Appendix H.

10.0 SAMPLE IDENTIFICATION/SHIPPING

Mark each sample, using a waterproof permanent marker, with the following information:

- Site code
- Sample identification code
- Project number
- Date/time
- Sampler's initials

After recording this information, cover each sample label with waterproof clear plastic tape to secure its attachment to the sample bottle. Record and track all samples under strict chain-of-custody protocol. Seal each sample in the field and check for proper labeling. Then pack all samples into coolers with blue-ice freeze packs. A chain-of-custody form must be completed for each cooler to be shipped or transported (see Section 4.3 of the Work Plan).

11.0 FIELD RECORDING PROCEDURES

A field notebook will be maintained during all field activities. All field measurements including water surface elevation readings and ground water pH, conductivity, temperature, etc. will be recorded sequentially with a waterproof permanent marker. Other data and information recorded will include the sampling date, sample description and identification code, sample preservation methods, the sampling conditions (e.g., weather, etc.) and explosimeter/total organic vapor meter readings at each well.

APPENDIX D

PROCEDURE FOR COLLECTING SURFACE WATER SAMPLES AT DISCRETE DEPTH

PROCEDURE FOR COLLECTING SURFACE WATER SAMPLES AT DISCRETE DEPTH

1.0 GENERAL

The collection of surface water samples is usually performed for the purpose of assessing water quality of a body of water. To obtain representative results, all sampling must be executed to prevent the introduction of contaminants to the sample. For this reason, the selection of appropriate materials of construction for sampling equipment is crucial. This selection must be based upon the chemical parameters of concern.

In some situations, sample stations will be located such that the collection of samples at discrete depths greater than three feet will be required. Methods for obtaining a water sample at a discrete depth include:

- dipper (surface only)
- peristaltic pump (limited to 8 meter maximum depth)
- Kemmerer bottle (used for water depths of 3 to 300 feet)

This procedure is for the collection of samples from a surface water body at depth (i.e., greater than 3 feet) using a Kemmerer bottle.

The Kemmerer bottle is a messenger-activated water sampling device. In the open position, water flows easily through the device. Once lowered to the desired depth, a messenger is dropped down the sample line tripping the release mechanism and closing the bottle. In the closed position, the bottle is sealed, both on top and bottom, from any additional contact with the water column and can be retrieved.

The preferred material of construction for a kemmerer bottle used for sampling for priority pollutant analyses is PVC. The end seal caps or stoppers should be silicone. The capacity of the sampler used may be varied based upon the sample volume required for the analyses.

2.0 HEALTH AND SAFETY REQUIREMENTS

Although the work involved with collecting surface water samples is associated with a hazardous waste site, the primary safety concern for this activity will be to ensure proper boating procedures are followed. Therefore, in addition to the protocols outlined in the HASP, the following safety guidelines will be followed during the sampling program:

- A minimum of two and a maximum of three persons shall be in the boat at all times.
- All personnel shall wear U.S.Coast Guard-approved personal flotation devices (PFDs) while in the boat.
- The boat used during surface water sampling will be a large (approximately 16-foot length), flat-bottomed type to provide stability and ample work area.
- The boat shall be equipped with an anchor, anchor rope, two oars and small outboard motor.
- The boat operator will be familiar with the safety procedures necessary for operating the boat on the Buffalo River.
- Sampling will be conducted when weather conditions allow for safe operation of the boat and the potential of capsize due to wave action is minimized.

In addition to these safety procedures, appropriate dermal and respiratory protection shall be worn in accordance with the Health and Safety Plan (Appendix A).

3.0 SAMPLE COLLECTION PROCEDURE

Surface water samples will be collected using the following major items of equipment:

- thermometer
- messenger
- cable
- precleaned, three-gallon glass container with Teflon-lined lid
- sample bottles
- motorized boat with oars
- coolers and ice
- pH meter
- conductivity meter

The surface water sampling procedure is described below:

1. Ensure appropriate safety protocols are employed.

2. Anchor boat over sample location.

3. Record field measurements of:

    - air temperature
    - water temperature (surface and mid-depth)
    - depth of water
    - water level

    Section 6.0 describes additional recordkeeping requirements.

4. Determine mid-depth at sampling location. Mark this distance on retrieving cable attached to kemmerer bottle.

5. Lower bottle over the bow of the boat to depth indicated on cable. Send messenger down cable to close bottle seal. Retrieve sample.

6. Using the drain line, slowly fill 2-40 ml VOA bottles so no head-space remains in bottles.

7. Fill separate 250 ml plastic beakers or bottles with sample. Immediately measure pH and specific conductivity. Record these measurements in the field log book.

8. Slowly drain the remaining sample from kemmerer bottle into a precleaned three-gallon glass jar. The jar is to be precleaned in accordance with the procedures described in Appendix H.

9. Collect two liters of sample at each discrete sample location and composite in the three-gallon glass jar.

10. Cover the three-gallon jar with a Teflon-lined lid and place in a cooler with ice between sample locations.

11. Repeat the procedure at each discrete sample location.

12. Clean sampling equipment between sampling stations according to procedures described in Appendix G.

4.0 SAMPLE HANDLING/PRESERVATION

After retrieving the four discrete samples at each location, the three-gallon glass container will contain a minimum of two gallons of partially mixed samples. To provide proper mixing, check to make sure the bottle is sealed tightly. Holding the bottle firmly in two hands, slowly invert the bottle three times.

Subdivide the composite sample into appropriately labelled, precleaned containers as described in Table 2-2 of the Work Plan. Immediately preserve each sample according to the methods described therein.

Sample containers used, preservation methods, and maximum sample holding time must be in accordance with mandatory EPA methods as shown in Table 2-2 of the Work Plan. Sample bottle cleaning protocol will be as presented in Appendix H.

5.0 SAMPLE IDENTIFICATION/SHIPPING

Mark each sample, using a waterproof permanent marker, with the following information:

- Site code
- Sample identification code
- Project number
- Date/time
- Sampler's initials

After recording this information, cover each sample label with waterproof clear plastic tape to secure its attachment to the sample bottle. Record and track all samples under strict chain-of-custody protocol. Seal each sample in the field and check for proper labeling. Then pack all samples into coolers with blue-ice freeze packs. A chain-of-custody form must be completed for each cooler to be shipped or transported (see Section 4.3 of the Work Plan).

6.0 FIELD RECORDING PROCEDURES

A field notebook will be maintained during all field activities. All field measurements including water depth readings at each sample station and surface water pH, conductivity, temperature, etc. will be recorded sequentially with a waterproof permanent marker. Other data and information recorded will include the sampling date, sample description and identification code, sample preservation methods and the sampling conditions (e.g., weather, etc).

APPENDIX E

PROCEDURE FOR COLLECTION OF BOTTOM SEDIMENT CORE SAMPLES IN DEEP WATER

1.0 GENERAL

The collection of sediment samples is performed to generally assess the quality of the sediments. Often, the sampling of bottom sediments is complicated by the structural properties of the material and the fact that sampling takes place below a water surface. Sediments may also exhibit non-uniform characteristics which vary with depth and area. In some sampling situations, it is desirable to obtain a representative column of sediment for chemical analysis.

The selection of approximate sampling materials and the application of proper sampling techniques will aid in obtaining representative samples. Methods for obtaining sediment samples include:

- Hand corer
- Gravity corer
- Ponar Clamshell-type Scoop

This procedure is for the collection of samples using a hand corer. The hand corer is equipped with handles to which 5-foot extension handles can be attached for sampling in water depths of up to 15-feet. The corer is typically of brass construction. When sampling for priority pollutant analysis, a liner sleeve of cellulose acetate butyrate (CAB) is used to prevent the core tube from contaminating the sample. Where sediments are soft and cannot be retained in the tube, an eggshell core catcher and nosepiece is fitted to the cover.

2.0 HEALTH AND SAFETY REQUIREMENTS

Although the work involved with collecting sediment samples is associated with a hazardous waste site, the primary safety concern for this activity will be to ensure proper boating procedures are followed. Therefore, in addition to the protocols outlined in the HASP, the following safety guidelines will be followed during the sampling program:

- A minimum of two and a maximum of three persons shall be in the boat at all times.
- All personnel shall wear U.S.Coast Guard-approved personal flotation devices (PFDs) while in the boat.

- The boat used during sediment sampling will be a large (approximately 16-foot length), flat-bottomed type to provide stability and ample work area.
- The boat shall be equipped with an anchor, anchor rope, two oars and small outboard motor.
- The boat operator will be familiar with the safety procedures necessary for operating the boat on the Buffalo River.
- Sampling will be conducted when weather conditions allow for safe operation of the boat and the potential of capsize due to wave action is minimized.

In addition to these safety procedures, appropriate dermal and respiratory protection shall be worn in accordance with the Health and Safety Plan (Appendix A).

3.0 SAMPLE COLLECTION PROCEDURE

Sediment samples will be collected utilizing the following equipment:

- Wildco KB Hand Core Sampler, 30" length
- Extension Handle
- Liner Tubes - CAB (10)
- Eggshell Core Catchers (3)
- Nosepiece (2)
- Boat with motor, anchor, oars

The sediment sampling procedure is described below:

1. Ensure appropriate safety procedures for boat operation are followed.
2. Record field measurements such as air temperature, water temperature (surface and at sediment/water interface), depth to sediment, water level and other pertinent information as described in Section 6.0.
3. Anchor boat from bow over sample location.
4. Inspect the corer for damage; insert CAB liner and attach nosepiece. Where sediments are soft and may be lost, insert core catcher.
5. Determine depth from water surface to sediment/water interface using a measuring rod.
6. From the stern, gently lower the core sampler to the sediment surface and hold in a perpendicular position. Force the core sampler into the sediment until either a 24-inch sample is obtained or refusal is encountered. Use a smooth continuous, twisting motion.

7. Withdraw the core sampler in a single smooth, twisting motion to minimize suction.

8. Follow sample handling procedures in Section 4.0.

9. Decontaminate the sampling equipment between sample locations. Wash with solution of soap and water; rinse with tap water; rinse three times with distilled water; and, finally rinse with acetone, in that order.

4.0 SAMPLE HANDLING/PRESERVATION

After retrieving the sediment sample to the boat, the following procedures will be implemented:

- Extrude the sample from the CAB liner into a precleaned quart glass jar provided by the analytical laboratory.
- Seal jar with Teflon-lined cap and label with waterproof, indelible ink as described in Section 5.0.
- Store the sample out of direct sunlight. Use styrofoam to keep sample cool.
- Transport the sample to lab for mixing prior to analysis.

Each individual sample will be mixed in a stainless steel bowl to provide a homogeneous sample prior to subdividing for chemical analysis. The mixing will be performed according to the following procedure:

- Decontaminate stainless steel mixing bowl, and mixing tools prior to use to prevent cross-contamination of samples. Use equipment cleaning procedure presented in Appendix G.
- Place individual sample into bowl and mix with stainless steel spatula until a homogeneous sample is obtained.
- Subdivide the sample into individual bottles as outlined in Table 2-2 of the Work Plan.
- Decontaminate removal tool, bowl, and mixing tools. Allow to air dry before re-use.

After samples have been subdivided, place into coolers with blue-ice for transport to the analytical laboratory.

5.0 SAMPLE IDENTIFICATION/SHIPPING

Mark each sample, using a waterproof permanent marker, with the following information:

- Site code
- Sample identification code
- Project number
- Date/time
- Sampler's initials

After recording this information, cover each sample label with waterproof clear plastic tape to secure its attachment to the sample container. Record and track all samples under strict chain-of-custody protocol. Seal each sample in the field and check for proper labeling. Then pack all samples into coolers with blue-ice freeze packs. A chain-of-custody form must be completed for each cooler to be shipped or transported.

6.0 FIELD RECORDING PROCEDURES

A field notebook will be maintained during all field activities. Data and information which will be recorded during sediment sampling includes:

- Date
- Time
- Location
- Sampler name
- Weather
- General Observations/Remarks
- Sample Description and Identification
- Sample Preservation and Handling Methods
- Equipment used

7.0 FIELD RECORDING PROCEDURES

A field notebook will be maintained during all field activities. All field measurements including water depth at each core sample collection location will be recorded sequentially with a waterproof permanent marker. Other data and information recorded will include the sampling date, sample description and identification code, sample preservation methods, and the sampling conditions (e.g. weather, etc.).

APPENDIX F

FIELD INSTRUMENT
CALIBRATION AND MAINTENANCE

FIELD AND INSTRUMENT CALIBRATION AND MAINTENANCE

Calibration and maintenance procedures for the field instruments identified below are presented in Tables F-1 through F-4.

- Portable pH Meter (Table F-1)
- Portable Specific Conductance Meter (Table F-2)
- Explosimeter (Table F-3)
- NHu Photoionization Detector (Table F-4)

TABLE F-1

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH METER

Accuracy

The calibrated accuracy of the pH meter will be 0.1 pH unit, over the temperature range of -2°C to 40°C.

Calibration

The pH meter will be calibrated by immersing the sensing probe in a container of certified pH buffer solution traceable to the National Bureau of Standards, and by comparing the meter reading to the known value of the buffer solution, which is stirred. The meter will be two-point calibrated in the field at the beginning and end of each group of measurements.

Maintenance

1) When not in use or between measurements, the pH probe will be kept immersed in or moist with buffer solution.

2) The meter batteries will be checked at the end of each day and recharged when needed.

3) The pH probe will be replaced any time that the meter response time becomes greater than two minutes or the metering system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.

4) If replacement of the pH probe fails to resolve instrument response time and stability problems, the equipment maintenance officer will send the instrument to its manufacturer for maintenance and repair.

5) A maintenance log will be kept for each pH monitoring instrument. All maintenance performed on the instrument will be recorded on this log with date and name of the organization performing the maintenance.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The pH buffers used to calibrate the meter will also be documented. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

TABLE F-2

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD CONDUCTIVITY METER

Accuracy

The calibrated accuracy of the specific-conductance meter will be within three percent of full-scale over the temperature range of -2°C to 40°C.

Calibration

The specific-conductance meter will be calibrated by immersing the sensor in a container of potassium-chloride standard solution and comparing the meter reading with the known value of the standard solution. The potassium-chloride solution will be prepared in accordance with Standard Methods for the Examination of Water and Wastewater, sixteenth edition, 1985, Part 205.

Maintenance

1) The meter batteries will be checked at the end of each day and recharged when needed.

2) The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes and the meter must be recalibrated more than once per day, the instrument will be sent to the manufacturer for maintenance and repair.

3) A maintenance log will be kept for each specific-conductance meter. All maintenance performed on the instrument will be recorded on this log with date and name of the organization performing the maintenance.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The standard solution used to calibrate the meter will also be documented.

TABLE F-3

CALIBRATION AND MAINTENANCE OF EXPLOSIMETER

Accuracy

Gas concentrations of up to 100 percent lower explosive limit (LEL) are measured directly on the meter in one percent increments.

Calibration

The MSA Model 2A, Explosimeter Indicator, designed for general use, it factory-calibrated on pentane in air. Pentane calibration is used because it is representative of petroleum vapors and, when testing most other combustible gases, generally results in readings which are conservative.

When there is suspicion that silanes, silicones, silicates and other silicon-containing compounds are present in the tested atmosphere, the instrument will be calibrated after every five tests using aerosol-type two percent methane-in-air (MSA Calibration Kit No. 454380). When leaded gasoline vapors are present, an inhibitor filter (MSA No. 47740) will be used to nullify the vapor's effect on the filament.

The adjusting knob will be used to zero the instrument prior to use in accordance with manufacturer's instructions.

Maintenance

1) The meter batteries will be replaced after every 12 hours of continuous operation.

2) A maintenance log will be kept for each explosimeter. Any and all maintenance performed on the instrument will be recorded in the log with the date and name of the organization performing the maintenance.

TABLE F-4

CALIBRATION AND MAINTENANCE OF HNu PHOTOIONIZATION ANALYZER

Accuracy

The HNu PI 101 is temperature compensated so that a 20°C change in temperature corresponds to a change in reading of less than two percent full-scale at maximum sensitivity. The useful range of the instrument is from 0.2 to 2000 ppm with an accuracy of 0.1 ppm. Response time is less than three seconds to 90 percent of full-scale.

Calibration

The meter will be calibrated using a cylinder of pressurized gas certified by a reputable supplier. The calibration gas will be in the same matrix in which the measurements will be taken. The span pot will be adjusted so the instrument will read the exact value of the calibration gas. For a HNu factory-calibrated by benzene, the calibration will be made using bottled "span gas" supplied by HNu.

Maintenance

1) If any of the following conditions occur, consult the troubleshooting guide provided in the Instruction Manual:

    a) No meter response in any switch position (including BATT CHK).
    b) Meter response in BATT CHK, but reads zero or near zero for all others.
    c) Instrument reads correctly in BATT CHK and STBY, but not in measuring mode.
    d) Instrument responds in all positions, but signal is lower than expected.
    e) Erratic meter movement occurs.
    f) Instrument response slow or irreproducible.
    g) Low battery indicator.

Should the troubleshooting techniques fail to resolve the problem, the Equipment Maintenance Officer will send the instrument to the manufacturer for repair and maintenance.

1) The light source window will be cleaned every four weeks during periods of continued use.

2) The meter battery will be checked at the beginning and end of each day. If the needle is not within or above the green battery arc on the scaleplate, the battery will be recharged prior to making any measurements.

APPENDIX G

EQUIPMENT CLEANING PROCEDURES

EQUIPMENT CLEANING PROCEDURE

The samples that will be collected during this investigation will be analyzed for both inorganic (i.e. primarily metals and cyanide) and organic (i.e. volatiles, semi-volatiles and pesticides) parameters. It is expected that these parameters will be present only at very low concentrations (i.e. ppm concentrations). For this reason, rigorous cleaning of all sample equipment is mandatory to minimize the potential for sample contamination.

The cleaning procedure that will be used during this investigation is designed to remove inorganic and organic substances of the type identified above. This procedure is as follows:

A. PVC Sampling Equipment

1. Soap and water wash
2. Tap water rinse
3. 10% V/V nitric acid/deionized water wash
4. Deionized water rinse (minimum of three rinsings)
5. Air dry before using

B. Stainless Steel Sampling Equipment

1. Soap and water wash
2. Tap water rinse
3. Acetone rinse
4. Hexane rinse
5. Distilled water rinse (minimum of three rinsings)
6. Air dry before using

APPENDIX H

SAMPLE BOTTLE CLEANING PROCEDURES

SAMPLE BOTTLE CLEANING PROCEDURES

Proper sample bottle cleaning is imperative to eliminate the possibility of sample contamination. Such contamination will result in false analytical results or analytical anomalies.

All sample containers used during the Remedial Investigation will be provided by the laboratory contracted to perform the sample analyses. All bottles provided by the laboratory will be precleaned using the cleaning procedures listed below:

1. All polyethylene bottles for inorganic sample parameter analysis:
    a. soap wash;
    b. tap water rinse;
    c. nitric acid wash with 25% volume/volume nitric acid/deionized water; and
    d. rinse with copius quantities of deionized water (at least four rinsings).
2. All glass bottles, except volatile vials, for organic sample parameter analysis:
    a. soap wash;
    b. tap water rinse;
    c. rinse with acetone (pesticide grade); and
    d. rinse with copius quantities of deionized water (at least six rinsings and two complete fillings of bottle to overflowing).
3. All volatile vials:
    a. soap wash;
    b. rinse with copious quantities of deionized water (at least six rinsings);
    c. add thiosulfate (two drops of 10% solution);
    d. dry for 1/2 hour in an oven at a temperature of 103°C (without caps and septa); and
    e. cool and cap with precleaned septa (soap washed and rinsed with deionized water, dried at 103°C for one hour).

APPENDIX I

METHOD FOR ANALYSIS OF TOTAL ORGANIC HALOGENS IN SOIL

TOTAL ORGANIC HALIDE ANALYSIS FOR SOIL SAMPLES

The soil samples which will be collected during the Remedial Investigation will be analyzed to determine the level of Total Organic Halides (TOX) present. As a standard method does not currently exist by which to make this determination for the soil itself, the following procedure has been developed to obtain a leachate sample for TOX analysis. This procedure is as follows:

1. Add 1 gram of the soil sample to 1 ml distilled/deionized water and 1 ml ethyl acetate. Shake the mixture vigorously.
2. Perform a sonication extraction.
3. Separate the phases by centifugation.
4. Proceed with Method 9020 (TOX Analysis) with the leachate obtained. Method 9020 is described in detail in Test Methods for Evaluating Solid Waste - Volume 1C: Laboratory Manual Physical/Chemical Methods (USEPA Document No. SW-846 - November 1986).

APPENDIX J

LABORATORY QUALITY ASSURANCE/ QUALITY CONTROL PLAN

2/3593

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

RECRA ENVIRONMENTAL, INC.

QUALITY ASSURANCE/QUALITY CONTROL PLAN

Prepared by

Recra Environmental, Inc.
Audubon Business Centre
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Amherst, New York 14150

2/3593

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1.0 INTRODUCTION

1.1 Program Description

The objective of Recra Environmental, Inc. is to deliver high quality analytical data to its clients. We wish to accomplish this objective in a fashion which will meet the timeframe of our clients.

This document has been prepared to illustrate the quality control/quality assurance program in effect at Recra Environmental, Inc., in order to assure that the data generated will be of consistent high quality.

1.2 Document Format

This document has been prepared in a form consistent with the "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans".

The following format outlines how pertinent information will be presented in the following sections along with a brief description of information contained in each topic area. The major subject matter of the following sections provides the detail through which Recra Environmental, Inc., will ensure "Project Quality Assurance Management." The following subsections illustrate procedures internally applied to data acquisition and reporting.

Organization and Responsibility

Indicates structure of the organization and where various responsibilities lie concerning the quality control program.

Quality Assurance Objectives

Presented are general and specific quality assurance objectives for the project relative to the parameters under study.

Chain of Custody

Protocol for maintaining custody of samples is described in detail.

Analytical Equipment

Lists equipment available at Recra Environmental, Inc., calibration procedures and frequencies.

Data Processing

Discusses how data is generated, reduced and reported. Mechanisms included in this process are identified.

Internal Quality Control

The internal quality control program is described with regard to the mechanisms used to monitor precision and accuracy of data generated.

Performance and System Audits

Describes programs in place to verify that the quality assurance/quality control program is effective and identifies areas of potential error and/or bias.

Preventive Maintenance

Indicates the measures employed by Recra to insure the consistent operation of all laboratory equipment regarding this project.

Data Quality Assessment

Indicates how quality control data is used to monitor performance of the laboratory. Specific examples and how various QC/QA scenarios will be handled are presented.

Corrective Action

Indicates what action is taken once a quality control problem is identified.

Quality Assurance Reports

Mechanisms by which Recra will provide for both internal and external QA reports are presented.

2.0 PROJECT QUALITY ASSURANCE MANAGEMENT

Quality Control/Quality Assurance procedures, details of our methods, procedures and the management controls are described in this program manual.

Ultimate responsibility for data generated by our environmental laboratory is under the direction of Dr. Arun K. Bhattacharya, Senior Vice President/Laboratory Director.

Operational responsibility rests with Ms. Deborah J. Travis, Laboratory Operations Manager. Contributors to the data generation are detailed in Section 2.1 (Organization and Responsibility).

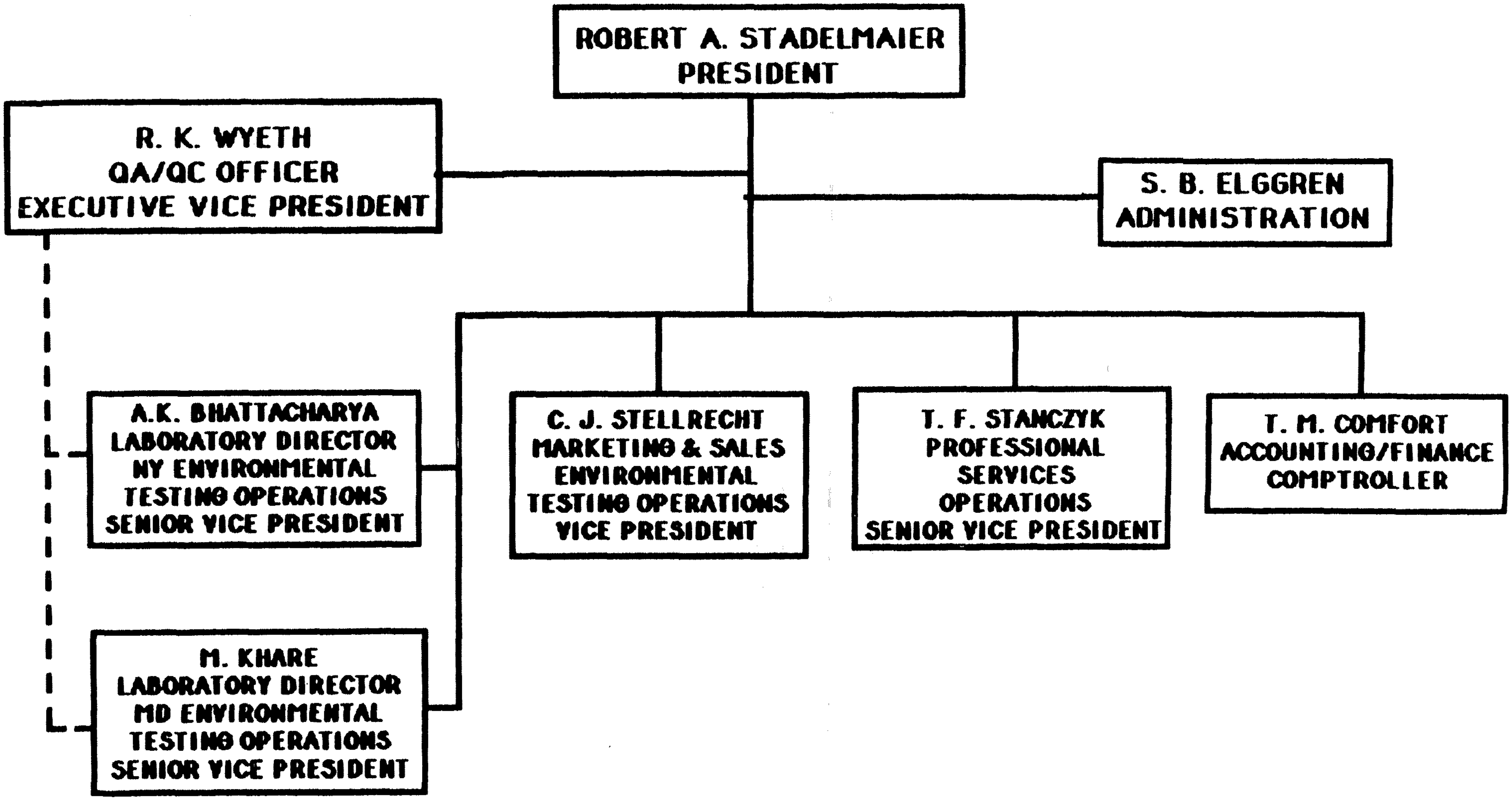
2.1 Organization and Responsibility

2.1.1 General Procedures

Recra Environmental, Inc., as a corporate entity has the singular responsibility of providing chemical consulting and analytical services to our clients relative to the management of hazardous waste and regulatory requirements. Figure A-1 illustrates the position of the laboratories within the overall organizational structure of Recra Environmental, Inc. The management of Recra Environmental, Inc., rigidly adheres to accepted QA/QC protocols and methodologies; the organization is dedicated to a control program that provides an analytical product of consistent high quality. The organizational chart for the group is shown in Figure A-2.

Figure A-1

RECRA ENVIRONMENTAL, INC.

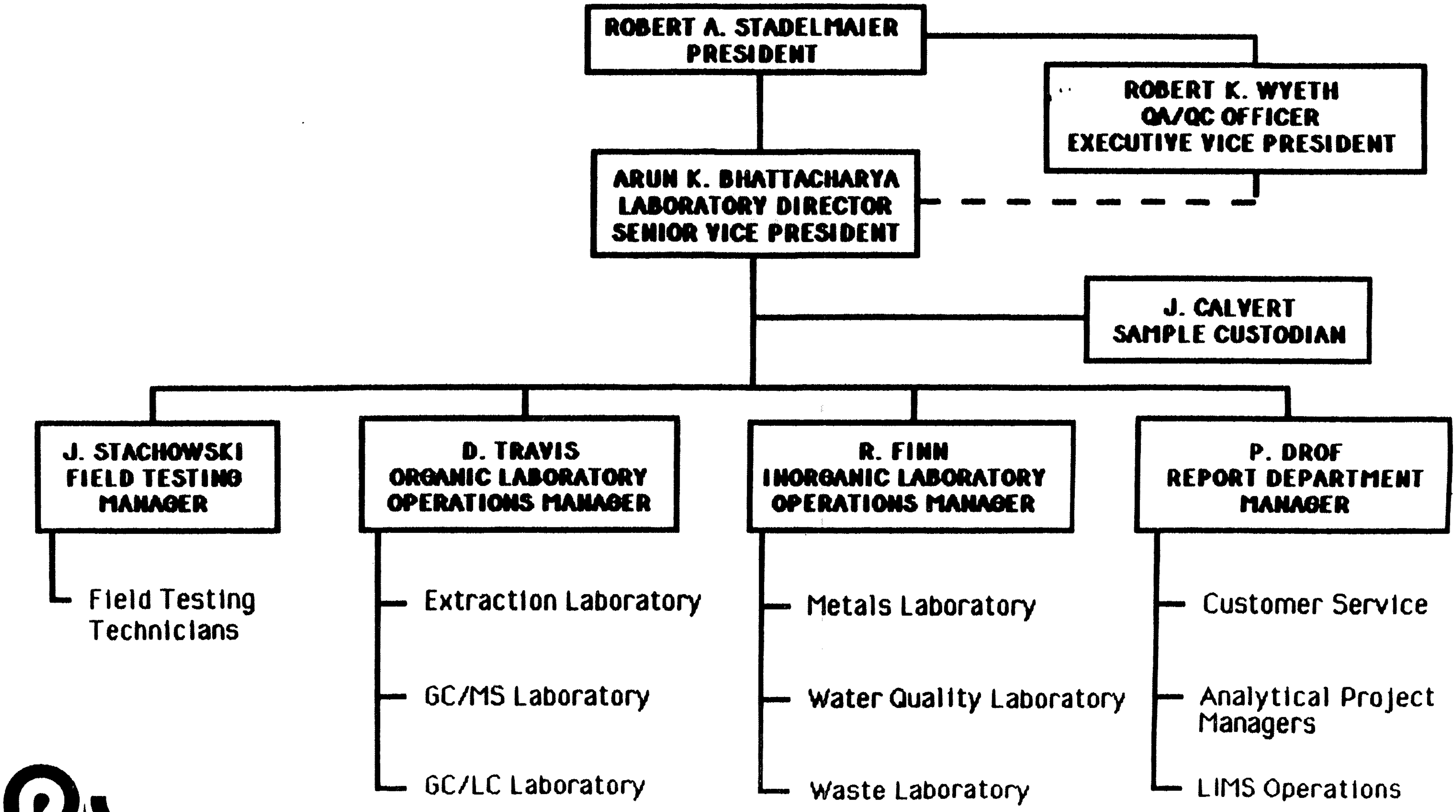


Recra Environmental, Inc.

Revised 1/88

Figure A-2

RECRA ENVIRONMENTAL, INC.
NEW YORK ENVIRONMENTAL TESTING OPERATIONS



Revised 1/88

Both management and staff understand their responsibility to maintain an effective QA/QC program. Personnel work together to monitor all QA/QC activities and assure that these activities are performed according to authorized policies and procedures. Standard operating procedures practiced by the staff to achieve this goal include but are not necessarily limited to the following:

a.) Logging of complete sample information, chain of custody and introducing control samples into the sample workload.

b.) Daily monitoring and documentation of all ancillary equipment involved in the generation of analytical data.

c.) Daily monitoring and documentation of proper performance of all analytical instruments.

d.) Assuring that subsampling and other handling procedures are suitable to the types of samples received.

e.) Preparing and evaluating results of inter- and intralaboratory sample analysis.

f.) Supervising the quality of laboratory supplies to assure that materials, reagents, and chemicals do not jeopardize the reliability of analytical results.

g.) Assuring that all test and measurement equipment is properly calibrated.

h.) Preparing QA/QC samples, standard solutions, and performing related calculations.

i.) Insuring consistent quality in that all sample containers are cleaned utilizing defined washing procedures.

j.) Individual job numbers are assigned to groups of samples to eliminate the possibility of sample mixing.

k.) All samples are received and logged by the sample custodian to minimize the potential for errors during this initial activity.

l.) Quality of solvents, gases and water are continually monitored for high purity.

m.) Standard glassware washing protocol is established and followed in order to provide consistently clean labware for analyses.

n.) Glassware sets are numbered so that any suspected contamination problem can be traced.

Details of specific QA/QC activities and procedures follow, but as a general overview, it is the responsibility of each individual analyst to perform the specified number of quality control analyses on a given set of samples. The proper number of replications, spikes and blanks has been mandated by the laboratory manager and is not left to the analysts' discretion. In addition to performing the proper amount of quality control, the analyst is responsible for the initial review and assessment of the data generated. If data is outside of warning limits or out of control, the source of the problem will be identified with the appropriate supervisor. Supervisors are responsible for all data generated from their section and all data in an analytical report must be signed by the appropriate supervisor.

All analytical reports are written by an analytical project manager before final submission to the laboratory director. All analytical reports (including all quality control data) are personally reviewed by the QA/QC officer. More specific details on how data quality is reviewed, assessed and either approved or rejected is presented in latter sections of this document.

2.1.2 Specific Responsibilities

Relative to this specific project, Dr. Arun K. Bhattacharya, Senior Vice President, will be ultimately responsible for the performance of all staff personnel and for the overall quality of the generated data. As project manager, all administrative functions including budget control, contractual issues, accounting, and/or other business concerns will be directly under the control of Dr. Bhattacharya.

Operations management will reside with Ms. Deborah J. Travis, Laboratory Manager. Data assessment relative to completeness, comparability and quality as well as final project data/report review will be completed under the direct control of Mr. Robert J. Siudzinski, QA/QC officer.

A permanent sample controller/custodian is assigned the responsibility of sample receipt for any samples received at Recra Environmental, Inc. Laboratories in Tonawanda, New York. Once received, the sample controller insures that all samples are received in good condition (i.e.

unbroken, cooled, etc.). He insures that the associated paperwork, such as chain of custody sheets, are completed and is responsible for signing the chain of custody forms. The custodian sees that the samples are subsampled if necessary and preserved properly for the specific parameters of interest. The sample custodian is also responsible for the final disposal of all samples once such disposal authorization is received from the laboratory operations manager.

The actual analytical activities will be subdivided between different departments and groups within Recra Environmental, Inc. Ms. Deborah J. Travis, the Acting Organic Department Coordinator, will be responsible for the activities of the separations laboratory (i.e. the preparation of samples for subsequent analysis) and gas chromatography. Joseph Bitka the GC/MS Lab Supervisor will be responsible for all gas chromatography/mass spectrometry analysis. Mr. Richard V. Finn, Inorganic Department Manager, will be responsible for metals and water quality analysis.

Individual analysts, under the direction of the supervisors, are responsible for the performance of instrument calibration, and sample analysis along with the performance of associated quality control analyses, e.g. blanks, spikes, duplicates, etc. All data are entered into individually bound laboratory notebooks specific to instruments and analyses.

Supervisors are charged with maintaining instrumentation in proper operating order according to manufacturers' specifications. Scheduling of routine servicing as well as reacting to out-of-control instrument problems are duties of the supervisors. They are also the initial reviewers of the analytical data and accompanying quality control information. Following their review, and acceptance of the data, supervisors prepare reports for submission to the report writing group.

The laboratory director/quality control officer is responsible for the final review of all analytical data and resolution of any and all suspect data.

2.2 QA Objectives

The quality assurance objectives regarding Recra's efforts in the project are described in terms of accuracy, precision, completeness, representativeness and comparability.

Comparability of data sets is a function of numerous variables, including laboratory errors and bias, the representativeness of the samples and the inherent population variances between the samples.

In terms of the degree of representativeness, the field sampling activities can be generally be seen to account for >80% of the variance within data sets. The remaining 20% or less of the noted variance in the data is attributable to both systematic and non-systematic laboratory error.

2.3 Laboratory Chain of Custody

Recra's chain of custody procedures are based upon the NEIC policies and procedures (EPA-330/9-78-001-R).

A full-time, permanent sample controller/custodian is assigned the responsibility of sample receipt for the laboratory. It is the responsibility of the sample custodian to receive all incoming samples at the laboratory. Once received, the custodian insures that all samples are received in good condition (i.e., unbroken, cooled, etc.). He insures that the associated paperwork, such as chain of custody sheets, are completed and is responsible for signing the chain of custody forms. The custodian sees that the samples are subsampled if necessary and preserved properly for the specific parameters of interest. The sample custodian is responsible for the final disposal of all samples once such disposal authorization is received from the laboratory manager.

All chain of custody sheets are signed and retained in our file for future reference. An example of a chain of custody form is presented in Figure A-3.

Once the sample has been entered into the central sample log (Table A-1), the sample custodian correlates the particular samples with the requested tests to be performed. An Analytical Services Request Form (Figure A-4) is used to describe analyses required on particular samples. Each set of samples is given an individual job number to facilitate tracking of samples through the laboratory and provides for readily available job status.

After initial logging and processing, all samples are stored by job number in one of two large walk-in coolers held at 4°C until such time as analysis is begun. Samples are secured in the walk-in cooler and during processing via Recra's professionally installed and maintained (Wells Fargo) security system throughout the Recra laboratory building. This system, in addition to the access restrictions implied as company policy, restrict entry to the laboratory to authorized personnel only.

At the time of sample analysis, in accordance with the production schedules prepared by the laboratory manager and supervisors, analysts remove the samples from the walk-in cooler and log all sample identification information. As processing continues, all required methods data is recorded and stored for future reference as well as for archival purposes. Prepared samples (extracts, digested samples, etc.) are re-coded and stored until instrumental analysis, at which time separate bound logs are again employed to preserve all additional information and data.

TABLE A-1
RECRA ENVIRONMENTAL, INC.
ANALYTICAL SAMPLE INVENTORY

DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE REC.	PROJ #/ CLIENT	JOB #	PRES.	DELIVERY	REC. COOL.	SAMPLE ID	SAMPLING DATE	BOTTLE DESCRIPTION - COMMENTS
								___ FS ___ P ___ AC ___ VOA ___ FS ___ P ___ AC ___ ___ FS ___ P ___ CW ___ ___ FS ___ P ___ CW ___
DATE	PROJ #/ ENT	JOB	PI	D ERY	REC. OOL	MPL D	SAMPLING TE	BOT DES PTI CO NTS

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ANALYTICAL SERVICES REQUEST FORM

FIGURE A-4

1. Project #: ____________________
2. Initiator of Request: ____________________
3. Sales Contact: ____________________
4. Date of Request: ____________________
5. Required Completion Date: ____________________
6. Client Name and Address:
____
____
____
____
ATTN: ____________________
7. ☐ Carbon Copy ____________________
8. Telephone # (   ) ____________________
9. Chain of Custody ☐ Y ☐ N
10. Sample Date: ____________________
___ See Log for Sample Dates
11. ___ See Log for Full Sample I.D.
12. Preserved in Field ☐ Y ☐ N
17. Sample History ____________________
____
____
____
18. Anticipated # of Samples ____________________

23. Job #: ____________________
24. ASRF (Job) Date: ____________________
25. Samples Received: ____________________
26. Quote #: ____________________
____
R.E.I. USE ONLY

13. Collected By ___ Recra ___ Client
14. ___ Field Report
15. Sample Type ___ Soil ___ Sludge
___ Water ___ Oil ____________
___ Other ____________
16. Report Writer ____________________

Waste Lab	$

19. ANALYTICAL PARAMETERS TOTAL $

WQ	$	Metals	$	GC/LC	$	GC/MS BN/AP	$

20. Sample I.D.: ________ Actual # of Samples
___ Sample I.D.'s apply to all parameters

GC/MS VOL	$

21. VOA Scheme
___ Actual # vials
___ # Field Blanks
___ pts x ___ Vials
In Duplicate ___ Yes
Lab Composited ___ Yes
___ # Vials/Point

22. Specific Requirements: ie. report content, special handling, safety, preserved or filtered in field, etc.
____
____
____
____

29. P.O. # ____________________

27. Signature (Customer Service Representative) ____________________
All Info. Checked for Accuracy

cc: Address:
____
____
____

28. Signature (Sample Custodian) ____________________
All Info. Checked for Accuracy

2.4 Analytical Procedures

Recra Environmental, Inc., is fully equipped to analyze organic, inorganic and elemental parameters in a variety of matrices. Specific laboratory equipment housed in our facility is listed in Table A-2.

2.4.1 Analytical Equipment Calibration

The methods and frequency of calibration are equipment specific. In all cases, certified analytical standards are purchased from commercial suppliers or made from U.S. Environmental Protection Agency stock materials. All new standards are compared to calibration curves to check for improper dilutions or degradation of the solution. All dilutions (intermediate standards) are recorded in a standard log which describes who, when and how the standard solutions were made.

2.4.1.1 Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS)

The mass spectrometer (MS) is tuned prior to each analytical event and verified after twelve hours of continuous operation, using DFTPP or BFB (as appropriate) according to EPA procedures. The tuning results are maintained on file.

Standard curves are periodically prepared based on the analysis of pure chemicals at known concentrations. At least three levels are analyzed within the dynamic range of the analytical system.

For volatile organics, surrogates are used for purge and trap recovery standards. Quantitation is accomplished via internal standardization techniques.

For semi-volatile organics, surrogates are added to the raw sample to assess preparatory recoveries, d_{10} phenanthrene is added to all extracts and calibration solutions immediately before analysis for purposes of internal standardization.

Method blanks are analyzed with each group of samples to assess potential contamination or interferences. When all GC/MS analyses are completed, the extracted ion currents of the characteristic ions of the recovery and internal quantitation standards are profiled.

Surrogates are added to all samples and standards and are monitored daily.

2.4.1.2 Gas Chromatographs

To verify detector sensitivity and chromatographic performance, calibration curves are generated from the analysis of pure compounds at known concentrations covering the dynamic range within each analysis group.

Detector response is compared with a historical file for each compound or class of compounds to validate acceptable performance. If acceptable standard curves are not generated, corrective measures such as replacing glass injector linings, changing septa, changing columns and "baking" columns and/or detectors are employed until proper performance is established.

2.4.1.3 Atomic Absorption Spectrophotometer

Prior to the determination of the concentration of a particular metal in a sample, a minimum of three concentrations of a working standard are analyzed and the linearity of the instrument is verified through regression analysis.

Working standards are prepared fresh daily from manufacturer's certified stock solutions. The response of a particular standard concentration is monitored in absorbance units and compared to set criteria. If the proper absorbance is not attained the standard is remade and/or the instrument is readjusted until specifications are met. A minimum of five background readings and five sample or standard readings are taken for each aliquot which is analyzed.

A standard reference material is analyzed with each set of analyses to add assurance of the proper operations of the analytical system.

TABLE A-2

RECRA ENVIRONMENTAL, INC.

Laboratory Equipment List

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Gas Chromatograph/Mass Spectrometer (GC/MS) o Super INCOS data system 5.6 o Computer controlled gas chromatograph o Electron ionization source o Capillary/packed column injector o Archival data storage o Subambient GC oven temperature control o Nine track magnetic tape drive o High speed printer o NBS/EPA Mass Spectral Library (42,000 compounds)	Finnigan Model 5100 (2 Units)
Gas Chromatograph/Mass Spectrometer (GC/MS) o Super INCOS data system o Electron ionization source o Capillary/packed column injector o Purge and trap sampler o Archival data storage o Nine track magnetic tape storage o High speed printer o NBS/EPA Mass Spectral Library (42,000 compounds)	Finnigan Model 3200
Gas Chromatograph/Mass Spectrometer (GC/MS) o Computerized data systems o Computer controlled gas chromatograph o Electron ionization source o Capillary/packed column injector o Purge and trap sampler o Archival data storage o Subambient GC oven temperature control o Nine track magnetic tape drive o High speed printer o NIH/EPA MSDC Mass Spectral Library (31,000 compounds)	Hewlett Packard Model 5993
Gas Chromatograph/Mass Spectrometer (GC/MS) o Computerized data system o Computer controlled gas chromatograph o Electron ionization source o Capillary/packed column injector o Subambient GC oven temperature control o Purge and trap sampler o Archival data storage (nine track tape) o NIH/EPA MSDC Mass Spectral Library (31,000 compounds)	Hewlett Packard Model 5993

TABLE A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Gas Chromatograph/Mass Spectrometer (GC/MS) o Super INCOS data system o Computer controlled gas chromatograph o Heated electron ionization source (SP) o Capillary/packed column injector o Archival data storage (streamer tapes) o Subambient GC oven temperature control o High speed printer o NBS/EPA Mass Spectral Library (42,000 compounds)	Finnigan Matt Model 5100 SP
High Performance Liquid Chromatograph (HPLC) o HPLC with ultraviolet detector at 254 and 280 nonometers o Gradient programing o Micro processor data system	Waters Model O 440/6000A
Gas Chromatograph (GC) o Capillary/packed column injector o Automatic liquid sampler o Electron capture (ECD) detector o Flame ionization (FID) detector computer integration of peaks	Hewlett Packard Model 5840A
Gas Chromatograph (GC) o Capillary/packed column injector o Dual column capabilities o Dual column automatic liquid sampler o Electron capture (ECD) detector o Flame ionization (FID) detector o Computer integration of peaks o Basic programing capability	Hewlett Packard Model 5880
Gas Chromatograph (GC) o Capillary/packed column injector o Dual column capabilities o Dual column automatic liquid sampler o Electron capture (ECD) detector o Flame ionization (FID) detector o Computer integration of peaks o Basic programing capability	Hewlett Packard Model 5880

TABLE A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Gas Chromatograph (GC) o Capillary/packed column injector o Dual column capabilities o Dual column automatic liquid sampler o Electron capture (ECD) detector o Flame ionization (FID) detector o Computer integration of peaks o Basic programing capability	Hewlett Packard Model 5880
Gas Chromatograph (GC) o Packed column injector o Electron capture detector o Automatic integration of peaks o Automatic liquid sampler	Hewlett Packard Model 5890
Gas Chromatograph (GC) o Packed column injector o Electron capture detector o Automatic integration of peaks o Volatile headspace autosampler	Hewlett Packard Model 5790
Gas Chromatograph (GC) o Packed column injector o Electron capture detector o Automatic integration of peaks	Hewlett Packard Model 5790
Gas Chromatograph (GC) o Packed column injector o Hall's detector o Photoionization (PID) detector o Flame ionization (FID) detector o Automatic purge and trap sampler o 10 Units ALS autosampler	Perkin-Elmer Model 2000
Gas Chromatograph (GC) o Packed column injector o Electron capture detector (ECD) o Flame ionization detector (FID) o Automatic liquid sampler	Perkin-Elmer Model 2000

TABLE A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Gas Chromatograph (GC)	Perkin-Elmer Model Sigma 1
o Packed column injector	
o Electron capture detector (ECD)	
o Flame ionization detector (FID)	
o Nitrogen-phosphorous detector (NPD)	
o Computer integration of peaks	
o Data console	
o Basic programing capability	
o Automatic purge and trap sampler	
Gas Chromatograph (GC)	Perkin-Elmer Model Sigma 3
o Packed column injector	
o Coulson's electrolytic conductivity detector	
o Computer integration of peaks	
o Automatic purge and trap sampler	
Gas Chromatograph (GC)	Gow-Mac Model 550
o Packed column injector	
o Thermal conductivity detector (TCD)	
Atomic Absorption Spectrophotometer (AA)	Perkin-Elmer Model 5000 (2 Units)
o Six lamp turret for automatic determination of six elements per sample	
o Graphite furnace	Perkin-Elmer Model-HGA-500
o Automatic sampler for graphite furnace	Perkin-Elmer Model-AS-40
o Automatic sampler for flame analyses	Perkin-Elmer Model-AS-50
o Deuterium and tungsten background correction	
o Electrodeless discharge lamps (EDL) power supply	
o Printer	
o Gas control box	
Atomic Absorption Spectrophotometer (AA)	Perkin-Elmer Model 603
o Deuterium background correction	
o Graphite furnace	
o Flame analysis capability	
o Data handling systems	
o Gas control box	
Word Processing System	CPT Model 8525
o 2 disk drives	
o Letter quality printer	

TABLE A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Muffle Furnace (2 Units)	Thermodyne Model 1500 Lindberg Model 51894
Soxhlet Heating Banks (8 Units)	Precision
Centrifuge	Damon Model HNS Clay Adams Dynac II
Laboratory Ovens	Blue M Model 100A American Model DX-58 American Model H9620 GCA - Model 16EG American Model N8620 Blue M Model SW17TA Blue M Model SW17TA Blue M Model OV8A Blue M Model OV12A GCA Boekel
U.V. Visible Spectrophotometer o Dual cell for blank correction o Capable of automatic scan o Recorder and/or digital readout	Perkin-Elmer Model 200
Spectrophotometer	Bausch and Lomb Model 20
Infrared Spectrophotometer	Perkin-Elmer Model 567
Carbon Analyzer o Capable of determining total, inorganic or organic carbon on aqueous matrices	Beckman Model 915A
Sonic Homogenizer (Polytron)	Brinkman Model PT 10/35
Oxygen Meter	Yellow Springs Model 57
Conductivity Bridge	Yellow Springs Model 31

TABLE A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Specific Ion/pH Meters	Orion Model 701
o Specific ion electrodes include chloride, fluoride, ammonia and cyanide	Orion Model 901 Fisher Model 630
Fume Removal Hoods	(4) Labconco Model 5900
o Total of nine fume hoods o Several have make-up air	(2) Hemco (3) kewanee
Computer System	Apple Model 2e
o 128K of random access memory o 2 disk drives o Plotter o Dot matrix printer	
Aqua Tester	Hellige Model 611A
Water Baths	Blue M Model MW1130A Polytherm Model PY6 Tecam Model IIB
Kjeldahl Digestion Units	Labconco
Bio-Oxidation Systems	Horizon
o Includes bio-oxidation tanks and reactor vessels	
Bomb Calorimeter (2 Units)	Parr Model 1341
Autoclave	Ashcroft
Water Systems	Barnstead Model 4 (Still) Penpure Millipore Model Milli Q
Vacuum Pumps	Vac Torr Model 20 Gast Model 0211
Wrist Action Shaker	Burrell Model 75
Melting Point Apparatus	Electrothermal

Table A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
Refrigerator/Incubators	
o 5' x 15" Walk-in cooler	-
o 12' x 11' Walk-in cooler	-
o Refrigerator-Flammable Storage	Labline Model - Frigid-Cab (5 Units)
o General Storage Refrigerator (6 Units)	
o Refrigerator	Labline
o Incubator	GCA Model 815
o Freezer	Whirlpool
o Freezer	Admiral
o Freezer	Admiral
Pressure Filtration Apparatus	Millipore Model YT30 (2 Units)
Manometric BOD Apparatus	Hach
Closed Cup Flash Point Tester	Pensky Martens (2 Units) Fisher Model - Tag
Open Cup Flash Point Tester	Fisher Model - Tag
N.A.C.E. Corrosion Testing Apparatus	
Rotary Evaporator	Brinkman
Hotplates	Thermolyne Model 2200 Lindberg (3 Units)
Vortex Mixer	American
Viscometer	Brookfield Model LVF
Balance	
o Toploading Balance	Sartorius Model 1103
o Toploading Balance	Mettler Model PC440
o Toploading Balance	Fisher Model 7204
o Analytical Balance	Mettler Model AE160
o Analytical Balance	Mettler Model AE160
o Analytical Balance	Mettler Model H31AR

Table A-2 (continued)

ITEM/DESCRIPTION	MANUFACTURER/MODEL NUMBER
TEP Extractor o 10 Unit System	Manufactured to EPA Specifications
Sonic Disruptor	Tekmar Model TM500 Heat Systems Model W375 (3 Units)
Prime 2755 Computer System o 1 Mg RAM o 496 Mg hard disk o 1 Modem cabinet o 2 Laser printers o 1 Printax line printer o Misc. software	
Laboratory Information Management System (LIMS) o 1 Mb RAM o 2 800 K floppy drive o 1 Imagewriter printer o 1 Plotter o Misc. software	Apple (MacIntosh) S.E.
IBM AT Personal Computer (512 K RAM) o 30 Mb Hard disk and 1.2 Mb disk drive o Genoa graphics card o Amdek monitor o FX100 Epson printer o Hayer modem o Various software packages o Froms/data master (Finnigan Matt Software)	
Appe IIe (3 Units) o 128K RAM o 2 - 5¼ floppy disk drive o 1 - MX100 printer o 1 - Hays Modem o 1 - Apple monitor	
PT200 - Prime Terminal	

2.5 Data Reduction, Validation and Reporting

Each major measurement parameter/system has specific means employed for data reduction, validation and internal/external reporting which are somewhat different but follow the same general scheme.

Generally, for any and all measurement systems at Recra, the following chronological steps are adhered to:

- o sample receipt;
- o sample logging, inventory, chain-of-custody;
- o sample splitting and preservation (if and/or required);
- o sample storage;
- o sample preparation (extraction and/or digestion);
- o sample analysis (standard, QC and samples);
- o data calculation;
- o data reporting (internal);
- o data review/QC logging;
- o re-analysis (if and when required) and assessment;
- o report preparation;
- o report review/final QC review;
- o report issuance/central file maintenance;
- o sample archival and/or disposal.

Four (4) specific groups are generally involved in the analytical protocols for most projects. These groups are:

a) Water Quality;

b) Metals;

c) GC (and Separations Laboratory); and

d) GC/MS (and Separations Laboratory).

The specific means of processing samples and data within these analytical groups are discussed separately below.

2.5.1 Water Quality

This group is responsible for the analysis of received samples for pH specific conductance, chloride, and total organic carbon, etc. Each of these test procedures utilizes a separate bound data notebook which contains appropriate information such as:

- analysis date
- analyst
- job #
- sample I.D.
- initial volume or weight of sample
- dry weight (for solids only)
- volume distilled
- volume extracted
- sample absorbance from UV-VIS spectrophotometer at the appropriate analytical wavelength
- blank absorbance value
- standard curve concentrations and absorbances
- method blank absorbances
- results of replicate sample abosorbances

- spike (recovery) determinations
- final sample concentrations

With the above information and calculations performed in exact accordance with the published methods, results are easily located and verified. Data from the logbook is reviewed by the supervisor and upon initial approval is again reviewed via established QA/QC criteria. The data is then sent to the report writing group and subsequently entered into the final report form.

2.5.2 Metals

In a similar fashion, the metals department enters the following information into separate bound notebooks or on computer printouts:

- analysis date
- analyst
- job #
- sample I.D.
- initial volume or weight of sample
- final volume after digestion (if required)
- five (5) background absorbance readings from the AA for each sample per metal
- five (5) sample absorbance readings from the AA for each sample per metal
- method blank absorbance readings
- five (5) absorbance readings of each of five (5) standards run for each metal during each working shift and five (5) absorbance

readings for a mid-range standard after each group of ten (10) samples.

- absorbance readings for all replicate samples.
- absorbance readings for all spike samples
- absorbance readings for all standard reference material

Linearity of the standard curve is verified through regressional analysis and final sample concentrations are entered in a metals data logbook once quality control information, including the results of the SRM's, is deemed acceptable. As was the case with the water quality data, these results are eventually transcribed into the final report form for final data/QC review and subsequent issuance of the report.

2.5.3 Gas Chromatography (including separations laboratory)

The sample processing begins in the separations laboratory where a bound notebook is maintained for the purpose of recording all pertinent information regarding the extraction and clean-up (if required) for the samples. This logbook contains the following data:

- analyst
- extraction date
- job #
- sample I.D.
- extracted volume or weight of sample
- final concentration volume
- vial # (for extracts produced)
- analysis type (BN, AP, Pest.)

- glassware set

The above information is required for either GC or GC/MS analyses. The addition of "glassware set" has proved most useful in Recra's experience. Within a laboratory such as Recra's, which is involved in the analysis of waste samples or contaminated aqueous samples, the glassware information allows for identification of one specific area in which potential quality control problems may be found.

After samples have been prepared for analysis by the separations group, the GC department uses a series of logs and reporting forms to maintain the necessary data. The first is the bound injection log which contains the following:

- analyst
- injection date
- job #
- sample I.D./vial #
- volume injected
- instrument run number
- method number (specific column and instrument conditions for the particular analyses)
- detector used

On the day that specific analyses are performed, a five (5) point standard curve is generated via both computer assisted raw data plotting and regression analyses, using the areas as integrated by the gas chromatograph (Figures A-5, A-6 and A-7). The integrations and the standard curves are reviewed by the analyst for consistency and accuracy, and if found acceptable (and approved by the supervisor) the sample concentrations are calculated using standardized forms for water and sediment. These forms will also contain information relative to field blanks, method blanks and solvent blanks associated with this analysis. Information/data required for these calculations are acquired from both the separations and the injection logbooks. All chromatographs, standards information, QA/QC results, copies of separations and injection logbook pages and other project specific information is permanently maintained by job # and client in separate files.

All resultant data at the time of final report preparation is transcribed onto the final report form for data and QC review by the laboratory operations manager prior to issuance of the report.

FIGURE A-5

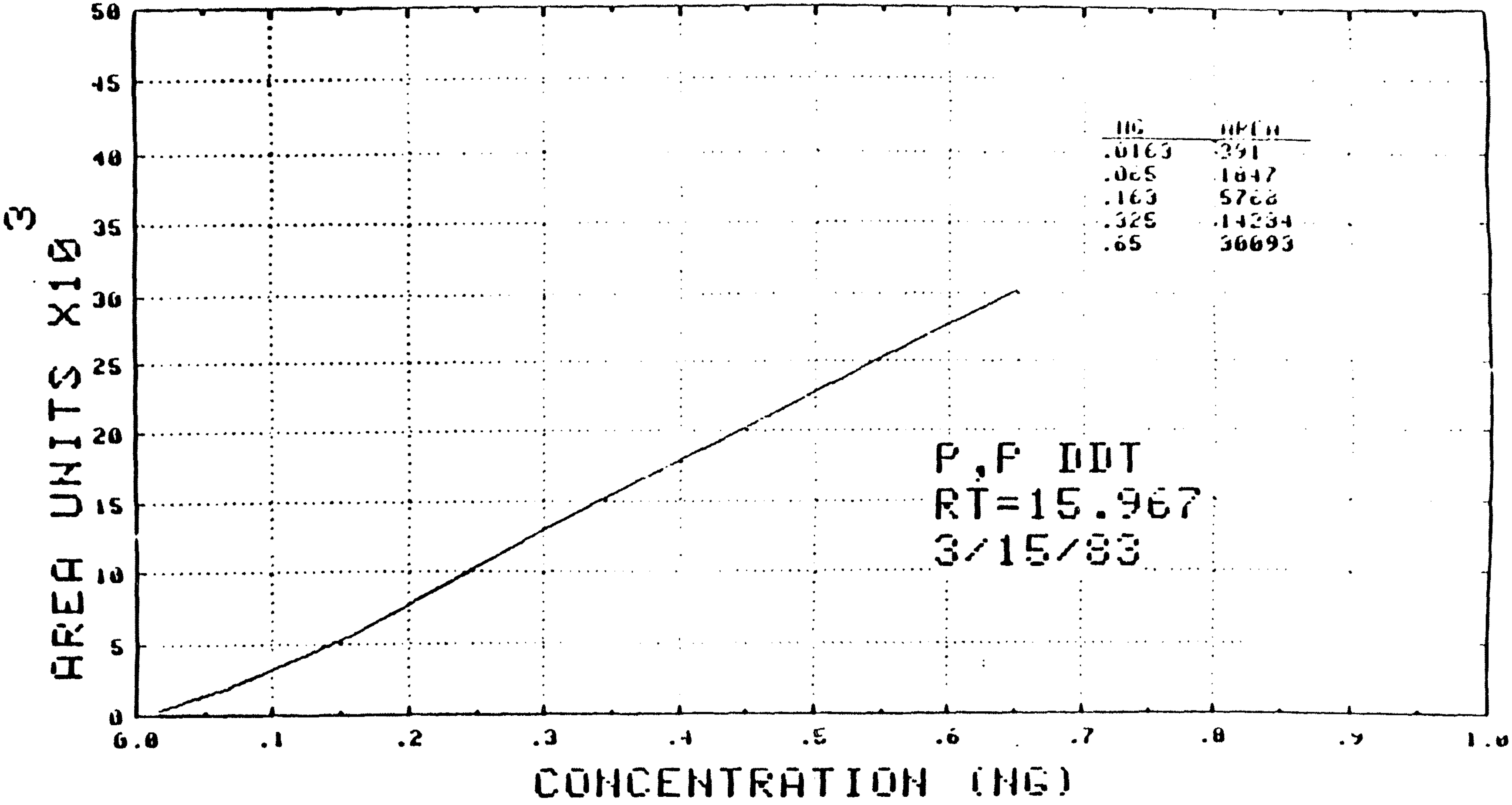

AREA UNITS X10 3
0
5
10
15
20
25
30
35
40
45
50
0.0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
CONCENTRATION (NG)
NG AREA
.0163 391
.065 1847
.163 5768
.325 14234
.65 36693
P,P DDT
RT=15.967
3/15/83

FIGURE A-6

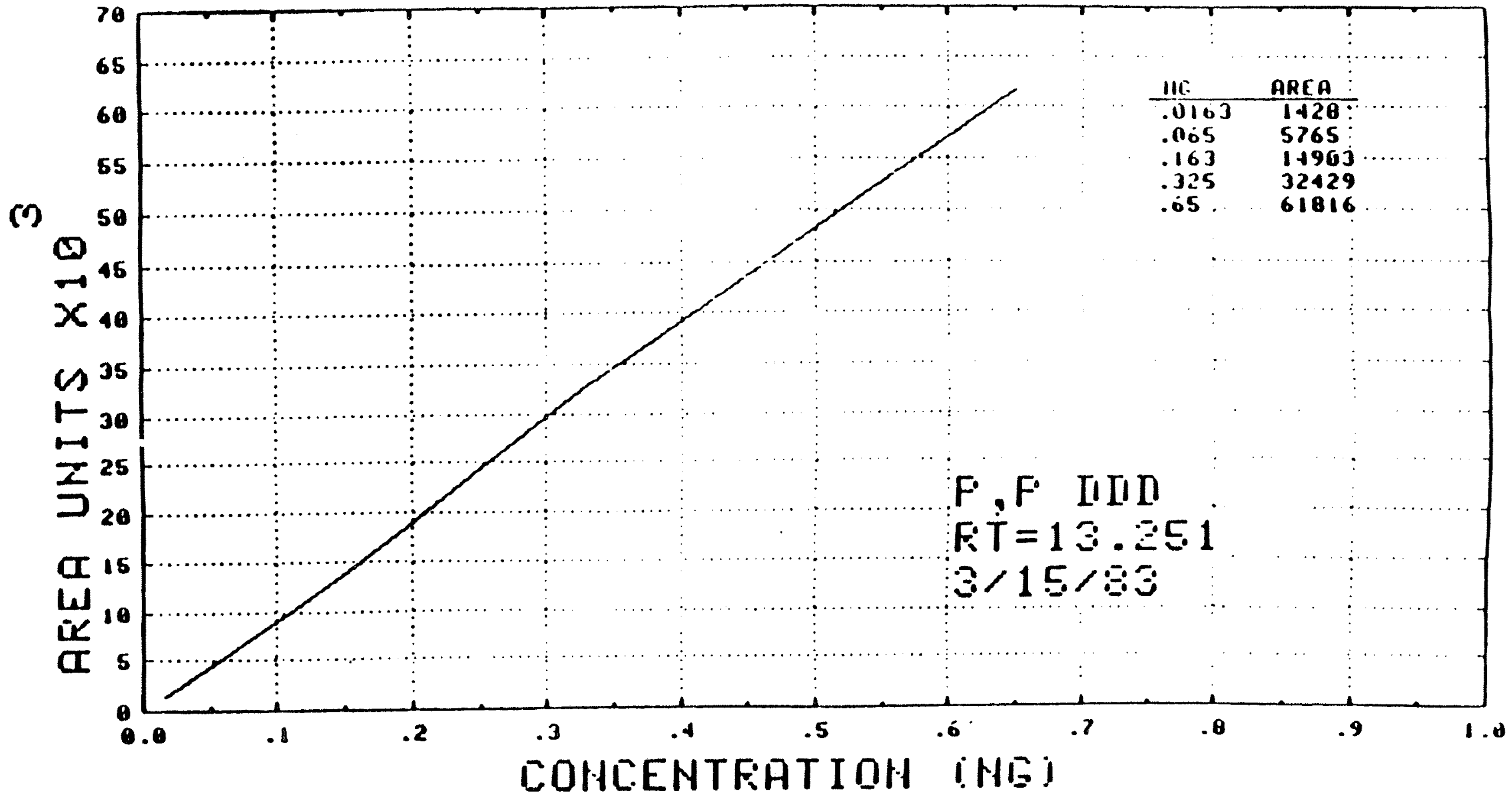
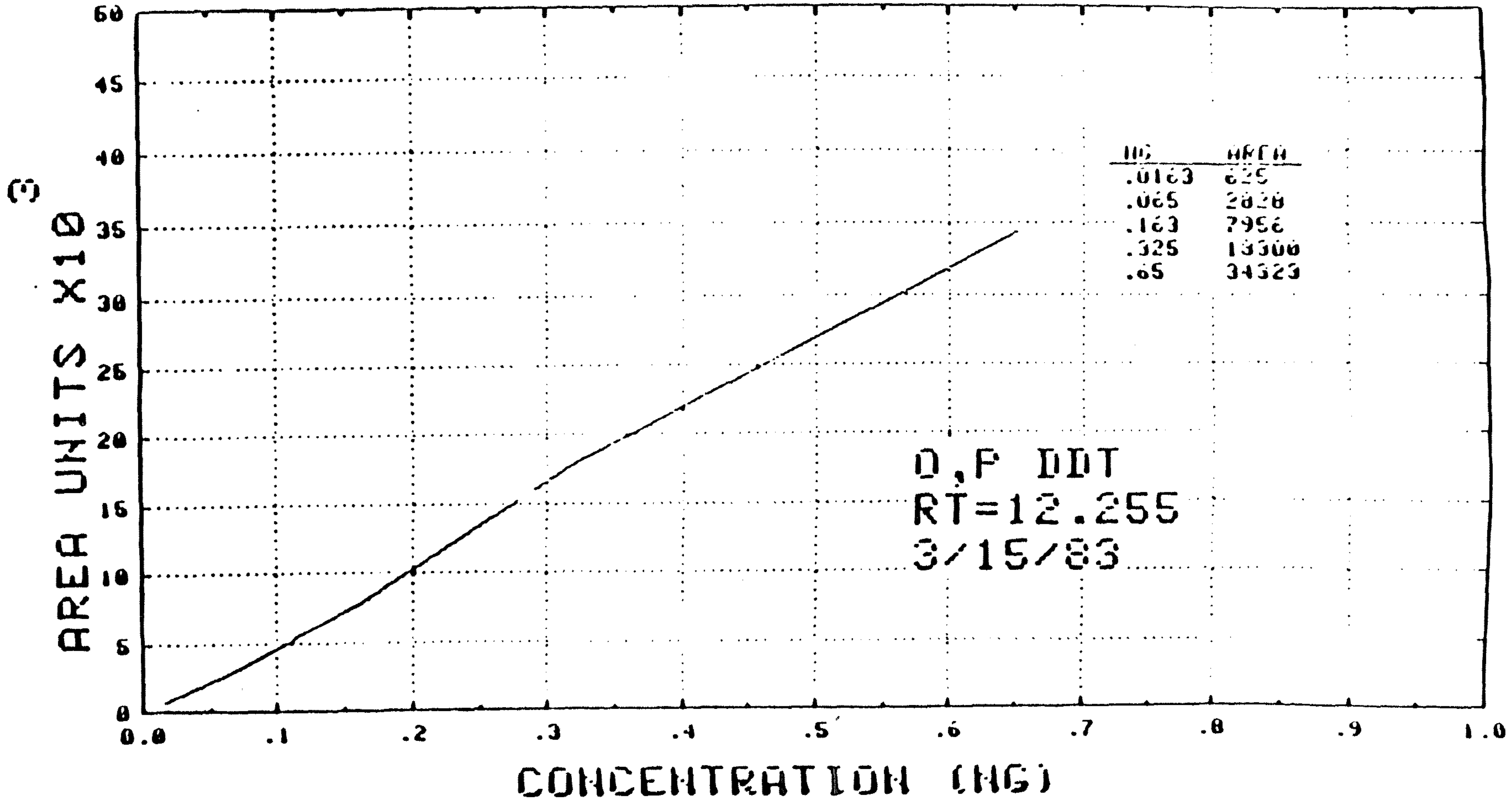

AREA UNITS X10 (3)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
0.0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
CONCENTRATION (NG)
NG AREA
.0163 1428
.065 5765
.163 14963
.325 32429
.65 61816
P,P DDD
RT=13.251
3/15/83

FIGURE A-7



NG	AREA
.0163	625
.065	2828
.163	7956
.325	13300
.65	34323

2.5.4 Gas Chromatography/Mass Spectrometry (GC/MS)

Regarding the analysis of base neutral, acid-phenolic and volatile priority pollutant or HSL compounds (and/or for pesticide/PCB confirmation), separate bound injection logs are again employed.

A bound injection log is maintained for each of Recra's six (6) GC/MS units and contains the following information:

- analysis date/time
- analyst
- computer file number
- sample I.D. and extract vial #
- job #
- injected volume
- extracted volume
- final volume and dilution
- column #
- injection port temperature
- GC temperature program
- run time
- column pressure
- EM volts
- multiplier setting
- internal standard retention time and % recovery
- surrogate retention time and % recovery

On each day of analysis, a standard curve is generated from which calibration factors are determined. Samples are searched for the characteristic ions of each compound of interest (as listed in the method) and if the ion's retention time and ratio meet the established EPA criteria, the compound is qualitatively identified and the concentration is calculated from the primary ion area. This same type of form is used for the evaluation of field blanks, method blanks and solvent blanks used in these analyses. The data is then reviewed relative to the appropriate quality control results for that set of data. Internal reporting forms are used for precision and accuracy data for the GC/MS analysis of the volatiles and/or base neutral, acid phenolic or pesticide/PCB determinations. Assuming that all data is determined to be acceptable by the GC/MS supervisor, the data is transmitted to the report preparation group for subsequent preparation and final review and report issuance by the laboratory director.

All raw data/forms are maintained for future reference. Files are maintained by client and job number. Sample chromatographs and raw spectra are stored on nine track magnetic tapes.

2.5.5 Reporting of Results

Each day that samples are received at the laboratory, a separate job number is assigned for a given batch of samples. If more than one matrix arrives, the matrices are separated and individual job numbers are assigned. For instance, if water samples and soil samples are received on a given day, two (2) individual job numbers will be assigned. Each report that is generated refers to one job number and its corresponding set of samples.

Each report will have a cover letter indicating the report date and the date samples were received. The job number is prominently displayed on the cover letter to facilitate communication should any questions arise. The report will contain data for all parameters requested as well as all applicable QC information.

All quality control data generated on the particular batch of samples will be reported as a part of Recra's submission with the data.

2.6 Internal Quality Control

2.6.1 General Control Measures

When discussing a quality assurance/quality control program, it is generally accepted that there are two distinct aspects of the program. Quality assurance consists of the system whereby the laboratory can assure clients, government agencies, accediting bodies, etc., that the laboratory is generating data of proven and known quality.

Quality control may be defined as those operations undertaken in the laboratory to ensure that the data produced are generated within known probability limits of accuracy and precision. Quality control information is presented in Sections 2.6.1 and 2.6.2.

2.6.1.1 Sample Containers

All sample containers provided to clients or used by Recra field personnel are properly cleaned for the appropriate trace analysis. All sample bottles utilized for sample splitting are subjected to the same cleaning procedures listed below:

- All polyethylene bottles (for inorganic analysis) are:

1. soap washed
2. tap water rinsed
3. nitric acid washed 25% v/v nitric acid/deionized water
4. rinsed with COPIUS quantities of deionized water (at least four rinsings)

- All glass bottles except volatile vials (for organic analysis) are:

1. soap washed
2. tap water rinsed
3. rinsed with acetone (pesticide grade)
4. rinsed with COPIUS quantities of deionized water (at least six rinsings and two complete fillings of bottle to overflowing).

- All volatile vials are:

1. soap washed
2. rinsed with COPIOUS quantities of deionized water (at least six rinsings)
3. thiosulfate added (two drops of 10% solution)
4. dried for ½ hour in a 103°C oven (without caps and septa)
5. cooled and capped with precleaned septa (soap washed and rinsed with deionized water, dried at 103°C for 1 hour).

All sample containers are discarded after their initial use to eliminate the possibility of contaminating samples. Volatile field blanks are provided on a routine basis to check for sample contamination in the field and during sample storage. All volatile vials contain sodium thiosulfate for quenching of chlorine unless specified otherwise by the client. Clients are discouraged from providing their own sampling containers due to the possibility of sample contamination.

2.6.1.2 Sample Identification

All samples received are logged into a central sample log. All information on the sample label is transcribed into this document.

2.6.1.3 Sample Preservation

All samples will be preserved according to USEPA procedures and cooled to 4°C prior to analysis.

2.6.1.4 Laboratory Reagent Quality

The quality of reagents used in conducting analytical determinations is continuously monitored by the laboratory staff.

All standards and reagents are prepared with chemicals that meet the American Chemical Society "Analytical Reagent Grade" standards. Special reagents are utilized for procedures which require purity beyond reagent grade. For example, we utilize nitric acid which is specially prepared to be low in trace metals as a preservation reagent.

All reagent solutions are labelled as to their contents, date prepared, and the analyst's initials. In addition to analyzing method blanks to check for reagent contamination, the reagents are continuously observed for signs of degradation, such as precipitation, change in color, or mold formation. Unstable reagents, such as various titrants are standardized each day they are used.

2.6.1.5 Laboratory Water

The laboratory water used for making reagents and rinsing of glassware is constantly monitored by an in-line meter to meet and exceed the electrical conductivity requirements of TYPE I water as described in the EPA Quality Control Handbook, March 1979, see Table A-3.

2.6.1.6 Solvents

All laboratory solvents utilized for sample extractions are pesticide grade. Solvents are checked for purity on a continuing basis for compounds which may interfere with the specific analysis being performed.

2.6.1.7 Gases

Gases used for chromatographic procedures are high purity or ultra high purity and are equipped with in-line scrubbers to remove trace constituents. These scrubbers take the form of oxygen traps, molecular sieves, and moisture traps. Each is useful for specific applications in gas chromatography. Various combinations of the above scrubbers are employed depending on the particular instrument requirements.

TABLE A-3

SECTION ON REAGENT WATER
EPA QUALITY CONTROL HANDBOOK, MARCH 1979

TABLE 2-2
REQUIREMENTS FOR REAGENT WATER

Grade of Water	Maximum Total Matter (mg/l)	Maximum Electrical Conductivity at 25°C (umhos/cm)	Resistivity at 25°C (M x cm)	pH at 25°C	Minimum Color Retention Time of $KMnO_4$ (min)
Type I	0.1	0.06	16.67	-	60
Type II	0.1	1.0	1.0	-	60
Type III	1.0	1.0	1.0	6.2-7.5	10
Type IV	2.0	5.0	0.2	5.0-8.0	10

2.6.1.8 Laboratory Glassware

Whenever possible, disposable glassware is employed to reduce the possibility of cross-contamination of samples. Glassware used for metals analyses is cleaned according to the following procedure:

1. Glassware is rinsed with a 1:1 nitric acid-water mixture
2. Thorough rinsing with tap water
3. Final rinsing is accomplished with copious quantities of deionized water

Organic glassware is cleaned according to the following procedure:

1. Rinsed with last solvent used
2. Rinsed with reagent grade acetone
3. Tap water rinsed
4. Detergent washed
5. Tap water rinsed
6. Nitric acid rinsed (25% solution)
7. Deionized water rinsed
8. Rinsed with reagent grade acetone
9. Rinsed with pesticide grade hexane

2.6.2 Specific Quality Control Procedures

The quality control program in effect at Recra Environmental Laboratories is based upon recommendations contained in the EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories (March 1979), 600/4-79-019.

There are two main criteria which must be met in order to evaluate the quality of generated data. The first criteria is that the data must be accurate. This is a measure of the correctness of the data. Accuracy is a measure of the ability of a laboratory to determine the true concentration of a constituent in a sample. The second criteria is precision. Precision is a measure of the reproducibility of the data. In order to assess the quality of data, both criteria must be defined. It is possible for a test to be precise and yet very inaccurate. Precision and accuracy charts are maintained for specific parameters as described in the EPA handbook.

2.6.2.1 Duplicates

A minimum of 10 percent of all samples analyzed by the laboratory are analyzed in duplicate. A duplicate analysis is performed for every set regardless of the number of samples/sets. This information indicates the precision or reproducability of the data generated and is expressed on a precision quality control chart.

The precision chart presented in Figure A-8 is typical of charts used to monitor laboratory precision and is based upon information presented in Section 6 of the EPA Handbook of Analytical Quality Control in Water and Wastewater Laboratories (March 1979), 600/5-79-019.

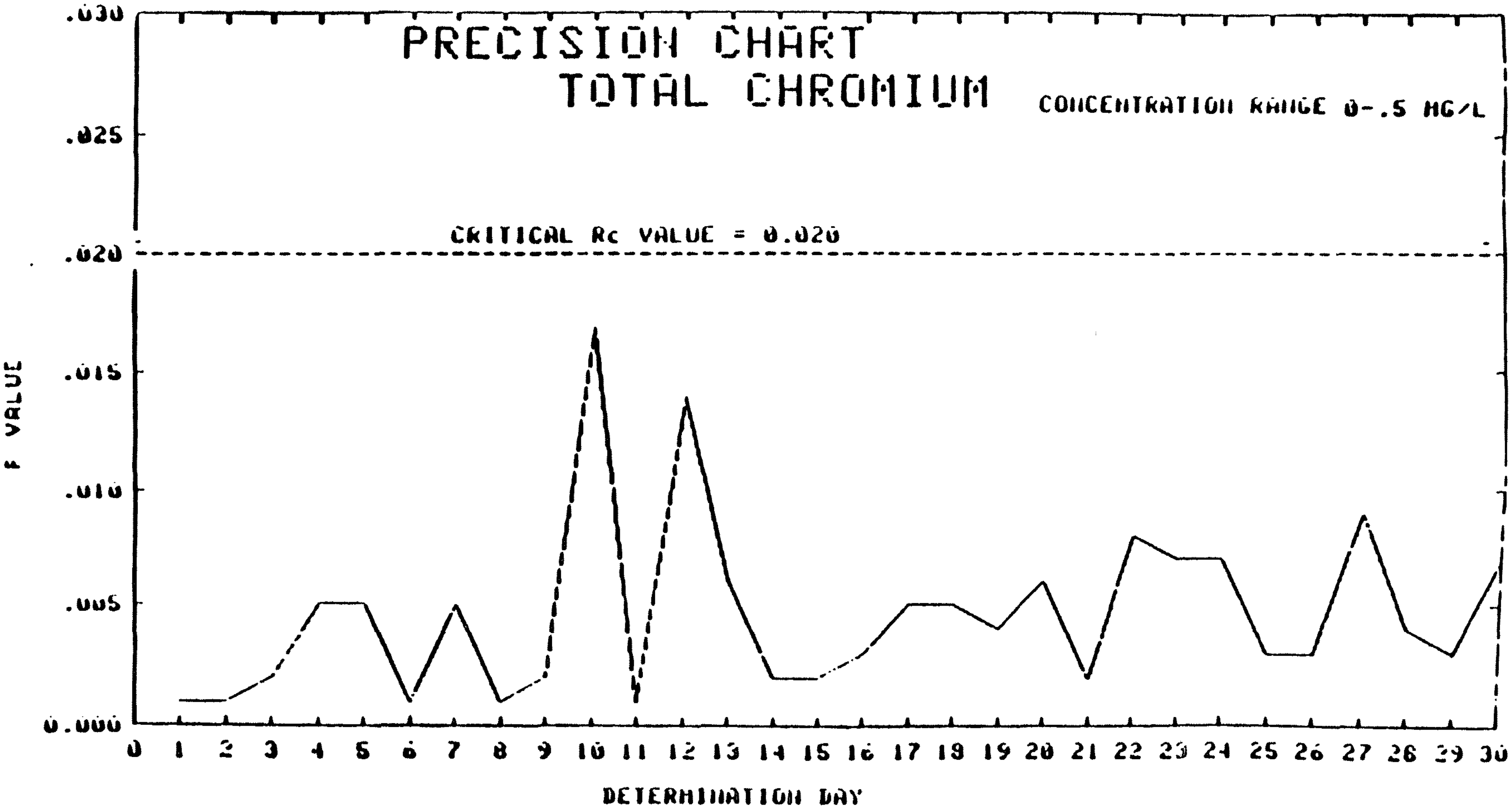
The Upper Control Limit (UCL) was calculated as follows:

$$\begin{aligned} UCL &= D_4 R \\ &= 3.27\ (0.006) \\ &= 0.0196 \end{aligned}$$

Where;

D_4 = Shewhart factor for ranges based upon duplicate analyses.
$\bar{R}$ = The mean range of multiple replicate determinations.

FIGURE A-8


PRECISION CHART
TOTAL CHROMIUM
CONCENTRATION RANGE 0-.5 MG/L
CRITICAL Rc VALUE = 0.020
F VALUE
.030
.025
.020
.015
.010
.005
0.000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
DETERMINATION DAY

The critical R value (R_c) is the upper control limit rounded off to an operationally feasible number; i.e. the R_c = 0.020. This R_c or critical R value is the maximum allowable difference between replicate determinations on a single sample in the 0-0.5 mg/l concentration range. The $\bar{R}$ value is plotted every day analyses are performed and the points are reviewed for trends. If an $\bar{R}$ value exceeds the R_c value, the data is invalid and the cause for such performance is investigated and corrected before analyses are resumed.

2.6.2.2 Known Constituent Addition (Spikes)

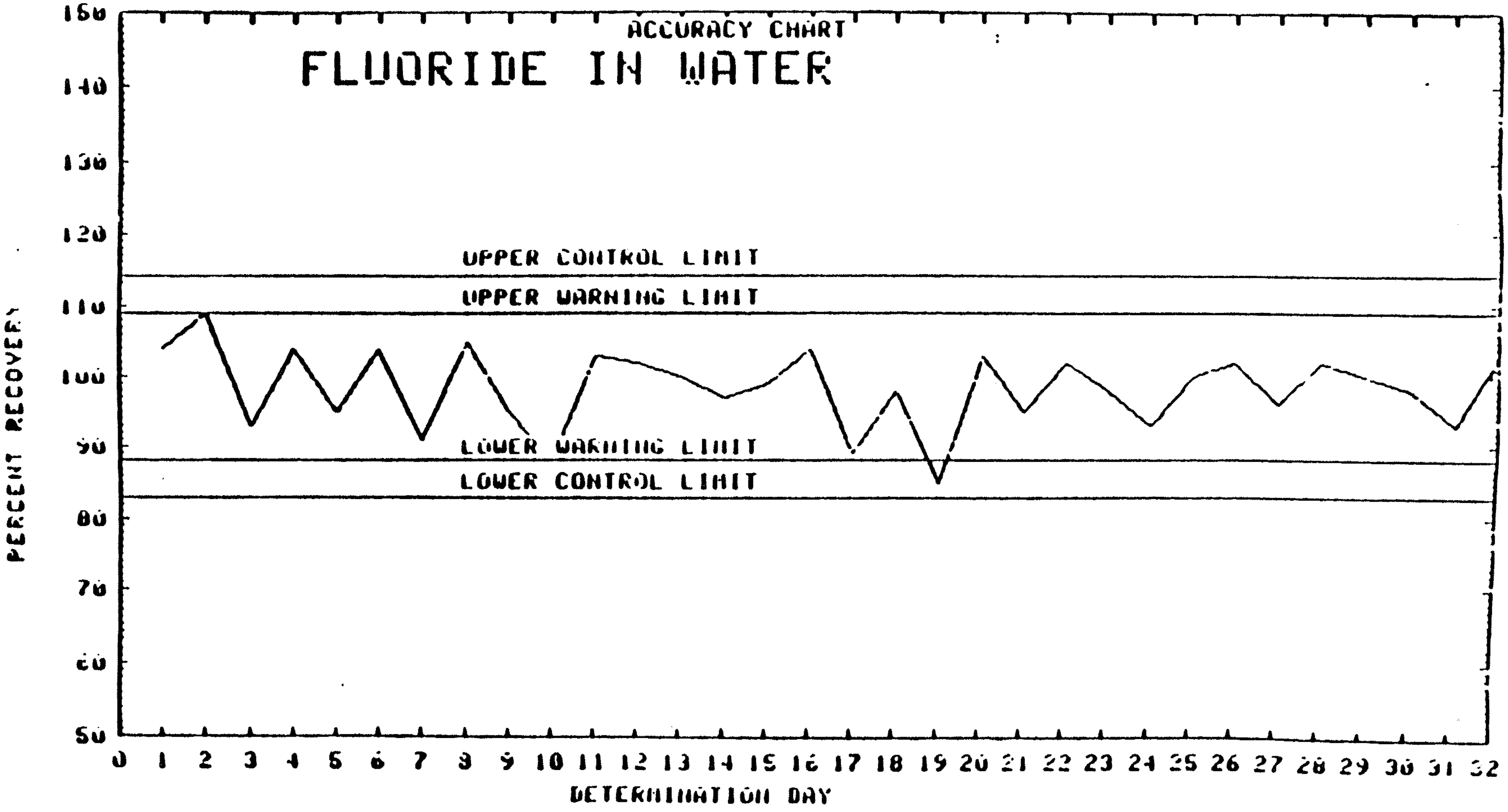
A minimum of 10 percent of all samples analyzed by the laboratory are spiked with known amounts of the compounds being analyzed. The amount of the compound recovered from the sample compared to the amount added is expressed as percent recovery. The percent recovery of an analyte is an indication of the accuracy of an analysis and is expressed on an accuracy chart. A spiked sample is determined on all sets of greater than five samples.

The accuracy chart presented in Figure A-9 was developed by determining the mean percent recovery of Fluoride in a series of typical water samples. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Spiked Sample - Background}}{\text{Known Value of Spike}} \times 100\%$$

The standard deviation of the recoveries was calculated utilizing the formula presented in Section 2.6.2.5. The upper and lower warning limits are set at plus and minus 2 standard deviation units. The upper and lower control limits are set at plus and minus 3 standard deviations.

FIGURE A-9


ACCURACY CHART
FLUORIDE IN WATER
UPPER CONTROL LIMIT
UPPER WARNING LIMIT
LOWER WARNING LIMIT
LOWER CONTROL LIMIT
PERCENT RECOVERY
150
140
130
120
110
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
DETERMINATION DAY

The acceptance criteria for this chart are as follows:

> The quality assurance value indicates acceptable analysis values when it falls between the lower warning limit (LWL) and the upper warning limit (UWL).
>
> If the quality control value falls between the control limit and warning limit (UCL and UWL or LCL and LWL), the analysis should be scrutinized as possibly out-of-control. The sample results are still acceptable at this point.
>
> If the quality control value falls outside the control limits (UCL or LCL), this indicates an out-of-control situation. The analysis must be stopped until the reason for the problem has been identified and resolved. After it has been corrected, the problem must be documented in the procedure book, with its solution noted.

2.6.2.3 Standard Reference Materials (SRM's)

Standard reference materials are independently supplied samples with known concentrations of selected parameters. They are often accompanied not only with a known value but an acceptable range for analytical results. Recra Environmental, Inc., maintains a full supply of available SRM's. An SRM value is determined with each set of samples regardless of the number of samples/sets. In cases where an independently supplied SRM is not available, one is prepared by the laboratory staff.

2.6.2.4 Blanks

An analyst must always be aware of the potential problems associated with contamination of glassware, reagents, solvents, etc. which are especially critical during trace level analyses. The method used to monitor these possible contamination problems is the analysis of blanks. There are generally three types of blanks that are routinely analyzed. The first is the method blank which consists of analyzing deionized water in exactly the same fashion as a sample. This type of blank points out problems, such as contaminated glassware and reagents. A method blank is performed with each set of analyses in the laboratory regardless of the number of samples in the set.

A second type of blank is a reagent/solvent blank which is utilized to check the purity of new batches or lots of reagents or solvents. This type of blank is performed as necessary.

The third blank is a field blank. This provides information on possible contamination of samples in the field during collection and/or transport.

2.6.2.5 Statistical Reporting

When quality control information is generated on a particular sample or set of samples, this information is reported in the final data report.

The precision data is a result of replicate determinations and is expressed as the percent coefficient of variation. The percent coefficient of variation is determined by the formula $\%C$ of $V = 100\ S/\bar{x}$ where S equals the standard deviation of the replicate determination and $\bar{x}$ equals the mean of the obtained values.

The mean $(\bar{x})$ and standard deviation (S) are calculated according to the formuli:

$$\text{Mean } (\bar{x}) = \frac{\text{Sum } X}{N}$$

$$\text{Standard Deviation } (S) = \frac{\text{Sum } (x-\bar{x})^2}{N-1}$$

Where N = number of values observed
x = value observed

The accuracy data is generated from spiking of samples with selected compounds or surrogates and is expressed as a percent recovery. The percent recovery is calculated by the formula, % Recovery = 100 x (Observed-Background/Spike), where observed equals the concentration of the sample after spiking, background is the concentration before spiking, and spike is the concentration of known material added to the sample.

2.7 Performance and System Audits

By NEIC definition, an audit is a systematic check to determine the quality of operation of some function or activity. Audits are further defined as being of two (2) basic types; performance and system audits.

A performance audit is one in which quantitative or qualitative data are independently obtained for comparison with routinely obtained data from a measurement system. Performance audits are completed at Recra Environmental, Inc., via a number of mechanisms including the New York State Department of Health laboratory certification program as well as the analysis of ERA check samples and EPA's quality assurance check sample program. The New York State Department of Health samples are analyzed for all drinking water parameters on a semi-annual basis. Recra

Environmental, Inc., is currently certified by the New York State Department of Health for all physical and chemical analyses of water and wastewater. In addition, the commercially available check samples and/or the EPA's check samples are processed through the laboratory on a frequency of at least monthly per department. The routine use of all available applicable SRM's also provides for a more or less continuous performance audit.

Systems audits, as opposed to performance audits, are strictly qualitative and consist of an on-site review of a laboratory's quality assurance system and physical facilities for calibration and measurement. System audits are routinely performed (approximately once per year) by the New York State Department of Health personnel as an element of our participation in their certification program. The New York State Department of Environmental Conservation has also audited our facility on occasions relative to our analytical services contracts and our New York State Superfund contract. Additionally, detailed internal audits are performed on a semi-annual basis by the laboratory director. Health and Safety audits are also performed by Recra's Safety Officer.

2.8 Preventative Maintenance

Preventative maintenance is performed contractually on the following laboratory equipment;

2.8.1 Mettler H31AR Analytical Balance

This balance is under a service agreement with the manufacturer to provide emergency service, preventive maintenance and calibration on an annual basis.

2.8.2 Hewlett Packard Model 5993B and 5993C (2 units) Gas Chromatograph /Mass Spectrometers

These systems are under service agreements with Hewlett Packard which covers all repair parts, extended parts, labor and travel, and three annual preventive maintenance service visits. These visits involve cleaning, adjusting, inspecting, and testing procedures designed to reduce product failure and/or extend useful product life. Between visits, routine operator maintenance and cleaning is performed according to manufacturer's specifications.

2.8.3 Finnigan Gas Chromatograph/Mass Spectrometer

The systems are under a service agreement with Finnigan Corporation which covers all repair parts, extended parts, labor and travel, and three annual preventive maintenance service visits. These visits involve cleaning, adjusting, inspecting, and testing procedures designed to reduce product failure and/or extend useful product life. Between visits, routine operator maintenance and cleaning is performed according to manufacturer's specifications.

2.8.4 Perkin-Elmer Atomic Absorption Spectrophotometer (Model 603 and 5000)

The 12-month emergency maintenance plan with Perkin-Elmer covering these system includes replacement parts required during emergency maintenance and all emergency maintenance visits. Routine operator maintenance and cleaning is performed by an experienced analyst or chemist according to manufacturer's specifications.

2.8.5 Hewlett Packard Gas Chromatographs (Models 5890, 5880, 5840, 5790)

These systems are under a service agreement with Hewlett Packard which covers all repair parts, extended parts, labor and travel, and three annual preventive maintenance service visits. These visits involve cleaning, adjusting, inspecting, and testing procedures designed to reduce product failure and/or extend useful product life. Between visits, routine operator maintenance and cleaning is performed according to manufacturer's specifications.

2.9 Data Quality Assessment

2.9.1 Overview of the Recra Quality Control Program

As a part of Recra Environmental, Inc.'s, routine quality assurance/ quality control program the following information is generated.

a.) Precision-in terms of percent coefficient of variance. This parameter is determined via replicate sample analysis on a frequency of once per sample set or one sample in ten (10%) whichever is greater (i.e., if one sample is received and analyzed that sample is duplicated, for 1 to 10 samples a randomly selected sample is duplicated, for 11 to 20 samples two (2) randomly selected samples are duplicated, etc.).

b.) Accuracy-in terms of percent recovery (recovery of known constituent additions or surrogate recoveries). This parameter is determined via analysis of spiked and unspiked samples. The general objective is to spike with such a quantity or to raise the sample concentration to 75% of the working analytical range. For large ongoing projects, it is often times most advantageous to perform the spiking of a random sample after the initial analysis has been completed. Recovery data is gathered in two (2) forms; relative recovery and absolute recovery. Relative recovery is based on spike added to actual samples while absolute recovery is based upon the spiking of laboratory water or solutions known to be free of the constituents of interest for the particular analysis being performed. The frequency of spiking for both absolute and relative recoveries is one per sample set (greater than 5 samples) or one sample in ten (10%) whichever is greater (i.e., the selection of relative recovery or absolute recovery is often based upon the volume of sample available for analysis. Generally, if greater than ten samples are received, a relative and an absolute recovery will be measured).

c.) With each set of samples (or a single sample) a method blank is prepared and analyzed. If field blanks are received (as is always the recommended situation with volatile organic analysis), this blank is processed as and reported as a sample. Additionally, solvent blanks are prepared as required, based upon method blank results and/or changes in solvent suppliers/lots. Unprocessed solvent blanks are continually analyzed on the GC and/or GC/MS as a routine control measure for these instruments.

d.) Standard Reference Materials (SRM's) are used for all applicable analyses. Sources of SRM's include the U.S. Environmental Protection Agency, commercially available material from ERA and/or laboratory produced solutions. SRM's, when available and appropriate, are processed and analyzed on a frequency of one per set of samples, regardless of the number of samples in a set.

e.) Stock and working standard solutions and separate spiking solutions are prepared from materials supplied by the U.S. Environmental Protection Agency repository or purchased from commercially available sources. Standard curves are generated daily for all organic procedures as opposed to simply verifying "working standard curves". Standard curves are produced once per working shift/day and/or are verified by re-analysis of mid-range standards at least every tenth sample. Standard curves for T-recoverable phenolics and cyanides are verified on a daily basis. Standard curves are also reviewed for consistency to help identify problems that could be associated with the applicable instruments and/or the standard solutions.

2.9.2 QA/QC Data Acquisition

2.9.2.1 Precision

Actual data relative to precision is based upon the coefficient of variance criteria and is calculated as follows:

$$\% \text{ C of V} = 100 \times \frac{S}{\bar{x}}$$

Where $\bar{x}$ = mean of replicate determinations

and S = standard deviation

Additionally, precision charts (R charts) are maintained for applicable parameters or surrogates. The precision chart previously presented in Figure 8 is typical of charts used to monitor laboratory precision.

2.9.2.2 Accuracy

The percent recovery of an analyte is an indication of the accuracy of an analysis and is expressed on an accuracy chart. The previously presented accuracy chart (Figure 9) was developed by determining the mean percent recovery of Fluoride in a series of typical water samples.

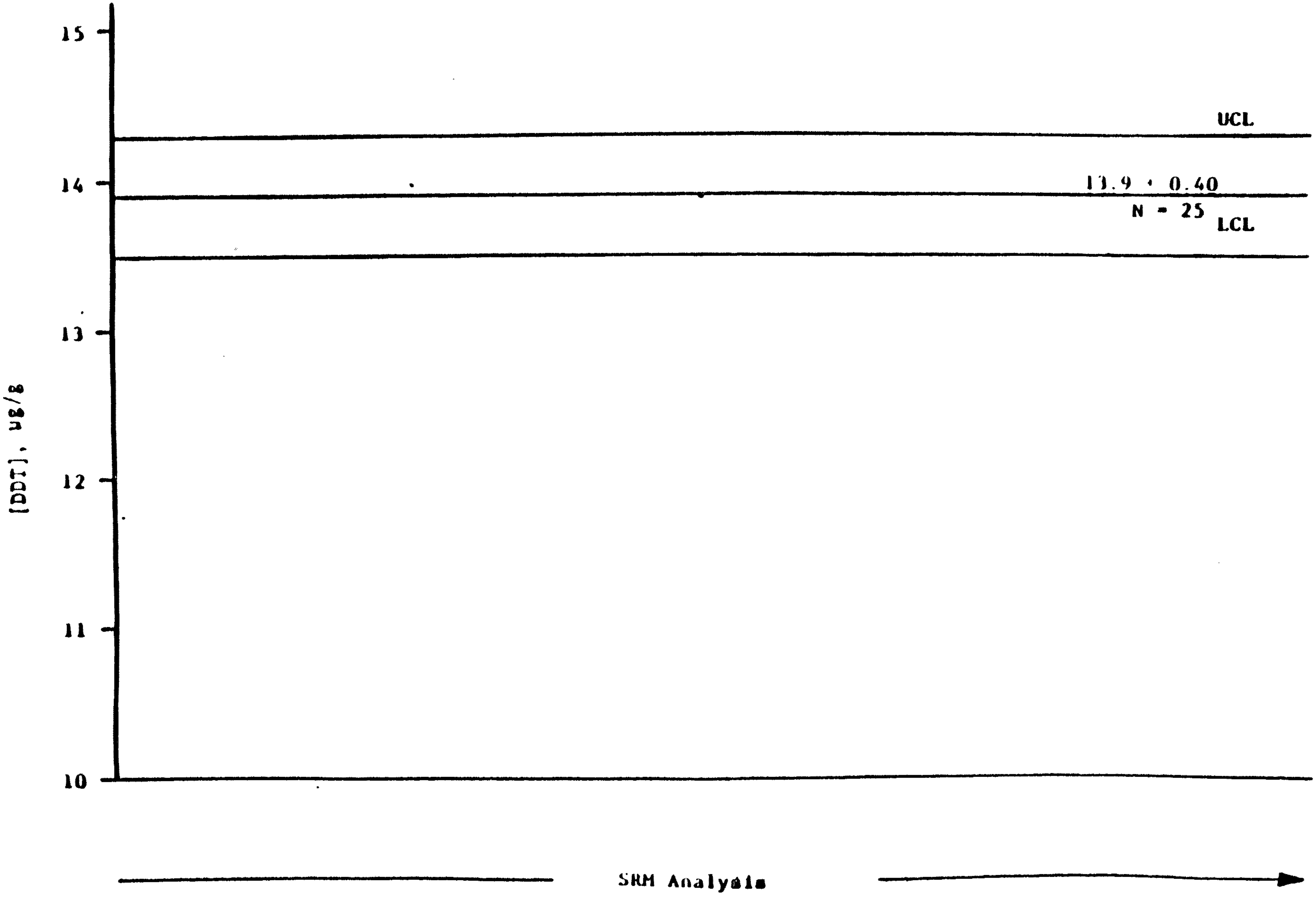
The standard deviation of the recoveries are calculated utilizing the previously mentioned formuli.

The upper and lower warning limits are set at plus and minus 2 standard deviation units. The upper and lower control limits are set at plus and minus 3 standard deviation units.

2.9.2.3 Standard Reference Materials (SRM's)

As previously noted, SRM's are used wherever possible. U.S. Environmental Protection Agency and commercially available SRM's are generally received with a known concentration and 95% confidence interval. Control charts for these types of materials are constructed using the known concentration ± the 95% confidence limits as upper and lower control limits. On SRM's prepared by Recra Environmental Laboratories the materials are analyzed at least 20 times and the mean and confidence levels are calculated prior to construction of the SRM control chart in the same fashion as presented above. Figure A-10 illustrates an SRM control chart for total DDT (sum of o,p'-DDE; p,p'-DDE; o,p'-DDD; p,p'-DDD, o,p'DDT and p,p'-DDT) currently being used for QA/QC purposes relative to an on-going analytical project.

QUALITY CONTROL CHART
STANDARD REFERENCE MATERIAL
SEDIMENT
DDT
SRM MEAN; 95% CONFIDENCE INTERVAL



2.9.3 QA/QC DATA REVIEW

2.9.3.1 Initial Review (analyst, supervisor)

As has been previously described, the initial review of sample and QA/QC data is performed by the analysts and their immediate supervisor.

This initial review process begins with the standards; their response factors (either absorbance or area units), retention times (for GC, GC/MS), curve linearity, and both short and long-term consistency of the response factors. These considerations allow for the assessment of instrumental conditions as well as the integrity of the actual stock and/or working standard solutions. For the GC and/or GC/MS data, the next step in the assessment process is to review the retention time match between standard and sample chromatographs as well as the comparability of sample and standard/library mass spectra for GC/MS data. This step of the process can also employ the review of peak geometry and peak integration techniques. Finally, within this initial review, the analyst will determine whether or not possible sample and/or background interference as a function of method, field and/or solvent blanks, exists within the analyses reported. Apparent deviations from established controls and/or warning limits are at least initially defined during this review phase.

2.9.3.2 Secondary Review (Project Manager, QA/QC Manager)

The Project Manager and QA/QC Manager further review the data relative to the above variables as required and continue the assessment process by reviewing the calculated values, duplicate results (relative to % C of V and the established control charts), percent relative and/or absolute recoveries (based upon established limits and control charts), SRM results when available relative to the actual recovered concentrations and the established control charts. It is during this process that a final assessment of completeness is also made. Completeness, by definition, is a measure of the amount of valid data obtained from a measurement system compared to the amount that would be expected to be obtained under correct normal conditions. As an example, the determination of volatile priority pollutants involves the addition of three (3) surrogate compounds to every sample undergoing analysis. The analysis would be considered valid in the completeness category if three of the three surrogates met the acceptance criteria.

The Project Manager and QA/QC manager then decides as to the overall quality of the data. If necessary, because of the circumstances surrounding the particular analysis of a given sample or set of samples, the laboratory director will also participate in this decision process.

2.9.3.3 Final QA/QC Review and Evaluation/Decision Process

Assuming that the completeness test, where appropriate, is successful a number of data quality scenarios can present themselves. These scenarios and Recra's decision processes relative to these situations are outlined below.

a.) If precision, accuracy and SRM (if available) data are all within the established warning limits; proceed with final issuance of data report including all QA/QC results.

b.) If precision, accuracy and SRM (if available) are within control limits but one or all of these parameters exceed the warning limits, the source(s) of bias/error needs to be evaluated, but proceed with final issuance of data report including all QA/QC results, and the results of the evaluation of bias/error as part of the report.

Source of error/bias may be found in the following:

- calculation errors
- transcription errors
- sample matrix (i.e., high suspended solids in water sample; oily sediment, etc.)
- sample homogenity
- level of contaminant measured (validity of the precision measurement is a factor of concentration)
- analyst error (warning/control limits exceeded for one analyst more frequently than another)

- o appropriateness of method(s) based upon sample type (wastewater as opposed to drinking water)

c.) If precision, accuracy and/or SRM (if available) are out of control, one of the following approaches to the problem will be used:

1.) SRM out-of-control whether or not precision or accuracy are controlled; method based errors are suggested and all data is suspect. If SRM is verified as out of control (i.e., standards are checked, etc.), all samples should be re-analyzed or data reported as out of control if no additional sample available or cannot be obtained.

2.) SRM (if available) is in control but absolute recovery is out of control; method based error is suspected. If standards and spiking solutions are verified to be accurate as independent solutions, all data is suspect until reprocessing and re-analysis of absolute recovery sample is completed to prove only random error. If systematic error (constant out of control absolute recovery) is found, all samples require re-analysis after corrective action has been taken.

3.) SRM (if available), absolute recovery and precision are in control but relative recovery is out of control; matrix problem likely. Proceed to issue data report with appropriate qualifications as to possible matrix effects.

4.) SRM (if available), absolute recovery and relative recovery are in control but precision is out of control; matrix problem likely in the form of sample heterogenity. If sample appears homogeneous, re-analyze; if data still out of control, issue data report with qualifications. If, on the other hand, data are in control, analyst error is suspected and all data in this sample set must be re-analyzed.

5.) SRM and absolute recovery are under control but both relative recovery and precision are out of control; matrix effects, sample homogenity problems and/or analyst error are suspected. If after re-analysis of a well-mixed homogeneous sample by different analyst(s) is still out of control, issue the data report and state data is out of control based upon sample matrix effects. If after re-analysis relative recovery is within control limits but precision is still uncontrolled, issue the data report and advise of potential errors relative to heterogenity of sample. If, in the last possible case, re-analysis indicates adequate precision but uncontrolled relative recovery, issue the final data report and again advise of possible sample matrix effects on this data.

2.10 Corrective Action

If a particular analysis is deemed "out-of-control" corrective action must be taken to insure continued data quality.

Precision limits are defined by a percent coefficient of variation which, when exceeded, indicates unacceptable analytical performance. Accuracy limits are expressed in percent recovery of spiked material. A recovery below or above the set criteria indicates a need for corrective action.

The following presents a number of corrective actions which may be employed, depending upon the particular situations.

a.) Calculations are rechecked.

b.) Sample handling, i.e. digestion, concentration, and/or extraction logs are checked for discrepancies in sample handling.

c.) Analyte concentration is reviewed to determine if it has severely influenced the reliability of the precision or recovery calculations.

d.) Instrument and method peformance is verified by inspecting data on standard reference materials processed in the same data set.

e.) Quality control data on the other samples in the data set, including surrogate recovery, internal standards, etc., are reviewed to determine if the problem is method related or sample related.

f.) If original sample is available, the sample is assessed for homogenity.

g.) If sample is unavailable and no explanation for poor quality control results can be determined, the client is notified and additional sample is obtained. If additional sample is unavailable, the results are issued with a qualification as to their accuracy.

The coordinator of each analytical section is responsible for initiating corrective action when necessary. The laboratory operation's manager is responsible for approving the appropriate corrective action.

2.11 Quality Assurance Reports

Quality assurance reports are a mechanism whereby management receives periodic information on the performance of the laboratory and subsequent data quality.

The internal program consists of laboratory supervisors and project managers reporting on the QA/QC performance to the laboratory QA/QC manager on a per sampling event basis. The laboratory operations manager, in turn, reports to the laboratory director/general manager on the same frequency.

Information which is contained in the Quality Assurance reports consists of the following:

- assessment of measurement data accuracy, precision and completeness
- results of the performance and systems audits
- report of significant QA problems and recommended/implemented solutions

FIGURE A-3

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

ROJECT NO.

SITE NAME

AMPLERS (SIGNATURE):

TATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS								REMARKS

ELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
ELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
ELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS:	

Distribution: Original accompanies shipment; copy to coordinator field files

APPENDIX K

BOREHOLE

BACKFILLING AND GROUTING PROCEDURE

BOREHOLE
BACKFILLING AND GROUTING PROCEDURE

GENERAL

Boreholes that are not completed with a monitoring well or that are drilled only for the purpose of obtaining subsurface geological information must be backfilled prior to abandonment to prevent the possibility of down hole contamination. The backfilling process is accomplished by pumping a cement/ bentonite slurry (grout) down the borehole, filling it from bottom to ground surface. Upon curring, the grout will act as a protective seal preventing downward migration of contaminants.

DETERMINATION OF HEALTH AND SAFETY REQUIREMENTS

The site-specific Health and Safety Plan must be consulted before drilling and backfilling (if necessary) is initiated to insure that the requirements for personnel protection are met.

MATERIALS NEEDED

1. Portland Cement Type I
2. Bentonite Powder or crushed pellets
3. Potable water
4. Tremi pipe
5. High-capacity pump on drill rig

PROCEDURES

1. Varied proportions of Portland cement (40-60%), potable water (40-60%), and bentonite clay (2 to 3%) are used to backfill the borehole. The grout is mixed in a 55-gallon drum or a mud box using a high-pressure pump on a drill rig by placing both the intake and discharge hoses of the pump in the mixing container. This method allows a more uniform grout to be generated.

2. With the augers still in the borehole, a tremi pipe is lowered down the annulus of the hollow stem with one end connected to the high-capacity pump.

3. The pump draws the premixed grout from the mixing container and pumps the grout down the borehole through the tremi pipe. The rapid introduction of grout down the borehole by pumping reduces the change of leaving voids in the grout.

4. The level of the grout slurry should be continuously checked during pumping using a weighted tape. The augers and tremi pipe are pulled as the slurry rises with the bottom of both approximately one foot below the upper surface of the grout.

APPENDIX B.2

CHRONOLOGICAL LISTING OF MODIFICATIONS TO WORK PLAN/QUALITY ASSURANCE PLAN

New York State Department of Environmental Conservation
600 Delaware Avenue, Buffalo, NY 14202-1073

Thomas C. Jorling
Commissioner

April 21, 1988

Mr. David Sauer
Buffalo Color Corporation
P.O. Box 7027
Buffalo, NY 14240-7027

Re: Buffalo Color Plant "D" Area
RI/FS

Dear Mr. Sauer:

Buffalo Color's request to perform the terrain conductivity survey, as described in the February 1988 Work Plan for the Plant "D" Area, on an "as soon as possible" basis is acceptable to the Department under the following conditions.

1. The survey will be carried out as it is described in Task #2 of the RI/FS Work Plan dated February 1988 and no other tasks will be performed.
2. In the process of revising the Work Plan into its final form, that no changes be made in Task #2 unless mutually agreed upon by Buffalo Color and the Department of Environmental Conservation.
3. Buffalo Color will notify the Department at least 5 working days before the field work for the survey is to begin.

If you have any questions regarding these conditions, contact this office as soon as possible.

Very truly yours,

John L. Krajewski

John L. Krajewski
Senior Engineering Geologist
Division of Environmental
Enforcement

JLK/mf

4.3.5.17

cc: S. Mittel - DEC, Albany
J. Tygert - DEC, Region 9
M. Rivara - NYDOH, Albany
L. Rusin - NYDOH, Buffalo

New York State Department of Environmental Conservation
600 Delaware Avenue, Buffalo, NY 14202-1073

Thomas C. Jorling
Commissioner

May 10, 1988

Mr. David Sauer
Buffalo Color Corporation
P.O. Box 7027
Buffalo, NY 14240-7027

Re: Plant "D" Area RI/FS

Dear Mr. Sauer:

Attached to this letter are the comments pertaining to the April 1988 revised work plan for the Plant "D" Area Remedial Investigation/Feasibility Study. If Buffalo Color agrees with these comments and the appropriate changes are made in the text, then the work plan will be acceptable to the Department.

Work may proceed at the site before the text is corrected, but the corrected pages and any addendums must be submitted to the Department no later than May 18, 1988. However, the work performed must also be in compliance with the agreed upon revisions.

If you have any questions relating to this letter, do not hesitate to contact me at 716-847-4582.

Very truly yours,

John L. Krajewski

John L. Krajewski
Senior Engineering Geologist
Division of Environmental
Enforcement

JLK/mf

Attachment

cc: K. Bainbridge
Malcolm Pirnie

J. Tygert - DEC, Region 9
C. Allen - DEC, Albany

Mr. James Schutt
Allied-Signal, Inc.
P.O. Box 1129R
Morristown, NJ 07960

COMMENT LIST

1. EPA recommends the use of ice cubes for cooling samples in the field and in transit to the laboratory. Blue ice packs should not be used.

2. Trip blanks should be analyzed for VOA's only. Total organic carbon and metals analysis on trip blanks should be dropped.

3. The laboratory must comply with 1987 NYS CLP what are they protocols and deliverables. Only the EPA CLP is referenced in the work plan.

4. In addition the enclosed seven (7) forms need to be completed as part of the deliverables package.

5. Analytical cleanups are mandatory, when needed.

6. Approval for deviations from the 1987 NYS CLP protocols must be documented and permission granted for the use of these deviations by the QA/QC officer, John Rankin, in the Albany office of the NYS Department of Environmental Conservation.

7. VOA water samples should be analyzed within seven (7) days rather than the ten (10) cited in Note 1 of Table 2-7.

8. Backfilling piezometers and monitoring wells with grout must be done with a tremie tube. Appendix K only describes the backfilling of abandoned bore holes.

9. On page 2-3 of the April 1988 work plan, the last sentence in the last paragraph should read "The ultimate disposal of these spoils will be executed in accordance with NYS Department of Environmental Conservation regulations."

10. In section 2.3.8.2 of the April 1988 work plan, it must be stated that the sampling dates will be mutually agreed upon by the representatives of Buffalo Color and the NYS Department of Environmental Conservation.

11. Benzidine must be included in the list of base/neutral extractable priority pollutants listed in Tables 2-1 and 2-5 of the work plan.

12. On page A-21 of Appendix A of the work plan the frequency of air monitoring must be indicated.

13. In Appendix C of the work plan, it must state that any NAPL sampled will be chemically identified and analyzed for the list of groundwater analytes.

14. It must state in the work plan that return water from any rotary drilling that might be necessary must be collected in

drums. Appendix C in the work plan must state that purge water from the sampling procedures will be collected in drums and disposed of according to NYS Department of Environmental Conservation regulations.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

Customer Sample Code	Laboratory Sample Code	Analytical Requirements*					
		*VOA GC/MS	*BNA GC/MS	*VOA GC	*PEST PCB	*METALS	*OTHER

* Check Appropriate Boxes

* CLP, Non-CLP
* HSL, Priority Pollutant

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

July 15, 1988

Mr. Shive Mittal
Senior Project Engineer
Western Remedial Action Section B
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001

Re: Buffalo Color Area "D" RI/FS
Borehole Sampling Procedure

Dear Mr. Mittal:

The Work Plan for the subject RI/FS states in Section 2.3.4.1 that continuous split-spoon soil samples will be collected at each borehole. The purpose of this letter is to formally document Malcolm Pirnie's request to use standard sampling [split-spoon samples taken every five (5) feet] within the uniform silty clay layer. The silty clay layer was encountered at approximately the same elevation across the entire site, with a constant thickness of 30 feet, verified by deep borings MW-1-88, MW-7-88, B-5-88, and B-3-88.

It is my understanding, based on my telecom with Marty Doster (NYSDEC) of 6/9/88, that this is acceptable given that continuous sampling resumes beyond the silty clay layer.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Project Manager
Senior Environmental Scientist

dtg

c: Walt Manijak, Buffalo Color
Martin Doster, NYSDEC
Paul Werthman, MPI
File: C-1

1115-03-1

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

July 15, 1988

Mr. Shive Mittal
Senior Project Engineer
Western Remedial Action Section B
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001

Re: Buffalo Color Area "D" RI/FS
Cleaning of Split-spoon Sampler in NAPL Saturated Strata

Dear Mr. Mittal:

The Work Plan for the subject RI/FS states in Section 2.3.4.1 that the split-spoon sampler will be thoroughly cleaned prior to obtaining a new sample at depth. The purpose of this letter is to formally document Malcolm Pirnie's request to thoroughly clean the split-spoon sampler every ten (10) feet in NAPL saturated strata.

It is my understanding, based on my telecom with Marty Doster (NYSDEC) on 5/16/88, that this change is acceptable given that the spoons will be thoroughly cleaned at the end of this 10-foot interval. It has been previously agreed that all borings made through NAPL saturated strata will be terminated in the silty clay confining layer that underlies the site in order to prevent downhole migration of contaminants.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Project Manager
Senior Environmental Scientist

dtg

c: Walt Manijak, Buffalo Color
Martin Doster, NYSDEC
Paul Werthman, MPI
File: C-1

1115-03-1

S. 3515 ABBOTT ROAD P.O. BOX 1938 BUFFALO, NY 14219 716-828-1300 TELEX 137364

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

July 15, 1988

Mr. Shive Mittal
Senior Project Engineer
Western Remedial Action Section B
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001

Re: Buffalo Color Area "D" RI/FS
MW-1-88 Bentonite Pellet Seal Installation

Dear Mr. Mittal:

The Work Plan for the subject RI/FS states in Section 2.3.5.2 that a minimum four-foot bentonite pellet seal will be installed above the sand pack during monitoring well installation. A modification of this planned design was required at one (1) deep well due to problems encountered, as explained below. This modification was necessary to insure the integrity of the bentonite seal installed.

During the installation of deep monitoring well MW-1-88, a problem arose during the installation of the bentonite-pellet seal. Water and clay inside the hollow-stem augers caused the bentonite pellets to stick to the inner wall of the augers creating bridging problems during placement of bentonite pellet seal. A 2-foot seal was obtained after 14 hours of well installation. A bentonite slurry was then pumped down the borehole above the bentonite pellets. The final seal for the monitoring well consisted of 2 feet of bentonite pellets and 6 feet of bentonite slurry completing an 8-foot seal. The slurry was allowed to set approximately 30 minutes before the remainder of the borehole was cement-grouted to ground surface in accordance with the grouting procedures in Appendix K of the Work Plan dated February 1988, as revised April 1988.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Project Manager
Senior Environmental Scientist

c: Walt Manijak, Buffalo Color
Martin Doster, NYSDEC
Paul Wethman, MPI
File: C-1

S. 3515 ABBOTT ROAD P.O. BOX 1938 BUFFALO, NY 14219 716-828-1300 TELEX 137364

To: R. Frappa

From: W. Manijak

August 10, 1988

Area "D" RI/FS
Analytical Sampling Parameters - Round #2
Week of 8/15/88

This memo is to verify our telecom of 8/9/88.

After discussions with S. Mittal and M. Doster of the NYDEC, BCC agreed to sample for the following compounds which are in addition to the priority pollutant lists.

A. Metals

1. Aluminum
2. Barium
3. Iron
4. Magnesium
5. Manganese

B. Organics from Target Compound List (TCL)

1. Aniline
2. N-Nitrosodiphenylaniline
3. Acetone
4. ~~2-Butanol~~ (MEK) 2-Butanone
5. Xylene

C. Other Peaks Identified

1. Isomers of Ethylmethylbenzene
2. Isomers of Methylchlorobenzene
3. Propylbenzene
4. 1,2,3,4 Tetrahydro-2-Methyl Naphthalene

Since specific isomers of ethylmethylbenzene and methyl chlorobenzene were not identified only a quantitative approximation of these isomers is required.

If there are any questions, please contact myself or David Sauer @ 827-4708/4525.

Sincerely,

Walter Manijak

Walter Manijak

C: D. Sauer (BCC)
M. Doster (NYDEC - Region 9)
S. Mittal (NYDEC - Albany)
K. Bainbridge (Malcolm-Pirnie)

August 16, 1988

To: Kent Bainbridge

From: Walt Manijak

Area "D" Sampling Parameters

2nd Round

This is to confirm our telecom regarding the sampling parameters for round 2. In the memo dated August 10, 1988, the chemical 2-butanol should be changed to 2-Butanone (MEK).

Walt

Walt Manijak

C: R. Frappa
D. Sauer
S. Mittel (NYDEC)
M. Doster

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS. SCIENTISTS & PLANNERS

October 13, 1988

Mr. Walt Manijak
Buffalo Color Corporation
P.O. Box 7027
Buffalo, New York 14240-7027

Re: Remaining Remedial Investigation
Field Activities at the Area "D"

Dear Mr. Manijak:

The purpose of this letter is to address modifications to the subject field activities that have been proposed by the New York State Department of Environmental Conservation (NYSDEC). As originally conceived and presented in Buffalo Color's Order on Consent and the approved RI Work Plan, these remaining activities involved the collection of twenty (20) surficial (i.e., maximum depth of 2 feet) soil samples. Our comments based on a review of the NYSDEC's proposal are presented below. A counter-proposal, based on our evaluation of the data needed to properly assess the site, is also presented.

BACKGROUND

To place this discussion of proposed field program modifications into perspective, it is essential to define the desired objective of the remaining field work. The twenty (20) surficial soil samples were originally to be collected to define the extent of contamination at the site and to provide data for a risk assessment. This approach apparently was based on the expectation that much of the contaminated soils at the site existed at the surface.

Work completed to-date during the present RI indicates that contamination starts at a depth of 6-8 feet over most of the site. Little near surface contamination was evident except around the location of the former incinerator. The collection and analysis of some surficial soil samples is needed to verify this finding. However, the NYSDEC has proposed a modification of analytical parameters.

One of the principal suppositions used by the NYSDEC as a basis for their proposed modifications (see attached) was that soil samples exhibiting a high EOX and little or no semivolatiles (SV) was evidence for the presence of volatiles. Therefore, NYSDEC has proposed that a number of additional shallow borings be made to collect soil samples for volatiles analysis. Presumably, the objective of this sampling would be to characterize the volatile organic contaminants NYSDEC suspected to be present. However, this approach is not technically supported on the basis of all the information now available. The reasons for this conclusion follow:

1. The absence of HSL SVs and presence of high EOX does not necessarily mean volatiles are present. This result may only indicate that non-HSL SVs are present. (Only the EPA HSL SVs were analyzed for during this program.) The HNu readings provide a more reliable indication of the presence of volatiles than EOX. When the HNu data is reviewed, it is apparent that HNu readings of zero (0) were obtained at many of the locations found to have high EOX, but no HSL SVs.

2. Based on a review of the boring logs, it is evident that the samples exhibiting elevated HNu readings were obtained from depths of 14-25 feet below ground surface. These depths equate to just at or below the saturated zone. (The only exception to this was the elevated HNu readings obtained from samples collected near the former incinerator site.) Consequently, except near the incinerator site, the volatile contaminants present occur primarily at depth. Therefore, the ground water monitoring data will provide the best indication of the character of volatile organics present.

3. The ground water data for the first round of monitoring is now available. This data does identify specific volatile organic substances to be present in wells that exhibited elevated HNu readings during installation.

In summary, the volatile organic contaminants occur primarily within the saturated zone and, consequently, the ground water monitoring data will adequately characterize this contamination. Further, soil borings are not needed for this purpose.

The ground water data will also provide the most useful information relative to the mobility of metal contaminants present at the site. Analysis of soil samples for EP Tox will provide little useful information in this regard (i.e., this leach test will be of no use in calculating the loading of metals to the Buffalo River).

Based on the above discussion, we believe that the focus of the remaining RI field activities should aid in our clarification of the pathways of off-site contaminant migration. The data gaps which need to be addressed to accomplish this objective are discussed in the next section.

FURTHER ASSESSMENT OF CONTAMINANT MIGRATION PATHWAYS

The two principal pathways of off-site migration of contaminants from the Area "D" are via ground water and erosion into the Buffalo River. Erosion may occur as a result of both river scour and wind erosion. Ground water contaminants may migrate in a dissolved/dispersed form at the water table interface (i.e., lighter than water) and/or at the bottom of the saturated zone at the confining layer interface (i.e., more dense than water).

The ground water monitoring and soil boring data collected to-date will be used to assess the migration pathways identified above. However, based on our understanding of site characteristics that has evolved during the present on-going RI, a number of data - gaps can be identified. These are summarized below:

1. The soil samples collected during the RI were composites of various depth intervals. The analyses of these samples indicates that only PAHs and/or other insoluble hazardous substances are present in much of the southeastern to northeastern area of the site. Ground water samples in the same area verify the absence of mobile contaminants. Therefore, the principal pathway of off-site migration of these substances would be surface erosion. Surficial soil samples are needed in this area to assess the potential for erosion transport since the composite samples collected previously do not identify the extent to which contaminants occur at the surface. Specific data requirements are summarized in Figure 1 and Table 1.

2. Figure 1 and Table 1 also identify the locations of additional surficial soil samples needed to determine the character and extent of contaminants present at the surface subject to erosion. The surficial soils data is also needed for risk assessment purposes.

3. The NYSDEC has suggested that the collection of surficial soil samples should focus on the Area "D" shoreline. It is our understanding that the objective of sampling the shoreline area would be to characterize the soils/fill material most subject to erosion over the near term.

   On October 7, 1988, Malcolm Pirnie scientists surveyed the shoreline of the shoreline of the Area "D" to assess appropriate sampling locations. On the basis of this survey, we feel that the collection of surficial soil samples from the bank or rivers edge of the Area "D" is generally either not feasible or technically desirable. Practical limitations include the fact that the bank is very steep, almost a straight drop in many areas, and covered over much of its area by large pieces of broken concrete.

   Technical considerations lead us to conclude that soil boring samples already collected will be more useful for assessing contaminant loading to the river via erosion than surficial samples collected near the shoreline. The soils that are exposed along the bank are subject to weathering (i.e., leaching, etc.) and consequently, any surficial samples of these soils likely would not be representative of the total contaminant load being transported into the river over the long term. Conversely, the soil boring samples collected around the perimeter of the site provide a truer representation of the contaminated soils subject to off-site migration by erosion for three reasons. First, these samples have not been exposed to weathering for unknown periods of time. Second, these samples represent a vertical profile of the entire depth of fill material subject to erosion. Third, it is certain that the hazardous substances in the soil boring samples are from the Area "D" while the origin of any such substances in samples collected at the river's edge is subject to question due to the possibility of transport via the river from an upstream source.

4. During the survey of the Area "D" shoreline (see preceding item #3) on October 7, 1988, deposits of a tar-like substance were observed at several locations. In each instance this material was observed, it was located at the river's edge. Based on a reading of the staff gauges installed during the RI, the river level had dropped by approximately 6 inches since the last site activities (i.e., end of June) to the lowest level observed during the RI. The receding water line has resulted in exposure of the tar-like material which is located in areas that were under water during RI activities conducted during May and June.

   All of the tar-like material observed is located at the water's edge along the Area "D" shoreline. None was observed above the water line on the bank and none was encountered during the RI soil boring program. These factors make it impossible to identify the source of this material. Given the mode of occurrence of this material, it is possible that it could have been transported via the river from an upstream source.

   The tar-like material has a strong organic odor and when disturbed, it released substances that formed an oily sheen on the water. Based on these observations, it is evident that this material is a source of contaminants to the river. To further investigate this material, we recommend that two samples be collected and analyzed. We further recommend that the shoreline upstream on both sides of the river be inspected to further assess the source of the tar-like material.

5. At the direction of NYSDEC, all ground water wells installed during the present RI were screened to straddle the water table. The objective of this design was to evaluate the presence of ground water contaminants lighter than water. Such substances were expected on the basis of the limited information available prior to the RI.

   The RI soil boring program revealed the presence of a confining layer approximately 25-28 feet below ground surface. The most permeable strata within the saturated zone is located just above this confining layer. Very high HNu readings were obtained from split spoon samples collected within this strata at soil borings installed in the northwest area of the site. A well screened just above the confining layer in this area is recommended to assess the source of the high HNu readings and whether contaminants denser than water are present.

> Very high concentrations of hazardous substances were found in soil and ground water samples collected near the former incinerator site. In addition, the area northwest of the incinerator site also exhibited organic contamination and steep water level contours. A sheen was also observed along the shoreline in this area. For this reason, we recommend that wells screened just above the confining layer also be installed in these latter two (2) areas to assess the presence of contaminants denser than water.

PROPOSAL FOR REMAINING RI FIELD ACTIVITIES

Surficial Soil Samples. The locations of the proposed surficial soil samples are shown in Figure 1. Rationale for these locations is summarized in Table 1.

Tar-like Material Grab Samples. Two (2) samples to characterize the tar-like material found along the Area "D" shoreline are proposed. The sampling proposed locations are shown in Figure 1.

Ground Water Samples. We proposed to install three (3) additional wells which would be sampled on one (1) occasion. The proposed well locations are shown on Figure 1. Rationale for these wells is summarized in Table 1.

COST OF PROPOSED REMAINING RI ACTIVITIES

The cost of the proposed modifications to the RI is presented in Table 2.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Project Manager,
Senior Enviornmental Scientist

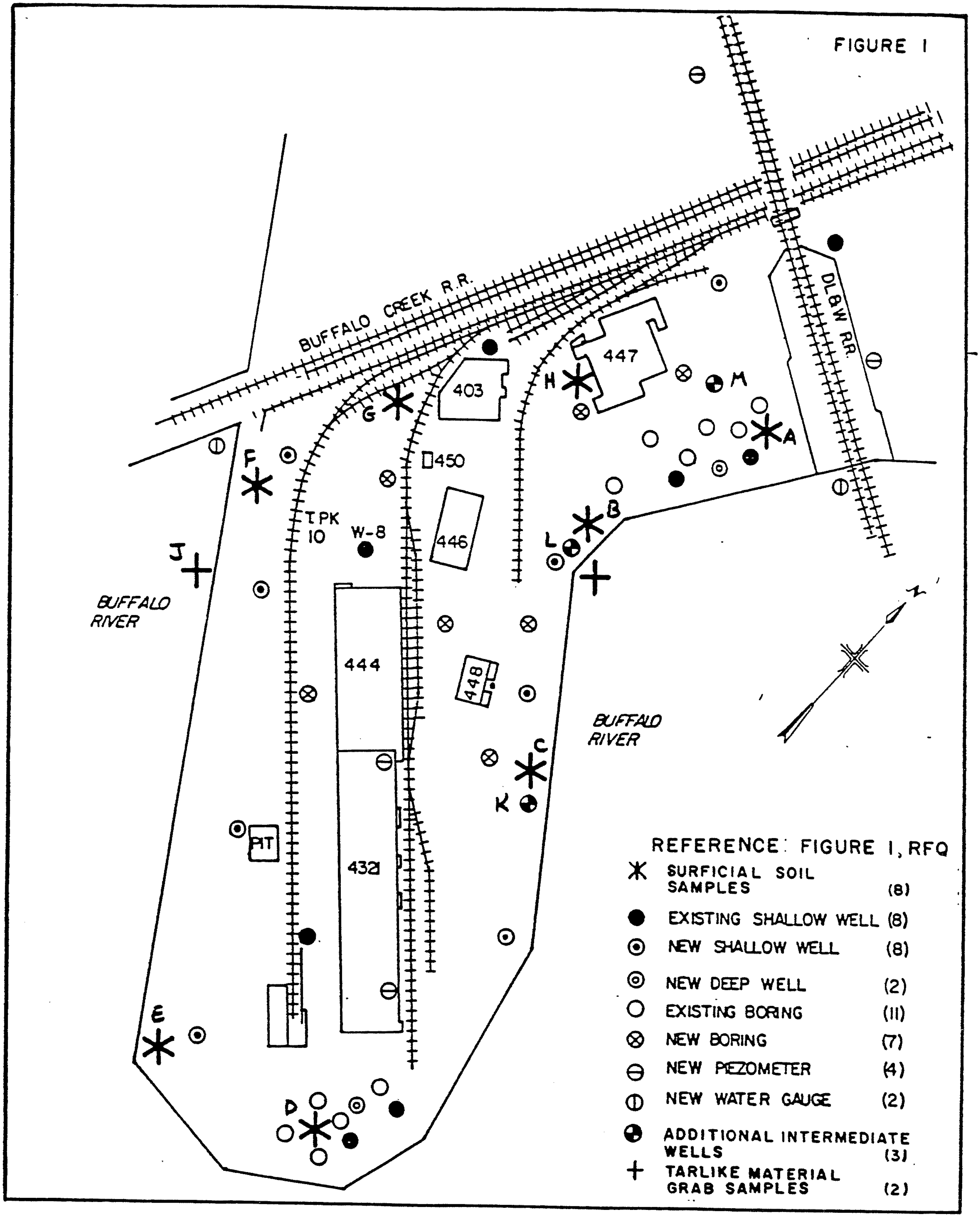
KLB/dmg

Attachments

1115-03-1

KLB10138/ltr2

FIGURE 1



MALCOLM PIRNIE

AREA "D" RI/FS
SITE INVESTIGATION PLAN

BUFFALO COLOR CORPORATION

JANUARY 1988

TABLE 1

RATIONALE FOR SELECTION OF SAMPLING LOCATIONS

Sample Type	Location	Contaminants Present[1]		Sampling Objectives[2]
		Soil	GW	
SS	A	PAHs Benzidine Metals	(W-15) PAHs Chlorobenzene Benzene Toluene Fe	a, c, d
SS	B	(B-2),(MW9) Nitrobenzene PAHs Fe	(MW9) Dichlorobenzenes 2,4-Dimethylphenol Naphthalene Acetone Ethylbenzene Fe	a, b, d
SS	C	(B-1),(MW4) Dichlorobenzenes 1,2,4-Trichlorobenzene Nitrobenzene 2-Chloronaphthalene PAHs Fe	(MW4) Dichlorobenzenes 2-chlorophenol 2,4-dimethylphenol Chlorobenzene Ethylbenzene Acetone Fe	a, b, d
SS	D	(MW1) Fe, Cu, Pb	(MW1) 2-Butanone	a, b, d
SS	E	(MW2) Nitrobenzene Naphthalene PAHs Fe, Ni	(MW2) Carbon disulfide Total xylenes Fe, Pb, Zn	a, b, d
SS	F	(MW5),(MW6) Phthalates PAHs Fe	(MW5),(MW6) Acetone 4-Methyl-2-pentanone Fe	a, b, d
SS	G	No Data	No Data	a, c, d
SS	H	No Data	No Data	a, c, d
GS	I	No Data	No Data	h
GS	J	No Data	No Data	h

TABLE 1

RATIONALE FOR SELECTION OF SAMPLING LOCATIONS

Sample Type	Location	Contaminants Present[1]		Sampling Objectives[2]
		Soil	GW	
GW	K	(B1),(MW4) Dichlorobenzenes 1,2,4-Trichlorobenzene Nitrobenzene 2-Chloronaphthalene PAHs Fe	(MW4) Dichlorobenzenes 2-chlorophenol 2,4-dimethylphenol Chlorobenzene Ethylbenzene Acetone Fe	f, g
GW	L	(B2),(MW9) Nitrobenzene PAHs Fe	(MW9) Dichlorobenzenes 2,4-Dimethylphenol Naphthalene Acetone Ethylbenzene Fe	f, g
GW	M	(B7),(MW8) Bis(2-ethylhexyl) phthalate Fe HNu 250 ppm	(MW8) 2-chlorophenol Phthalate Chloroform Chlorobenzene Ethylbenzene Fe, Zn	e, f, g

NOTES:

1. Contaminants present based on results of analysis of soil and ground water samples collected during the RI.

2. Sampling Objectives
   a. Determine contaminants present in surficial soil to assess loading to river via erosion.
   b. Assess extent of contamination found at nearby borings installed during RI.
   c. Provide data to assess occurrence of contaminants in surficial soils in an area of the site for which no other data is available.
   d. Provide data for a risk assessment.
   e. Samples ground water to evaluate the cause of high HNu readings in split-spoon samples collected within the saturated zone.
   f. Characterize the ground water contaminants present in the permeable zone just above the confining layer.
   g. Assess presence of ground water contaminants having a density greater than water and migrating at the bottom of the saturated zone.
   h. Assess character of tar-like material found along the shoreline of the site.

TABLE 2

COST OF REMAININGS RI ACTIVITIES

I. Cost of Original Proposal (20 2-foot surficial soil samples)	
A. Labor	
1) Sampling (12 hours)	570
2) Data Assessment/Report	1,670
B. Driller	880
C. Sample Analysis	
1) 20 Samples Analyzed as per Work Plan	11,418
D. Expenses	120
TOTAL	$14,678
II. Cost of Proposed Modifications	
A. Labor	
1) Negotiations with NYSDEC	3,968
2) Sampling	5,800
3) Data Assessment/Report	3,600
B. Driller	7,995
C. Sample Analysis	
1) Soils as per Work Plan	5,710
2) Ground Water	3,165
a) volatiles, AE, BN, metals, TOC, TOX	
D. Expenses	1,200
TOTAL	$30,438

Additional Cost of Modifications = $15,760

buffalo
COLOR CORPORATION
p.o. box 7027 buffalo, new york 14240-7027
716-827-4500

October 20, 1988

Mr. Kent Bainbridge
Malcolm-Pirnie, Inc.
P.O. Box 1938
Buffalo, NY 14219

Re: Remedial Investigation Field Activities - Area D

Dear Mr. Bainbridge:

The Malcolm-Pirnie counter-proposal dated October 13, 1988, is acceptable to BCC. You are requested to proceed as soon as possible to take advantage of the remaining good weather.

Attached is a copy of the 10/13/88 proposal for reference.

Very truly yours,

Walter Manijak

Attach.

C: D. Sauer
R. Dombkowski
R. Prèdale (Allied Signal)
G. Bolles

executive and sales offices
[illegible]

4227 FD

buffalo
COLOR CORPORATION

p.o. box 7027 / buffalo, new york 14240-7027
716-827-4500

October 25, 1988

Mr. Shive Mitial
New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, New York 12233-0001

Reference: Area D RI/FS - Site #915012

Dear Mr. Mitial:

Originally in the approved work plan presentation of the RI report to the NYDEC was scheduled for January 1989. This was based upon a five week turn around of the sample analysis. Unfortunately the turn around time was closer to 15 weeks as you are aware. Another 5 weeks have been lost through negotiations between NYDEC and Buffalo Color regarding the placement of the 20 shallow borings.

Having reached agreement (NYDEC and Buffalo Color) regarding the additional field data collection, the last phase of the field work will commence the week of November 7, 1988. This is the earliest the drillers can mobilize. Assuming an optimistic 8 week turn around on these field data, Buffalo Color is anticipating a submittal of the RI report to the NYDEC by April 15, 1989.

As usual, you will receive a copy of all field data as it becomes available to BCC. The second round of water samples should be available within two weeks.

Very truly yours,

Walter Manijak

Walter Manijak
Project Manager

WM:dt

cc: M. Doster (NYDEC)
R. Predale (Allied Signal)
D. Sauer
K. Bainbridge (Malcolm - Pirnie)
G. Bolles

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toll free 800—631-0171

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

October 28, 1988

Mr. Walt Manijak
Area "D" RI/FS Project Manager
Buffalo Color Corporation
100 Lee Street
Buffalo, New York 14210

Re: Modifications of Remedial Investigation Field Activities - Area "D" as Defined in the Malcolm Pirnie Proposal Dated October 13, 1988 - Revision No. 4

Dear Mr. Manijak:

I have received your letter dated October 20, 1988 which documents Buffalo Color Corporation's formal acceptance of the Malcolm Pirnie (MPI) proposal for the subject modifications and instructs MPI to proceed as soon as possible to perform the modified RI activities. This letter will serve to formally document the sample collection methods that will be used to perform these activities. Other details not addressed in the proposal are also clarified herein.

Surficial Soil Samples - These samples will be collected in the manner described in the approved work plan dated February 1988, as revised April 1988. Chemical analyses of these samples will be for the analytical parameters identified in the work plan for surficial soils.

Tar-Like Material Grab Samples - These samples were not addressed in the approved work plan. These samples will be collected with precleaned stainless steel spatulas. The cleaning procedure will be as specified in the work plan for stainless steel sampling equipment. Chemical analysis of these samples will be for the same analytical parameters as the surficial soil samples (i.e., EPA priority pollutant metals, EPA Base/Neutral priority pollutants, total organic halogen).

Ground Water Samples - The three (3) additional wells will be installed and developed in accordance with the procedure given in the work plan, with the following exceptions. First, since no soil samples will be collected from the borehole during installation of these wells, continuous split spoon sampling of the borehole will not be performed, except for the final 6-8 feet which will be sampled to define the fill/confining layer interface so that the well screens can be properly positioned. Second, these three wells will be sampled only on one (1) occasion immediately following well development. The sampling method will be in accordance with the procedure presented in the work plan. The ground water samples collected from these wells will be analyzed for the EPA priority pollutant volatiles, acid extractables, base neutrals, metals and total organic carbon, and total organic halides.

Project Schedule - The original project schedule presented in the approved work plan called for the submission of the draft RI report by January 1, 1989. This submission date was contingent upon MPI having in-hand the results of all sample analyses by November 1, 1988. The sample results for the modified RI field activities that are the subject of this letter will not be available until approximately the first week in January 1989. Consequently, we are requesting that the date for submission of the draft RI report to Buffalo Color/Allied Signal be extended to March 7, 1989 to allow MPI a reasonable amount of time to analyze and interpret all the RI data following its receipt.

Additional Modifications - Based on your request during our meeting of October 25, 1988, MPI will collect one (1) additional surficial soil sample to a depth of two (2) feet at the location of the former pit southeast of MW3. This sample will be analyzed for the same chemical parameters as the other surficial soil samples. Also, as discussed during our meeting, the additional ground water samples will be analyzed for the NYSDEC Target Compound List (TCL) volatile and semivolatile parameters rather than the EPA priority pollutant volatiles, acid extractables, and base neutrals.

The cost of these additional modifications is as follows:

Labor	$ 50
Analytical	570
Driller	110
TOTAL	$730

Quality Control Samples - All the QC samples as required to conform to the Environmental Protection Agency Contract Lab Protocol (CLP) were not included in the proposed RI modifications. No change in the number of QC samples is required for analysis of soil samples since these QC samples were already included with the twenty (20) surficial soil samples that were originally planned to be collected.

However, three (3) ground water samples will now be collected as a part of the modified RI activities. Consequently, three (3) QC samples (i.e., matrix spike, matrix spike duplicate, and method blank) will be required for this aqueous matrix.

If you have any questions regarding the above, please contact us.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Senior Project Scientist,
Project Manager

Paul H Werthman

Paul H. Werthman, P.E.
Vice President

c: R. Dombkowski, BCC
J. Schutt, Allied Signal
File: C-1
1115-03-1

KLB10268.2/ltr2

ADDENDUM TO HEALTH AND SAFETY PLAN

DATE: November 7, 1988

TO: All Buffalo Color Area "D" Remedial Investigation Field Personnel

FROM: Kent L. Bainbridge

SUBJECT: Site Health and Safety Requirements

1.0 INTRODUCTION

Based on the results of soil and ground water sample analyses completed to date during the Area "D" Remedial Investigation (RI) activities, a number of chemical substances have been detected that were not addressed by the site Health and Safety Plan (HASP) at the beginning of the project. The purpose of this present document is to supplement the HASP for the remaining RI field activities.

2.0 ADDITIONAL CHEMICAL SUBSTANCES DETECTED

The chemical substances detected in soil and ground water at the site are presented in Table 1. Only those substances not already addressed by the HASP are identified. For information concerning the other substances (i.e., metals, PAHs) present at the site, consult the site HASP dated January 1988.

3.0 HAZARD EVALUATION

The purpose of this section is to provide information relative to the harmful health effects that potentially could be caused by the above chemicals. "Safe" levels of exposure based on existing standards and guidelines are also identified. The information presented herein was taken primarily from Dangerous Properties of Industrial Materials, Sixth Edition (1984), by N. Irving Sax.

TABLE 1

ADDITIONAL CHEMICAL SUBSTANCES DETECTED AT THE AREA "D"

Chemical Substance	Media(1)	Concentration(2)	Location of Highest Concentration
Volatiles			
Methylene Chloride	GW	BQL-15	MW-4
Acetone	GW	BQL-5.4	MW-4
Benzene	GW	BQL-28	MW-3
Toluene	GW	BQL-0.56	MW-9
Chlorobenzene	GW	BQL-37	MW-4
Ethylbenzene	GW	BQL-43	MW-4
Xylene	GW	BQL-1.7	MW-4
Semivolatiles			
2-chlorophenol	GW	BQL-1.2	MW-4
1,4-dichlorobenzene	GW	BQL-4.9	MW-4
	Soil	BQL-13	B-1, MW-4
1,2-dichlorobenzene	GW	BQL-21	MW-4
	Soil	BQL-110	B-1, MW-4
Nitrobenzene	GW	BQL-0.011	MW-5
	Soil	BQL-1100	B-1, MW-2, MW-7
1,2,4-trichlorobenzene	GW	BQL-1.5	W-15
	Soil	BQL-150	B-1
2,4-dinitrotoluene	GW	BQL-2.0	W-13
	Soil	BQL-2.6	MW-3

NOTES:

(1) Only ground water samples were analyzed for volatiles. Soil samples were analyzed for both volatiles and semivolatiles.

(2) Ground water (GW) concentrations are expressed as mg/l. Soil concentrations are expressed as mg/kg dry weight basis.

(3) BQL = Below Quantitation Limits

Methylene Chloride - Methylene chloride is a carcinogen and can cause narcotic effects. It is very dangerous to the eyes. Except for its property of inducing narcosis, it has very few other acute toxicity effects. It has been used as an anesthetic in Europe and is still used there for local anesthesia. Experiments have shown that 25,000 ppm concentration for 2-hour exposures were not lethal. Concentration of 7,200 ppm after 8 minutes caused paresthesia of the extremities; after 16 minutes, acceleration of the pulse to 100; during the first 20 minutes, congestion in the head, a sense of heat and slight irritation of the eyes. At a level of 2,300 ppm, there was no feeling of dizziness during 1-hour exposures, but nausea did occur after 30 minutes of exposure. The limit of perception by smell is set at 25-50 ppm concentrations. Can cause a dermatitis upon prolonged skin contact. A respirator for organic vapors and fumes should be worn to avoid excessive inhalation. Used as a food additive permitted in food for human consumption.

Standards/guidelines for "safe" level of exposure(1).

TLV(2)
  TWA (air): 50 ppm
  STEL (air): -

PEL(3)
  TWA (air): 500 ppm
  CL (air): -
  PK (air): 2000 ppm/5 minutes in any 2 hours

Acetone - Acetone is a skin and eye irritant at 500 ppm or greater. Acetone is narcotic in high concentration. In industry, no injurious effects from its use have been reported, other than the occurrence of skin irritation resulting from its defatting action, or headache from prolonged inhalation. A food additive permitted for human consumption.

Acetone is flammable and a dangerous fire risk. Explosive limits in air 2.6 - 12.8%.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY
B/N-A
ANALYSES

SAMPLE ID	MATRIX	DATE COLLECTED	DATE REC'D AT LAB	DATE EXTRACTED	DATE ANALYZED

:DU,OPREP,1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY

ORGANIC ANALYSES

SAMPLE ID	MATRIX	ANALYTICAL PROTOCOL	EXTRACTION METHOD	AUXILARY CLEAN UP	DIL/CONC FACTOR

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY
VOA
ANALYSES

SAMPLE ID	MATRIX	DATE COLLECTED	DATE REC'D AT LAB	DATE EXTRACTED	DATE ANALYZED

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY
PESTICIDE/PCB
ANALYSES

SAMPLE ID	MATRIX	DATE COLLECTED	DATE REC'D AT LAB	DATE EXTRACTED	DATE ANALYZED

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY

INORGANIC ANALYSES

SAMPLE ID	MATRIX	METALS REQUESTED	DATE RECEIVED	DATE DIGESTED	DATE ANALYZED

:DU,IPREP,!

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY

INORGANIC ANALYSES

LABORATORY SAMPLE CODE	MATRIX	ANALYTICAL PROTOCOL	DIGESTION PROCEDURE	MATRIX MODIFIER	DIL/CONC FACTOR

FIELD INVESTIGATION REPORT

DATE 5/13/88

DAY	S	M	T	W	TH	F	S
						✓	

Project Buffalo Color RI/FS No. ________

Contractor Buffalo Drilling Co

Subject Daily Field activities not adhering to Work Plan

To K. Bainbridge

WEATHER	Brite Sun	Clear	Overcast	Rain ✓	Snow
TEMP.	To 32	32-50	50-70 ✓	70-85	85 up
WIND	Still	Moder ✓	High	Report No.	
HUMIDITY	Dry	Moder	Humid ✓		

B-1-88:

NAPL encountered in saturated zone. Did not want to breech clay confining layer which would allow spread of contaminants beyond the confining zone.

D.E.C. was notified (S. Mittal) and permission was granted to stop at the clay.

This will apply to all deep boring where significant levels of contamination occur in the saturated zone.

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Owner

Signature Richard [illegible] Title Hydrogeologist

Wiley-Fisk Form 8-3

FIELD INVESTIGATION REPORT

DATE 5-16-88

DAY	S	M ✓	T	W	TH	F	S

WEATHER	Brite Sun	Clear ✓	Overcast ✓	Rain	Snow
TEMP.	To 32	32-50 ✓	50-70	70-85	85 up
WIND	Still	Moder	High	Report No	
HUMIDITY	Dry	Moder ✓	Humid		

Project Buffalo Color RI/FS No. ______

Contractor Buffalo Drilling Co

Subject NYSDEC Comments

To K. Bainbridge

Marty Doster (DEC) allowed Cleaning of split spoon barrel every 10 Ft in NAPL Areas. Spoons Will still be rinsed & brushed clean.

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Owner

Signature Richard F

Title Hydrogeologist

Wiley-Fisk Form 8-3

+ Analytical Table Summary

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

May 18, 1988

Mr. Walt Manijak
Buffalo Color Corporation
100 Lee Street
Buffalo, NY 14210

Re: Response to NYSDEC Comments

Dear Mr. Manijak:

NYSDEC comments pertaining to the April 1988 revised Work Plan for the Plant "D" Area RI/FS were attached to a May 10th letter addressed to Mr. Dave Sauer, Buffalo Color Corporation from John L. Krajewski of NYSDEC. Enclosed is our response to these comments.

If there are any questions, please contact me.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent Bainbridge

Kent L. Bainbridge
Project Manager
Senior Environmental Scientist

dtg

Attachments

c: Dave Sauer, Buffalo Color Corp.
Paul Werthman, MPI
File: C-1

1115-03-1

S. 3515 ABBOTT ROAD P.O. BOX 1938 BUFFALO, NY 14219 716-828-1300 TELEX 137364

COMMENT 1: EPA Recommends the use of ice cubes for cooling samples in the field and in transit to the laboratory. Blue ice packs should not be used.

RESPONSE: Ice will be used for cooling samples in the field and in transit to the laboratory. See Table 2-7, Note 4.

COMMENT 2: Trip blanks should be analyzed for VOAs only. Total organic carbon and metals analysis on trip blanks should be dropped.

RESPONSE: Trip blanks will be analyzed for VOAs only. Total organic carbon and metals analysis will not be performed on trip blanks. See Page 4-5.

COMMENT 3: The laboratory must comply with 1987 NYS CLP protocols and deliverables. Only the EPA CLP is referenced in the work plan.

RESPONSE: Based on telecoms with Mr. Bart Malone and Mr. John Rankin of the NYSDEC in Albany on 5/16/88, it is our understanding that the NYS CLP and EPA CLP are essentially identical. Consequently, the methods that have been referenced will comply with the 1987 NYS CLP protocols. However, if the commenter has a specific concern relative to the analytical methodology to be used, we request that the commenter relate this concern in specific terms so we can make whatever modifications that may be appropriate.

COMMENT 4: In addition the enclosed seven (7) forms need to be completed as part of the deliverables package.

RESPONSE: The seven (7) forms enclosed by NYSDEC will be completed as part of the deliverables package.

COMMENT 5: Analytical cleanups are mandatory, when needed.

RESPONSE: Analytical cleanups are not specifically required by the CLP. However, the CLP does identify a Corrective Action Program whenever matrix interference problems are encountered. An appropriate corrective action may involve an analytical cleanup. Malcolm Pirnie's (MPI) contract with the laboratory (RECRA Environmental) requires that the lab notify MPI of all sample matrix and/or QC problems encountered and the proposed corrective action to be taken. The contract further requires that RECRA document, on the analytical package, all corrective actions taken, including analytical cleanups. Based on a telecom with Mr. John Rankin, NYSDEC QA/QC Officer, it is our understanding that this approach is satisfactory.

COMMENT 6: Approval for deviations from the 1987 NYS CLP protocols must be documented and permission granted for the use of these deviations by the QA/QC officer, John Rankin, in the Albany office of the NYS Department of Environmental Conservation.

RESPONSE: Any deviations from the CLP analytical methodology will be made only when permission has been granted by Mr. John Rankin, NYSDEC QA/QC officer. Such permission will be formally documented.

COMMENT 7: VOA water samples should be analyzed within seven (7) days rather than the ten (10) cited in Note 1 of Table 2-7.

RESPONSE: VOA water samples will be analyzed within seven (7) days. Note 1 of Table 2-7 has been changed to indicate this.

COMMENT 8: Backfilling piezometers and monitoring wells with grout must be done with a tremie tube. Appendix K only describes the backfilling of abandoned bore holes.

RESPONSE: Backfilling piezometers and monitoring wells will be done through a tremie tube. This procedure is now described in Section 2.3.5.2 on Page 2-6.

COMMENT 9: On page 2-3 of the April 1988 work plan, the last sentence in the last paragraph should read "The ultimate disposal of these spoils will be executed in accordance with NYS Department of Environmental Conservation regulations.".

RESPONSE: The last sentence on Page 2-3 has been changed to read as above.

COMMENT 10: In Section 2.3.8.2 of the April 1988 work plan, it must be stated that the sampling dates will be mutually agreed upon by the representatives of Buffalo Color and the NYS Department of Environmental Conservation.

RESPONSE: The above statement has been added in Section 2.3.8.2 (see page 2-10).

COMMENT 11: Benzidine must be included in the list of base/neutral extractable priority pollutants listed in Tables 2-1 and 2-5 of the work plan.

RESPONSE: Benzidine will be listed in Table 2-5 of the work plan.

COMMENT 12: On page A-21 of Appendix A of the work plan the frequency of air monitoring must be indicated.

RESPONSE: During drilling operations, the boreholes will be monitored continuously using a Photovac TIP or similar organic vapor monitoring device. Breathing zone monitoring will be performed at a minimum of one-hour intervals. Atmospheric conditions will be monitored prior to the geophysical survey, field survey of sampling locations, and collection of ground water samples. These additions to Appendix A may be found on pages A-20 and A-21.

COMMENT 13: In Appendix C of the work plan, it must state that any NAPL sampled will be chemically identified and analyzed for the list of ground water analytes.

RESPONSE: Section 5.0 has been added to Appendix C. This section states that all NAPL samples will be chemically identified and analyzed for the list of ground water analytes.

COMMENT 14: It must state in the work plan that return water from any rotary drilling that might be necessary must be collected in drums. Appendix C in the work plan must state that purge water from the sampling procedures will be collected in drums and disposed of according to NYS Department of Environmental Conservation regulations.

RESPONSE: A discussion of the disposal of return water from rotary drilling has been added to Section 2.3.4.2 and may be found on Page 2-4.

A discussion of disposal of purge water from ground water sample collection has been added to Appendix C and may be found in Section 7.0.

The approximate locations are shown on Figure 2-1 The procedures for drilling the borehole will be as follows:

- A plastic sheet six-mils in thickness will be placed over the soil in the working area around each borehole to isolate the surface soil from the drill cuttings. A 12-inch diameter hole will be cut in the sheet to allow the auger to pass through it. Sheets of plywood will be used to provide a stable work surface.
- Augers will be checked for alignment after each five-foot section of auger flight has been advanced.
- A boring will be made through overburden materials (to bedrock) by advancing a nominal 4-1/4-inch I.D. continuous-flight, hollow-stem auger casing, producing a borehole with an outside diameter of eight inches.
- To define the geologic character of the encountered soils, continuous split-spoon soil samples will be collected from all borings using a 2-inch O.D., 27-inch long split-spoon sampler, and Standard Penetration Test Methods (ASTM D-1586). The split-spoon sampler will be thoroughly cleaned prior to obtaining a new sample at depth to avoid cross-contamination.
- An HNu photoionization analyzer will be used to scan each split-spoon sample as it is collected to detect the presence of hydrocarbon vapors. Air monitoring of the breathing zone will be performed, using the HNu, in accordance with the Health and Safety Plan (Appendix A). The auger and sampling equipment will be steam-cleaned between borings to prevent cross-contamination.
- Each boring will be logged by a Malcolm Pirnie geologist using the Unified Soil Classification System (SCS) or Burmister SCS. Descriptions of the consistency and color and field estimates of the moisture content, plasticity, and gradation (e.g. moist, wet, highly plastic, poorly graded) will be recorded in a log book in indelible ink.
- All samples obtained from each boring well will be placed in Teflon-lined screw-top bottles, cataloged and archived at the Malcolm Pirnie soils laboratory for future reference.
- All drilling spoils will be placed in drums stationed next to each boring location. The ultimate disposal of these spoils will be executed in accordance with NYS Department of Environmental Conservation regulations.

- In the event that rotary drilling is necessary, all return water from drilling will be collected in drums. The water collected in drums will be disposed of according to NYS Department of Environmental regulations.
- Following the completion of all sampling, these boreholes will be backfilled with a cement/bentonite grout mixture using the procedure presented in Appendix K.

2.3.4.2 Boring Logs

The soil borings will be drilled under the supervision of a Malcolm Pirnie geologist who will log each boring. The boring logs will include the following at a minimum:

a. Top and bottom depths of material encountered and the type of material

b. Estimate of the moisture content of the material(s)

c. Drill fluid losses (top and bottom depths)

d. Changes in drill speed including areas of "chatter" or binding of the bit and time of drilling for landfill or bedrock zones

e. Depth at which water is encountered

f. Water levels at the beginning and end of each shift, and just prior to backfilling the hole

g. Top and bottom of casing as casing is advanced per shift

h. Type of drill, bit sizes, and changes of drill bits/sizes and reasons for changes

i. Name of geologist and driller

j. Date, boring number

k. Soil description

l. Standard penetration test blow counts

The field borehole log form that will be used for documentation purposes is presented in Appendix B.

2.3.4.3 Hand Augers

Up to 20 soil borings will be made to a depth of two feet, using a hand bucket auger. A composite sample will be collected at each boring location for subsequent chemical analysis (see Section 2.3.9). The location of each boring will be selected in the field on the basis of field observations and the results of the EM survey.

screens five feet in length will be placed at the top of the uppermost permeable stratum encountered so that the screened zone intersects the water table. A one-foot deep, clean-washed silica sand booting will be installed at the bottom of each boring as a base for the well screen to prevent settling. Clean, washed (medium uniform, 0.010-0.020-inch or larger) sand will be backfilled into the annular space to a depth of two feet above the top of the screen, after which a minimum four-foot bentonite pellet seal will be installed. The remainder of the borehole will be cement-grouted to the ground surface. Backfilling with grout will be done with a tremie tube.

The top of the monitor riser will extend two feet above grade and be protected by a vented four-inch diameter steel casing anchored in cement to a depth of approximately 2.5 feet and extending 2.5 feet above grade. The protective casing will be fitted with a keyed-alike locking cap and will be labeled with permanent markings for identification purposes. A concrete surface collar will be constructed around the protective steel casing to stabilize the installation and prevent the infiltration of surface water. Each monitor location will be surveyed for vertical and horizontal location and recorded on the site map.

The top of casing and ground surface elevation will be used to reference lithologic contacts, ground water and well screen elevations. Installation details of all monitors will be graphically documented.

Monitoring wells will be constructed in a similar manner, as described previously for piezometer installations. Since these wells are to be used for ground water quality sampling, however, each well will be constructed using two-inch diameter stainless steel well screen with accompanying two-inch diameter plain steel riser pipe (see Figure 2-2). The screens will typically be five feet in length.

2.3.5.3 Monitor Development

All new piezometers and wells will be developed following installation. Each well will be allowed to stand a minimum of 48 hours and maximum of 96 hours after installation to insure that the non-shrink grout has set. Prior to development, the static water level and well bottom depths will be measured. Development will be relative to evacuated volume, visual clarity, character of

2.3.8.1 Soils

Soil samples collected from the deep borings, together with those collected from the installations of piezometers and monitoring wells, will be organized according to the following plan:

- For each deep boring, a Composite "A" sample will be made of all of the apparently contaminated soil. The physical appearance of the soil (notably discoloration and odor) will be used to make this determination. Observations in the field of gross differences in physical appearance within the Composite "A" stratum may require sampling and analyses of substrata within a Composite "A." However, different colors or shades of color alone will not constitute grounds for subdividing. In some areas, there may be no discoloration or odor at all and, hence, no Composite "A." Final determinations will be made by taking HNu or OVA total organic vapor meter readings. The Composite "A" zone will vary in depth between sampling locations.
- At each boring, a Composite "B" sample will be made of the first complete 2-foot spoon sample of apparently uncontaminated soil. This will be within the next five feet of boring sample after Composite "A."
- A "C"-zone sample will be made of the 2-foot spoon sample starting 5 feet below the top of the Composite "B" sample.
- The deep soil boring locations are shown in Figure 2-1. A hypothetical representation of the soil sampling plan is illustrated in Figure 2-3.
- All soil samples will be archived for a period of five (5) years.
- In the installation of subsequent ground water monitoring wells and piezometers, C-zone samples will not be chemically analyzed, but will be archived.

In addition to the above, shallow soil borings will be made with a hand auger to a depth of two (2) feet. There will be up to twenty (20) shallow borings across the site with their locations and density determined by field observations and the geophysical survey.

2.3.8.2 Ground Water

All of the existing and newly installed monitoring wells will be sampled on two (2) occasions, approximately three (3) to eight (8) weeks apart. The sampling dates will be selected to allow sample collection during the approximately highest and lowest ground water table elevation conditions that occur during the 3-8 week period. The exact sampling dates will be agreed upon by Buffalo Color and the NYS Department of Environmental Conservation. The locations of all wells are shown on Figure 2-1. Locations of the new wells may be modified from those shown, depending on the results of the EM terrain conductivity survey (Section 2.3.3).

The specific ground water monitoring well sampling procedures that will be used are presented in Appendix C. Ground water samples will not be filtered prior to analysis.

2.3.8.3 Surface Water

Surface water samples will be collected from the Buffalo River on each of the same two (2) occasions that ground water samples are collected. Sampling will be performed at two (2) stream monitoring stations: one (1) located immediately upstream of Area "D", and one (1) immediately downstream, as shown on Figure 2-4. The samples collected for chemical analysis at each station will consist of composites of four (4) samples taken at mid-depth at equally-spaced points across the width of the river. Specific sample collection procedures are presented in Appendix D.

2.3.8.4 Stream Sediments

A total of eight (8) river-bottom sediment samples will be collected at two (2) locations in the Buffalo River as shown on Figure 2-4. These locations are centered on sounding lines 735+00 and 747+00 on the U.S. Army Corps of Engineers Buffalo Harbor drawing No. 795-BFR-1/5. Four (4) samples will be collected near the "Area D" Weathering Area and four (4) near the Iron Sludge Lagoons. The samples will be core samples collected through the entire depth of deposit into compacted bottom material or to a maximum depth of 24 inches. The samples will be collected roughly parallel to shore, spaced at equal distances from each other in a water depth of ten (10) feet or less.

The procedure to be used to collect stream bottom sediments is presented in Appendix E.

2.3.9 Sample Analytical Program (Task 9)

2.3.9.1 Parameters for Physical/Chemical Analysis

The environmental samples collected during this program will be analyzed for the physical/chemical parameters identified in Table 2-1.

TABLE 2-5

PRIORITY POLLUTANT BASE/NEUTRAL EXTRACTABLES

Acenaphthene
Acenaphthylene
Anthracene
Benzidine
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Benzo(g,h,i)perylene
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
4-Bromophenylphenylether
Butyl benzyl phthalate
2-Chloronaphthalene
4-Chlorophenylphenylether
Chrysene
Dibenzo(a,h)anthracene
Di-n-butyl phthalate
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
Diethylphthalate
Dimethylphthalate
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-nitrosodi-n-propylamine
Phenanthrene
Pyrene
1,2,4-Trichlorobenzene

TABLE 2-7 (Continued)

ANALYTICAL METHODS/PROTOCOLS
FOR
SURFACE AND GROUND WATER, SOILS AND STREAM SEDIMENTS

NOTES:

1) All field samples will be delivered to the lab within one (1) day of their collection. The lab shall adhere to CLP contract-required holding times. VOA analysis of water samples must be completed within 7 days of VTSR (Validated Time of Sample Receipt). VOA analysis of soil samples must be completed within 10 days of VTSR. If separatory funnel or sonication procedures are employed for extractions for semivolatile and pesticide analyses, extraction of water samples shall be completed within 5 days of VTSR, and extraction of soil samples shall be completed within 10 days of VTSR. If continuous liquid-liquid extraction procedures are employed, the extraction of water samples shall be started within 5 days of VTSR.

   The VTSR shall be the date on which a sample is received at the Laboratory, as recorded on the Chain-of-Custody form and the lab's central sample log.

2) Analysis of water and soil/sediment samples for all metals (other than Mercury) must be completed within 180 days of the VSTR. Analysis of mercury must be completed within 26 days.

3) Analyze in field immediately upon collection of sample.

4) Preservatives will be added to the sample bottles in the field immediately after the sample has been collected. Ice will be used to cool samples in the field and in transit to the laboratory.

5) Containers shown are those necessary to satisfy volume requirements for water analysis. The mass of soil needed for analysis of all parameters, except volatiles will be satisfied by filling one liter wide-mouth amber glass jar fitted with a Teflon-lined cap. Analysis of volatiles in soil will require two 40 ml VOA glass vials with Teflon septums.

REFERENCES

1) USEPA Contract Laboratory Program, Statement of Work for Work for Organic Analysis, Multi-Media, Multi-Concentration. October 1986, Revised 1/87, 2/87, 7/87.

2) USEPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration.

3) Test Methods for Evaluating Solid Waste, USEPA Office of Solid Waste and Emergency Response. SW846, third edition. November 1986.

All original forms and field notebooks will be placed in the project record file that will be maintained at Malcolm Pirnie's office in Buffalo, New York.

Data validation will be facilitated by adherence to Standard Operating Procedures (SOPs) identified for the performance of all field activities (see Section 2.0), calibration checks on all field instruments at the beginning and end of each day of use, and manual checks of field calculations.

4.6.2 Laboratory Analyses

The laboratory procedures for data reduction, validation and reporting for all chemical parameters included on the EPA CLP target compound list (TCL) will be in accordance with the specific requirements identified in Exhibit B of the CLP SOWs (References 7 and 8). Procedures for non-TCL parameters will be as described in the laboratory's QA/QC Plan (see Section 2.5 of Appendix J).

4.7 Internal Quality Control Checks and Frequency

Quality control sample analyses that will be performed during this project to document the acceptability of the data will include the following:

- Trip blank
- Matrix spike
- Matrix spike duplicate
- Method blank

The frequency of QC sample analysis for all analyses will be in accordance with the EPA CLP requirements as summarized below.

The laboratory will prepare trip blanks that will accompany sample bottles into the field and be returned to the lab with the samples collected. One (1) trip blank will be collected and analyzed for volatile organics each day that samples to be analyzed for volatiles are collected in the field. Preparation of trip blanks will involve the placement of distilled laboratory water into appropriate precleaned sample bottles.

The laboratory will perform one (1) spiked analysis (matrix spike) and one duplicate spike sample analysis (matrix spike duplicate) for each group of samples of a similar matrix (e.g., water, soil) and concentration level (for soil samples only), once:

- each case of field samples received, or
- each 20 field samples in a case, or
- each 14 calendar period during which field samples in a case were received (said period beginning with the receipt of the first sample in that Sample Delivery Group),

Area "D" will be used to determine appropriate levels of personal protection. Based upon the existing data base, minor concentrations of organic vapors are anticipated. Levels are anticipated to be below the permissible exposure limits (PEL) established by OSHA for the individual compounds. Respiratory and dermal protection may be modified (upgraded or downgraded) based upon the field monitoring data.

Contaminated soil layers are most likely to be encountered in known disposal areas. The monitoring program will indicate the potential for the volatilization of significant levels of contaminants when the soil is physically disturbed by drilling and sampling equipment. The necessary level of respiratory protection will be based upon these sampling results.

A combustible gas and oxygen meter will be utilized during the field activities. Monitoring instruments will be protected from surface contamination during use to allow for easy decontamination. Additional monitoring instruments may be added if the situations or conditions change.

Prior to surface penetration during auger drilling and soil sampling activities, background instrumentation measurements will be established and recorded with all support equipment engines turned off to eliminate the interfering effect of exhaust. All field measurements of this nature will be obtained and documented on the appropriate forms by the Site Health and Safety Officer. In addition, all values generated are subjected to immediate interpretation as a means of ensuring the effectiveness of the existing level of protection.

During drilling operations, the boreholes will be monitored continuously using a Photovac TIP or similar organic vapor monitoring device. Observed values will then be recorded and maintained as part of the permanent field record. Breathing zone monitoring will be performed at one-hour intervals at a minimum. The actual frequency of breathing zone monitoring will be dependent primarily upon values generated by the cuttings and the proximity of the worker's breathing zones to the source of contamination. Contaminant values which are in excess of established action levels appropriate for the prescribed level of protection will be immediately addressed. These action levels are described below.

The ends of the core samples will be surveyed with the Photovac TIP (or similar equipment) as each sample is retrieved. These values will be recorded with the respective sample number and will be used to determine the adequacy of employee personal protection equipment.

Atmospheric conditions will be monitored prior to the geophysical survey, field survey of sampling locations, and collection of ground water samples. Specific procedures to be followed during sampling of ground water monitoring wells are given in Appendix C.

8.2 Monitoring Action Levels

General guidelines associated with readings obtained with organic vapor analyzers must be considered with regard to other site conditions as follows:

- Level B - Total atmospheric concentrations of unidentified vapors or gases ranging from 5 to 50 ppm on the instrument (vapors not suspected of containing high levels of chemicals toxic to the skin);
- Level C - Total vapor readings register between background and 5 ppm above background on monitoring instruments; and
- Level D - No detectable inhalable toxic substances.

The explosimeter will be used to monitor levels of both combustible gases and oxygen during drilling activities. The results from this instrument may be interpreted as follows:

- Less than 10% LEL - Continue operations with caution;
- 10-25% LEL - Continuous monitoring with extreme caution;
- Greater than 25% LEL - Explosion hazard, shut-down operations and evaluate source;
- Less than 19.5% oxygen - wear SCBA;

If NAPL is detected floating on the water surface in the well, sampling may be accomplished by the following procedure:

1. Slowly lower a single check valve bailer (i.e. a bailer with a ball valve on the bottom) down the well into the immiscible layer of NAPL. Care should be taken to lower the bailer just through the NAPL layer, but not significantly down into the underlying ground water.

2. Remove the bailer from the well, while being sure not to agitate the sample. Allow the bailer to stand for a few minutes so that the immiscible phases will separate.

3. Decant the denser ground water portion of the bailer into a wastewater barrel through the stopcock on the bottom of the bailer. The less dense immiscible NAPL layer may be emptied into the proper sampling containers by the same method.

5.0 NON-AQUEOUS PHASE LIQUID ANALYSIS

Any NAPL samples collected during the investigation will be chemically identified and analyzed for the list of ground water parameters presented in Table 2-1.

6.0 WELL PURGING PROCEDURE

Where Non-aqueous Phase Liquids (NAPL) are not detected, well purging will precede sample collection. The purging procedure to be used is described below.

1. Measure the distance from the top of the casing to the water surface using an electronic water level indicator. Accuracy will be to 0.01 feet. Make duplicate water level measurements at every fifth well. Between wells, wash the end of the water level indicator probe with soap and water and rinse with deionized water to avoid cross-contamination of wells.

2. Measure the distance to the bottom of the well using a graduated measuring tape with a weight attached.

3. Calculate the volume of water in the well.

4. At wells having water levels that remain 25 feet or less below the top of casing, use a suction-lift pump to remove three (3) to five (5) well volumes. (A well volume is the volume of water standing inside the casing prior to evacuation.) Dedicated new polyethylene discharge and intake tubing (3/8" I.D. low density polyethylene) will be used at each well.

   During excavation of the well, position the intake end of the tubing just below the surface of the well water. If the water level drops, lower the tubing as needed to maintain flow. Pumping from the top of the water column will insure proper flushing of the well.

   If the well purges to dryness and recharges rapidly (within 15 minutes), continue to purge water from the well until 3-5 volumes have been removed. If the well purges to dryness and is slow to recharge, terminate purging.

5. At wells having water levels that are initially 25 feet below the top of casing, or that draw down to this level because of a slow recharge rate, use a dedicated 1-1/2-inch PVC bailer, five (5) feet in length, to evacuate the well. The line for this bailer will be dedicated new 1/4-inch nylon. Prior to its use in the field, clean the dedicated purging bailer in accordance with the procedure given in Appendix G.

7.0 DISPOSAL OF PURGE WATER

In all cases, purge water from sampling procedures will be collected in drums and disposed of according to NYS Department of Environmental Conservation regulations.

8.0 WELL SAMPLE COLLECTION PROCEDURE

After ground water well purging has been completed, ground water samples may be collected as soon as the well has recharged sufficiently. However, all sample collection should be completed within 24 hours after well evacuation. The well sampling procedure that will be used is described below.

1. Use the electronic liquid level indicator to measure the distance from the top of casing to the water surface in the well. After the measurement is completed, clean the probe, as described previously, before use at the next well.

2. Collect ground water samples at each well using a dedicated 1-1/2-inch stainless steel bailer. The bailer will have a five-foot monofilament polypropylene leader. Attach a dedicated 1/4-inch nylon rope to the leader to lower the bailer into the well. Lower the bailer below the surface of the water to the extent that only the leader, and not the nylon rope, makes contact with the water. Prior to its use in the field, clean the stainless steel bailer and leader in accordance with the cleaning procedure given in Appendix G.

3. Place all samples into appropriate precleaned sample containers. Place small aliquots (approximately 200 mls) from the first and last bailer samples withdrawn from the well into separate plastic beakers or bottles and immediately measure the ground water pH, conductivity, and temperature, using portable field pH and conductivity meters.

9.0 SAMPLE HANDLING/PRESERVATION

Place all samples into precleaned sample containers supplied by the analytical laboratory. Sample containers used, preservation methods, and maximum sample holding time must be in accordance with mandatory EPA methods as shown in Table 2-7 of the Work Plan. Sample bottle cleaning protocol will be as presented in Appendix H.

10.0 SAMPLE IDENTIFICATION/SHIPPING

Mark each sample, using a waterproof permanent marker, with the following information:

- Site code
- Sample identification code
- Project number
- Date/time
- Sampler's initials

After recording this information, cover each sample label with waterproof clear plastic tape to secure its attachment to the sample bottle. Record and track all samples under strict chain-of-custody protocol. Seal each sample in the field and check for proper labeling. Then pack all samples into coolers with blue-ice freeze packs. A chain-of-custody form must be completed for each cooler to be shipped or transported (see Section 4.3 of the Work Plan).

11.0 FIELD RECORDING PROCEDURES

A field notebook will be maintained during all field activities. All field measurements including water surface elevation readings and ground water pH, conductivity, temperature, etc. will be recorded sequentially with a waterproof permanent marker. Other data and information recorded will include the sampling date, sample description and identification code, sample preservation methods, the sampling conditions (e.g., weather, etc.) and explosimeter/total organic vapor meter readings at each well.

FIELD INVESTIGATION REPORT

DATE 5/23/88

DAY S ☒M T W TH F S

Project Buffalo Color RI/FS No. ______

Contractor Buffalo Drilling Co

Subject Daily Field Activities not adhering to WorkPlan

To K. Bainbridge

WEATHER	Brite Sun	Clear ✓	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70 ✓	70-85	85 up
WIND	Still	Moder ✓	High	Report No.	
HUMIDITY	Dry	Moder ✓	Humid		

MW-1-88:

Problems with Pellet bridging during placement of Bentonite pellet seal. 10 hrs. of installation and 2' of seal completed. A thick bentonite (40%) cement (60%) slurry was pumped down to complete seal (6 Ft thick). Entire seal thickness 8 Ft. Allowed Slurry to set for ½ hr. before pumping down grout Backfill.

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Owner

Signature Richard Frappa

Title Hydrogeologist

Wiley-Fisk Form 8-3

New York State Department of Environmental Conservation
600 Delaware Avenue, Buffalo, NY 14202-1073

Thomas C. Jorling
Commissioner

May 24, 1988

Mr. David Sauer
Buffalo Color Corp.
P.O. Box 7027
Buffalo, NY 14240

Re: Buffalo Color RI/FS
Site ID #915012

Dear Mr. Sauer:

With regard to the RI/FS work plan for the above referenced site, the comment responses and revised pages submitted in the May 18, 1988 letter from Malcolm Pirnie to Walt Manijak of Buffalo Color are acceptable, except for comment #3. In comment #3, the company does not agree to change the contract laboratory protocol (CLP) reference from EPA to DEC 1987. The Department must insist that this change be made. The proper reference should read "1987 NYS Department of Environmental Conservation CLP".

If this reference is changed in the appropriate pages of the work plan and the revised pages distributed, then the work plan will be accepted as final. The revised pages included with the May 18th letter will be distributed as final to the appropriate individuals for insertion into the work plan.

If you have any questions, please contact this office.

Very truly yours,

John L. Krajewski

John L. Krajewski
Senior Engineering Geologist
Division of Environmental
Enforcement

JLK/mf

cc: M. Doster - Region 9
S. Mittal - Albany

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

May 27, 1988

Mr. John L. Krajewski
Senior Engineering Geologist
New York State Department of
Environmental Conservation
Division of Environmental Enforcement
600 Delaware Avenue
Buffalo, New York 14202-1073

Re: Buffalo Color Area "D" RI/FS Ground Water Well
Sampling Procedure

Dear Mr. Krajewski:

The work plan for the subject RI/FS states, in Appendix C, that dedicated stainless steel bailers will be used to collect samples from the monitoring wells installed in Area "D". The purpose of this letter is to formally document Malcolm Pirnie's request to use nondedicated bailers for ground water sample collection. It is my understanding, based on our telecom of 5/27/88, that this change is acceptable given that the bailers will be cleaned between wells in accordance with the cleaning procedure given in Appendix G of the Work Plan dated February 1988, as revised April 1988.

Sincerely,

Malcolm Pirnie, Inc.

Kent Bainbridge

Kent L. Bainbridge
Project Manager
Senior Environmental Scientist

c: Walt Manijak, Buffalo Color
Patrick W. Concannon, NYSDEC
Paul Werthman, MPI
File: C-1

1115-03-1

FIELD INVESTIGATION REPORT

DATE 5/31/88

DAY	S	M	T	W	TH	F	S
			X				

Project Buffalo Color RI/FS No. ______

Contractor Buffalo Drilling Co

Subject NYSDEC Comment

To K. Bainbridge

WEATHER	Brite Sun	[✓ Clear]	[✓ Overcast]	Rain	Snow
TEMP.	To 32	32-50	[✓ 50-70]	70-85	85 up
WIND	Still	[✓ Moder.]	High	Report No	
HUMIDITY	Dry	[✓ Moder.]	Humid		

Kent Bainbridge called D.E.C. to obtain permission not to use dedicated bailers for sampling to reduce cost. DEC allowed the use of stainless steel Bailers w/proper cleaning protocol.

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4. Owner

Signature Richard Frappa Title Hydrogeologist

Wiley-Fisk Form 8-3

FIELD INVESTIGATION REPORT

DATE 6-2-88

DAY	S	M	T	W	TH	F	S

Project Buffalo Color RI/FS No.

Contractor Buffalo Drilling Co.

Subject Daily Field Activities Not Adhering to Work Plan

To K. Bainbridge

WEATHER	Brite Sun	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No	
HUMIDITY	Dry	Moder	Humid		

MW-7-88:

Getting downhole contamination with current drilling method. Conference call with Kent Bainbridge (MPI), Jim Barron (Buff. Drilling), + myself we decided to grout up current hole; move approx. 5-10' away auger down with 6¼" Hollow Stems to 35' (clay confining layer begins @ 29'). Install 8⅝" steel casing + pressure grout in place. Pump out approx. 25' of grout in casing + allow to cure in place overnight. Auger through casing and grout with 4¼" Hollow Stems and begin continuous sampling @ 36' to bedrock.

Inside of augers was fairly dry, therefore used pellets for seal. No problems during installation.

DISTRIBUTION:
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2. Field Office
3. File
4. Owner

Signature Richard Frapp Title Hydrogeologist

Wiley-Fisk Form 8-3

Kent B.

600 Delaware Avenue, Buffalo, NY 14202-1073

June 1, 1988

Mr. David Sauer
Buffalo Color Corporation
P.O. Box 7027
Buffalo, NY 14240

Re: Buffalo Color Plant "D" Area
RI/FS, Site ID #915012

Dear Mr. Sauer:

As a result of recent discussions with you, Kent Bainbridge of Malcolm Pirnie, and John Rankin of this Department certain corrections and updates of the May 24, 1988 letter from this office to Buffalo Color are necessary. The first change concerns the contract laboratory protocol (CLP) to be used for the analytical work. In a phone conversation with John Rankin, he authorized the use of the US EPA CLP that was originally designated in the remedial investigation work plan. Disregard the comment in the May 24th letter referring to the 1987 NYS DEC CLP.

With regard to the request for re-using bailer's for groundwater sampling with cleaning in-between, compliance with the following requirements is necessary. The cleaning procedure will be the one currently specified for stainless steel sampling equipment in Appendix G of the work plan. The bailers must be pre-cleaned before their initial use as well as between wells. The rope attached to the bailer must be changed between wells. This change in sampling procedure must be cited in the remedial investigation report. The revised sampling procedure should be reported and the authorization for this change should be indicated.

With regard to the 7 day versus 10 day requirement for volatiles analysis, notify the Department as soon as this issue is resolved with John Rankin. The personnel to notify of this determination and any future work plan determinations are as follows:

1. NYSDEC - Buffalo office
    a. Glen Bailey - attorney (716) 847-4582
    b. Martin Doster - engineer (716) 847-4585

2. NYSDEC - Albany office
    a. Shive Mittal - engineer (518) 457-0315

My responsibilities for the Buffalo Color site have been completed and, therefore, it will be inappropriate to contact me concerning future site related matters.

Very truly yours,

John L. Krajewski

John L. Krajewski
Senior Engineering Geologist
Division of Environmental
Enforcement

JLK/mf

cc: Shive Mittal - DEC, Albany
John Rankin - DEC, Albany
Marty Doster - DEC, Buffalo

Kent Bainbridge
Malcolm Pirnie, Inc.
S-3515 Abbott Road
Orchard Park, NY 14127

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

June 2, 1988

Malcolm Pirnie, Inc.
Attn: Mr. Kent Bainbridge, P.E.
S3515 Abbott Rd.
Buffalo, NY 14219

Re: Buffalo Color Analyses

Dear Kent,

Per our earlier discussions, enclosed please find a letter from Mr. Rankin of the NYSDEC confirming the use of the soxhlet extraction for the Buffalo Color soil/sediment samples.

Should you have any questions, please feel free to call.

Sincerely,

C. James Stellrecht
Vice President

bg
enc.

Audubon Business Centre • 10 Hazelwood Drive, Suite No. 106 • Amherst, New York 14150 • (716) 691-2600

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

RECEIVED
MAY 27 1988

May 20, 1988

Mr. James Stellrecht, Vice President
Recra Environmental, Inc.
Audubon Business Centre
10 Hazelwood Drive
Suite 106
Amherst, NY 14150

Dear Jim:

This confirms our telephone conversation of May 16, 1988 in which we agreed to use soxhlet extraction in place of sonication for the preanalysis preparation of soil samples collected at the Buffalo Color site.

The reason for this action is that the sample particle site is so large that soxhlet extraction would provide the more aggressive and complete extraction.

I truly appreciate your continued desire to provide the most effective and efficient analytical method available.

If you have any further questions or suggestions please do not hesitate to contact me.

Sincerely,

John M. Rankin
Quality Assurance Officer
Division of Hazardous Waste Remediation

cc: M. Serafini

buffalo
COLOR CORPORATION

p.o. box 7027 / buffalo, new york 14240-7027
716-827-4500

June 7, 1988

Mr. S. Mital
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Mital:

This is to confirm our telephone conservation.

On Friday, May 13, 1988, the drilling team was putting in a deep boring just west of the old incinerator building as part of the Area D RI/FS. They encountered soil strongly contaminated with volatile organics from just below the surface down to a depth of about 20 feet. The plan called for the boring to be deep (i.e., down to bedrock - about 62 feet deep).

I called you and made two requests for deviation from the work plan.

1) To abort the lower portion of the deep boring once the clay level (about 25 feet depth) was reached in order to prevent organic migration down the borehole.

2) To use one set of sampling spoons up to 5 times (10 feet) within the organic-contaminated "A" zone before cleaning. The plan called for all the "A" zone samples to be composited so there was no danger of their cross contamination.

We appreciate your concurrence with both requests. This approach is being applied to the other borings and wells which penetrate the organic contaminated "A" zone.

Yours truly,

David E. Sauer

David E. Sauer
Manager Environmental Affairs

DES:dt

cc: W. Manijak
J. Schutt (Allied Signal)
K. Bainbridge (Malcolm Pirnie)

4.3.5.17

FIELD INVESTIGATION REPORT

DATE 6/9/88

DAY

S	M	T	W	TH	F	S
				✓		

Project Buffalo Color RI/FS No.

Contractor Buffalo Drilling Co

Subject NYSDEC Comment

To K. Bainbridge

WEATHER	Brite Sun ✓	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70	70-85 ✓	85 up
WIND	Still	Moder	High	Report No	
HUMIDITY	Dry	Moder	Humid		

Since the clay confining layer was confirmed to present across the entire site (MW-7-88, B-5-88, MW-1-88) and is very uniform throughout the entire thickness (appox. 25') permission to use standard sampling was granted by Marty Doster (NYSDEC).

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2. Field Office
3. File
4. Owner

Signature Richard Frappa Title Hydrogeologist

Wiley-Fisk Form 8-3

Standards/guidelines for "safe" levels of exposure:

TLV
   TWA (air): 750 ppm
   STEL (air): 1000 ppm
PEL
   TWA (air): 1000 ppm
   CL (air): -
   PK (air): -

Benzene - Benzene is a suspected human carcinogen. Acute or chronic poisoning most commonly occurs through inhalation of vapor, though benzene can penetrate the skin, and poison in that way. Daily exposure to a concentration of 100 ppm or less (only very low concentrations are expected in the tunnel) will usually cause damage if continued over a protracted period of time. In acute poisoning, the worker becomes confused and dizzy, complains of tightening of the leg muscles and of pressure over the forehead, then passes into a stage of excitement. If allowed to remain in exposure, he quickly becomes stupefied and lapses into coma. In non-fatal cases, recovery is usually complete and no permanent disability occurs. In chronic poisoning the onset is slow, with the symptoms vague; fatique, headache, dizziness, nausea and loss of appetite, loss of weight and weakness are common complaints in early cases. Later, pallor, nosebleeds, bleeding gums, menorrhagia, petechiae and purpura may develop. There is a great individual variation in the signs and symptoms of chronic benzene poisoning.

Standards/guidelines for "safe" levels of exposure:

TLV
   TWA (air): 10 ppm
   STEL (air): -
PEL
   TWA (air): 10 ppm
   CL (air): 25 ppm
   PK (air): 50 ppm/10 minutes/8 hour period

Toluene - Toluene is a skin and eye irritant and toxic by ingestion. Acute poisoning, resulting from exposures to high concentrations of the vapors, are rare with toluene. Inhalation of 200 ppm of toluene for 8 hours may cause impairment of coordination and reaction time; with higher concentrations (up to 800 ppm), these effects are increased and are observed in a shorter time. In the few cases of acute toluene poisoning reported, the effect has been that of a narcotic, the workman passing through a stage of intoxication into one of coma. Recovery following removal from exposure has been the rule. As occasional report of chronic poisoning describes an anemia and leucopenia, with biopsy showing a bone marrow hypoplasia. These effects, however, are less common in people working with toluene, and they are not as severe.

Exposure to concentrations up to 200 ppm produces few symptoms. At 200-500 ppm, headache, nausea, eye irritation, loss of appetite, a bad taste, lassitude, impairment of coordination and reaction time are reported, but are not usually accompanied by any laboratory or physical findings of significance. With higher concentrations, the above complaints are increased and in addition, anemia, leucopenia and enlarged liver may be found in rare cases. A common air contaminant.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 100 ppm
  STEL (air): 150 ppm
PEL
  TWA (air): 200 ppm
  CL (air): 500 ppm/10 minutes
  PK (air): -

Chlorobenzene - Chlorobenzene is a fairly strong narcotic and possesses only slight irritant qualities. It is possible that prolonged exposure to chlorobenzene may cause kidney and liver damage. Avoid inhalation and skin contact.

Chlorobenzene presents a moderate fire risk. Exposure limits 1.8 - 9.6% in air.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 75 ppm
  STEL (air): -
PEL
  TWA (air): 75 ppm
  CL (air): -
  PK (air): -

Ethylbenzene - Ethylbenzene is a moderate irritant to the skin, eyes, mucous membranes and via oral and inhalation routes. The liquid is an irritant to the skin and mucous membranes. A concentration of 0.1% (i.e., 1000 ppm) of the vapor in air is an irritant to the eyes, and a concentration of 0.2% is extremely irritating at first, then causes dizziness, irritation of the nose and throat and a sense of constriction of the chest. Exposure of guinea pigs to 1% concentration has been reported as causing atoxia, loss of consciousness, tremor of the extremities, and finally death through respiratory failure. Ethylbenzene has been shown experimentally to cause teratogenic effects.

Erythema and inflammation of the skin may result from contact of the skin with the liquid. Exposure to the vapor causes lachrymation and irritation of the nose and throat, dizziness, and a sense of constriction of the chest.

Ethylbenzene is flammable and a dangerous fire risk.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 100 ppm
  STEL (air): 125 ppm
PEL
  TWA (air): 100 ppm
  CL (air): -
  PK (air): -

Xylene - The xylenes are moderately to highly toxic via oral and inhalation routes. The xylenes are eye irritants at a concentration of 200 ppm.

Flammable, moderate to high fire risk.

Standards/guidelines for "safe" levels of exposure:

- TLV
  - TWA (air): 100 ppm
  - STEL (air): 150 ppm
- PEL
  - TWA (air): 100 ppm
  - CL (air): -
  - PK (air): -

2-chlorophenol - This substance is an experimental equivocal tumorigenic agent. 2-chlorophenol is moderately toxic via skin adsorption, inhalation, or ingestion. Strong irritant to tissue.

Moderate fire hazard.

Standards/guidelines for "safe" levels of exposure:

- TLV
  - TWA: -
  - STEL: -
- PEL
  - TWA: -
  - CL: -
  - PK: -

1,2-dichlorobenzene - Moderately toxic by inhalation and oral routes. It is an irritant to skin, mucous membranes and the eyes. Results of testing this substance for carcinogenic properties have been indefinite.

Moderate fire hazard.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): C 50 ppm(4)
  STEL (air): -
PEL
  TWA (air): -
  CL (air): 50 ppm
  PK (air): -

<u>1,4-dichlorobenzene</u> - Moderately toxic by inhalation; highly toxic by oral ingestion. 1,4-dichlorobenzene has been reported to cause liver injury in humans. An irritant to eyes.

Moderate fire hazard.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 75 ppm
  STEL (air): 110 ppm
PEL
  TWA (air): 75 ppm
  CL (air): 50 ppm
  PK (air): -

<u>Nitrobenzene</u> - Nitrobenzene is moderately toxic via oral and germal routes. It causes cyanosis due to formation of methemoglobin. It is a skin and eye irritant. Rapidly adsorbed through skin; the vapor is hazardous. In case of contact, immediately remove all contaminated clothing including shoes. Flush skin and eyes with plenty of water for at least 15 minutes. Call a physician for eyes. May cause headache, drowsiness, nausea, vomiting, methemoglobinemia with cyanosis.

Moderate fire hazard.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 1 ppm
  STEL (air): -
PEL
  TWA (air): 1 ppm
  CL (air): -
  PK (air): -

1,2,4-trichlorobenzene - Moderately irritating to skin. Moderately toxic via oral ingestion and inhalation.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): C 5 ppm
  STEL (air): -
PEL
  TWA (air): -
  CL (air): -
  PK (air): -

2,4-dinitrotoluene - May be carcinogenic, mutagenic, and neoplastigenic. Highly toxic via oral ingestion and inhalation. It is an irritant and an allergen. It can cause anemia, methemoglobinemia, cyanosis and liver damage.

Standards/guidelines for "safe" levels of exposure:

TLV
  TWA (air): 1.5 mg/m^3
  STEL (air): -
PEL
  TWA (air): 1.5 mg/m^3
  CL (air): -
  PK (air): -

4.0 ACTION LEVELS

All remaining RI field activities shall be performed in accordance with the action levels given in the HASP, with the following exception. Full face respirators shall be worn at all times whenever HNu readings indicate the presence of total volatile organic vapors at a concentration of 1 ppm above background in the breathing zone. If the breathing zone concentration of total organic vapors exceed 5 ppm, all personnel shall leave the immediate area of the work site where these vapors exist until they have disipated. Work may resume when breathing zone concentrations are below 5 ppm.

5.0 Personnel Protection

The remaining RI field activities will include the collection of nine (9) surficial soil samples (i.e., to a depth of approximately 2 feet), two (2) samples of tar-like material located at the perimeter of the site at the river's edge, and installation of three (3) ground water monitoring wells. One (1) sample will be collected from each well following well development.

The personnel protection equipment that shall be used during the remaining RI field activities are given below:

Surficial Soil Sampling -

- Rubber boots
- Saranex® coated coverall
- Hard hat
- Nitrile outer gloves
- Latex inner gloves
- Safety glasses or full face respirator*

* A full face respirator with organic vapor cartridges shall be worn whenever HNu instrument readings indicate the presence of total organic vapor in the breathing zone at a concentration of 1 ppm above background.

Tar-Like Material Sampling

Same as for surficial soil sampling.

Monitoring Well Installation

Same as for surficial soil sampling.

Monitoring Well Sampling

Same as for surficial soil sampling.

NOTES:

1) Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day without adverse effect, as defined by the American Conference of Governmental Industrial Hygienists (ACGIH).

The TLV level is sometimes interpreted as the "safe" concentration of contaminant in the work place air. Is it safe to assume this?

No, No, a thousand times, NO! When using TLVS for worker protection it is most important to keep in mind that many qualifications apply to the above deceptively brief definition, for instance:

1. individual susceptibilities may vary
2. bases for setting TLVS vary
3. quality of toxicity information varies
4. absorption of contaminant through the skin can invalidate TLV assumptions
5. mixtures require special consideration
6. many important substances have yet to appear in the TLV list
7. TLVS can be expressed in different terms

For these reasons, the ACGIH recommends that TLVS should be used and interpreted only by persons trained in the discipline of industrial hygiene.

Chemists or engineers interested in greater understanding of the factors involved in setting the TLVS of all materials in the TLV list will want to obtain Documentation of the Threshold Limit Values, available from ACGIH, 6500 Glenway Avenue, Building D-5, Cincinnati, Ohio 45211 or telephone (513) 661-7881.

2) The TLV (Threshold Limit Value) is an American Conference of Governmental Industrial Hygienists (ACGIH)-recommended, time-weighted average concentration of a substance to which most workers can be exposed without adverse effect.

3) OSHA PELs are 8-hour time weighted average (TWA) levels, except as otherwise noted in 29 CFR 1910.1000. CL and PK are also OSHA air contaminant standards. These designations refer to ceiling value and peak value, respectively.

4) A "C" limit (i.e., ceiling limit) indicates that the substance is fast acting with respect to its ability to produce adverse health effects. Substances with this type of response are best controlled by a "C" limit that should not be exceeded.

buffalo
COLOR CORPORATION
p.o. box 7027 buffalo, new york 14240-7027
716-827-4500

November 18, 1988

Mr. Kent Bainbridge
Malcolm-Pirnie
P.O. Box 1938
S-3515 Abbott Road
Buffalo, NY 14219

Re: Area "D" RI/FS Supplemental Analytical Data

Dear Kent:

As per your request this letter is issued to confirm the analytical parameters listed in your October 29th memo. As stated in the memo the superficial soil sample are to be analyzed for priority pollutant metals, base neutral semi-volatile priority pollutants and TOX.

The water was to be analyzed for TCL volatiles and semi-volatiles, priority pollutant metals, TOC and TOX.

Sincerely,

Walt

Walter Manijak

C: D. Sauer

executive and sales offices

APPENDIX C

GEOLOGY AND HYDROGEOLOGY

MALCOLM
PIRNIE

APPENDIX C.1

EM TERRAIN CONDUCTIVITY SURVEY

APPENDIX C.1 - EM TERRAIN CONDUCTIVITY SURVEY

C.1.1 METHODOLOGY

The purpose of the terrain conductivity survey is to measure the apparent conductivity of subsurface materials which is dependent on pore water conductivity and ion exchange within and between the water and solid phases.

Very low frequency electromagnetic waves are induced into the subsurface by a transmitter coil. The time-varying magnetic field generated induces small electrical currents in the subsurface which are measured by the receiver along with the primary magnetic field. The ratio of the two magnetic fields is proportional to the bulk conductivity of the subsurface between the transmitter and receiver.

Conductivity values elevated above background levels are typically due to conductive ground water or buried metals, such as pipelines, building debris or drums. The purpose of this survey is to locate anomalous areas of elevated conductivity values. Subsequent investigations will then concentrate on these areas.

C.1.2 SURVEY

An electromagnetic (EM) terrain conductivity survey was performed on the 19-acre peninsula site using a Geonics Model EM 34-3 terrain conductivity meter in the 10-meter antenna spacing configuration. Approximately 400 readings were taken on May 3-4, 1988. The values are posted at a location midway between each transmitter and receiver location on Figure C.1.1. The values were then computer-contoured and are presented in Figure 4-9.

C.1.3 RESULTS

In general, readings taken on the peninsula were irregular and elevated with respect to readings one would expect over an undisturbed area. The general non-uniformity of readings is most likely due to the original fill, subsequent plant construction and operations and final razing of the site.

Because the entire Buffalo Color property contains sources of electromagnetic noise, no background readings could be obtained. Readings considered to be regionally background were taken near the northern boundary of South Park in Buffalo. The park is approximately three (3) miles from the Buffalo Color property. Ten readings ranging from 22 to 26 mmhos/meter were taken at the park and are considered to be indicative of background values.

Readings on the peninsula property ranged from 22 to greater than 300 mmhos/meter. The values were computer-contoured and are presented as Figure 4-9. Values greater than 300 mmhos/meter or stations where no reading could be obtained due to excess interference were given values of 300, indicating a high-magnitude anomaly. Although Figure C.1.1 shows a high degree of irregularity over the entire peninsula, there are data trends in the following areas.

The survey has indicated areas where caution should be exercised regarding the boring program. The high-magnitude readings could indicate barrels in addition to the high-conductivity wastes present. These areas could also be contaminant sources. Other electrically resistive organic contaminant sources could also obviously be present in other areas but probably not contained in barrels.

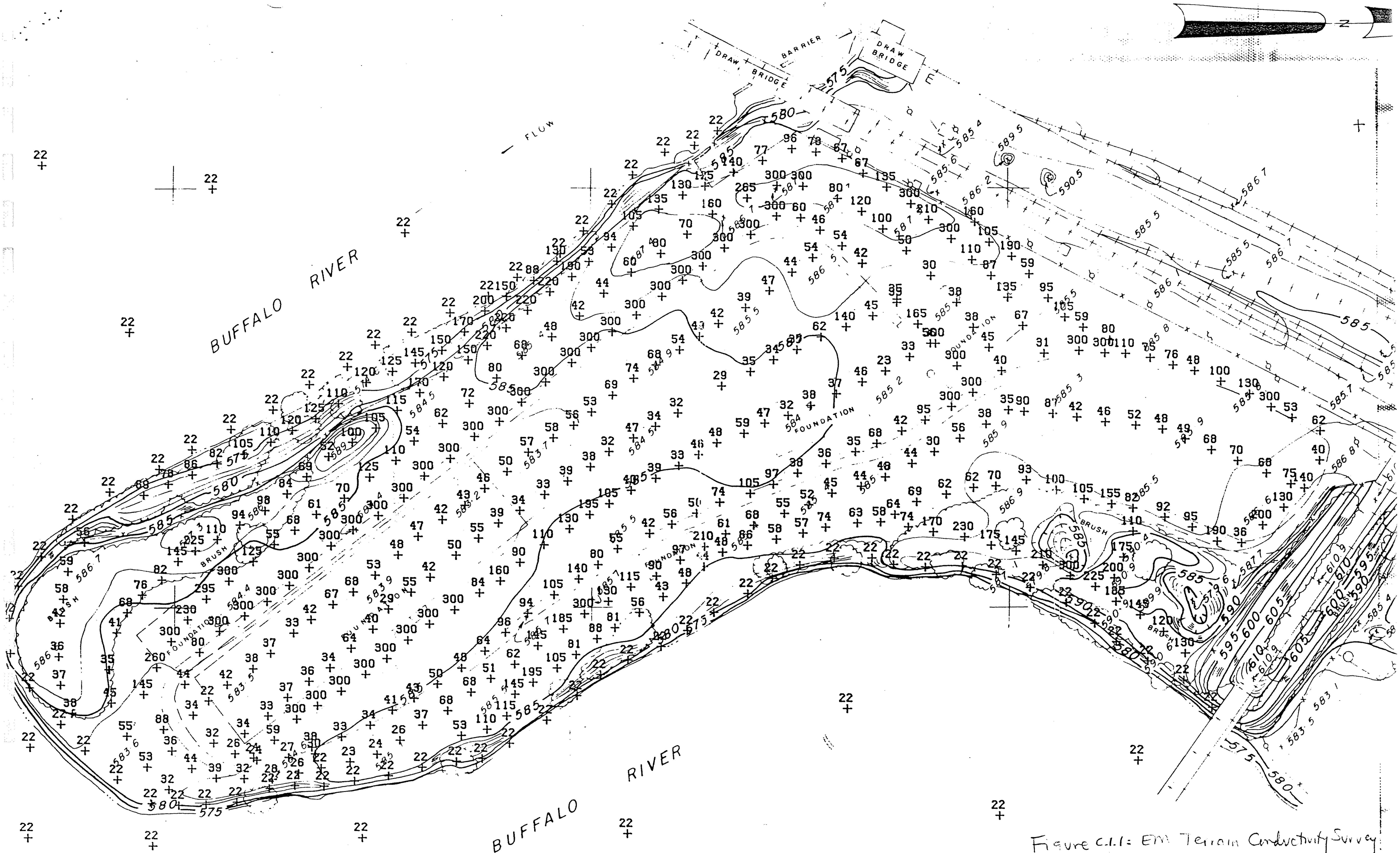


Figure C.1.1: EM Terrain Conductivity Survey
Posted Data Values
(mmhos/meter)

APPENDIX C.2

BOREHOLE LOGS

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp

PROJECT RI/FS

SITE Area "D"

LOCATION Buffalo, NY

CONTRACTOR Buffalo Drilling

METHOD OF BORING: SOIL 4¼" Hollow Stem Augers

ROCK

JOB NO. 1115-03-1 HOLE NO. MW-1-88 SHEET NO. 1 OF 4

WEATHER Showers/overcast INSPECTOR R. Frappa

TEMP. °F STARTED 2^00 P.M. May 17 1988

DIP ° FINISHED 2^00 P.M. May 19 1988

ELEVATIONS: DATUM

CASING DIAM.

GROUND SURFACE 583.95

CORE DIAM. WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Blue dye on outer wall of	0					2	Blue dye on ground
	Spoon, DK Blue stained gravelly	1	FILL	1	2	11/24	10	Surface
	SAndy Fill some SILT						17	
	No Volatiles HNU 0ppm Damp	2					10	HNU 0ppm
Alluvium	0-4" same 4+ DK red						4	
	Brown SILT And Fn-med SAND	3	SM	2	2	12/24	3	HNU 0ppm
	little fn-gravel damp						3	
	tr Blue staining	4					2	
	0-4" same w/ Blue staining						2	
	4+ Grayish brown Clayey	5	ML	3	2	12/24	1	0ppm
	SILT w/ little fn SAND moist						3	
	tr blue staining	6					3	
	Brown fn-med SANDY						1	
	SILT uniform composition	7	ML	4	2	24/24	1	0ppm
	no Blue dye present						2	
		8					2	
	Transition from previous						2	
	to Brown SILTY Fn-med	9	ML	5	2	24/24	1	
	SAND moist becoming wet						2	
	at last 2" of spoon	10					3	
	Same wet to saturated						1	
		11	ML	6	2	23/24	2	
							1	
		12					2	
	0-10" Same 10-12" mottled						3	
	w/ Gray fn-med sAnd 12+ Gray	13	SM	7	2	24/24	2	
	SILTY Fn-med SAND						3	
	Saturated Abundant Plant mat	14					5	

(Leaves, stems etc)

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 0115-03-1 HOLE NO. MW-1-88 SHEET NO. 2 OF 4

Alluvium	Wellsorted Gray silty Fn-med SAND w/abundant Plant matter Saturated	14 15	SM	8	2	24/24	1 2 4 6	
	Fn-Cs SANDs + Fn gravels grading to fn-cs SAND saturated	16 17	GP	9	2	18/24	WRH 2 3 8	HNU - 0ppm
	River Fn-Cs SANDS and Fn-Cs Gravels little SILT Saturated	18 19	GP	10	2	24/24	2 5 8 33	End of day
	Poorly Sorted Fn-Cs SAND and Fn-Cs subrd Gravels Saturated	20 21	GP	11	2	17/24	5 11 14 47	W.L. 11.2'
	0-19" same Saturated 19+ Gray Uniform Firm Clayey SILT Wet	22 23	GP CH	12	2	24/24	8 -10 12 35	Blowin
Glaciolacustrine	Gray highly plastic Clayey silt to SILTY Clay tr of orange SILT wet	24 25	CH	13	2	18/24	2 3 5 4	
	Gray highly Plastic and Sticky SILTY CLAY wet	26 27	CH	14	2	24/24	2 3 3 4	Conducted falling head permeability test at 28" Inconclusive Results
	Same saturated	28 29	CH	15	2	24/24	WR WR WR WR	
	Same wet to saturated	30 31	CH	16	2	24/24	WR WR WHR 2	
	Same wet to saturated	32 33 34	CH	17	2	24/24	WR WR WR WR	

MALCOLM PIRNIE

Field Borehole Log

~~JOB~~ Hole NO. MW-1-88 ~~HOLE~~ Job NO. 01115-034 SHEET NO. 3 OF 4

	SAme slightly siltier wet to saturated	34 35	CH	19	2	24/24	WR WR WR 2	
	SAme Warved w/ Clayey silt at approx 6" intervals wet to saturated	36 37	CH	19	2	24/24	WR WR WR WR	
	Same wet to saturated	38 39	CH	20	2	24/24	WR WR WR WR	
	Same wet to saturated	40 41	CH	21	2	24/24	WR WR WR 1	
	Same saturated	42 43	CH	22	2	24/24	WR WR 1 4	
	Same saturated a ½" clayey silt lens at 18" (varve)	44 45	CH	23	2	24/24	WR WR WR WR	
	Same small silt varve saturated	46 47	CH	24	2	24/24	WR WR WR WR	
	Same saturated 2 small silt varves	48 49	CH	25	2	24/24	WR WR WR WR	Quit @ 2^{15} drill got soaked by formation water
	Same saturated	50 51	CH	26	2	24/24	WR WR WR WR	WL 42.85 0 ppm
Till	0-4" Same Saturated 4+ Gray SILTY CLAY w/ some fn-cs SAND & fn-med Gravel Saturated	52 53 54	GC	27	2	24/24	WR WR WR WR	

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-031 HOLE NO. MW-1-88 SHEET NO. 4 OF 4

Till	Gray Clayey SILT and Fn-Cs SAND little fn-med Gravel shale frags wet	54 55 56	GC	28	2	24/24	WR WR WR WR	
	same saturated	57 58	GC	29	2	24/24	WR WR WR WR	
	same saturated	59 60	GC	30	2	24/24	WRH WRH 2 3	
	Same saturated	61 62	GC	31	2	24/24	WR 2 3 5	
	Gray fn Sandy SILT w/some Clay and med-cs sand little fn-cs gravel saturated	63 64	GC	32	2	24/24	WRH 2 4 5	
	0-4" same saturated 4+ Gray v.fn SAND and SILT tr clay some med-cs subrd gravel shale Lms	65 66	GC	33	2	20/24	WRH 4 17 23	wet
	Firm gray SILT and vfn SAND some fn-cs gravel Lms frags wet	67 68	GM	34	2	14/24	24 37 78 100/5"	
	same till w/ large broken pieces of slightly weathered limstone wet	69 70	GM	35	2	6/24	23 100/½"	Refusal 68.5'

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-2-88 SHEET NO. 1 OF 2
WEATHER Rain INSPECTOR R. Frappa
TEMP. 60 °F STARTED 12^{40} .M. May 24 19 88
DIP ° FINISHED 2^{00} .M. May 24 19 88
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.82
CORE DIAM. WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
	0-8" Med brown VFN-med	0	FILL	1	2	14/24	10	O ppm in Hole, spoon, air
	SAND some SILT little	1					24	
	subrd gravel dry 8-12"						11	→cindery material w/glass
	Cement frags 12+ Black →	2					34	Frags slight irridescent Sheen dry
	Black uniform clayey		FILL	2	2	17/24	6	
	SILT (cindery) damp	3					6	O ppm Hole, air
	to wet						8	
		4					9	
	0-11" Same wet 11+ Black		FILL	3	2	17/24	15	
	Gravelly Sandy Fill w/	5					11	0ppm - Hole + air
	pieces of Coke & Coal						75	
	slight oily sheen	6					33	
	Same Black gravelly		FILL	4	2	8/24	10	
	material, wood frags con-	7					7	Oppm Hole + air
	crete, gray slag-like						8	
✓	material damp	8					7	musty odor ~ diesel fuel
	Same w/ some glassy		FILL	5	2	7/24	2	
✓	epoxy-like subrd material	9					3	Oppm Hole + air
	damp to moist						3	
		10					7	
	Same Black stained		FILL	6	2	6/24	2	
	woodfrags, concrete,	11					4	Oppm - Hole + air
	coke pieces moist						7	
	Slightly Oily	12					5	
	Same Abundant wood		FILL	7	2	19/24	8	
*	frags, red brick +	13					4	water in spoon
	Concrete saturated						5	0 ppm air + spoon
		14					8	

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115.03.1 HOLE NO. MW-2-88 SHEET NO. 2 OF 2

Fill	Same Saturated	14					8	
	oily sheen w/asphalt	15	FILL	8	2	15/24	5	0 ppm - spoon, air, Hole
	sulpher odor - Bottom						5	
	of spoon well sorted Black	16	Alli				4	stopped at 16'
Alluvium	med sAnd							
		17						
		18						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo NY
METHOD OF BORING: SOIL 4¼" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-3-88 SHEET NO. 1 OF 2
WEATHER overcast INSPECTOR R. Frappa
TEMP. 55 °F STARTED 10³⁰ .M. May 25 19 88
DIP °   FINISHED 12³⁰ .M. May 25 19 88
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 584.53
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RETD. (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black SILT w/some	0	FILL	1	2	12/24	7	
	fn-med SAND + Clay 1. Hle	1					9	0 ppm air + sample
	fn-med gravel, coke						13	
	+ glass frags w/Red Brick	2					9	damp
	Same Black fill w/Slight		FILL	2	2	13/24	3	
	mottling of red brown	3					7	0 ppm - air + spoon very difficult
	SILT w/ Abundant constru-						3	drilling ½ hr for Interval
	ction debris kiln bricks moist	4					9	probably cement pad
	0-5" Black Clayey SILT		FILL	3	2	8/24	7	
	(industrial Sludge) 5"+ Black	5					3	0 ppm air + sample
	and Brown mottled SAndy						3	Slight musty odor
	SILT w/gravel moist to wet	6					4	
	0-3" Cs angular Gravel		FILL	4	2	8/24	3	
	3"+ Black clayey SILT	7					2	2-4 ppm in spoon
	(FILL) with asphalt-like						2	air 0 ppm
	odor oily sheen wet	8					3	
Alluvium	0-5 same as 3"+ in previous		ML	5	2	24/24	WR	
	5"+ Gray uniform clayey	9					2	air 0 ppm
	SILT permiated w/ Black						2	spoon 5-15
	Staining over 60% sample moist	10					3	
	same 60-20% Black		ML	6	2	24/24	WR	
	stained strong	11					WR	5-15 ppm sample
	disiel fuel like odor						2	3 ppm Hole
	wet	12					2	0 air
	0-6" same 6"+ transitional		SM	7	2	24/24	WR	5-10 ppm spoon
	to gray fn sand + SILT to	13					WR	3 ppm Hole
	Fn-med SAnd 20"+ Compre-						3	0 - air
	ssed leaf + plant matter	14					4	oily sheen on sample

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-3-88 SHEET NO. 2 OF 2

Alluvium	Gray fn-med Sand	14					2	
	w/ Plant matter strong	15	SP	8	2	27/24	2	5-15 ppm in spoon
	disiel-like odor oily						2	0 in air
	sheen Saturated						3	
	Same w/ abundant wood	16					2	
	+ plant matter Becoming	17	GP	9	2	19/24	3	5-25 ppm Spoon
	gravelly last 4" w/ med-						7	
	cs subrd rivergravel w/						33	W.L. 12.8'
	black product strong	18						
	Odor							

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 01115-03d HOLE NO. BMW-4-88 SHEET NO. 1 OF 2
WEATHER Rain INSPECTOR R. Frappa
TEMP. 55 °F STARTED 2^{45} PM May 16 1988
DIP ° FINISHED 9^{30} AM May 17 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.09
CORE DIAM. WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Dk Brown Silty SANDY Fill	0	FILL	1	00 2	14/24	2	Began with Respirators
	w/some Fn-Cs subrd	1					3	0 ppm HNU
	Gravel some charcoal-like						4	Hit concrete while drilling moved
	material moist	2					27	rig 1' south
	Dk Brown sandy Silty		FILL	2	2	10/24	10	
	Fill some Fn-Cs gravel	3					7	0 ppm Removed Respirators
	7-10" Concrete fragment						26	
	moist	4					12	
	0-4" Same		FILL	3	2	4/24	100/5"	
	Spoon bounced off bottom	5						0 ppm
	w/each blow							Drilled through concrete
	approx. 8" concrete floor	6						floor 1/2 hr drill time
Alluvium	Black stained sandy		ML	4	2	10/24	7	
	SILT w/little Clay	7					8	HNU - 25ppm top of Hole
	Napthalene Contaminated						5	4ppm Breathing zone
	Mothball odor moist	8					6	
	Gray Clayey Silt w/Black		ML	5	2	13/24	4	
	Staining w/little fn sand	9					4	Breathing zone 3ppm
	tr fn rd gravel damp						8	
	15ppm in spoon	10					6	
	Gray Uniform Clayey		ML	6	2	18/24	2	
	SILT w/Black staining	11					2	15ppm in hole
	58ppm in spoon						3	2ppm in breathing zone
	moist	12					4	
	Gray Clayey SILT w/		ML	7	2	24/24	1	End of day
	Little VFn Sand w/	13					2	
	Black staining over 50%						2	
	of Sample moist to wet	14					1	

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03 HOLE NO. 1115-03-6 SHEET NO. 2 OF 2

Alluvium	0-8" same wet to Saturated	14					1	HNU -60ppm
	8-16" Red Brown Clayey	15	ML	8	2	18/24	1	
	SILT little fn SAnd 16-18"						2	
	Black SAturated (NAPL) sands	16					3	NAPL saturated
	0-14" Redbrown med-fn						1	Napl in sample
	SAndy SILT tr Clay Saturated	17	SM	9	2	20/24	WRH	HNU 30 ppm in Hole
	14^{+} Dkbr sAndy silt w/						1	W.L. 15.1' B.G. ½ hr latter 14.6"
	Compressed Plant matter (leaves	18					2	stems etc.) Saturated
	0-10" Fn-med SAnd saturated						1	
	10^{+} Redbrown SILT w/ Abundant	19	SP	10	2	24/24	1	HNU 25 ppm in Hole
	Plant matter (leaves, stems)						2	
		20					5	
								Hole blew in to 18.5'
								set screen bottom at 17.5'
								5' screen

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-5-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 55 °F STARTED ~~[illegible]~~ P.M. 5/25 1988
DIP ° FINISHED 945 AM 5/26 1988
CASING DIAM.
CORE DIAM.
ELEVATIONS: DATUM
GROUND SURFACE 587.25
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RETD. (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	0-6" Red Brown Sandy SILT w/little Clay organic rich rootlets 6"+ Dk Brown & Black Sandy SILT mottling coke frags damp	0 1 2	FILL	1	2	12/24	4 5 5 7	0ppm - air + spoon
	Same as 6"+ w/ red & lt yellow Brick frags Black chacoal-like gravel w/coke concrete frags damp	3 4	FILL	2	2	6/24	12 100/2"	V. Tough drilling concrete spoils
	0-3" Subrd Cs gravel and crushed insulator brick debris 3"+ Red & Brown mottled Sandy Fill material w/gray cinders	5 6	FILL	3	2	7/21	4 5 3 3	0ppm air + spoon damp
	Red brown Silty Clay w/some fn-med sand some pieces of Black coke + gray cinders wet	7 8	FILL	4	2	5/24	2 3 100/0"	V. tough drilling 15min/1'
Alluvium	Firm Reddish Brown Clayey SILT slightly mottled w/ gray SILT some plant matter damp to moist	9 10	ML	5	2	15/24	3 6 5 7	0ppm air + spoon
	Same slightly less clay damp some black cindery material Bottom 1" moist	11 12	ML	6	2	15/24	5 5 7 7	0ppm air + spoon
	Red Brown SILT Loam tr plant matter moist Becoming wet to saturated at 13" Black oily staining were	13 14	ML	7	2	24/24	2 1 2 2	0ppm air + spoon

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-5-88 SHEET NO. 2 OF 2

Alluvium	Red Brown SILT mottled	14					WRH	0 ppm in air - spoon
	w/ gray Fn-med. SAND	15	ML	8	2	24/24	WRH	
	Saturated Black staining						1	
	w/slight petro odor at 0-4"	16					2	
	0-5 same sat - no staining						WRH	0 ppm air - spoon
	5+ gray fn-med SAND	17	SM	9	2	24/24	2	
	some SILT wet to SAT.						3	
	No contamination	18					3	

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 115-03-1 HOLE NO. MW-6-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 65 °F STARTED 1^{15} PM May 26 1988
DIP ° FINISHED 9^{30} AM May 27 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 587.33
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
	Dk brown Sandy SILTY Fill w/some Fn-Cs gravel, red brick frags, cement, coke, dry-damp	0 1	FILL	1	2	10/24	12 28 13 6	0 ppm air + sample
	Dk brown silty fn-cs sand some fn gravel wood frags Black coke-like frags damp	2 3	FILL	2	2	14/24	7 11 9 33	0 ppm air + sample
	Poor sample due to construction debris; red brick frags w/little of previous 2-4' damp	4 5	FILL	3	2	5/24	35 6 6 5	0 ppm air + sample Drill chatter
FILL	Same fill material w/Brick frags & cinders. Large piece of steel in bottom of spoon	6 7	FILL	4	2	6/24	3 100/5"	V. tough drilling 1/2 hr for 2" 0 ppm Pulled off hole & move 1' forward
	Dk brown SANDY SILT little clay some fn-med gravel, some cinders V. moist	8 9	FILL	5	2	16/24	2 2 2 3	drilled to 8' & sampled 0 ppm
	Same mottled w/red Brown fn-med Sand cindery material moist to wet	10 11	FILL	6	2	14/24	2 3 5 4	0 ppm air + sample
	0-5" Red brown clayey silt 5+ Black gravelly material w/ silt & Fn-cs Sand Saturated	12 13 14	FILL	7	2	9/24	1 2 100/3"	0 ppm Quit for day after hit auger refusal and breaking auger caps

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MV-6-88 SHEET NO. 2 OF 2

FILL	Black Fn-cs gravel w/ some Fn-cs Sand and Silt, abundant pieces of glass Saturated	14 15 16	FILL	8	2	19/24	1 1 1 1	0 ppm spoon + air
	0-4" same saturated 4+ V. Cs angular gravel	16 17 18	FILL	9	2	8/24	1 3 5 9	0 ppm air + spoon

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
JOB NO. 115-03-1 HOLE NO. MW-7-88 SHEET NO. 1 OF 4
PROJECT RI/FS
WEATHER Overcast INSPECTOR R. Frappa
SITE Area "D"
TEMP. 65 °F STARTED 2^00 PM June 1 1988
LOCATION Buffalo, NY
DIP .... ° FINISHED 4^30 PM June 7 1988
CONTRACTOR Buffalo Drilling Co.
ELEVATIONS: DATUM
METHOD OF BORING: SOIL 4¼" Hollow Stem Augers
CASING DIAM.
ROCK through 8⅝" Casing
GROUND SURFACE 588.89
CORE DIAM.
WATER LEVELS

REMARKS: To prevent downhole contamination, the original 30' hole drilled with 4¼" HSA was backfilled. A New hole was drilled to 35' (5' into clay) w/6¼" HSA. A 8⅝" casing was grouted in Borehole. 4¼" HSA drilled through grout to rock

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE				BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
			USCS	NO.	SIZE (IN.)	RET'D (IN.)		
	Black Fe oxide-rich SILT and fn-med SAND some fn gravel dry	0 1	FILL	1	2	14/24	11 10 7 4	0ppm air spoon .2ppm headspace
	Same black SILT small granules w/ mettalic appearance high specific gravity moist	2 3	FILL	2	2	18/24	10 9 8 8	0ppm air spoon .2ppm headspace V. Slight Petrochem odor
	Black Tar-like SILT Oily Feel wet to saturated	4 5	FILL	3	2	18/24	2 3 3 2	0ppm air + sample .2-.4ppm Headspace
	Black + red Brown mottled SILTY Sludge Oily	6 7	FILL	4	2	14/24	3 2 3 2	0 ppm air + spoon .2-.4 Headspace
	Varigated (predominantly black) Construction debris abundant metallic-looking material damp	8 9	FILL	5	2	13/24	3 3 2 1	0 ppm air + spoon 1-2 ppm Headspace
	Same w/ Black fn-cs SAnd + Gravel damp w/ metallic looking material	10 11	FILL	6	2	12/24	2 3 3 2	0 ppm air + spoon 1-2 ppm Headspace
	Same moist becoming wet on spoon bottom	12 13 14	FILL	7	2	14/24	2 2 2 2	0 ppm air + sample Headspace 1-2 ppm

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-7-88 SHEET NO. 2 OF 4

Fill	Same moist last 2" wet to Saturated	14 15	FILL	8	2	17/24	3 4 3 3	0 ppm spoon & air 1-3 ppm Headspace
	Black gravelly FILL w/ Brick & other construction debris Saturated	16 17	FILL	9	2	14/24	20 26 10 14	0 ppm air & spoon 2-3 ppm Headspace
	Black SILTY SAndy Sludge Saturated	18 19	FILL	10	2	24/24	2 2 2 3	0 ppm air & spoon 5-7 ppm Headspace
Alluvium	0-5" same wet 5"+ mottled Black & gray Clayey SILT Slight petrochem. odor (Amine)	20 21	ML	11	2	21/24	2 2 3 4	2-3 ppm spoon 15 ppm Headspace 0 ppm breathing zone
	Gray Fn-med SAND lenses in Gray Clayey SILT V. Strong Amine odor same as MW-8-88 oily Sheen on Sa	22 23	ML or SM	12	2	24/24	1 3 4 4	0 ppm air Blow in 5-7 ppm Headspace NAPL Present
	Black Fn-Cs SAnds & gravels w/ oily sheen, NAPL Present Saturated Strong odor	24 25	GP	13	2	19/24	1 3 5 5	2-3 ppm air 4 ppm spoon 6-8 ppm Headspace
	Black Fn-Cs SAnds & gravels 4" Piece of wood in spoon Bottom Strong odor Saturated	26 27	GP	14	2	16/24	3 13 20 15	2-3 ppm in spoon 0 ppm air 7-10 ppm Headspace NAPL Present
Glaciolacustrine	0-10" same 10"+ Gray SILTY Clay to clayey SILT smeared w/ Black NAPL	28 29	GP CH	15	2	19/24	1 2 2 5	2-3 ppm spoon 0 air
	Gray Clayey SILT w/ NAPL Smearing the in & outer walls of spoon	30 31	CH	16	2	24/24	3 2 3 1	0 spoon & air Stopped Drilling
	Not taken (see remarks)	32 33 34		17	2	/24		to prevent down hole Contamination

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-7-88 SHEET NO. 3 OF 4

	Not Taken Grout in Casing	34 35						
Glacio lacustrine	Brown Gray Clayey SILT or SILTY CLAY highly Plastic no sign of contamination	36 37	CH	18	2	24/24	WR ↓	0ppm air, spoon, headspace
	Same Silty Clay moist	38 39	CH	19	2	24/24	WR ↓	0 ppm air & Headspace
	Same w/ 2 fn silt varves moist	40 41	CH	20	2	24/24	WR ↓	0ppm
	Same moist	42 43	CH	21	2	24/24	WR ↓	0ppm
	Same moist	44 45	CH	22	2	24/24	WR ↓	
	Same moist	46 47	CH	23	2	24/24	WR ↓	
	Same moist large subrd drop stone	48 49	CH	24	2	24/24	WR ↓	
	Same moist numerous fn SILT varves tr fn sand	50 51	CH	25	2	24/24	WR ↓	
	Same silt varves present moist to wet	52 53	CH	26	2	24/24	WR ↓	
		54						

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-7-88 SHEET NO. 4 OF 4

Glaciolacustrine	Same silty Clay w/ 2 Fn SILT varves tr Fn sand wet	54 55 56	CH	27	2	24/24	WR	0ppm air, spoon + Headspace
TILL	0-12" Same little Fn sand 12"+ Gray Clayey SANDY SILT w/some Fn gravel saturated	56 57 58	GC	28	2	24/21	WR	
	Same as 12"+ Firm wet to saturated	58 59 60	GC	29	2	24/24	WR	
	Gray Brown loose Clayey SANDY SILT little Fn-med Gravel Highly Plastic Saturated	60 61 62	GC	30	2	24/21	WR WRH	0ppm air, spoon + Headspace
	same saturated	62 63 64	GC	31	2	1/24	WRH 4	
	0-6" same saturated 7" Dk Gray Limestone	64 65 66	GC	32	2	7/24	4 100/1"	

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, New York
CONTRACTOR Buffalo Drilling Co.
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-8-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 70 °F STARTED 2 05 .M. May 27 1988
DIP ° FINISHED 4 05 .M May 27 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.68
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black Fn-cs SAND w/ abundant construction debris, glass, bricks, slag concrete, large broken cobble damp	0 1 2	FILL	1	2	14/24	4 8 12 13	0 ppm air & spoon
	Red Brown Clayey SILT w/ some vfn - med sand little construction debris bricks, concrete tr slag damp	3 4	FILL	2	2	20/24	6 5 5 5	0 ppm air & spoon V. tough drilling 1/2 hr for 2'
	Same less construction debris 20-30% Black cindery material tr coke damp to moist	5 6	FILL	3	2	15/24	3 4 3 4	0 ppm air - sample
	Red brown SILT Loam w/ abundant black cinders about 20% moist becoming wet on spoon bottom	7 8	FILL	4	2	14/24	5 3 4 3	0 ppm - air & sample
	Same moist w/ < 1" coal debris	9 10	FILL	5	2	15/24	5 2 3 4	0 ppm - air & sample
Alluvium	0-6" same moist to wet 6+ Red brown clayey SILT mottled w/ gray clayey SILT moist	11 12	ML	6	2	17/24	3 4 4 6	0 ppm
	0-19" Same as 6"+ in previous moist to wet 19+ med Gray SAND Saturated	13 14	ML SP	7	2	21/24	3 3 4 3	5 ppm spoon 0 ppm air

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-031 HOLE NO. MW-8-88 SHEET NO. 2 OF 2

Alluvium	0-13" Red & gray med	14					1	HNU - 10ppm Spoon
	sand transitional at 13"	15	SP	8	2	15/24	1	0 - air
	to Red & Gray mottled		SM				2	5 - hole
	SILT and Fn Sand Saturated	16					1	
	Same as 13" +						3	HNU air 0 ppm
	saturated	17	SM	9	2	20/24	3	spoon 250 ppm
							2	Hole 35ppm
	Volatile Petrochem Odor	18					3	End of drilling

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo, NY
METHOD OF BORING: SOIL 4¼" Hollow Stem Auger
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-9-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 75 °F STARTED 11^15 AM May 31 1988
DIP ° FINISHED 1^45 PM May 31 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.46
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Red Brown Clayey SILT mottled w/ Black fn Sand and cindery material abundant brick and Construction →	0 1 2	FILL	1	2	11/24	17 18 18 11	0 ppm air + spoon → debris dry to damp
	same large limestone cobble in spoon damp	3 4	FILL	2	2	3/24	6 8 7 8	0 ppm in spoon + air 0 ppm in Hole
	Black Clayey SILTY Industrial Sludge little fn sand and gravel very moist	5 6	FILL	3	2	17/24	3 2 1 1	0 ppm spoon + air Headspace 0 ppm
	0-11" same Black sludge w/ glass frags wet 11"+ orge Brown Clayey SILT Damp	7 8	FILL	4	2	16/24	1 1 8 9	5 ppm - spoon 0 - air + hole
	Black clayey SILT w/ slight mottling w/a gray clayey SILT abundant gold metallic-like fine wire frag →	9 10	FILL	5	2	22/24	2 3 4 5	2 ppm spoon 5 ppm Headspace damp to moist
Alluvium	0-5" same damp to moist 5-12" Black + gray mottled fn-med SAND moist 12"+ Black vfn Sand wet Contaminated	11 12	SM to ML	6	2	22/24	1 2 2 2	3 ppm spoon No odor 0 - air Headspace 38 ppm
	0-8" same Black vfn SANDs saturated 8" transitional to gray SILT w/ Black staining saturated	13 14	ML	7	2	24/24	1 1 1 WRH	0 ppm air 2 ppm spoon & Headspace

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-9-88 SHEET NO. 2 OF 2

Alluvium	Red Brown fn-med SAND some SILT Slight oily sheen Saturated some plant matter present	14 15	SM	8	2	24/24	1 WRH 1 2	0 air 1 ppm spoon 2ppm Headspace
	Brown fn-med SAND some SILT Abundant plant matter SAturated	16 17 18	SM	9	2	23/24	1 1 2 3	Air 0ppm Headspace 3ppm

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4¼" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. MW-10-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 70 °F STARTED 8¹⁵ AM June 1 19 88
DIP °
FINISHED 10¹⁵ AM June 1 19 88
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.49
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black Clayey SILT w/ some Black Fn SAnd little gravel (Industrial sludge) damp	0 1	FILL	1	2	19/24	3 4 14 26	0ppm air + Spoon + Head space in jar
	Varigated Fill material Red Bricks, concrete, Sludge gray slag w/ some Yell. Brown SILT dry	2 3	FILL	2	2	12/24	15 15 11 7	0ppm air + spoon + Headspace
Alluvium	0-5" same dry 5"+ Graybrown SILT w/ some fn SAnd uniform composition damp	4 5	ML	3	2	14/24	8 5 3 5	0 ppm air, spoon, headspace
	GrayBrown SILT grading to firm Red Brown SILT Loam Uniform damp	6 7	ML	4	2	21/24	4 12 11 14	0ppm sample + air head-space
	Redbrown crumbly SILT and Fn SAND ~~tr~~ white fn sand transitional at 10" to fn-med. sAnd moist	8 9	ML to SM	5	2	16/24	2 2 3 3	0ppm - air, sample, headspace
	RedBrown fn-med SAND Some SILT grading from moist to wet	10 11	SM	6	2	23/24	2 2 3 2	0ppm - air, headspace
	SAme sAnd saturated	12 13 14	SM	7	2	24/24	1 WRH WRH WRH	0ppm air, sample headspace

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. MW-10-88 SHEET NO. 2 OF 2

Alluvium	0-3" SAme 3-11" same w/	14	SP	8	2	24/24	1	
	mottlingofgrayFn-med						1	0ppm air, sample, Headspace
	SAnd 11" Gray Fn-med	15					3	
	SAnd Abundant Plantmatter						3	saturated
	DK Gray Fn-med SAND	16	SP	9	2	24/24	2	
	Some Plantmatter						3	0ppm air, sample + Headspace
	Saturated	17					4	
							3	Endaugers at 17'
		18						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp.
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow stem augering
ROCK N/A

JOB NO. 01115-03-1 HOLE NO. MW-11-88 SHEET NO. 1 OF 2
WEATHER Cloudy, rain INSPECTOR P. Krupin
TEMP. 42 °F STARTED 9:00 A.M. Nov 8 1988
DIP ° FINISHED 11:45 A.M. Nov 8 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.98
CORE DIAM.
WATER LEVELS

REMARKS: 0-18' No sampling using Splitspoon

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
	Black silty fill, construction debis, some gravel. Dry.	0	FILL	X	2"			No Split Spoon Sampling 0-18'
Alluvium	Dark + dark gray moist sand and silt. Fill	18	SM	1	2"	19/24	2 4 3 4	HNu reading 1-10 ppm odor present Organic strong. Put on respirators
	Dark gray to brown sand w/ some silt. moist	20	SM	2	2"	24/24	1 3 6 5	HNu - 2 ppm [illegible] water at 20'7".
	Gray sand w/ some silt, turning to sand w/ gravel at bottom. moist	22	SP	3	2"	5/24	3 3 4 6	HNu - 0 ppm [illegible]
	Gray coarse sand w/ fine silt and Gravel [illegible]	24	GP	4	2"	13/24	[illegible] 3 [illegible] 5	HNu - 0-3 ppm [illegible]
	Same as above	26	GP	5	2	7/24	[illegible] [illegible] [illegible] 6	HNu [illegible]
	Gray gravel and coarse sand w/ some silt Moist.	28	GP	6	2	17/24	7 19 48 [illegible]	HNu 150-200 ppm [illegible]
		30						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp

PROJECT RI/FS

SITE Area "D"

LOCATION Buffalo, NY

CONTRACTOR Buffalo Drilling

METHOD OF BORING: SOIL 4 1/4" Hollowstem augers

ROCK N/A

JOB NO. 01115-03-1 HOLE NO. MW-11-88 SHEET NO. 2 OF 2

WEATHER Cloudy, fair INSPECTOR [illegible]

TEMP. 42 °F. STARTED 09:00 A.M. Nov 8 1988

DIP ......° FINISHED 11:45 A.M. Nov 8 1988

ELEVATIONS: DATUM

CASING DIAM.

GROUND SURFACE

CORE DIAM.

WATER LEVELS

REMARKS: MW-11-88 continued

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RETD. (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
	Gray f-c sand and gravel	30	GP	7	2'	4/24	20	HNu – 150-200 ppm
	Moist. Some silt.						4	
							4	
							3	
	light brownish to gray	32	CH	8	2"	24/24	WTH	HNu – 1 ppm
	clay						WTH	
							1	
							1	
		34						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp.
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollowstem Auger
ROCK N/A

JOB NO. 1115-03-1 HOLE NO. MW-12-88 SHEET NO. 1 OF 1
WEATHER Cloudy, cool INSPECTOR A Krupin
TEMP. 40's °F STARTED 9:15 A.M. Nov 9 1988
DIP ° FINISHED 10:00 A.M. Nov 9 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.48
CORE DIAM.
WATER LEVELS

REMARKS: 0-18' No Sampling

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	NO.	SIZE (IN.)	RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
Fill	No Sampling 0-18'	0						
Alluvium	Dark gray f-SAND and silt well graded, wet Little gravel	18	SP	1	2"	20/24	2 1 3 5	HNu reading—0 ppm No odor.
	Same as above, some pieces of wood.	20	SP	2	2"	4/24	WTH 3 7 11	HNu reading—0 ppm No odor, oily looking
	Top 3" SAA. 13" brownish clay, wet compacted	22	SP CH	3	2"	16/24	7 7 7 7	HNu reading—0 ppm no odor
		24						
		26						
		28						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp.
JOB NO. 1115-03-1 HOLE NO. MW-13-88 SHEET NO. 1 OF 1
PROJECT
WEATHER Cloudy, Cool INSPECTOR P Krupin
SITE Area "D"
TEMP. 40's °F STARTED 2:30 P.M. Nov 9 1988
LOCATION Buffalo, NY
DIP °
FINISHED 4:00 P.M. Nov 9 1988
CONTRACTOR Buffalo Drilling Co.
ELEVATIONS: DATUM
METHOD OF BORING: SOIL 4 1/4" Hollowstem Augering
CASING DIAM.
ROCK N/A
GROUND SURFACE 585.44
CORE DIAM.
WATER LEVELS

REMARKS: No Sampling 0-18'

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
Fill	No Sampling	0						
Alluvium	Dark gray f-m SAND ~~and~~, some silt, rock fragments and wood wet	18	SM	1	2"	5/24	WTH 3 9 3	HNu - 0 ppm
	SAND f-c dark gray, increasing f-m gravel towards bottom. Also some silt wet	20	SP GP	2	2"	14/24	5 13 26 53	HNu - 0 ppm spoon HNu - 0.5-1 ppm headspace Slight "musty" odor
	7 inches SAND, f-c and gravel, black wet 7 inches tightly compacted light brown clay	22	GP CH	3	2"	14/24	17 8 7 9	HNu - 0 ppm HNU - 5-10 ppm headspace "Musty" odor - like ink
		24						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp JOB NO. 1115-03-1 HOLE NO. PZ-1-88 SHEET NO. 1 OF 2

PROJECT RI/FS WEATHER Sunny, Hot INSPECTOR R. Frappa

SITE Area "D" TEMP. 85 °F STARTED 3³⁰ P.M. June 15 19 88

LOCATION Buffalo, NY DIP ______ ° FINISHED 10⁰⁰ AM June 16 19 88

CONTRACTOR Buffalo Drilling Co ELEVATIONS: DATUM ______

METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers CASING DIAM. ______

ROCK ______ GROUND SURFACE 583.91

CORE DIAM. ______ WATER LEVELS ______

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. / DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Not Taken Concrete Foundation	0 1 2	FILL					Concrete Flooring
	0-3" Cement Powder 3"+ Dk brown SILT w/ little Fn SAND moist	3 4	FILL	1	2	12/24	1 1 2 2	H-N-V - Not Working Headspace checked Nextday No odor 0ppm For all
	same as 3"+ in previous	5 6	FILL	2	2	13/24	1 2 2 3	No odor
Alluvium	Dk brown Fn SAND little SILT wet V. moist	7 8	SM	3	2	24/24	WRH 1 1 1	No odor
	same as previous wet	9 10	SM	4	2	24/24	WRH 1 1 1	No Odor
	same as previous saturated	11 12	SM	5	2	24/24	1 1 WRH 1	NO odor water in Hole
	0-16" same 16"+ Gray Fn SAND and SILT wet to SAturated	13 14	SM	6	2	24/24	1 3 3 3	NO Odor

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. PZ-1-88 SHEET NO. 2 OF 2

Alluvium	Gray Fn SAND and SILT wet to Saturated	14 15	SM	7	2	24/24	1 1 3 5	No odor
	Gray Fn-med SAND little Gravel (subrd) saturated	16 17	SP	8	2	24/24	3 4 3 3	No odor End Sampling
		18						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp.
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, N.Y.
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. PZ-2-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Fcappa
TEMP. 72 °F STARTED 3^{00} PM June 2 1988
DIP ° FINISHED 4^{10} PM June 2 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 584.51
CORE DIAM. WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Dk Red Brown Fn-med SANDY SILTY FILL w/construction debris (Bricks, glass) dry	0 1 2	FILL	1	2	16/24	5 17 8 10	1-2 ppm - exhaust from rig 0 ppm air, sample
	Red Brown Fn-med SAND + SILT Little fn gravel tr construction debris damp	3 4	FILL	2	2	11/24	4 7 8 5	0 ppm air + headspace in jar
Alluvium	0-5" same moist 5"+ Gray vfn SAND and SILT some Clay; mottling w/Black SILT moist	5 6	ML	3	2	19/24	2 2 3 4	0 ppm air + headspace
	0-15" same as 5"+ in previous 15"+ Orange + Brown mottled vfn SAND + SILT w/some Clay moist	7 8	ML	4	2	18/24	2 3 3 2	0 ppm air + headspace
	0-16" transitional from 15"+ in previous to orge brown fn-med SAND w/little SILT 16"+ Gray + orge mottled fn-med SAND	9 10	SM	5	2	24/24	1 1 1 1	0 ppm Headspace + air wet
	Gray fn-med SAND some SILT Petrochem. odor Black to Brown staining wet	11 12	SM	6	2	23/24	1 WRH 1 2	2-3 ppm Headspace 0 air
	Orge Brown fn sand + SILT mottled with Gray Fn-med SAND wet	13 14	SM	7	2	24/24	3 2 3 2	4-5 ppm Headspace 0 air

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. B-2-88 SHEET NO. 2 OF 2

Alluvium	Gray+orng mottled fn-	14						air 0 ppm
	med SAND Plant matter	15	SP	8	2	17/24		Headspace 7-8 ppm
	bottom of spoon Petrochem							
	odor Foam on auger bit	16						some detergent in grdwater
	Gray Fn-Cs SAND Soap							0ppm air
	bubbles in pores of sample	17	SP	9	2	24/24		3-4 ppm headspace
	some Black staining							
		18						End auger 17'

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
JOB NO. 1115-03-1 HOLE NO. PZ-3-88 SHEET NO. 1 OF 2
PROJECT RI/FS
WEATHER Sunny INSPECTOR R. Frappa
SITE Area "D"
TEMP. 75 °F STARTED 1⁰⁰ AM June 16 1988
LOCATION Buffalo, NY
DIP ____ ° FINISHED 3⁰⁰ AM June 16 1988
CONTRACTOR Buffalo Drilling Co
ELEVATIONS: DATUM
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK
CASING DIAM.
GROUND SURFACE 585.68
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black Fn-med SAND and SILT FILL w/abund- and construction debris concrete, bricks dry	0 1 2	FILL	1	2	10/24	9 15 29 3	HNU not Working rechecked next day no odor
	Black Sandy SILTY Gravelly Fill bricks, concrete, slag damp	3 4	FILL	2	2	9/24	5 8 7 2	No odor Headspace 0ppm
	Dk Gray Sandy SILTY Gravelly Fill with bricks + other construction debris damp to moist	5 6	FILL	3	2	12/24	3 5 7 4	0ppm
	Dk brown Fill w/ wood Frags moist	7 8	FILL	4	2	14/24	4 5 4 7	0ppm
	Black Gravelly Fill Large piece of Wood in spoon Bottom moist	9 10	FILL	5	2	3/24	4 100/3"	0ppm
Alluvium	Gray SILT some vfn sand tr Wood frags V. moist to wet	11 12	ML	6	2	6/24	4 2 3 2	0ppm
	Brown SILT some vfn SAND Oily staining slight odor wet	13 14	ML	7	2	6/24	3 1 2 3	Headspace 7ppm

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 115-034 HOLE NO. PZ-3-88 SHEET NO. 2 OF 2

Alluvium	Brown Fn-med SAND	14					4	5-10 ppm Headspace
	little SILT saturated	15	SM	8	2	24/24	1	
	Oily sheen on sample						2	
	No odor	16					3	
	Br Fn SAND slight						1	
	Oily sheen	17	SP	9	2	24/24	1	5-10 ppm Headspace
	Saturated						1	
	No odor	18					3	End sampling

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling Co
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. PZ-4-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 80 °F STARTED 1^{20} PM June 17 1988
DIP ° FINISHED 3^{00} PM June 17 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.51
CORE DIAM.
WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE				BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
			USCS	NO.	SIZE (IN.)	RET'D (IN.)		
Fill	Brown SILT tr fn SAND w/some gravelly FILL No odor dry	0 1 2	FILL	1	2	18/24	12 17 10 8	0 ppm air + Headspace
	Firm brown SILT w/ some vfn sand little fn gravel dry	3 4	GM	2	2	12/24	3 4 2 7	0 ppm air + Headspace
	0-6" same 6"+ Gray SILT tr Clay Damp	5 6	GM ML	3	2	12/24	3 4 5 7	0 ppm " "
	Same as 6"+ in Previous moist	7 8	ML	4	2	12/24	3 4 5 9	0 ppm " "
	Gray and Brown Mottled SILT w/ tr clay moist	9 10	ML	5	2	17/24	2 3 6 7	0 ppm " "
	0-17" same moist 17-18" Gray + Brown mottled fn-med SAND some SILT wet	11 12	ML SP	6	2	18/24	3 4 5 5	0 ppm " "
	Brown + Gray mottled SILT w/ little clay w/ Occ. 1" lenses of fn saturated SAND	13 14	ML	7	2	24/24	5 3 3 3	0 ppm " "

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 115-03-1 HOLE NO. PZ-4-86 SHEET NO. 2 OF 2

Alluvium	Brown & Gray mottled Fn-med SAND some SILT Saturated	14 15	SM	8	2	24/24	1 1 1 2	0ppm air & Headspace
	0-11" same 11"+ Gray Fn-med Sand little SILT and Clay Saturated	16 17	SM SM	9	2	24/24	WR 1 3 5	0ppm " "
	Same as 11"+ some plant matter	18 19	SM	10	2	24/24	1 WRH 1 1	0ppm " "
		20						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4¼" Hollow Stem augers
ROCK

JOB NO. 1115-03-1 HOLE NO. B-1-88 SHEET NO. 1 OF 2
WEATHER Rain INSPECTOR R. Frappa
TEMP. 50 °F STARTED 11 AM .M. May 13 1988
DIP ° FINISHED 4 PM .M. May 13 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.63
CORE DIAM.
WATER LEVELS

REMARKS: Strong winds + rain - To prevent down hole contamination Boring was not completed to bedrock due to the presence of NAPL.

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE				BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
			USCS	NO.	SIZE (IN.)	RET'D. (IN.)		
FILL	Brown Firm SILT w/ Black charcoal-like silt w/ little Black staining. Construction debris brick Frags damp	0 1 2	FILL	1	O.D 2	16/24	5 24 27 20	Strong odor (mothballs) HNU 28 ppm respirators put on 1hr later headspace reading 180 ppm
	0-8" Black charcoal-like silt and rounded gravel transitional to yel brn Sandy SILT w/ tr fn gravel moist on bottom	3 4	FILL	2	2	19/24	6 24 25 20	HNU - 58 ppm Headspace in jar - 240 ppm
	DK Brown Fn/med SAndy SILT w/ Black staining throughout sample little subangular gravel moist	5 6	FILL	3	2	17/24	14 14 11 13	HNU-21 ppm spoon
Alluvium	0-4" same transitional to DK Brown Clayey SILT w/ little Fn sand some black staining moist	7 8	ML	4	2	22/24	4 4 6 7	HNU 4 ppm spoon
	Brown Clayey SILT tr fn sand w/ Black staining on top 3" V. moist	9 10	ML	5	2	18/24	3 3 5 4	HNU -5 ppm spoon Headspace in jar 120 ppm
	0-12" Same Little black staining 12+ Fn/med Sandy Clay & SILT wet	11 12	ML	6	2	19/24	2 2 3 2	HNU - 4 ppm
	Brown Fn-med SAND and SILT little Clay tr fn gravel Saturated	13 14	SM	7	2	24/24	1 WRH WRH WRH	Headspace in jar 62 ppm

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. B-1-88 SHEET NO. 2 OF 2

Alluvium	Brown fn-med SAndy SILT w/ Black Oily residue (NAPL) v.slippery Strong odor wet to saturated	14 15 16	SM	8	2	17/24	2 2 3 4	HNV 50ppm abundant NAPL
	Same as previous w/ compressed leaves abundant NAPL	17 18	SM	9	2	18/24	2 1 1 3	HNU 50-70ppm
	same as previous NAPL saturating the sample	19 20	SM	10	2	19/24	1 1 2 2	Drilling stopped to phone MPI on NAPL conditions
	0-6" Subrounded med-CS Gravel 6+ same brown sandy SILT NAPL saturated	21 22	GM	11	2	12/24	44 10 10 5	resumed drilling & sampling until clay silt zone is reached
	0-3" Gravel 3-8" decayed Wood 8-14" Brown SAndy Silt 0-14" NAPl Saturated 14+ →	23 24	GM SM	12	2	16/24	4 2 2 1	Gray Clayey Silt uniform wet
Glaciolacustrine	Gray Uniform Clayey SILT wet No NAPL in pore spaces or SILTY Clay	25 26	CH	13	2	18/24	2 1 WRH WRH	WL 18.3' 5/16 8:45 AM

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. B-2-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Fraggs
TEMP. 60 °F STARTED 8 55 AM June 9 1988
DIP ° FINISHED 11 30 AM June 9 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 586.24
CORE DIAM. WATER LEVELS

REMARKS: Boring was not completed to bedrock due to the presence of an immiscible oily contaminant.

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black SAndy SILTY FILL w/Abundant Construction debris bricks, concrete dry to damp	0 1 2	FILL	1	2	6/24	6 8 6 4	0ppm air & spoon & Headspace
	Concrete Foundation Sample could not Be Taken	3 4	FILL	2	2			1/2 hr to drill through
	DK Brown grading to golden brown fn-med SAND and SILT Slag, coke & construction debris damp	5 6	FILL	3	2	18/24	9 8 8 8	0ppm air & Headspace
	0-6" Golden brown fn-med SAND and SILT dry 6-12" mottling w/gray SILT loam w/Black staining 12"+ Black	7 8	FILL ML	4	2	19/24	5 2 2 2	0ppm air .2ppm Headspace Moist Stained Clayey SILT little Fn SAND
Alluvium	Dk Gray Clayey SILT w/little fn SAnd some Black Staining No odor damp	9 10	ML	5	2	15/24	2 3 5 6	0 ppm air .2ppm Headspace
	Same as previous less black staining but slight odor moist to wet	11 12	ML	6	2	18/24	2 2 3 9	0 air 4-5ppm Headspace
	0-20" same abundant Black Staining oily appearance wet 20" Gray fn SAnd & SILT saturated	13 14	ML	7	2	24/24	1 WRH WRH WRH	0 ppm air 1-2 ppm Headspace

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. B-2-88 SHEET NO. 2 OF 2

Alluvium	Gray Brown Fn SAND and SILT tr Clay some Black Oily staining slight Napthalene odor wet to saturated	14 15 16	SM	8	2	23/24	WR WR WR 3	0 ppm air 1 ppm Headspace
	0-15" same 15"+ Black fn-med SAND w/Oily Residue saturated	16 17 18	SM	9	2	21/24	WRH 1 3 2	0 ppm air 5-7 ppm Headspace
	DK Gray Fn-med SAND Strong turpentine-like odor Black Staining OILY some Plant matter saturated	18 19 20	SP	10	2	23/24	2 2 3 6	1-2 ppm air 5-15 ppm Headspace
	DK Gray Fn-med SAND Strong odor (same odor as previous) saturated	20 21 22	SP	11	2	17/24	WRH WRH 1 2	1-2 ppm air 60-70 ppm Headspace 10' water in hole
	Same saturated contaminated	22 23 24	SP	12	2	18/24	WRH -2 5 14	oily Film on Rinse water 1-2 ppm air 15 ppm headspace
	0-7" same 7"+ Fn-cs sand and Fn-med Gravel V. Strong Odor saturated	24 25 26	GP	13	2	12/24	2 3 2 5	1-2 ppm air 45-50 ppm Headspace
Glaciolacustrine	0-3" same as 0-7" in previous 3"+ Gray SILTY ClAY highly Plastic saturated	26 27 28	CH	14	2	23/24	WRH	1-2 ppm air 2-3 ppm Headspace

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
JOB NO. 1115-03-1 HOLE NO. B-3-88 SHEET NO. 1 OF 4
PROJECT RI/FS
WEATHER Sunny INSPECTOR R. Frappa
SITE Area "D"
TEMP. 75 °F STARTED 3³⁰ PM June 9 1988
LOCATION Buffalo, NY
DIP .... ° FINISHED 4¹⁰ AM June 10 1988
CONTRACTOR Buffalo Drilling
ELEVATIONS: DATUM ....
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
CASING DIAM. ....
ROCK ....
GROUND SURFACE 586.02
CORE DIAM. ....
WATER LEVELS ....

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	NO.	SIZE (IN.)	RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black SAndy SILTY FILL w/ construction debris some black industrial sludge dry to damp	0 1	FILL	1	2	18/24	7 9 13 23	0ppm air
	Concrete Floor	2 3	FILL	2	2	1"/24	100/3"	10" concrete + rubble ½ hr of drilling
	more concrete	4 5	FILL	3	2	2"/24	12 100/0"	End of day ½ hr to drill
	Assorted fragmented construction debris bricks, cement dry	6 7	FILL	4	2	8/24	[illegible] 100/5"	17 0ppm air + Headspace
Alluvium	Red Brown SILT w/ some Clay and Vfn SAND moist no odor	8 9	ML	5	2	24/24	WRH	0ppm air + Headspace
	Brown SILT Loam w/ little Clay tr fn SAND moist	10 11	ML	6	2	24/24	WRH	0ppm air + Headspace
	Med Brown SILT and fn SAND tr Clay Saturated	12 13 14	ML	7	2	24/24	WRH 1 1 1	0ppm air + Headspace

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1175-03-1 HOLE NO. B-3-88 SHEET NO. 2 OF 4

Alluvium	0-12" same as previous 12"+ same w/mottling of Gray fn SAND and SILT Saturated	14 15	ML SM	9	2	24/24	1 WRH 1 2	0ppm air & Headspace
	Red Brown & gray Fn-med SAND and SILT saturated	16 17	SM	9	2	24/24	1 2 2 2	0ppm air & Headspace
	Gray Fn-med SAND little SILT large piece of wood @ spoon bottom Saturated	18 19	SP	10	2	24/24	1 3 3 4	0ppm air 0ppm Headspace No odor
	Gray Fn-cs SAND tr subrd gravel Saturated	20 21	SP	11	2	16/24	WRH ↓ 4 4	0ppm air .2ppm Headspace No odor
	Gray Fn-cs SAND and Fn-med subrd gravel Bottom of spoon gray clayey SILT	22 23	GP	12	2	17/24	3 6 17 25	0ppm air 1ppm Headspace slight amine (turpentine) odor
	0-6" Brown Fn-cs SAnd and gravel	24	GP	13	2	16/24	5 8	Blow in 0ppm air
	6"+ Gray SILTY Clay	25	CH				13 36	1ppm Headspace add water to hole
	Standard SAMPling @ 5 Ft. intervals	26 27 28	CH					
	Gray SILTY Clay highly Plastic wet	29 30	CH	14		18/24	1 3 4 3	0ppm air & headspace
		31 32 33 34						

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 115-03-1 HOLE NO. B-3-88 SHEET NO. 3 OF 4

Glaciolacustrine	Same Saturated lower	34	CH	15	2	24/24	WR	0ppm air & Sample
		35						
		36						
		37						
		38						
	Same wet	39	CH	16	2	24/24	WRH	0ppm
		40						
		41						
		42						
		43						
	Same wet	44	CH	17	2	24/24	WRH	0ppm
		45						
		46						
		47						
		48						
	Same wet	49	CH	18	2	24/24	WRH	0ppm
		50						
		51						
TILL	0-6" same 6"+ Brown Gray SILTY Clay w/some fn sand little fn-med subrd gravel Saturated	52	GC	19	2	24/24	WRH 1 1 2	0ppm air & Headspace
		53						
		54						

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 115-03-1 HOLE NO. B-3-86 SHEET NO. 4 OF 4

FILL	Brown Fn-cs SAND and SILT some Clay little subrd gravel Shale Frags saturated	54 55	GC	20	2	24/24	WRH	
	Same as previous saturated	56 57	GC	21	2	24/24	WR	
	Same Saturated	58 59	GC	22	2	24/24	WRH 1 1 2	
	Same Saturated	60 61	GC	23	2	24/24	WRH	
	Same saturated	62 63	GC	24	2	24/24	WRH -	
	Same 0-12" Lms Frag	64 65	GC	25	2	12/24	4 5 100/1"	refused @ 65'
		66						

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling Co.
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 115-03-1 HOLE NO. B-4-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 85 °F STARTED 3^45 PM June 13 1988
DIP ° FINISHED 9^30 AM June 14 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.33
CORE DIAM.
WATER LEVELS

REMARKS: Boring terminated at Clay confining layer to prevent down hole contamination by oily H_2S Contaminant.

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black Sandy SILTY Charcoal-like FILL w/ slag Frags & other construction debris Bricks dry	0 1 2	FILL	1	2	16/24	15 14 33 30	0 ppm air and Sample
	Same Black FILL Bottom 3" Varigated construction debris dry	3 4	FILL	2	2	14/24	4 4 3 2	0 ppm air & Headspace
	Varigated sands & gravels construction debris dry	5 6	FILL	3	2	6/24	2 2 1 1	0 ppm Sample + Headspace
Alluvium	0-1" Same Lt Gray SILT w/some vfn Sand moist to wet little Black oily staining	7 8	ML	4	2	24/24	1 WRH ↓	0 air .2-.4 ppm Headspace
	Same w/ oily staining moist to wet	9 10	ML	5	2	23/24	1 1 1 2	0 air .5 ppm Headspace
	Gray Fn SAnd and SILT musty odor abundant Black staining Wet to saturated	11 12	ML	6	2	24/24	1 WRH ↓	0 ppm air 1-2 ppm Sample & Headsp
	Black Fn Sand and SILT Strong H_2S odor Saturated	13 14	ML	7	2	24/24	WRH ↓ 3 2	0 ppm air 2-5 ppm spoon

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 115-03-1 HOLE NO. B-4-88 SHEET NO. 2 OF 2

Alluvium	Dk Gray Fn-med SAND and SILT abundant Plant matter Strong sulpher Odor saturated	14 15 16	SM	8	2	24/24	WRH 6 1 1	0 ppm air 20-25 ppm Headspace
	DK Gray Fn-med SAND some SILT Strong sulpher odor No oily residue	17 18	SP	9	2	24/24	1 1 2 1	0 ppm air 70-85 ppm Headspace
	Gray Fn-Cs SAND some fn-med Gravel tr. SILT saturated slight odor Oily Residue	19 20	GP	10	2	24/24	WRH 4 5 2	1-2 ppm air 7-9 ppm Headspace
	same w/abundant woodfrags Strong odor thin immiscible layer in jar & rinsewater	21 22	GP	11	2	24/24	1 1 3 11	0 ppm air 5-10 ppm Headspace
	0-5" same sand & gravel 5"+ V. Firm SILT some Clay moist	23 24	GP ML	12	2	17/24	3 9 13 16	0 ppm air 1-2 ppm Headspace
Glaciolacustrine	Gray Clayey SILT transitional to SILTY Clay moist	25 26	CH	13	2	24/24	4 4 6 WRH	0 ppm air & Headspace Boring terminated At confining layer to prevent downhole contamination while drilling

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling
METHOD OF BORING: SOIL 4 ¼" Hollow Stem augers
ROCK NA

JOB NO. 0115-03-1 HOLE NO. B-5-88 SHEET NO. 1 OF 4
WEATHER Rain/Sun INSPECTOR RHE
TEMP. 50 °F STARTED 10⁴⁵ AM: May 11 1988
DIP ° FINISHED 2⁰⁰ PM: May 12 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.99
CORE DIAM. WATER LEVELS

REMARKS:

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Black Silty Fill construction debris (rubble) some med-cs gravel Dry	0 1 2	FILL	1	2	6/24	7 14 23 21	HNU Reading - 0ppm in hole + Spoon
	Black silty SAND Fill Broken Brick frags Damp	3 4	FILL	2	2	7/24	14 18 9 7	HNU: 0ppm
	Black SILT w/some Fn-Cs SAND little subrd gravel tr red brick frags Fill Material moist	5 6	FILL	3	2	11/24	4 3 1 1	HNU: 0ppm
Alluvium	Dk gray Sandy SILT Little subrd gravel wood frags Black oily residue at 3-5" Moist to Wet	7 8	ML	4	2	14/24	3 1 1 1	HNU = 0ppm in spoon, sample + hole Original ground surface
	0-10" Gray clayey SILT uniform composition damp to moist 10"+ Gray SILTY CLAY v plastic moist	9 10	ML	5	2	21/24	4 3 2 4	HNU: 0ppm
	Gray highly Plastic SILT and CLAY Moist transition to less plastic Clayey SILT	11 12	ML	6	2	24/24	WRH WRH 2 4	HNU - 0ppm
	0-12" Gray Fn SAND + SILT Damp 12-18" Fn gray SAND damp to wet 18"+ Fn SAND + SILT Damp to Wet	13 14	SM	7	2	23/24	3 2 2 5	HNU - 0ppm

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 415-03-1 HOLE NO. B-5-88 SHEET NO. 2 OF 4

Alluvium	Gray Silty Fn SAND w/ little med Sand wet to Saturated where med sand is present	14 15	SM	8	2	21/24	4 3 7 6	Lunch Break
	Dk gray Silty Fn Sand w/ lenses (4) of med SAND SAND Saturated	16 17	SM	9	2	24/24	2 2 4 4	Blow in
	0-11" Gray Fn SAND-SILT wet 11+ Cs to med SAND some fn subrd gravel Saturated	18 19	SM	10	2	22/24	2 5 11 11	water in hole 0 ppm Headspace
	Gray ~~[illegible]~~ med to Cs SAND some fn-med gravel increasing amount of gravel in lower portion of spoon Saturated	20 21	SP	11	2	24/24	11 22 32 51	W.L. 14.1' B.G.
	0-10" same saturated 10-16" gradional clayey SILT + fn-med SAND wet 16+ Firm gray clayey SILT moist	22 23	GL	12	2	24/24	13 9 10 12	added water to aid drilling
Glaciolacustrine	Firm uniform Gray Clayey SILT Wet	24 25	CH	13	2	19/24	5 6 13 11	
	Same as previous slightly more plastic wet	26 27	CH	14	2	17/24	2 3 3 4	
	~~Same wet~~ Gray plastic SILTY CLAY wet	28 29	CH	15	2	24/24	2 2 3 3	
	Same Highly Plastic Wet	30 31	CH	16	2	24/24	1 1 2 2	
	Same wet	32 33 34	CH	17	2	24/24	WRH WRH WRH ~~2~~	

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. B-5-86 SHEET NO. 3 OF 4

Glaciolacustrine	SAme gray Silty Clay wet	34 35	CH	18	2	24/24	WRH WRH WRH 3	
	Same wet	36 37	CH	19	2	24/24	WRH WRH WRH WRH	End of Day
	Same wet	38 39	CH	20	2	24/24	WR WR WR WR	W.L. 31.4' B.6 5/13 8AM
	SAme wet	40 41	CH	21	2	24/24	WRH WRH WRH 4	
	SAme wet	42 43	CH	22	2	24/24	WRH WRH WRH 1	
	SAme wet	44 45	CH	23	2	24/24	WRH WRH WRH 1	
	Same wet	46 47	CH	24	2	24/24	WR WR WR WR	
	Same tr. Fn-med sand saturated	48 49	CH	25	2	24/24	WR WR WR WR	
TILL	0-16 same saturated 16+ Sloppy Gray Silty CLAY w/ little Fn/cs sand and subangular gravel saturated	50 51	SC	26	2	24/24	WR WR WR WR	
	Gray ClAYey SILT w/ some fn-cs SAnd and fn-cs gravel increase in % gravel in lower portion of spoon	52 53 54	GC	27	2	24/24	WRH WRH WRH 5	

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 **HOLE NO.** B-5-88 **SHEET NO.** 4 **OF** 4

	Gray Clayey SILT some Fn-cs SAND and Fn-med gravel Plastic saturated	54 55 56	GC	28	2	24/24	WR WR WR 5	
	Gray SILT w/ little Clay some fn-cs SAnd little subrd shale frags wet	56 57 58	GC	29	2	14/24	6 9 11 13	
TILL	NOT TAKEN Driller drilled too FAr!	58 59 60		30		[illegible]	[illegible]	
	Gray SILT w/ some Fn-med SAnd little subrd gravel (shale) wet	60 61 62	GC	30	2	13/24	9 19 25 33	
	same saturated Frags of Lms	62 63 64	GC	31	2	8/24	11 100/1"	Refusal

MALCOLM PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp
PROJECT RI/FS
SITE Area "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling Co.
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Auger
ROCK

JOB NO. 1115-03-1 HOLE NO. B-6-88 SHEET NO. 1 OF 2
WEATHER Sunny INSPECTOR R. Frappa
TEMP. 80 °F STARTED 12^{30} PM June 14 1988
DIP ° FINISHED 3^{00} PM June 14 1988
ELEVATIONS: DATUM
CASING DIAM.
GROUND SURFACE 585.92
CORE DIAM. WATER LEVELS

REMARKS: Boring terminated at confining layer to prevent downhole contamination while drilling! NAPL Present

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE USCS	SAMPLE NO.	SAMPLE SIZE (IN.)	SAMPLE RET'D (IN.)	BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
FILL	Varigated Construction debris concrete bricks slag sandy SILTY FILL dry	0 1	FILL	1	2	18/24	33 23 21 15	0ppm air + Headspace
	same w/slag and Coal frags dry	2 3	FILL	2	2	14/24	6 7 5 4	0ppm air + Headspace
	Brown Fn-cs SAND some SILT tr fn gravel moist	4 5	FILL	3	2	15/24	3 1 3 1	0ppm air + Headspace
Alluvium	0-9" same as previous 9"+ Gray Clayey SILT w/some Black Staining moist No odor	6 7	FILL ML	4	2	17/24	1 1 2 4	0ppm air + Headspace
	Red Brown clayey SILT w/some Black stained portions No odor moist to wet	8 9	ML	5	2	16/24	1 1 1 1	0ppm air 4ppm Headspace
	Gray Fn-med SAND some SILT Saturated with strong Amine smelling oily NAPL	10 11	SM	6	2	24/24	1 1 1 1	0ppm air 40-50 ppm Headspace
	Same more SILT saturated Strong Amine odor	12 13 14	SM	7	2	24/24	1 1 2 1	0ppm air 5-10 ppm spoon 40-50ppm Headspace

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-L HOLE NO. B-6-88 SHEET NO. 2 OF 2

Alluvium	Gray Fn-med SAND Saturated some Black NAPL VStrong odor	14 15 16	SM	8	2	24/24	1 2 2 1	Oily Film on rinse water 2-4ppm air 20-30 Headspace
	Same sand w/Black NAPL saturated	16 17 18	SM	9	2	24/24	WRH 3 1	2-4 ppm air Respirators put on Headspace 50-70ppm
	Gray Fn-Cs SAND some Fn-med subrd gravel saturated No black staining some wood	18 19 20	GP	10	2	24/24	2 1 2 1	2-3ppm air 8-10ppm Headspace
	Gray Fn-med-Cs SAND and Fn-med Gravel saturated No Black Staining Wood pieces	20 21 22	GP	11	2	14/24	WRH	Headspace 2-5ppm air 2-3ppm
	Fn-Cs SAND some fn gravel grading downward to fn-cs gravel and Fn-med sand saturated	22 23 24	GP	12	2	12/24	3 -6 13 36	Headspace -2-3ppm
Glacio/lacustrine	0-16" same as previous 16"+ Gray Clayey SILT highly Plastic	24 25 26	GP CH	13	2	19/24	5 6 10 19	Headspace 2-3ppm End sampling

MALCOLM
PIRNIE

Field Borehole Log

CLIENT Buffalo Color Corp.
PROJECT RI/FS
SITE AREA "D"
LOCATION Buffalo, NY
CONTRACTOR Buffalo Drilling Co
METHOD OF BORING: SOIL 4 1/4" Hollow Stem Augers
ROCK

JOB NO. 1115-03-1 HOLE NO. B-7-88 SHEET NO. 1 OF 2
WEATHER Sunny Hot INSPECTOR R. FCappa
TEMP. 85 °F STARTED 9¹⁵ AM June 15 1988
DIP ° FINISHED 12³⁰ PM June 15 1988
ELEVATIONS: DATUM
CASING DIAM. 4 1/4" I.D.
GROUND SURFACE 586.58
CORE DIAM.
WATER LEVELS

REMARKS: Windy. Boring was not completed to Bedrock due to the presence of NAPL.

LOG	DESCRIPTION: COLOR; CONSISTENCY DENSITY; TEXTURE; STRUCTURE; SHAPE AND SURFACE CONDITION OF GRAINS; ODOR; ETC.	ELEV. — DEPTH	SAMPLE				BLOWS PER 6 INCH	NOTES: BORING; TESTING AND SAMPLING PROCEDURES; WATER LOSS AND GAIN; DRILLING AND TESTING EQUIPMENT; ETC.
			USCS	NO.	SIZE (IN.)	RET'D (IN.)		
FILL	DK Brown SANDY SILTY FILL w/ abundant construction debris (bricks, concrete wood) dry	0 1 2	FILL	1	2	13/24	2 20 18 10	0ppm air + Headspace
	Varigated FILL material Brown sand + SILT, Gray slag Red-Orge Bricks, white concrete damp	3 4	FILL	2	2	18/24	12 18 13 4	0ppm air 1-2 ppm Headspace
	Black Tar-like gravels No odor wet	5 6	FILL	3	2	14/24	4 3 3 3	air 0ppm Headspace 4ppm
Alluvium	0-8" Black gravels COated w/Black Oily NAPL 8"+: Black Stained Brown Fn SAND + SILT moist	7 8	FILL SM	4	2	24/24	3 3 3 5	Wet (Oily) spoon 0ppm air 2-3 ppm Headspace
	Gray Brown SILT w/ tr fn SAND Black staining over entire length of sample Weak Paint thinner odor	9 10	ML	5	2	18/24	3 3 5 5	0ppm air 2-3 ppm Headspace moist
	same as Previous w/same odor saturated	11 12	ML	6	2	20/24	2 3 2 3	0 ppm air 2-3ppm Head Space
	0-3" same 3"+ Gray FN-Med SAND some SILT Saturated in Black Oily liquid NAPL V. Strong	13 14	SM	7	2	24/24	1 2 1 2	0ppm air 30-40ppm Headspace odor

MALCOLM PIRNIE

Field Borehole Log

JOB NO. 1115-03-1 HOLE NO. B-7-88 SHEET NO. 2 OF 2

Alluvium	0-12" same NAPL saturated 12"+less NAPL saturated Gray Fn-med SAND some SILT	14 15 16	SM	8	2	24/24	3 2 2 3	0ppm air 8-10ppm Headspace oilslick on rinsewater surface
	Brown Fn-Cs SAND and fn-Med Gravel Strong Odor slightly Oily	17 18	GP	9	2	24/24	1 3 4 8	0ppm air 20-25ppm Headspace
	Same SAND+gravel V. Strong odor oily SAturated	19 20	GP	10	2	13/24	WRH 3 6 11	1-2 ppm air 30-40ppm Headspace
	Same River gravels strong odor Oily Film on water in Spoon	21 22	GP	11	2	10/24	1 3 6 16	0ppm air 80-90 ppm Headspace
	Fn-Cs SAND and Fn- Cs Gravels strong odor grading coarser down ward saturated	23 24	GP	12	2	24/24	1 4 24 13	1-2ppm air Headspace 200-220 ppm
	same sands and gravels strong odor Occ. wood frags	25 26	GP	13	2	24/24	7 15 57 42	Blow in 1-2 ppm air Headspace 175-200ppm
	Same w/ some SILT and Clay Wood on Bottom of spoon Strong Odor	27 28	GC	14	2	24/24	3 5 5 5	Headspace 200-225ppm 1-2ppm air
Glaciolacustrine	0-6" same 8"+ Gray SILTY Clay highly Plastic sticky Saturated	29 30	GC CH	15	2	21/24	16 4 1 1	0-1 ppm Air Headspace 50-60ppm End Sampling
		31 32 33 34						

APPENDIX C.3

OVERBURDEN CASING INSTALLATION PROCEDURES

APPENDIX C.3 - OVERBURDEN CASING INSTALLATION PROCEDURES

During continuous split-spoon sampling in the deep monitoring well MW-7-88, NAPL was encountered above the alluvium/clay interface (24.00 to 28.83 feet BGS). In order to avoid downhole contamination, it was decided to install an overburden casing approximately six feet into the clay strata. The casing was pressure grouted in place. The following procedure applies only to MW-7-88.

Advance borehole using 6 1/4-inch ID hollow-stem augers to a depth of 35.0 feet BGS (6.2 feet into the clay). Pump a cement/bentonite grout slurry into the interior of the augers through a tremie pipe located near the bottom of the boring. After grout was observed at grade and no bridging of the slurry was evident, the hollow-stem augers were removed from the boring. A 35-foot, 8 5/8-inch ID black steel casing was then placed into the borehole. At this point, additional grout was tremied into the annular space between the casing and the borehole wall until undiluted grout was observed at the ground surface. After approximately two hours, the grout inside the casing was pumped out to within five feet of the bottom. The grout was then allowed to set for 18 hours, at which time the top of the grout inside the casing was observed at 34.0 feet BGS.

APPENDIX C.4

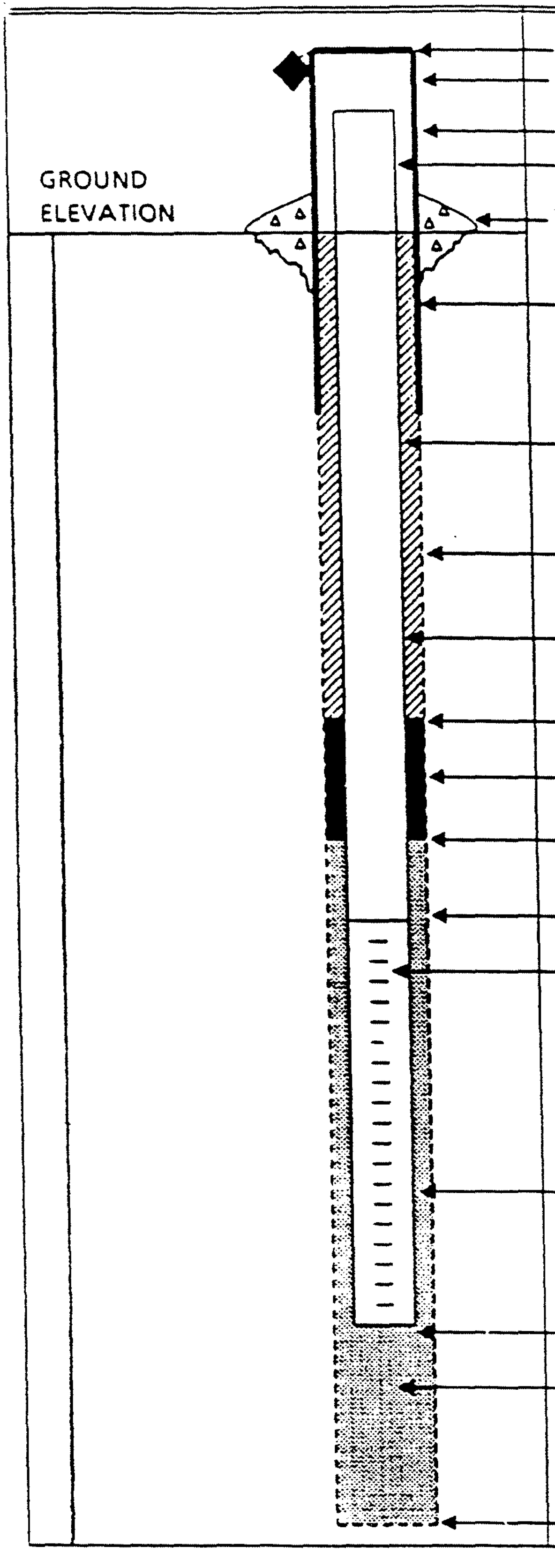
WELL CONSTRUCTION DETAILS

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS LOCATION Area "D"
PROJECT NO. 115-03-1 BORING MW-1-88
ELEVATION 583.95 DATE 5-23-88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4 1/4" Hollow Stem Augers
DEVELOPMENT METHOD Bailer



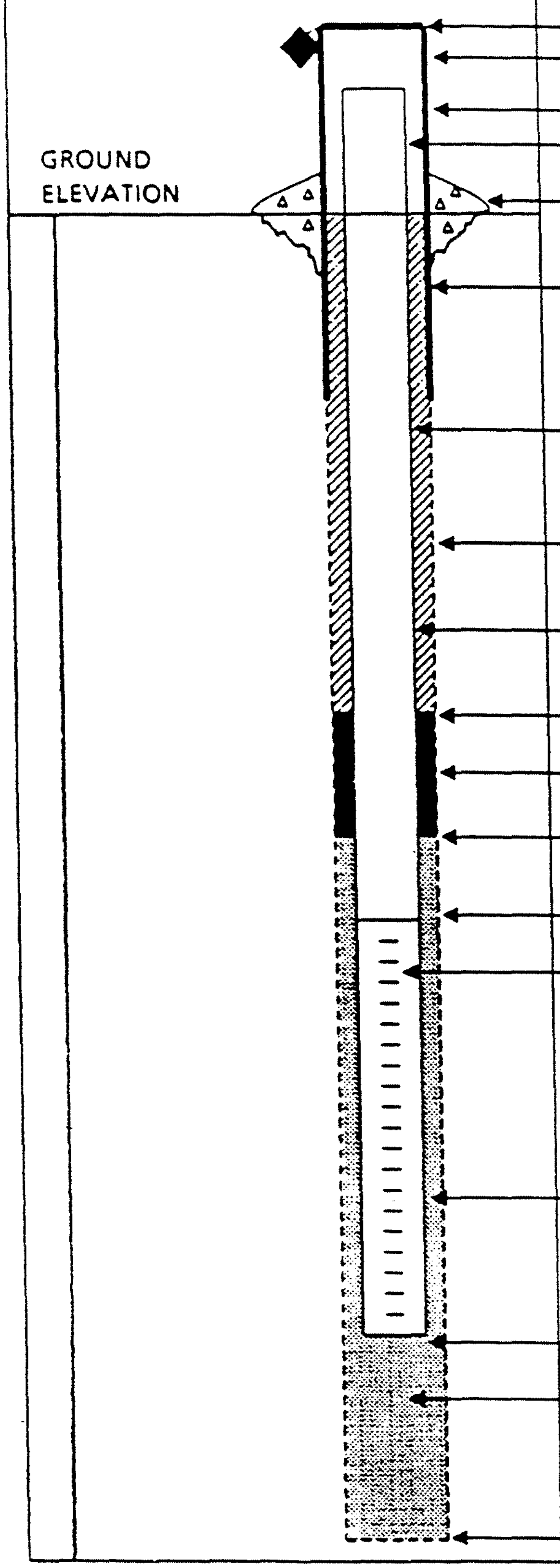
ELEVATION OF TOP OF SURFACE CASING: 586.68
ELEVATION OF TOP OF RISER PIPE: 586.56
STICK - UP TOP OF SURFACE CASING: 2.73
STICK - UP RISER PIPE: 2.61
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 52.5
TYPE OF SEAL: Bentonite Pellets (2') and Bentonite Slurry (6')
DEPTH TOP OF SAND PACK: 60.5
DEPTH TOP OF SCREEN: 62.5
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #3
DEPTH BOTTOM OF SCREEN: 67.5
DEPTH BOTTOM OF SAND PACK: 68.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 515.45/68.5

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING MW-2-88
ELEVATION 586.82
DATE 5/24/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailer



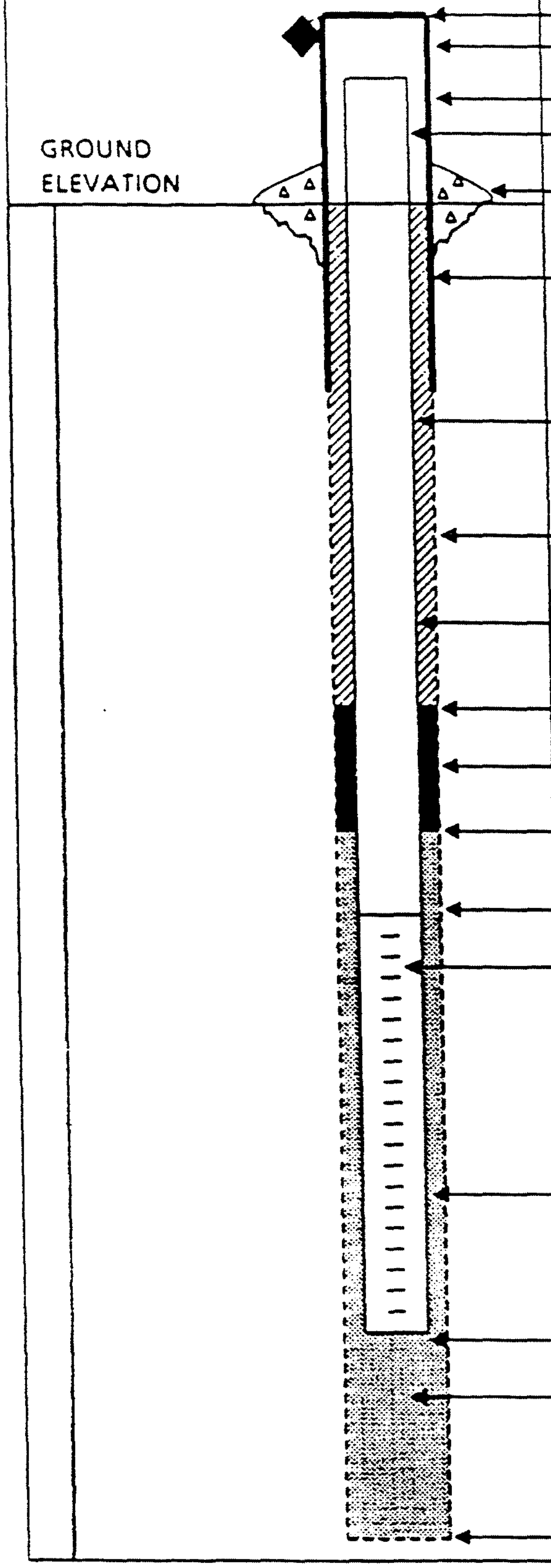
ELEVATION OF TOP OF SURFACE CASING : 590.09
ELEVATION OF TOP OF RISER PIPE: 589.98
STICK - UP TOP OF SURFACE CASING: 3.27
STICK - UP RISER PIPE : 3,16
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.0
DEPTH TOP OF SCREEN: 11.0
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.0
DEPTH BOTTOM OF SAND PACK: 16.0
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 570.82/16

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING MW-3-88
ELEVATION 584.53
DATE 5/25/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailer



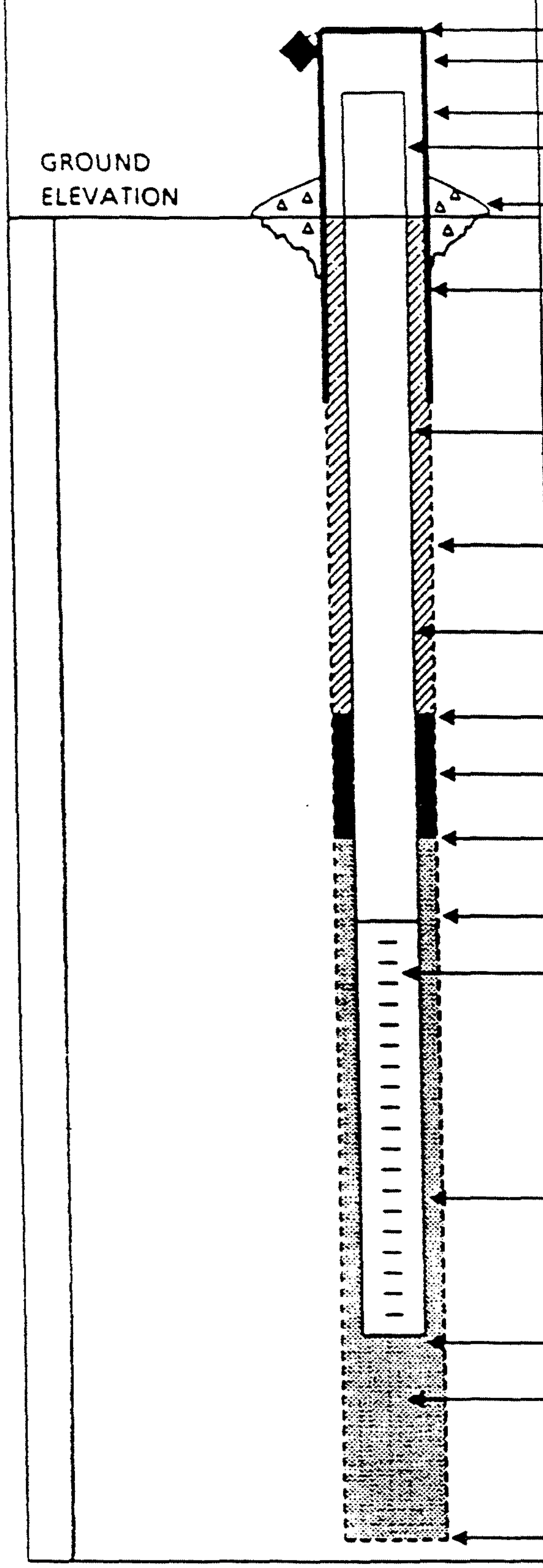
ELEVATION OF TOP OF SURFACE CASING: 586.87
ELEVATION OF TOP OF RISER PIPE: 586.76
STICK - UP TOP OF SURFACE CASING: 2.34
STICK - UP RISER PIPE: 2.23
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.0
DEPTH TOP OF SCREEN: 11.0
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.0
DEPTH BOTTOM OF SAND PACK: 17.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 567.53/17

MALCOLM PIRNIE

OVERBURDEN MONITORING WELL SHEET

PROJECT *Buffalo Color RI/FS* LOCATION *Area "D"*
PROJECT NO. *1115-03-1* BORING *MW-4-88*
ELEVATION *586.09* DATE *5/17/88*
FIELD GEOLOGIST *R. Frappa*

DRILLER *Buffalo Drilling*
DRILLING METHOD *4 1/4" Hollow Stem Augers*
DEVELOPMENT METHOD *Bailing*



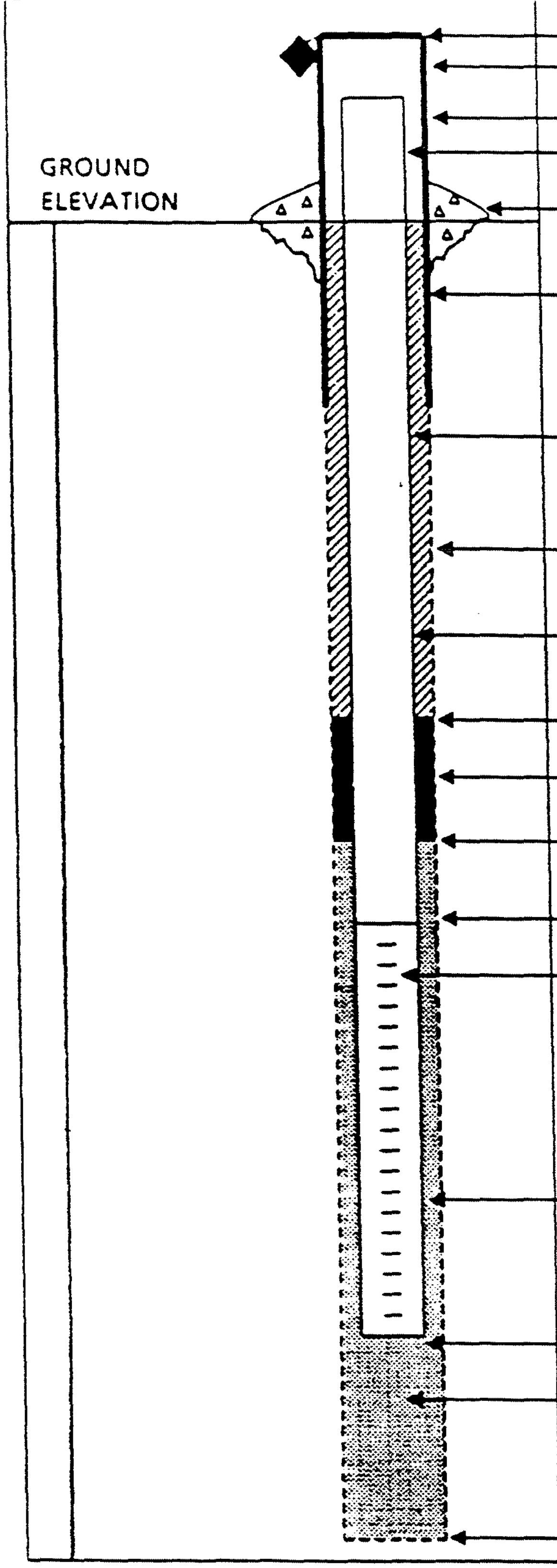
ELEVATION OF TOP OF SURFACE CASING: *588.46*
ELEVATION OF TOP OF RISER PIPE: *588.35*
STICK - UP TOP OF SURFACE CASING: *2.37*
STICK - UP RISER PIPE: *2.26*
TYPE OF SURFACE SEAL: *Cement*
I.D. OF SURFACE CASING: *4"*
TYPE OF SURFACE CASING: *Protective Steel*
RISER PIPE I.D. *2"*
TYPE OF RISER PIPE: *Type 306 Stainless Steel*
BOREHOLE DIAMETER: *8"*
TYPE OF BACKFILL: *Cement/Bentonite*
DEPTH TOP OF SEAL: *7.0*
TYPE OF SEAL: *Bentonite Pellets*
DEPTH TOP OF SAND PACK: *11.0*
DEPTH TOP OF SCREEN: *13.0*
TYPE OF SCREEN: *Type 306 Stainless Steel*
SLOT SIZE x LENGTH: *.010" Continuous Slot*
I.D. OF SCREEN: *2"*
TYPE OF SAND PACK: *Silica SAND Q-ROK #3*
DEPTH BOTTOM OF SCREEN: *18.0*
DEPTH BOTTOM OF SAND PACK: *19.0*
TYPE OF BACKFILL BELOW OBSERVATION WELL: *1 Ft Silica Sand + 1 Ft Natural Sands and Gravels from blow in*
ELEVATION / DEPTH OF HOLE: *566.09/200*

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS LOCATION Area "D"
PROJECT NO. 1115-03-1 BORING MW-5-88
ELEVATION 587.25 DATE 5/26/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4 1/4" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



ELEVATION OF TOP OF SURFACE CASING: 589.45
ELEVATION OF TOP OF RISER PIPE: 589.33

STICK - UP TOP OF SURFACE CASING: 2.20
STICK - UP RISER PIPE: 2.08

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: Cement/Bentonite

DEPTH TOP OF SEAL: 5.0

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 9.0

DEPTH TOP OF SCREEN: 11.25

TYPE OF SCREEN: Type 306 Stainless Steel

SLOT SIZE x LENGTH: .010" Continuous Slot

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: Silica SAND Q-ROK #2

DEPTH BOTTOM OF SCREEN: 16.25

DEPTH BOTTOM OF SAND PACK: 17.0

TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand

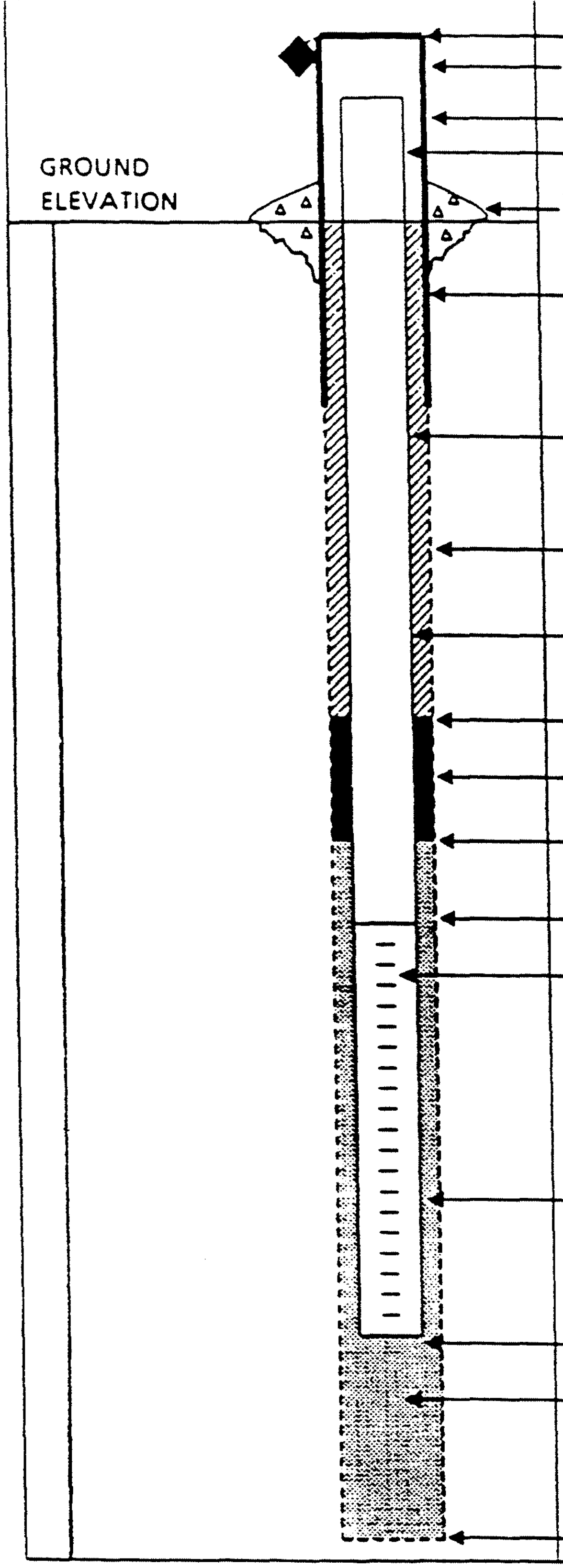
ELEVATION / DEPTH OF HOLE: 570.25/17.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS LOCATION Area "D"
PROJECT NO. 1115-03-1 BORING MW-6-88
ELEVATION 587.33 DATE 5/27/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing

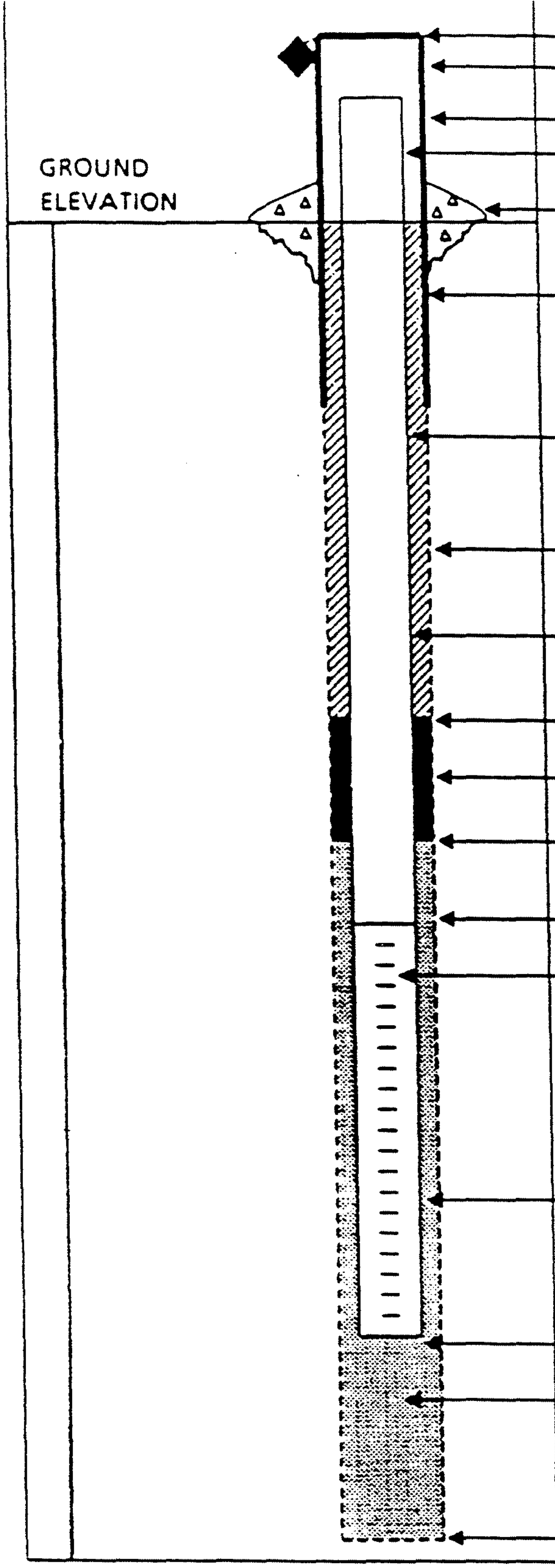


ELEVATION OF TOP OF SURFACE CASING : 589.49
ELEVATION OF TOP OF RISER PIPE: 589.38
STICK - UP TOP OF SURFACE CASING: 2.27
STICK - UP RISER PIPE : 2.16
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.0'
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.0'
DEPTH TOP OF SCREEN: 11.0'
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.0'
DEPTH BOTTOM OF SAND PACK: 17.0'
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 570.33/17.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
PROJECT NO. 1115-03-1
ELEVATION 588.89
FIELD GEOLOGIST R. Frappa
LOCATION Area "D"
BORING MW-7-88
DATE 6/8/88
DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



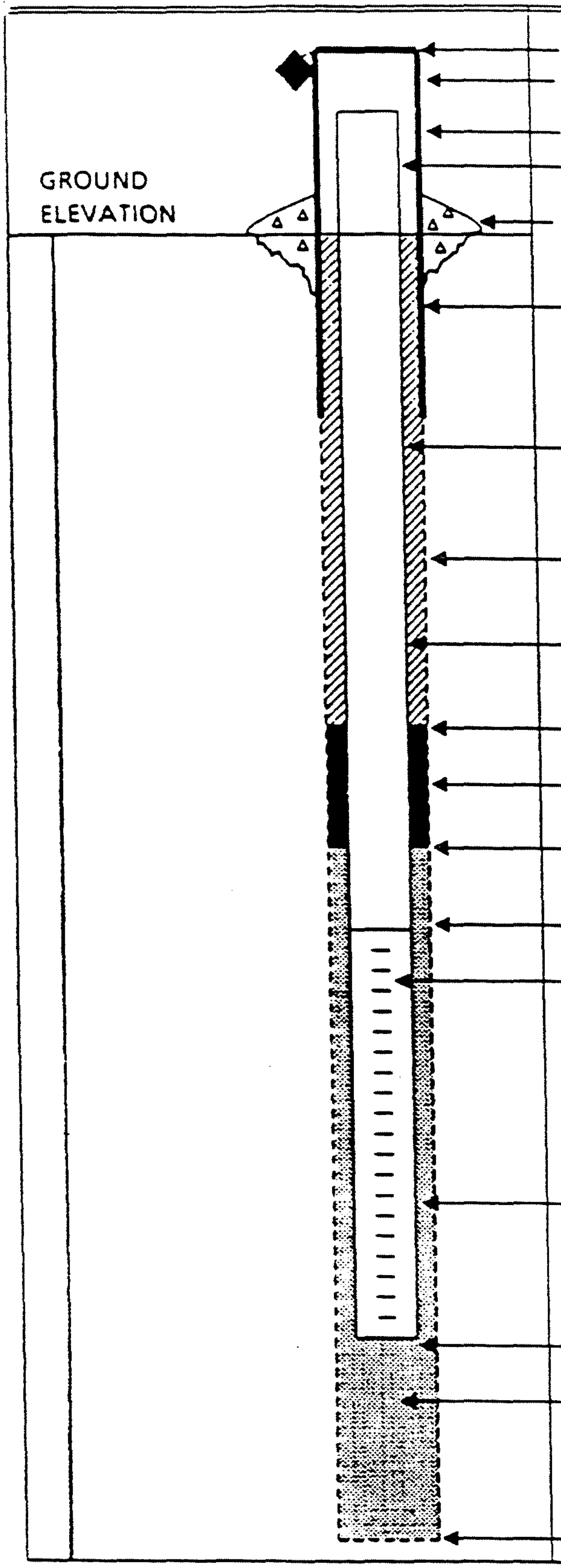
ELEVATION OF TOP OF SURFACE CASING: 592.27
ELEVATION OF TOP OF RISER PIPE: 592.15
STICK - UP TOP OF SURFACE CASING: 3.38
STICK - UP RISER PIPE: 3.26
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 53.5
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 57.5
DEPTH TOP OF SCREEN: 59.5
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 64.5
DEPTH BOTTOM OF SAND PACK: 65.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica SAND
ELEVATION / DEPTH OF HOLE: 523.4/65.5

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING MW-8-88
ELEVATION 586.32
DATE 5/31/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



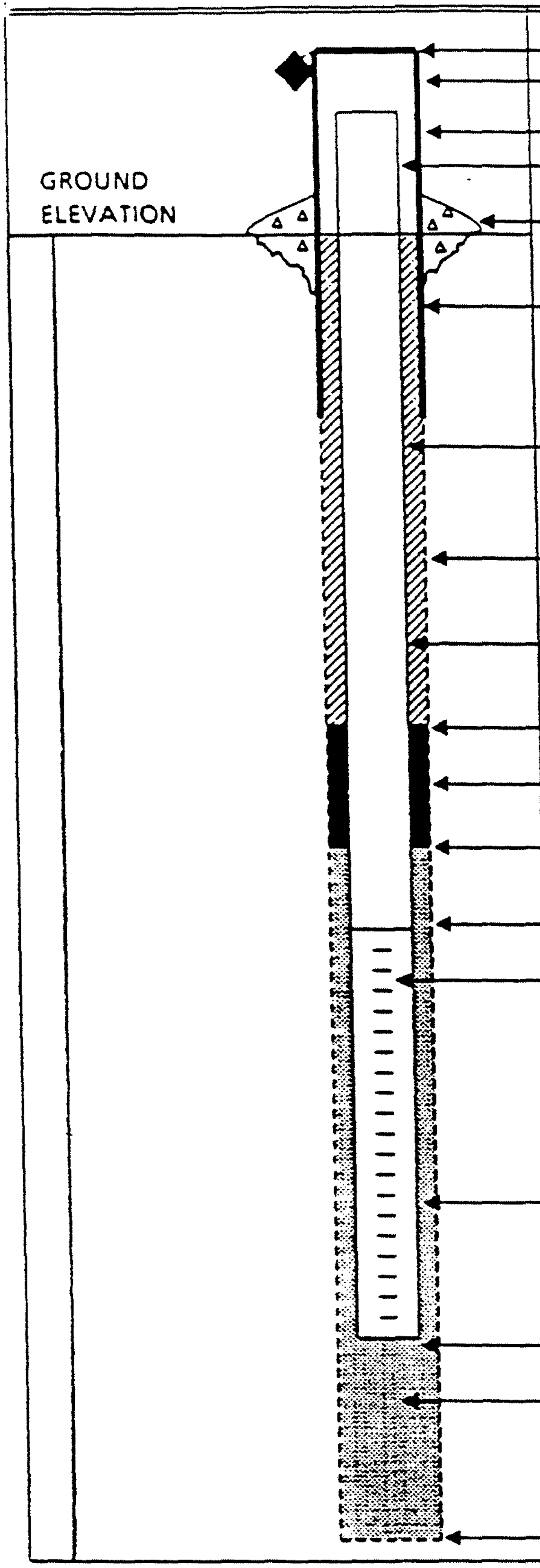
ELEVATION OF TOP OF SURFACE CASING: 588.88
ELEVATION OF TOP OF RISER PIPE: 588.77
STICK - UP TOP OF SURFACE CASING: 2.20
STICK - UP RISER PIPE: 2.09
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.5
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.5
DEPTH TOP OF SCREEN: 11.8
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.8
DEPTH BOTTOM OF SAND PACK: 16.8
TYPE OF BACKFILL BELOW OBSERVATION WELL: Natural Sands and gravels
ELEVATION / DEPTH OF HOLE: 569.32/17

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 115-03-1
BORING MW-9-88
ELEVATION 585.46
DATE 5/31/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing

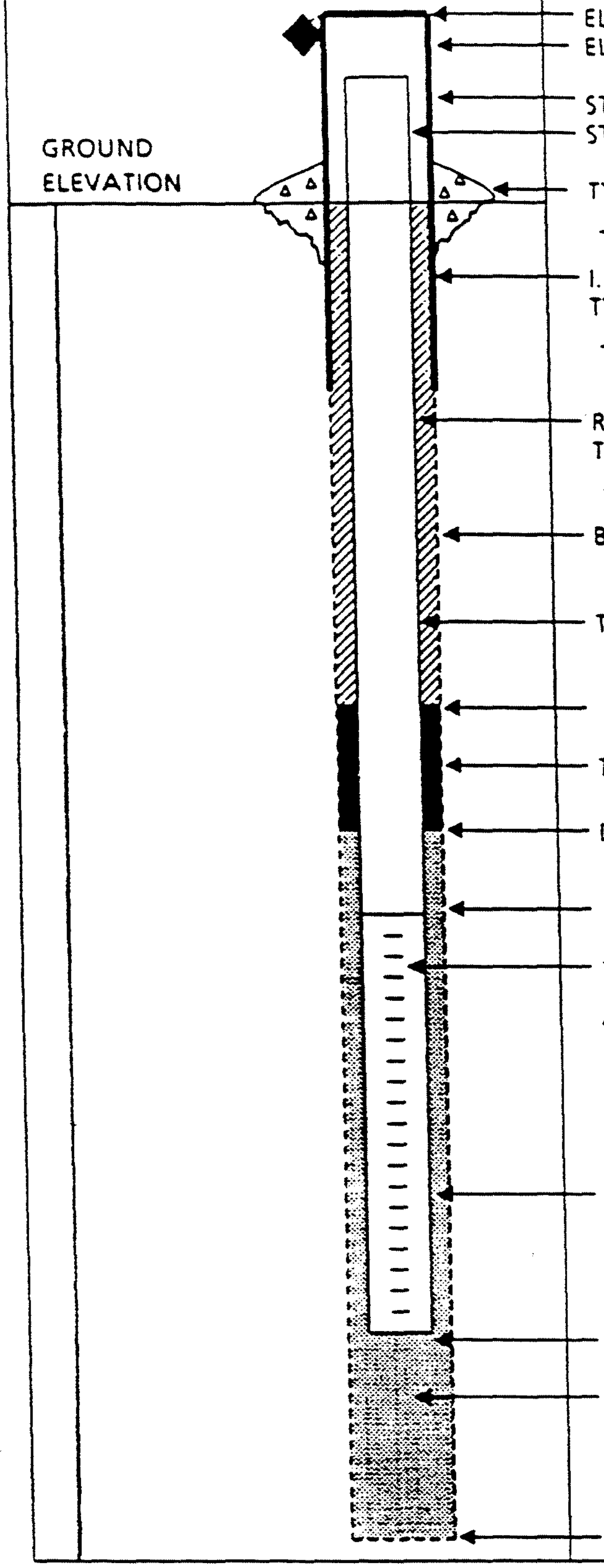


ELEVATION OF TOP OF SURFACE CASING: 587.53
ELEVATION OF TOP OF RISER PIPE: 587.41
STICK - UP TOP OF SURFACE CASING: 2.07
STICK - UP RISER PIPE: 1.95
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.5
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.5
DEPTH TOP OF SCREEN: 11.75
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.75
DEPTH BOTTOM OF SAND PACK: 17.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica sand
ELEVATION / DEPTH OF HOLE: 567.96/17.5

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
PROJECT NO. 115-03-1
ELEVATION 585.49
FIELD GEOLOGIST R. FrappA
LOCATION Area "D"
BORING MW-10-88
DATE 6/1/88
DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



ELEVATION OF TOP OF SURFACE CASING: 587.74
ELEVATION OF TOP OF RISER PIPE: 587.63
STICK - UP TOP OF SURFACE CASING: 2.25
STICK - UP RISER PIPE: 2.14
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 5.5
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 9.5
DEPTH TOP OF SCREEN: 11.5
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 16.5
DEPTH BOTTOM OF SAND PACK: 17.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 568.49/17.0

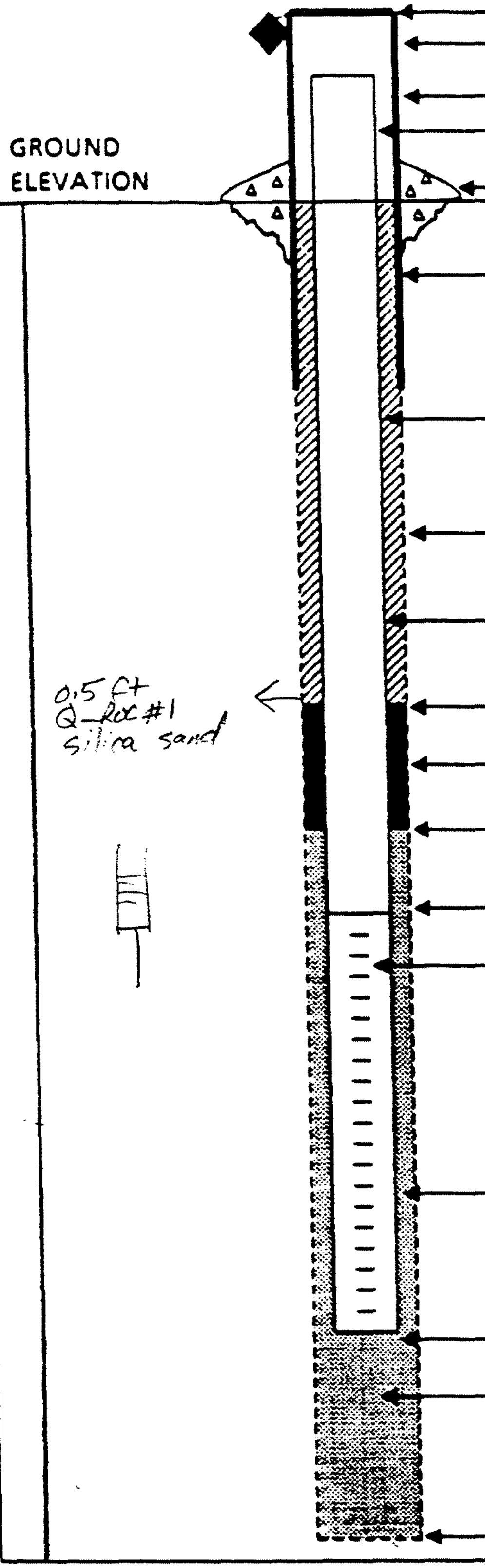
MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
PROJECT NO. 1115-03-1115
ELEVATION 586.98
FIELD GEOLOGIST P. Krupin

LOCATION Area "D"
BORING MW-11-88
DATE 11-8-88

DRILLER Buffalo Drilling
DRILLING METHOD 4 1/4" Hollow Stem Augers
DEVELOPMENT METHOD INERTIA PUMP



ELEVATION OF TOP OF SURFACE CASING: 589.23
ELEVATION OF TOP OF RISER PIPE: 589.11
STICK - UP TOP OF SURFACE CASING: 2.25
STICK - UP RISER PIPE: 2.13
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 stainless steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite powder
DEPTH TOP OF SEAL: 20 ft
TYPE OF SEAL: Bentonite Pellets (4 ft)
DEPTH TOP OF SAND PACK: 24 ft
DEPTH TOP OF SCREEN: 26 ft
TYPE OF SCREEN: Type 306 Stainless Steel
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica Sand Q-RoK #2
DEPTH BOTTOM OF SCREEN: 31 ft
DEPTH BOTTOM OF SAND PACK: 31.5 ft
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 31.5 ft

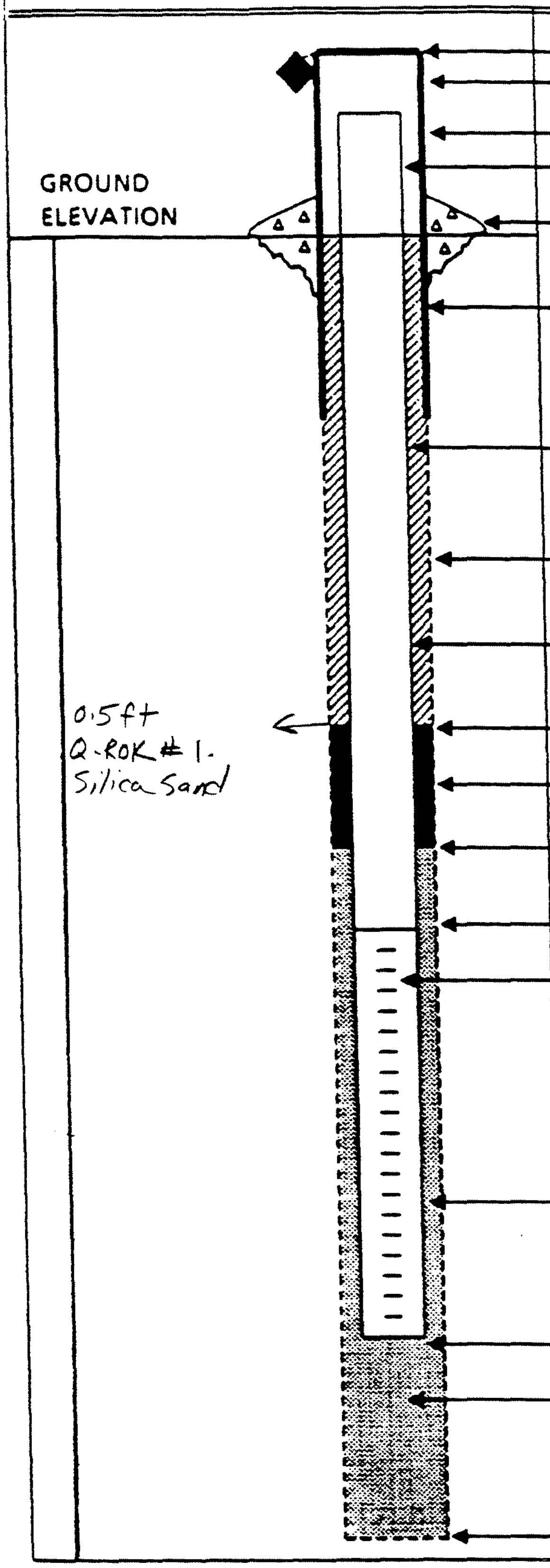
MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
PROJECT NO. 1115-03-1115
ELEVATION 585.48
FIELD GEOLOGIST P. Krupin

LOCATION Area "D"
BORING MW-12-88
DATE 11-9-88

DRILLER Buffalo Drilling
DRILLING METHOD 4 1/4" Hollow Stem Augering
DEVELOPMENT METHOD INERTIA PUMP



ELEVATION OF TOP OF SURFACE CASING: 587.38
ELEVATION OF TOP OF RISER PIPE: 587.26

STICK - UP TOP OF SURFACE CASING: 1.90
STICK - UP RISER PIPE: 1.78

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless steel

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: Cement/Bentonite powder

DEPTH TOP OF SEAL: 12.5 ft

TYPE OF SEAL: Bentonite pellets (4 ft)

DEPTH TOP OF SAND PACK: 16.5 ft.

DEPTH TOP OF SCREEN: 18.5 ft

TYPE OF SCREEN: 306 Stainless steel

SLOT SIZE x LENGTH: .010 Continuous slot

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: Silica sand Q-rok #2

DEPTH BOTTOM OF SCREEN: 23.5 ft

DEPTH BOTTOM OF SAND PACK: 24 ft

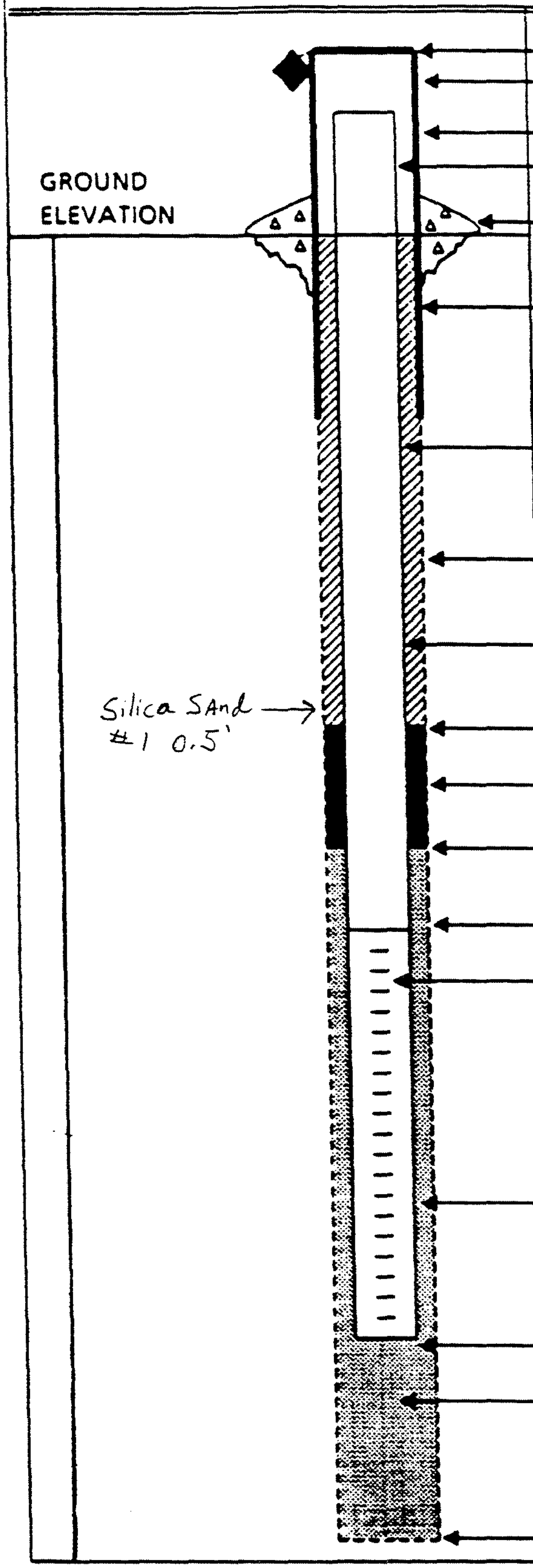
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica sand

ELEVATION / DEPTH OF HOLE: 24 ft

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
PROJECT NO. 1115-03-1115
ELEVATION 585.44
FIELD GEOLOGIST P. Krupin
LOCATION Area "D"
BORING MW-13-88
DATE 11-10-88
DRILLER Buffalo Drilling Co.
DRILLING METHOD 4 1/4" Hollow Stem Augering
DEVELOPMENT METHOD BAILER



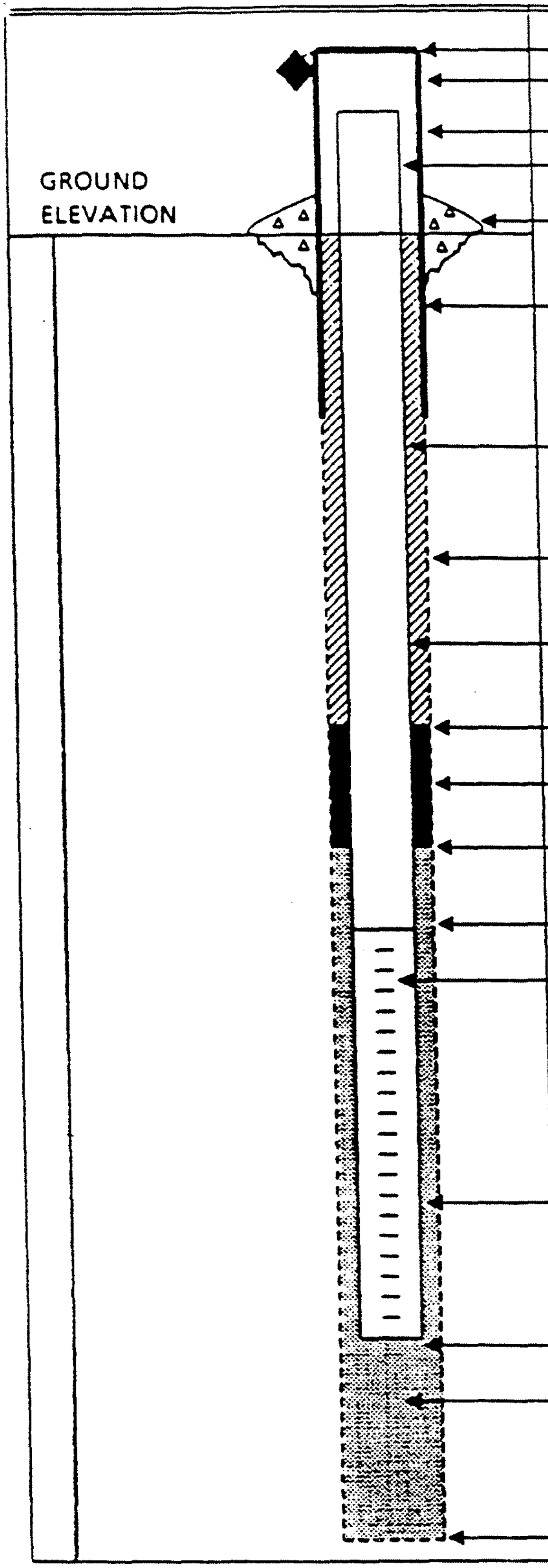
ELEVATION OF TOP OF SURFACE CASING: 587.24
ELEVATION OF TOP OF RISER PIPE: 587.12
STICK - UP TOP OF SURFACE CASING: 1.80
STICK - UP RISER PIPE: 1.68
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: 306 Stainless Steel
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite powder
DEPTH TOP OF SEAL: 12.5 ft
TYPE OF SEAL: Bentonite pellets (4 ft.)
DEPTH TOP OF SAND PACK: 16.5 ft
DEPTH TOP OF SCREEN: 18.5 ft
TYPE OF SCREEN: 306 Stainless steel
SLOT SIZE x LENGTH: .010 Continuous slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica Sand Q-ROK #2
DEPTH BOTTOM OF SCREEN: 23.5 ft.
DEPTH BOTTOM OF SAND PACK: 24 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 24 ft.

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING PZ-1-88
ELEVATION 583.91
DATE 6/16/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



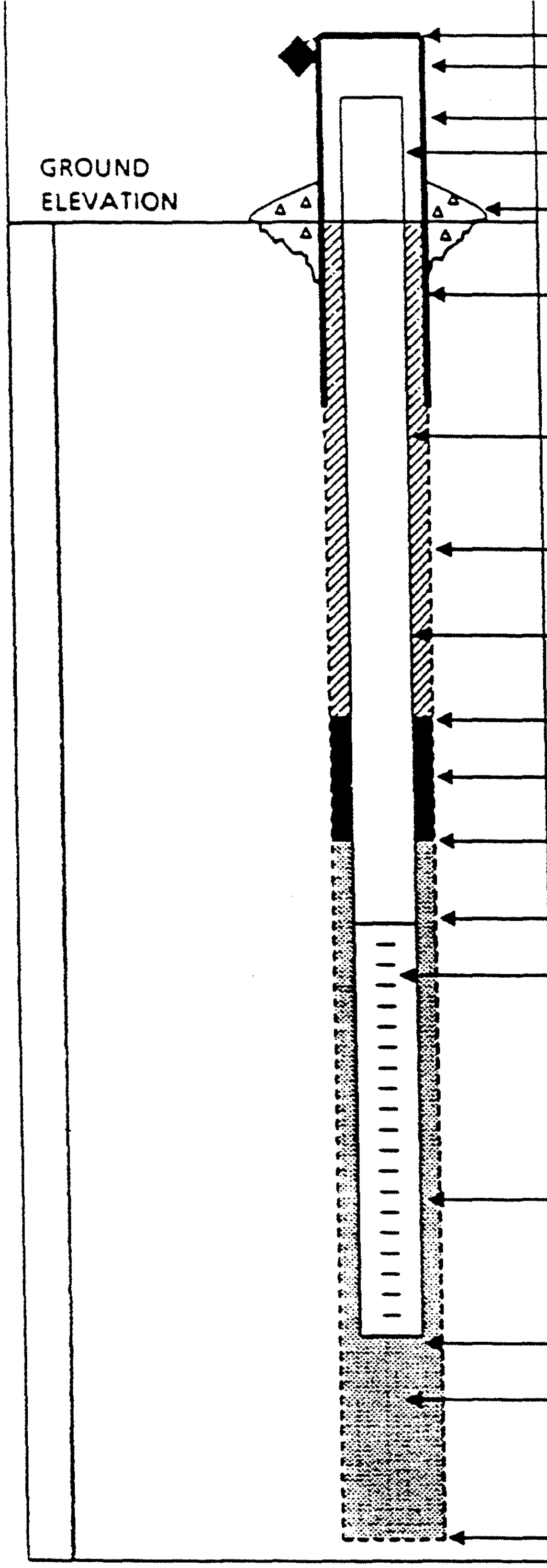
ELEVATION OF TOP OF SURFACE CASING: 586.12
ELEVATION OF TOP OF RISER PIPE: 586.01
STICK - UP TOP OF SURFACE CASING: 2.21
STICK - UP RISER PIPE: 2.10
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 7.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 11.0
DEPTH TOP OF SCREEN: 13.0
TYPE OF SCREEN: SCH 40 PVC
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 18.0
DEPTH BOTTOM OF SAND PACK: 18.0
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 565.91/18.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING P2-2-88
ELEVATION 584.51
DATE 6/3/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



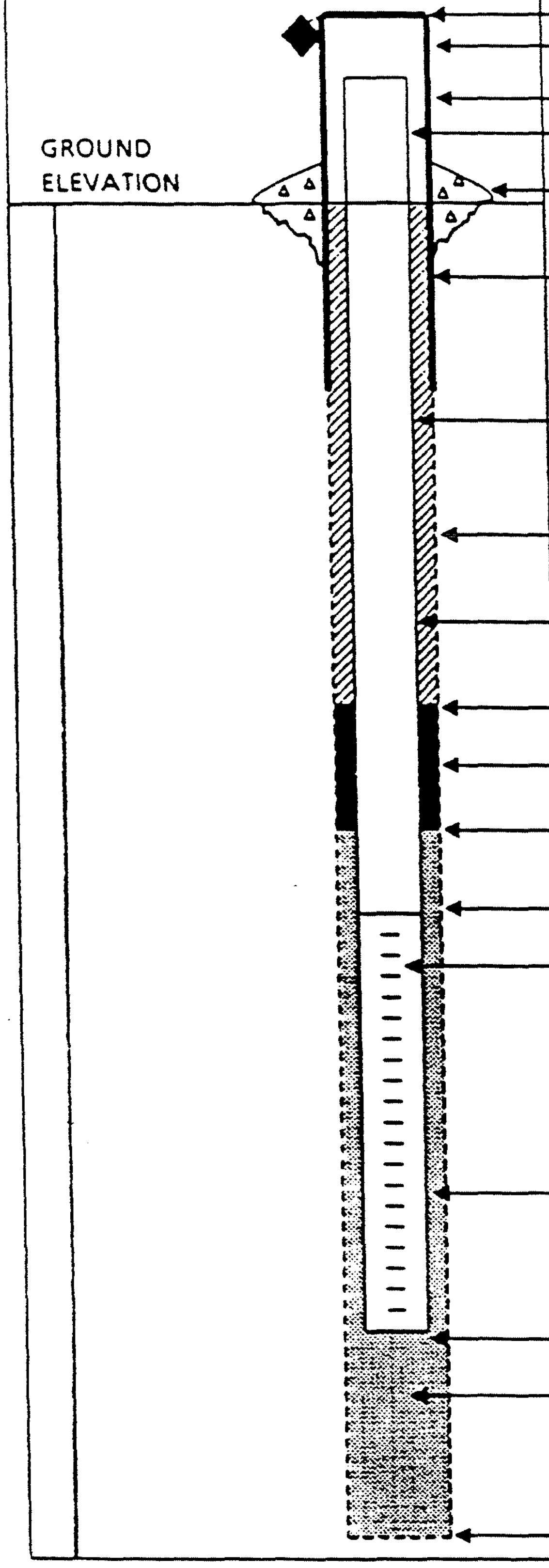
ELEVATION OF TOP OF SURFACE CASING: 586.85
ELEVATION OF TOP OF RISER PIPE: 586.74
STICK - UP TOP OF SURFACE CASING: 2.34
STICK - UP RISER PIPE: 2.23
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 6.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 10.0
DEPTH TOP OF SCREEN: 12.0
TYPE OF SCREEN: SCH 40 PVC
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 17.0
DEPTH BOTTOM OF SAND PACK: 18.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: Silica Sand
ELEVATION / DEPTH OF HOLE: 566.51/18.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS LOCATION Area "D"
PROJECT NO. 115-03-1 BORING P2-3-88
ELEVATION 585.68 DATE 6/16/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing

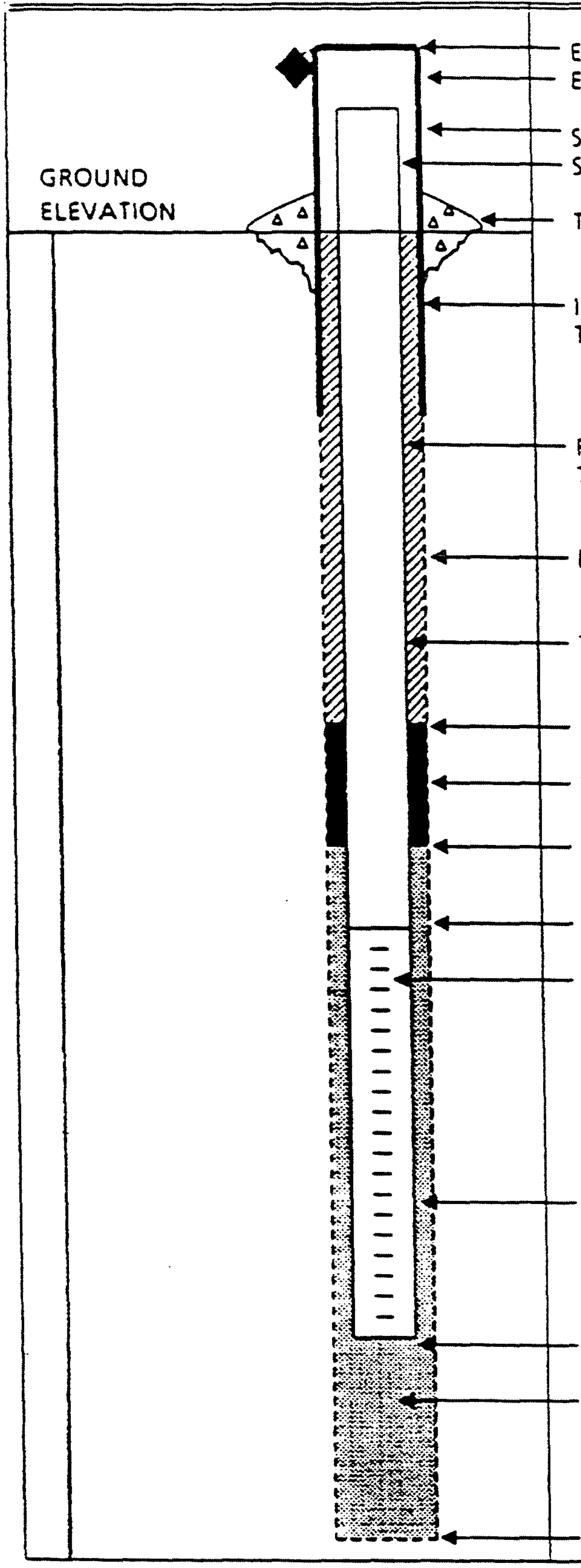


ELEVATION OF TOP OF SURFACE CASING: 588.18
ELEVATION OF TOP OF RISER PIPE: 588.07
STICK - UP TOP OF SURFACE CASING: 2.50
STICK - UP RISER PIPE: 2.39
TYPE OF SURFACE SEAL: Cement
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: Cement/Bentonite
DEPTH TOP OF SEAL: 7.0
TYPE OF SEAL: Bentonite Pellets
DEPTH TOP OF SAND PACK: 11.0
DEPTH TOP OF SCREEN: 13.0
TYPE OF SCREEN: SCH 40 PVC
SLOT SIZE x LENGTH: .010" Continuous Slot
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: Silica SAND Q-ROK #2
DEPTH BOTTOM OF SCREEN: 18.0
DEPTH BOTTOM OF SAND PACK: 18.0
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 567.68/18.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS	LOCATION Area "D"	DRILLER Buffalo Drilling
PROJECT NO. 1115-03-1	BORING PZ-4-88	DRILLING METHOD 4¼" Hollow Stem Augers
ELEVATION 586.51	DATE 6/17/88	DEVELOPMENT METHOD Bailing
FIELD GEOLOGIST R. FrappA		



ELEVATION OF TOP OF SURFACE CASING: 588.91

ELEVATION OF TOP OF RISER PIPE: 588.79

STICK - UP TOP OF SURFACE CASING: 2.40

STICK - UP RISER PIPE: 2.28

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: 4"

TYPE OF SURFACE CASING: Protective Steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: SCH 40 PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: Cement/Bentonite

DEPTH TOP OF SEAL: 9.0

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 13.0

DEPTH TOP OF SCREEN: 15.0

TYPE OF SCREEN: SCH 40 PVC

SLOT SIZE x LENGTH: .010" Continuous Slot

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: Silica SAND Q-ROK #

DEPTH BOTTOM OF SCREEN: 20.0

DEPTH BOTTOM OF SAND PACK: 20.0

TYPE OF BACKFILL BELOW OBSERVATION WELL:

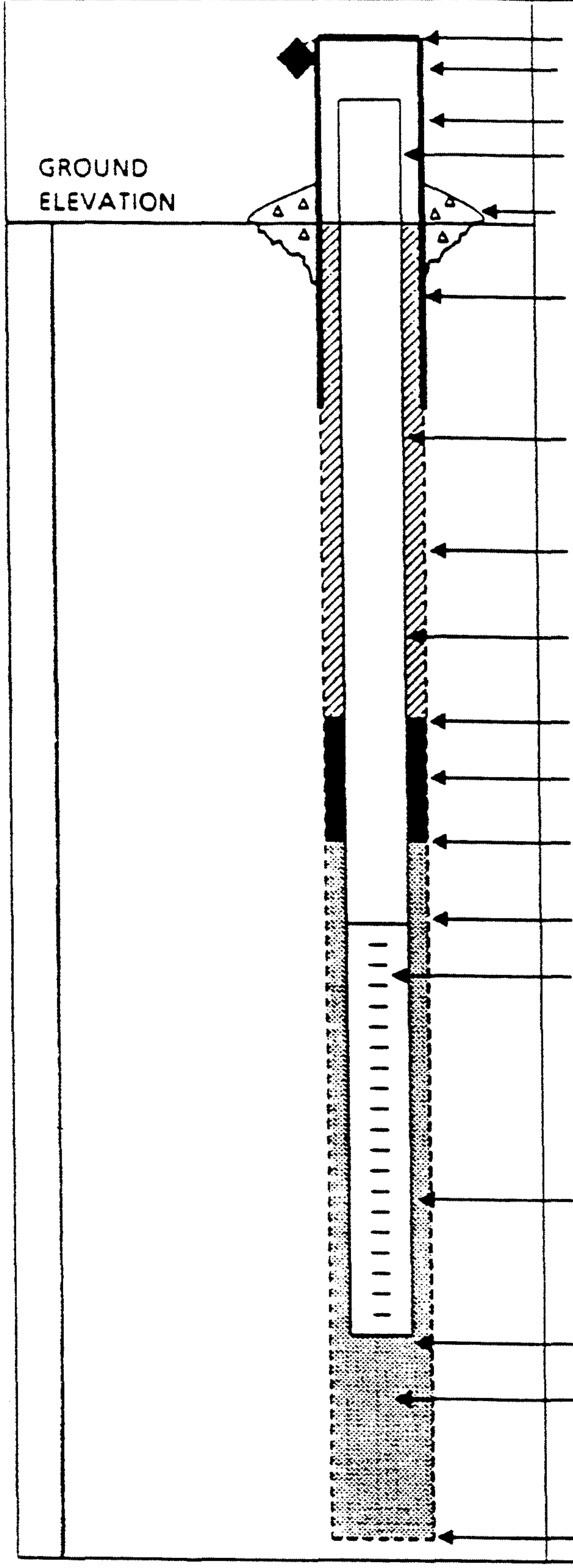
ELEVATION / DEPTH OF HOLE: 20.0

MALCOLM PIRNIE

OVERBURDEN
MONITORING WELL SHEET

PROJECT Buffalo Color RI/FS
LOCATION Area "D"
PROJECT NO. 1115-03-1
BORING Replacement Well 6
ELEVATION 587.00
DATE 6/20/88
FIELD GEOLOGIST R. FrappA

DRILLER Buffalo Drilling
DRILLING METHOD 4¼" Hollow Stem Augers
DEVELOPMENT METHOD Bailing



ELEVATION OF TOP OF SURFACE CASING: 589.05
ELEVATION OF TOP OF RISER PIPE: 588.94

STICK - UP TOP OF SURFACE CASING: 2.05
STICK - UP RISER PIPE: 1.94

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Protective Steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Type 306 Stainless Steel

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: Cement/Bentonite

DEPTH TOP OF SEAL: 7.0

TYPE OF SEAL: Bentonite Pellets

DEPTH TOP OF SAND PACK: 11.0

DEPTH TOP OF SCREEN: 13.0

TYPE OF SCREEN: Type 306 Stainless Steel

SLOT SIZE x LENGTH: .010" Continuous Slot

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: Silica SAND Q-ROK #

DEPTH BOTTOM OF SCREEN: 18.0

DEPTH BOTTOM OF SAND PACK: 18.0

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 569.00/18.0

APPENDIX C.5

DETAILS OF WELL DEVELOPMENT PROCEDURES

APPENDIX C.5 - DETAILS OF WELL DEVELOPMENT PROCEDURES

Well development was performed on all newly-installed monitoring wells/piezometers, including Well-6R. In addition, all existing wells were redeveloped to reduce sample turbidity.

All of the monitoring wells/piezometers, except for MW-11-88, MW-12-88, and Well-12, were developed by bailing. MW-11-88 and MW-12-88 were developed using an inertia pump and Well-12 was redeveloped using a peristaltic pump in conjunction with bailing. Table 4-2 in Section 4.0 of the Volume 1 summarizes the development method and the quantity of development water removed from each well, including some physical parameters (viz. pH, conductivity, temperature, turbidity, and visual appearance).

Both pumping and bailing were conducted in wells/piezometers in Area "D" in a manner that limited excessive disturbance of the formation. Pumping rates were limited to approximately 0.25 to 0.5 GPM. Development continued at each monitoring well/piezometer until the turbidity was below 50 NTU or no noticeable improvement in turbidity was observed. Newly-installed monitoring wells MW-1-88 and MW-4-88 remained turbid after development. This was attributed to well construction using a #3 filter sand. At many of the monitoring wells/piezometers (see Table 4-2), the water was strongly colored (viz. gray/brown, blue, black) and minor amounts of NAPL were observed.

APPENDIX C.6

HYDRAULIC CONDUCTIVITY TEST PROCEDURES

APPENDIX C.6 - HYDRAULIC CONDUCTIVITY TEST PROCEDURES

Wells exhibibiting rapid water level recoveries were tested by submerging a solid stainless steel cylinder (slug) in the well; allowing the water level to equilibrate; and withdrawing the slug while monitoring the rate of water level recovery. An In-Situ, Inc. Model SE1000B data logger and pressure transducer were used to monitor and record the recovery rates. The slug and transducer were decontaminated following procedures presented in the Work Plan.

Monitoring wells MW-5-88, MW-6-88 and Well-15, where water levels were less than two feet above the bottom of the screen, were bailed and recovery was monitored with an M-scope water level monitor.

Water level versus time data from the slug tests and bail tests were reduced to hydraulic conductivities by one of two methods. Recovery data from wells exhibiting water levels above the screened interval were reduced by the method of Hvorslev (1951). This method is most appropriate for wells cased below the water table in shallow unconfined aquifers. Recovery data from wells cased across the water table, as are many of the Area "D" monitoring wells and piezometers, were reduced by the method of Bouwer and Rice (1976). This method is most appropriate for partially penetrating wells in unconfined aquifers. Example calculations by the Hvorslev method (for MW-12-88) and for the Bouwer and Rice method (for PZ-4-88) are presented in Exhibits C.6-1 and C.6-2, respectively.

LIST OF EXHIBITS

Exhibit No.	Description
C.6-1	Hvorslev Calculations
C.6-2	Bouwer and Rice Calculations

EXHIBIT C.6-1

SLUG TEST FIELD SHEET

PROJECT AND LOCATION: Buffalo Color RI/FS **PROJECT NUMBER:** 1115-03-1
COMPLETED BY: R. Frappa/R. O'Laskey **CHECKED BY:**

WELL/PIEZOMETER DETAILS:

Installation No.: MW-12-88 Ground Elevation: 585.48 ft
Installation Date: 11-9-88
Reference Point (RP): TOR RP Elevation: 587.26 ft
Formation Monitored: Lower Alluvial Deposits
Storage Coefficient (Assumed): 0.35
Riser Length, Inner Dia., Mtl: 20.28', 2.245", Stainless Steel
Screen Length, Inner Dia., Slot, Mtl: 5.0', 1.9", 0.010" slot S.S.

L (Length of Sand Pack) 7.0' ft (cm)
r_c (Radius of Screen) 0.079' ft (cm)
r_s (Radius of Drill Hole at Screen) 0.33' ft, (cm)
Slug Dimensions or Volume 5' slug (0.047 ft³)

TEST:
Start Date 2-21-89 Start Time (T_0) 14:05
Static Level (H) 15.08 (ft BTOR)
Initial Pressure Head (H_0) 16.60 (ft BTOR)

CLOCK TIME	ELAPSED TIME t(h:m:s)	DEPTH h(ft BTOR)	$\frac{H-h}{H-Ho}$
14:05	0.0	16.60	1.00
	0.1	16.25	0.77
	0.2	15.95	0.57
	0.3	15.70	0.41
	0.3	15.54	0.30
	0.4	15.42	0.22
	0.5	15.30	0.14
	0.8	15.15	0.05
	1.0	15.11	0.02
	1.1	15.10	0.01

CLOCK TIME	ELAPSED TIME t(h:m:s)	DEPTH h(ft BTOR)	$\frac{H-h}{H-Ho}$

COMMENTS: withdrawal

Hvorslev method

NOTE:
(1) Test may be stopped when h = H-0.37 (H-Ho)
(2) BTOR = "Below Top of Reference Point"
(3) h:m:s = hours:minutes:seconds (circle appropriate unit)
(4) L may vary from screen length

EXHIBIT C-6-1 (CON'T)

** VARIABLE HEAD PERMEABILITY TEST **

PROJECT NAME: BUFFALO COLOR

PROJECT NUMBER: 1115-03-1

ATE TESTED: 2-21-89

WELL NUMBER: MW-12-88

INITIAL WATER LEVEL (Li): 15.08 FT TOR

ELAPSED TIME (MIN)	WATER LEVEL AT TIME t (Lt) (FT)	HEAD AT TIME t (Ht) Ht = Lt (FT)	HEAD RATIO Ht/Ho
0.0	16.60	1.5	1.00
0.1	16.25	1.2	0.77
0.2	15.95	0.9	0.57
0.3	15.70	0.6	0.41
0.3	15.54	0.5	0.30
0.4	15.42	0.3	0.22
0.5	15.30	0.2	0.14
0.8	15.15	0.1	0.05
1.0	15.11	0.0	0.02
1.1	15.10	0.0	0.01

WELL RADIUS (r) = 1 INCHES
SAND PACK RADIUS (R) = 4 INCHES
LENGHTH OF SAND PACK (L) = 7 FT

FIRST HEAD RATIO (H1) 0.77 ELAPSED TIME IN MINUTES (T1) 0.1
SECOND HEAD RATIO (H2) 0.41 ELAPSED TIME IN MINUTES (T2) 0.3

$$K = \frac{r^2 * Ln\ (L/R) * Ln\ (H1/H2)}{2\ (L) * (T2 - T1) * 60\ SEC/MIN}$$

** K = 2.895191E-03 CM/SEC **

OTE: DATA IS CONVERTED FROM ENGLISH TO METRIC UNITS

EXHIBIT C-6-1 (CONT)

MALCOLM PIRNIE

VARIABLE HEAD
PERMEABILITY TEST
PIEZOMETER No. MW-12-88

PROJECT: Buffalo Color RI/FS AREA "D"

CLIENT: Buffalo Color

JOB NO: 1115-03-1

DATE OF TEST: 2-21-89

SCREENED INTERVAL:

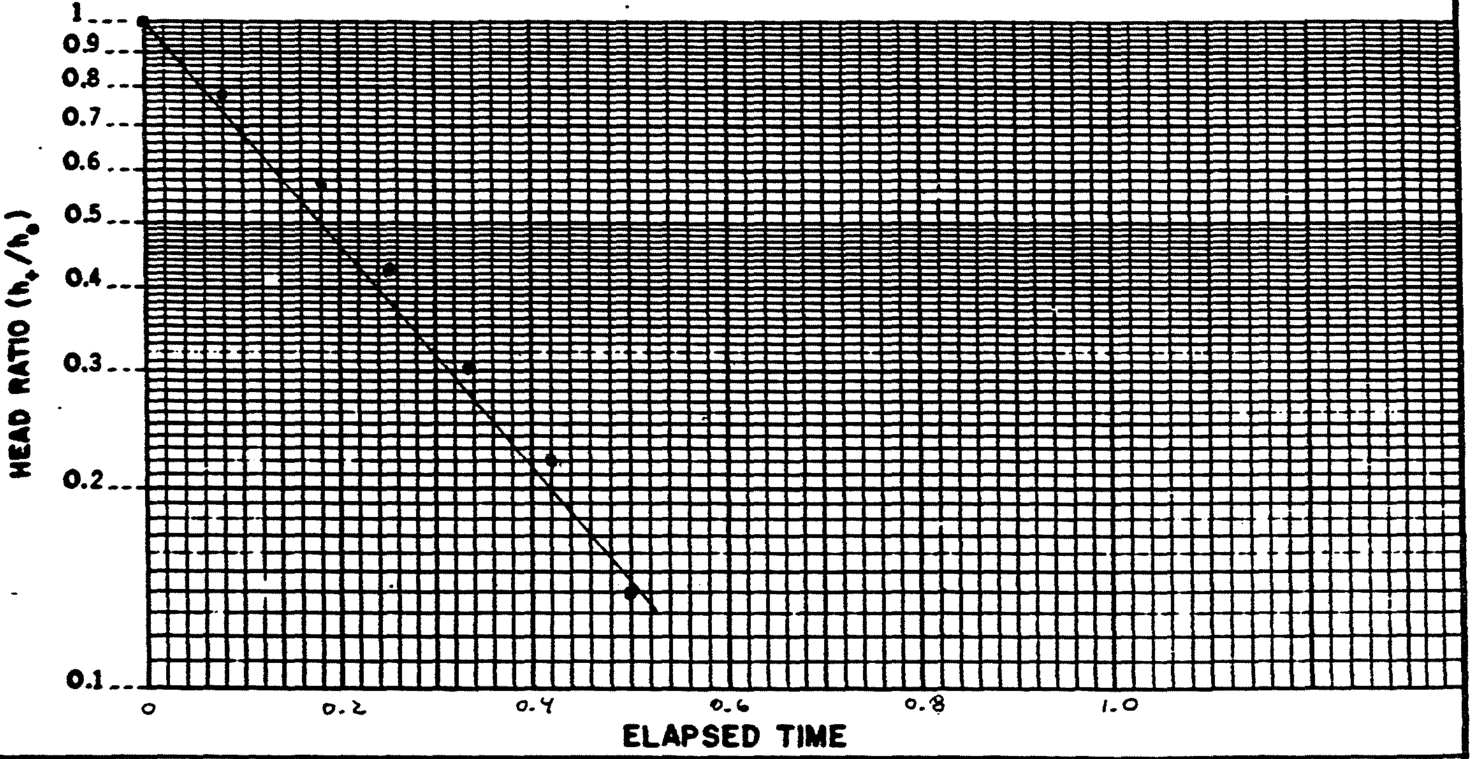
23.5 to 18.5 Ft. BGS

METHOD:

In-Situ/transducer 5' slug withdrawal

TEST DATA

ELAPSED TIME	HEAD RATIO (h_t / h_0)
0.0	1.00
0.1	0.77
0.2	0.57
0.3	0.41
0.3	0.30
0.4	0.22
0.5	0.14
0.8	0.05
1.0	0.02
1.1	0.01



CALCULATIONS:

EXHIBIT C.6-2

SLUG TEST FIELD SHEET

PROJECT AND LOCATION: Buffalo Color RI/FS PROJECT NUMBER: 1115-03-1
COMPLETED BY: R. Frappa CHECKED BY:

WELL/PIEZOMETER DETAILS:

Installation No.: PZ-4-88 Ground Elevation: 586.51 ft
Installation Date: 6-17-88
Reference Point (RP): TOR RP Elevation: 588.79 ft
Formation Monitored: Alluvium
Storage Coefficient (Assumed): 0.3
Riser Length, Inner Dia., Mtl: 17.28', 2.0", PVC
Screen Length, Inner Dia., Slot, Mtl: 5.0', 2.0", 0.010" PVC

L (Length of Sand Pack)	7.0'	ft (cm)
r_c (Radius of Screen)	0.083'	ft (cm)
r_s (Radius of Drill Hole at Screen)	0.33'	ft (cm)
Slug Dimensions or Volume	5' slug (0.047 ft³)	

TEST:

Start Date 9-15-88 Start Time (T_0) 17:33
Static Level (H) (ft BTOR)
Initial Pressure Head (H_0) (ft BTOR)

CLOCK TIME	ELAPSED TIME t(h:m:s)	DEPTH h(ft BTOR)	$\frac{H-h}{H-Ho}$
17:33	0.0	17.23	1.00
	0.0167	17.17	0.96
	0.0334	17.09	0.90
	0.05	17.04	0.87
	0.0834	16.95	0.81
	0.1167	16.85	0.74
	0.2834	16.69	0.63
	0.4501	16.60	0.57
	0.6167	16.54	0.53
	0.7834	16.46	0.47
	0.9501	16.41	0.44
	1.1167	16.36	0.40
	1.45	16.28	0.40
	2.28	16.14	0.25
	3.28	16.02	0.17
	4.28	15.94	0.12
	5.28	15.88	0.08
	6.78	15.81	0.03

COMMENTS: Withdrawal

Bouwer and Rice method

NOTE: (1) Test may be stopped when h = H-0.37 (H-Ho)
(2) BTOR = "Below Top of Reference Point"
(3) h:m:s = hours:minutes:seconds (circle appropriate unit)
(4) L may vary from screen length

EXHIBIT C-6-2 (CON'T)

```
BUFFALO COLOR   PZ-4-3S SLUG WITHDRAWAL
-------- ---------------------------------------------

TIME             WATER LEVEL     DRAWDOWN         H/HO
(SECONDS)          (FEET)          (FEET)
----------       -----------     -------      --------
   0                17.23           1.46    1
   1.002            17.17           1.40    .9589049
   2.004            17.09           1.32    .9041102
   3                17.04           1.27    .8698643
   5.004            16.95           1.18    .8082205
   7.002            16.85           1.08    .7397265
   17.004           16.69           0.92    .6301383
   27.006           16.6            0.83    .5684935
   37.002           16.54           0.77    .5273984
   47.004           16.46           0.69    .4726027
   57.006           16.41           0.64    .4383568
   67.002           16.36           0.59    .4041108
   87.00599         16.28           0.51    .3493162
   137.004          16.14           0.37    .2534243
   197.004          16.02           0.25    .171234
   257.004          15.94           0.17    .1164384
   317.004          15.88           0.11    7.534324E-02
   407.004          15.81           0.04    2.739783E-02

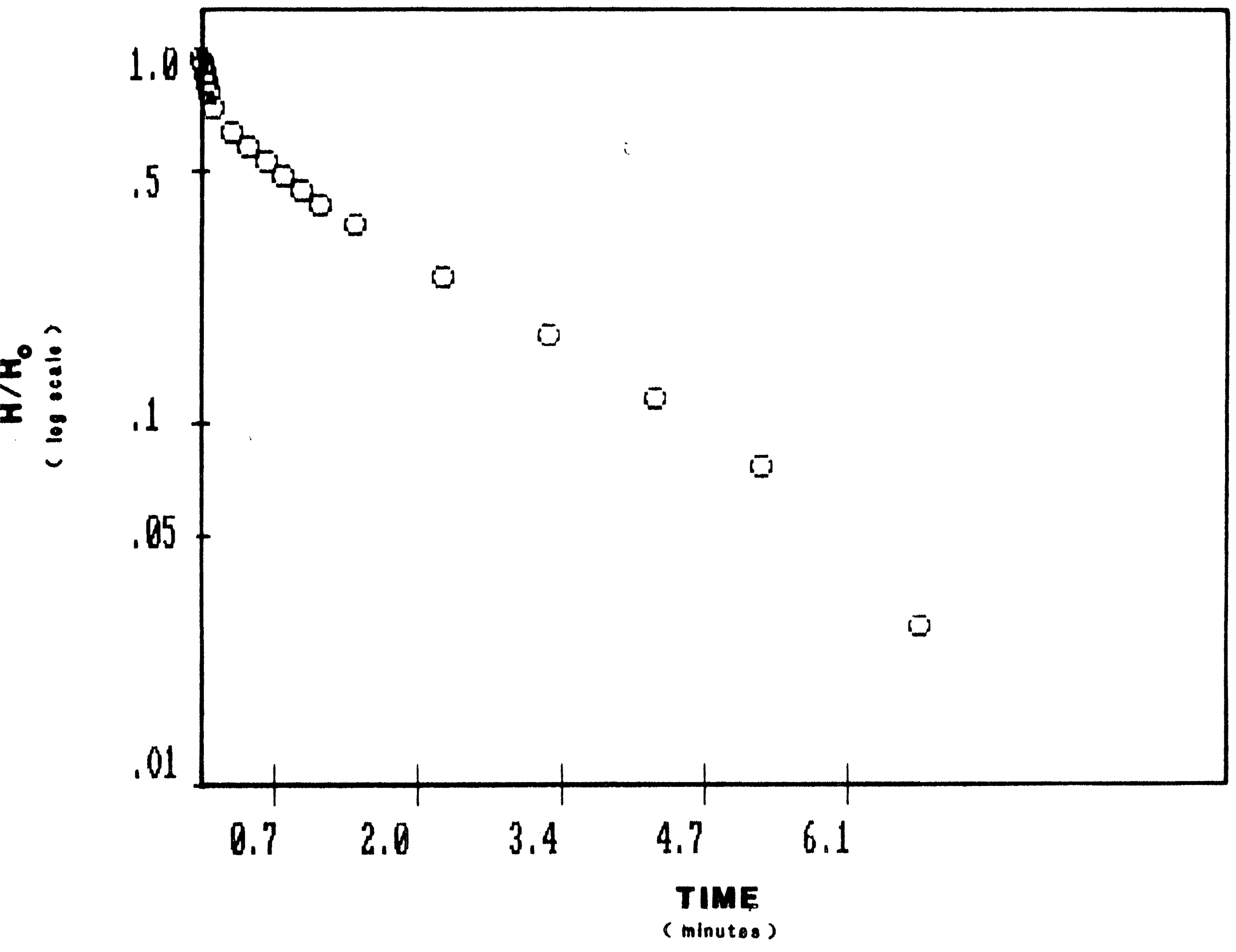
UNCONFINED AQUIFER

K = 0.4E-03CM/SEC
 =     7.8 GPD/FT2
 = 0.1E-04 FT/SEC
 =     1.0  FT/DAY

REGRESSION COEFFICIENT = -.9906821
```

EXHIBIT C.6-2 (CON'T)

BUFFALO COLOR: PZ-4-88 SLUG WITHDRAWAL



MALCOLM PIRNIE

APPENDIX C.7

HELP MODEL RUNS

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BUFFALO COLOR
FEBRUARY 24, 1989
OPEN LANDFILL WITH 6 IN. OF COVER LAYER

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                                LAYER 1
                                -------

         VERTICAL PERCOLATION LAYER
         THICKNESS                           =     6.00 INCHES
         EVAPORATION COEFFICIENT             =     3.300 MM/DAY**0.5
         POROSITY                            =     0.3510 VOL/VOL
         FIELD CAPACITY                      =     0.1740 VOL/VOL
         WILTING POINT                       =     0.1070 VOL/VOL
         EFFECTIVE HYDRAULIC CONDUCTIVITY    =    14.17000008 INCHES/HR


                                LAYER 2
                                -------

         WASTE LAYER
         THICKNESS                           =    80.00 INCHES
         EVAPORATION COEFFICIENT             =     3.300 MM/DAY**0.5
         POROSITY                            =     0.3510 VOL/VOL
         FIELD CAPACITY                      =     0.1740 VOL/VOL
         WILTING POINT                       =     0.1070 VOL/VOL
         EFFECTIVE HYDRAULIC CONDUCTIVITY    =    14.17000008 INCHES/HR
```

```
                    GENERAL SIMULATION DATA
                    -----------------------

      SCS RUNOFF CURVE NUMBER             =      70.00
      TOTAL AREA OF COVER                 =  725538. SQ. FT
      EVAPORATIVE ZONE DEPTH              =      10.00 INCHES
      EFFECTIVE EVAPORATION COEFFICIENT   =       3.300 MM/DAY**0.5
      UPPER LIMIT VEG. STORAGE            =       3.5100 INCHES
      INITIAL VEG. STORAGE                =       1.4050 INCHES


           MONTHLY MEAN TEMPERATURES, DEGREES FAHRENHEIT

   JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
   -------      -------      -------      -------      -------      -------
    27.07        28.66        35.88        46.81        58.51        67.85
    72.33        70.74        63.52        52.59        40.89        31.55

          MONTHLY MEANS SOLAR RADIATION, LANGLEYS PER DAY

   JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
   -------      -------      -------      -------      -------      -------
   109.76       171.20       272.51       386.55       482.75       535.35
   530.24       468.80       367.49       253.45       157.25       104.65

                      LEAF AREA INDEX TABLE

                         DATE       LAI
                         ----       ----
                            1       0.00
                          112       0.00
                          132       0.61
                          151       0.99
                          171       0.99
                          190       0.99
                          210       0.99
                          229       0.99
                          249       0.89
                          268       0.65
                          288       0.32
                          307       0.17
                          366       0.00
                     WINTER COVER FACTOR =    0.60


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                        MONTHLY TOTALS FOR   84

                         JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                         ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)     1.54    3.59    1.77    2.53    4.64    6.86
                           1.43    4.75    3.53    1.10    2.49    3.16

RUNOFF (INCHES)           0.000   0.000   0.000   0.000   0.000   0.000
                          0.000   0.000   0.000   0.000   0.000   0.000

EVAPOTRANSPIRATION        0.732   1.225   2.204   1.413   1.765   2.172
     (INCHES)             1.014   2.312   1.325   0.521   0.751   0.631

PERCOLATION FROM BASE     0.0000  0.0000  2.9982  1.1935  2.8749  4.6877
OF LANDFILL (INCHES)      0.4160  2.4344  2.2086  0.5704  1.7176  0.4854

DRAINAGE FROM BASE OF     0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)         0.000   0.000   0.000   0.000   0.000   0.000

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                       ANNUAL TOTALS FOR   84
 ----------------------------------------------------------------------
                                      (INCHES)    (CU. FT.)   PERCENT
                                      --------    ---------   -------
   PRECIPITATION                        37.39      2260656.   100.00
```

```
   RUNOFF                              0.000          0.      0.00

   EVAPOTRANSPIRATION                 16.065     971306.     42.97

   PERCOLATION FROM BASE OF LANDFILL  19.5867   1184240.     52.38

   DRAINAGE FROM BASE OF LANDFILL      0.000          0.      0.00

   SOIL WATER AT START OF YEAR        14.63      884491.

   SOIL WATER AT END OF YEAR          14.29      864237.

   SNOW WATER AT START OF YEAR         0.00           0.

   SNOW WATER AT END OF YEAR           2.07      125366.

   ANNUAL WATER BUDGET BALANCE         0.00          -1.      0.00
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                       MONTHLY TOTALS FOR   85

                         JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                         ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)     4.27    3.34    4.42    1.33    3.46    3.21
                           1.81    4.63    1.20    3.73    9.75    4.85


RUNOFF (INCHES)           0.000   0.000   0.000   0.000   0.000   0.000
                          0.000   0.000   0.000   0.000   0.000   0.000


EVAPOTRANSPIRATION        0.823   1.169   2.346   1.331   1.618   1.853
     (INCHES)             1.495   1.568   0.956   1.194   1.358   0.808
```

```
PERCOLATION FROM BASE     0.0000  0.0000  8.3239  1.4397  1.7808  1.4183
OF LANDFILL (INCHES)      0.3066  3.0649  0.2499  2.5361  8.3663  1.7789


DRAINAGE FROM BASE OF     0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)         0.000   0.000   0.000   0.000   0.000   0.000

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                      ANNUAL TOTALS FOR   85
 ----------------------------------------------------------------------
                                     (INCHES)    (CU. FT.)    PERCENT
                                     --------    ---------    -------
   PRECIPITATION                      46.00      2781229.     100.00

   RUNOFF                              0.000           0.       0.00

   EVAPOTRANSPIRATION                 16.520      998798.      35.91

   PERCOLATION FROM BASE OF LANDFILL  29.2654    1769428.      63.62

   DRAINAGE FROM BASE OF LANDFILL      0.000           0.       0.00

   SOIL WATER AT START OF YEAR        14.29       864237.

   SOIL WATER AT END OF YEAR          14.37       868985.

   SNOW WATER AT START OF YEAR         2.07       125366.

   SNOW WATER AT END OF YEAR           2.21       133627.

   ANNUAL WATER BUDGET BALANCE         0.00           -7.       0.00
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                     MONTHLY TOTALS FOR   86

                       JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                       ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)   2.31    2.60    1.95    3.33    4.42    4.15
                         2.82    2.73    3.88    4.34    3.11    4.02


RUNOFF (INCHES)         0.000   0.000   0.000   0.000   0.181   0.000
                        0.000   0.000   0.000   0.000   0.000   0.000


EVAPOTRANSPIRATION      0.823   1.169   2.273   1.392   1.194   2.349
     (INCHES)           1.724   1.379   1.244   1.300   0.903   0.712


PERCOLATION FROM BASE   0.0000  0.0000  4.7695  2.0511  3.0451  1.8009
OF LANDFILL (INCHES)    1.0958  1.3508  2.5299  3.1462  2.2076  2.5425


DRAINAGE FROM BASE OF   0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)       0.000   0.000   0.000   0.000   0.000   0.000

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                    ANNUAL TOTALS FOR   86
 ---------------------------------------------------------------------
                                    (INCHES)    (CU. FT.)    PERCENT
                                    --------    ---------    -------
  PRECIPITATION                      39.66      2397904.     100.00

  RUNOFF                              0.181       10969.       0.46

  EVAPOTRANSPIRATION                 16.463      995374.      41.51

  PERCOLATION FROM BASE OF LANDFILL  24.5393    1483685.      61.87

  DRAINAGE FROM BASE OF LANDFILL      0.000           0.       0.00

  SOIL WATER AT START OF YEAR        14.37       868985.

  SOIL WATER AT END OF YEAR          14.29       864240.

  SNOW WATER AT START OF YEAR         2.21       133627.

  SNOW WATER AT END OF YEAR           0.77        46254.

  ANNUAL WATER BUDGET BALANCE         0.00           -6.       0.00
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                      MONTHLY TOTALS FOR   87

                        JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                        ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)    2.90    0.85    3.66    3.40    1.35    8.36
                          3.09    3.38    5.32    2.62    4.44    2.77
```

```
RUNOFF (INCHES)           0.000   0.000   0.000   0.000   0.000   0.711
                          0.000   0.000   0.003   0.000   0.000   0.000


EVAPOTRANSPIRATION        0.823   1.169   2.232   1.522   0.577   2.145
     (INCHES)             1.379   1.415   1.876   1.211   0.651   0.753


PERCOLATION FROM BASE     0.0000  0.0000  3.8273  2.0004  0.7734  5.5039
OF LANDFILL (INCHES)      1.7079  1.9686  3.4348  1.4164  3.6884  1.3028


DRAINAGE FROM BASE OF     0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)         0.000   0.000   0.000   0.000   0.000   0.000

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                    ANNUAL TOTALS FOR   87
 ----------------------------------------------------------------------
                                       (INCHES)    (CU. FT.)   PERCENT
                                       --------    ---------   -------
   PRECIPITATION                        42.14      2547847.    100.00

   RUNOFF                                0.714       43169.      1.69

   EVAPOTRANSPIRATION                   15.752      952398.     37.38

   PERCOLATION FROM BASE OF LANDFILL    25.6239    1549257.     60.81

   DRAINAGE FROM BASE OF LANDFILL        0.000           0.      0.00

   SOIL WATER AT START OF YEAR          14.29       864240.

   SOIL WATER AT END OF YEAR            14.34       866851.

   SNOW WATER AT START OF YEAR           0.77        46254.
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   SNOW WATER AT END OF YEAR           0.77        46672.

   ANNUAL WATER BUDGET BALANCE         0.00           -6.      0.00

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                       MONTHLY TOTALS FOR   88

                         JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                         ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)     1.58    4.07    2.99    2.96    2.74    1.56
                           6.35    2.69    2.07    6.08    3.37    2.15

RUNOFF (INCHES)           0.000   0.000   0.000   0.000   0.000   0.000
                          0.000   0.000   0.000   0.000   0.000   0.000

EVAPOTRANSPIRATION        0.823   1.225   2.286   1.372   1.433   0.985
     (INCHES)             2.475   1.319   0.872   1.625   0.694   0.560

PERCOLATION FROM BASE     0.0000  0.0000  5.1148  1.5905  1.3110  0.5753
OF LANDFILL (INCHES)      3.8713  1.3684  1.2047  4.4554  2.6710  0.2943

DRAINAGE FROM BASE OF     0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)         0.000   0.000   0.000   0.000   0.000   0.000

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                         ANNUAL TOTALS FOR   88
  -----------------------------------------------------------------------------
                                         (INCHES)     (CU. FT.)    PERCENT
                                         --------     ---------    -------
    PRECIPITATION                         38.61       2334419.     100.00

    RUNOFF                                 0.000            0.       0.00

    EVAPOTRANSPIRATION                    15.668       947330.      40.58

    PERCOLATION FROM BASE OF LANDFILL     22.4567     1357765.      58.16

    DRAINAGE FROM BASE OF LANDFILL         0.000            0.       0.00

    SOIL WATER AT START OF YEAR           14.34        866851.

    SOIL WATER AT END OF YEAR             14.31        864986.

    SNOW WATER AT START OF YEAR            0.77         46672.

    SNOW WATER AT END OF YEAR              1.29         77864.

    ANNUAL WATER BUDGET BALANCE            0.00            -2.       0.00
*******************************************************************************




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    AVERAGE MONTHLY TOTALS FOR   84 THROUGH   88
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                          JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                          ------- ------- ------- ------- ------- -------


PRECIPITATION (INCHES)      2.52    2.89    2.96    2.71    3.32    4.83
                            3.10    3.64    3.20    3.57    4.63    3.39


RUNOFF (INCHES)            0.000   0.000   0.000   0.000   0.036   0.142
                           0.000   0.000   0.001   0.000   0.000   0.000


EVAPOTRANSPIRATION         0.805   1.192   2.268   1.406   1.317   1.901
     (INCHES)              1.617   1.599   1.254   1.170   0.871   0.693


PERCOLATION FROM BASE      0.0000  0.0000  5.0068  1.6550  1.9570  2.7972
OF LANDFILL (INCHES)       1.4795  2.0374  1.9256  2.4249  3.7302  1.2808


DRAINAGE FROM BASE OF      0.000   0.000   0.000   0.000   0.000   0.000
LANDFILL (INCHES)          0.000   0.000   0.000   0.000   0.000   0.000

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   AVERAGE ANNUAL TOTALS FOR   84 THROUGH   88
 ---------------------------------------------------------------------
                                    (INCHES)     (CU. FT.)    PERCENT
                                    --------     ---------    -------
   PRECIPITATION                     40.76        2464411.    100.00

   RUNOFF                             0.179         10828.      0.44

   EVAPOTRANSPIRATION                16.094        973041.     39.48

   PERCOLATION FROM BASE OF LANDFILL 24.2944      1468875.     59.60

   DRAINAGE FROM BASE OF LANDFILL     0.000             0.      0.00
```

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              PEAK DAILY VALUES FOR   84 THROUGH   88
    --------------------------------------------------------------
                                         (INCHES)     (CU. FT.)
                                         --------     ---------

      PRECIPITATION                        5.01        302912.1

      RUNOFF                               0.711        43015.6

      PERCOLATION FROM BASE OF LANDFILL    3.7036      223922.7

      DRAINAGE FROM BASE OF LANDFILL       0.000            0.0

      HEAD ON BASE OF LANDFILL               0.0

      SNOW WATER                             7.81      472219.6


      MAXIMUM VEG. SOIL WATER (VOL/VOL)         0.1555

      MINIMUM VEG. SOIL WATER (VOL/VOL)         0.1070

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APPENDIX D.1

EPA CONTRACT LABORATORY PROGRAM DOCUMENTATION PACKAGE

Due to the large volume of the EPA Contract Laboratory Program Documentation Package, it is being provided under separate cover (i.e., boxes). Specifically, one (1) copy will be retained in the Buffalo Color Corporation files, and a second copy has been provided to NYSDEC for their files.

APPENDIX E.1

EROSION POTENTIAL CALCULATIONS

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-3-89 SHEET NO. 1 OF 8
CHKD. BY KRM DATE 3-6-89 JOB NO. 1115-03-1
SUBJECT BUFFALO COLOR

EROSION POTENTIAL CALCULATIONS

ASSUMPTIONS :

1) NO VEGETATION ON SLOPES

2) SOUTHWEST BANK, AREA 5, AREA 6 AND INCINERATION AREA ALL CONTAIN <0.5% ORGANICS IN SOIL

3) SOIL AND WASTE TYPES WERE TAKEN FROM MONITORING WELL BORING LOGS

4) L.S FACTORS HAVE BEEN INTERPOLATED FROM TABLE 6 pg. 39. OF SW-867 REF. BELOW

5) SOIL AND WASTE IS ASSUMED TO WEIGH 75 lb/ft^3

6) ASSUMED A 25% INCREASE IN EROSION ALONG EASTERN BANK FROM WEATHERING AREA TO IRON OXIDE SLUDGE POND AREA DUE TO SCOUR

7) ASSUMED A 10% INCREASE IN EROSION ALONG SOUTHWESTERN BANK DUE TO SCOUR

SOURCE :

EQUATIONS AND VARIABLES ARE FROM USEPA MANUAL "EVALUATING COVER SYSTEMS FOR SOLID AND HAZARDOUS WASTE" PG 37-42, (SEE ATTACHED), SW-867

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-3-89 SHEET NO. 2 OF 8

CHKD. BY KRM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

EQUATION:

$$A = RKLSCP$$

WHERE
A = AVERAGE ANNUAL SOIL LOSS (TNS/AC)
R = RAINFALL AND RUNOFF EROSIVITY INDEX
K = SOIL ERODIBILITY FACTOR (TNS/AC)
L = SLOPE-LENGTH FACTOR
S = SLOPE-STEEPNESS FACTOR
C = COVER MANAGEMENT FACTOR
P = PRACTICE FACTOR

AREA 1: IRON OXIDE SLUDGE POND AREA ▨

R = 100 (FROM FIGURE 20. PG 37 OF MANUAL)

K = .33 (FROM TABLE 5. PG 38, VERY FINE SANDY LOAM WITH 4% ORGANICS)

LS = 14 (SLOPE LENGTH 21 FT. WITH A 68.5% SLOPE, FROM TABLE 6 PG. 39 (INTERPOLATED))

C = 1 (FROM TABLE 7 PG 40. NO VEGETATIVE COVER)

P = 1 (FROM TABLE 8 PG 41, NO SUPPORT PRACTICE.)

$$A = 100(.33)(14)(1)(1)$$

$$= 460 \text{ TNS/AC/YR}$$

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-6-89 SHEET NO. 3 OF 8

CHKD. BY KRM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 1 (CONT.)

$A = 460 \text{ TN/AC/YR}$

SLOPE AREA $= (21' \times 360')/43560 = 0.174 \text{ AC}$

SOIL LOSS $= 460 \text{ TN/AC/YR} (0.174) = 79.8 \text{ TN/YR}$

ASSUME SOIL WEIGHTS 75 lbs/ft^3

$79.8 \text{ TN/YR} \approx 78.0 \text{ CUYDS/YR}$ $\boxed{\text{SAY } 80 \text{ CY/YR}}$

SOIL LOSS $= 80 \dfrac{\text{CUYDS}}{\text{YR}} \cdot \dfrac{27 \text{ ft}^3}{\text{CUYD}} \cdot \dfrac{1}{0.174(43560 \text{ ft}^2)} \cdot \dfrac{12 \text{ IN}}{\text{FT}}$

$= \boxed{3.4 \text{ IN/YR}}$

WITH RIVER SCOUR SOIL LOSS =

$80 \times 1.25 = \boxed{100 \text{ CY/YR}}$

$= \boxed{4.3 \text{ IN/YR}}$

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-3-89 SHEET NO. 4 OF 8

CHKD. BY KLM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 2: INCINERATION AREA ▨

R = 100

K = 0.44 (LOAMY VERY FINE SAND, <0.5% ORGANICS)

LS = 5.9 (SLOPE LENGTH AVG. 37 FT. WITH A 34% SLOPE)

C = 1

P = 1

$$A = (100)(0.44)(5.9)(1)(1)$$

$$= 259.6 \ ^{TNS}/_{AC}/_{YR}$$

SLOPE AREA = (37' × 600') = 0.51 AC

SOIL LOSS = $(259.6 \ ^{TN}/_{AC}/_{YR})(0.51) = 132.6 \ ^{TN}/_{YR}$

ASSUME SOIL WEIGHTS $75 \ ^{lbs}/_{ft^3}$

$132.6 \ ^{TN}/_{YR} \approx 131.0 \ ^{CUYD}/_{YR}$ $\boxed{\text{SAY } 135 \text{ CY/YR}}$

SOIL LOSS $= 135.0 \frac{CUYD}{YR} \cdot 27 \frac{ft^3}{CUYD} \cdot \frac{1}{0.51(43560)} \cdot \frac{12 in}{ft}$

$\boxed{= 2.0 \text{ IN/YR}}$

WITH RIVER SCOUR, SOIL LOSS =

$135 \times 1.25 = \boxed{168.8 \ ^{CY}/_{YR}}$ SAY 170

$= \boxed{2.50 \ ^{IN}/_{YR}}$

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-3-89 SHEET NO. 5 OF 8

CHKD. BY KEM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 3: WEATHERING AREA ▨

$R = 100$

$K = 0.19$ (SANDY LOAM, 4% ORGANICS)

$LS = 12.4$ (SLOPE LENGTH AVG 14 FT, 66% SLOPE)

$C = 1$

$P = 1$

$$A = (100)(0.19)(12.4)(1)(1)$$

$$= 236 \ ^{\text{TONS}}/_{\text{AC}}/\text{YR}$$

SLOPE AREA $= (14 \times 320)/43560 = 0.103$ AC

SOIL LOSS $= (190 \ ^{\text{TN}}/_{\text{AC}}/_{\text{YR}})(.103 \text{ AC}) = 24.3 \ ^{\text{TN}}/_{\text{YR}}$

ASSUMING SOIL WEIGHTS APPROX $75 \ ^{\text{lbs}}/_{\text{ft}^3}$

$24.3 \ ^{\text{TONS}}/_{\text{YR}} \approx 24.1$ CU YDS/YR $\boxed{\text{SAY } 25 \ ^{\text{CY}}/_{\text{YR}}}$

$$\underline{\text{SOIL LOSS}} = 25 \frac{\text{CU YDS}}{\text{YR}} \times \frac{27 \text{ ft}^3}{\text{CU YD}} \times \frac{1}{0.103(43560)\text{ft}^2} \times \frac{12 \text{ in}}{\text{ft}}$$

$$= \boxed{1.8 \ ^{\text{IN}}/_{\text{YR}}}$$

WITH RIVER SCOUR SOIL LOSS =

$25 \times 1.25 = \boxed{31.3 \ ^{\text{CY}}/_{\text{YR}}}$ SAY 32

$$= \boxed{2.3 \ ^{\text{IN}}/_{\text{YR}}}$$

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-3-89 SHEET NO. 6 OF 8

CHKD. BY KRm DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 4: SOUTHWEST BANK

R = 100

K = .27 (SANDY CLAY LOAM, <0.5% ORGANICS)

LS = 5.1 (SLOPE LENGTH AVG 42', 30% SLOPE)

C = 1

P = 1

A = (100) (0.27) (5.1)

= 137.7 TNS/AC/YR

SLOPE AREA = (42' x 1310) / 43560 = 1.26 AC

SOIL LOSS = (137.7 TN/AC/YR) (1.26 AC) = 173.5 TONS/YR

ASSUME SOIL WEIGHTS APPROX 75 lbs/ft³

173.5 TNS/YR ≈ 171.4 CU.YDS./YR $\boxed{\text{SAY } 175 \text{ CY/YR}}$

SOIL LOSS = $175 \text{ CUYDS} \times \frac{27 \text{ ft}^3}{\text{CUYD}} \times \frac{1}{1.26 \cdot (43560) \text{ ft}^2} \times \frac{12 \text{ in}}{\text{ft}}$

$= \boxed{1.0 \text{ IN/YR}}$

WITH RIVER SCOUR SOIL LOSS =

175 x 1.1 $= \boxed{192.5 \text{ CY/YR}}$ SAY 195

$= \boxed{1.11 \text{ IN/YR}}$ SAY 1.2

MALCOLM PIRNIE, INC.

BY BJH DATE 3-6-89 SHEET NO. 7 OF 8

CHKD. BY KEM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 5: AREA BETWEEN IRON OXIDE SLUDGE POND AND INCINERATION AREA [redacted]

$R = 100$

$K_{NORTH \frac{1}{2}} = .48$, $K_{SOUTH \frac{1}{2}} = 0.44$ $K_{AVG} = 0.46$

$LS = 11$ (SLOPE LENGTH 18', 66 % SLOPE)

$C = 1$

$P = 1$

$A = (100)(.46)(13)(1)(1)$

$= 597$ TN/AC/YR

SLOPE AREA = (18' × 90) = 0.04 AC

SOIL LOSS = 597 TN/AC/YR (0.04 AC) = 23.9 TN/YR

ASSUME SOIL WEIGHTS 75 lb/ft³

23.9 TN/YR = 23.6 CU YD/YR $\boxed{\text{SAY 25 CY/YR}}$

SOIL LOSS = $25 \frac{\text{CUYD}}{\text{YR}} \cdot 27 \frac{\text{ft}^3}{\text{CUYD}} \cdot \frac{1}{0.04(43560)} \cdot \frac{12 \text{ IN}}{\text{ft}}$

$= \boxed{4.6 \text{ IN/YR}}$

WITH RIVER SCOUR SOIL LOSS =

$25 \times 1.25 = \boxed{313 \text{ CY/YR}}$ SAY 32

$= \boxed{5.8 \text{ IN/YR}}$

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 3-6-89 SHEET NO. 8 OF 8

CHKD. BY KEM DATE 3-6-89 JOB NO. 1115-03-1

SUBJECT BUFFALO COLOR

AREA 6: AREA BETWEEN WEATHERING AREA AND INCINERATION AREA

$R = 100$

$K = 0.44$

$LS = 13$ (SLOPE LENGTH 16', 67 % SLOPE)

$C = 1$

$P = 1$

$A = (100)(0.44)(13)(1)(1)$

$= 572 \ \text{TN/AC/YR}$

SLOPE AREA $= (16' \times 190') = 0.07$ AC

SOIL LOSS $= 572 \ \text{TN/AC/YR} \ (0.07 \ \text{AC}) = 40 \ \text{TN/YR}$

ASSUME SOIL WEIGHTS $75 \ \text{lbs/ft}^3$

$40 \ \text{TN/YR} \approx 39.6 \ \text{CUYD/YR}$ $\boxed{\text{SAY } 40 \ \text{CY/YR}}$

SOIL LOSS $= 40 \ \frac{\text{CUYD}}{\text{YR}} \cdot \frac{27 \ \text{ft}^3}{\text{CUYD}} \cdot \frac{1}{0.07(43560) \ \text{ft}^2} \cdot \frac{12 \ \text{IN}}{\text{ft}}$

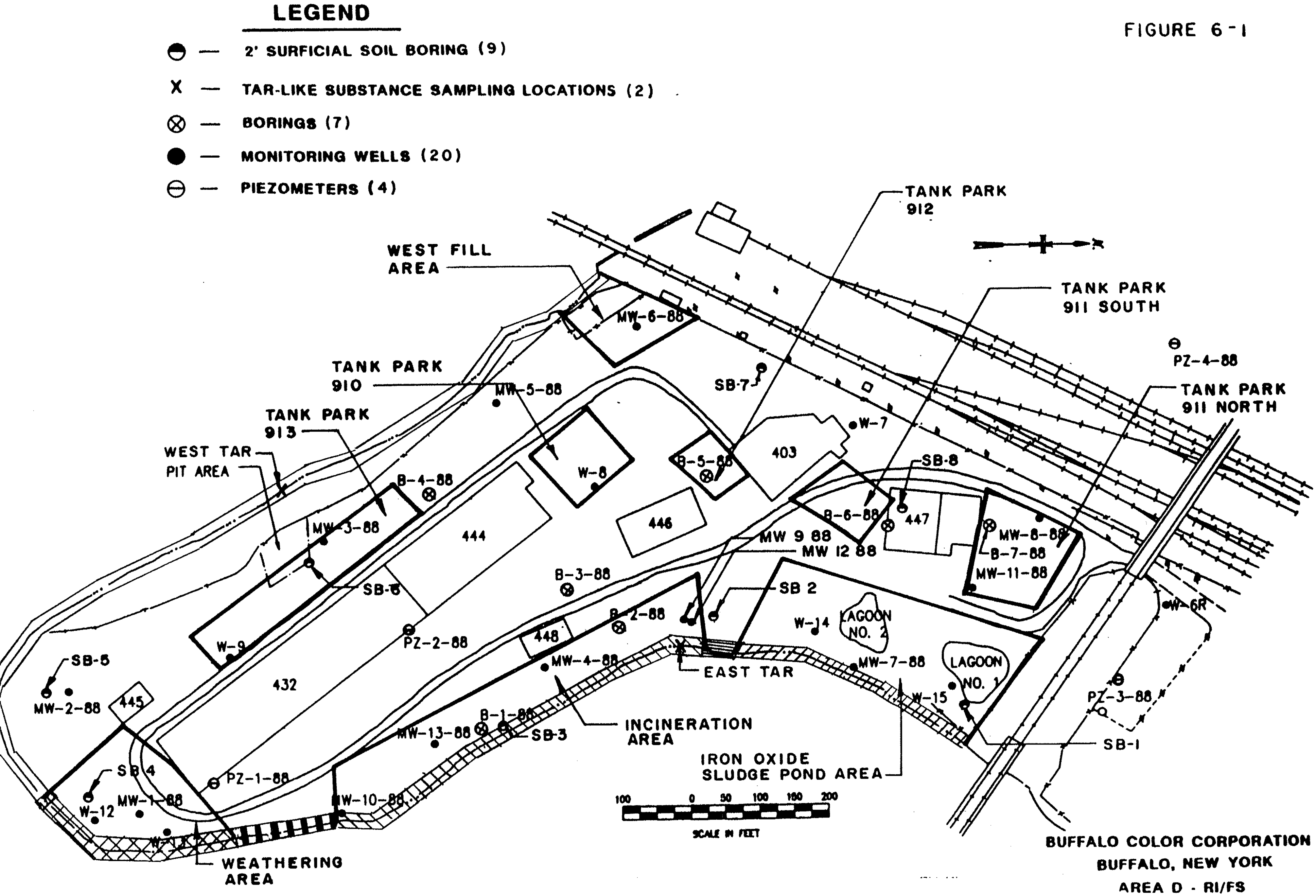
$= \boxed{4.3 \ \text{IN/YR}}$

WITH RIVER SCOUR SOIL LOSS =

$40 \times 1.25 = \boxed{50 \ \text{CY/YR}}$

$= \boxed{5.3 \ \text{IN/YR}}$

FIGURE 6-1



BUFFALO COLOR CORPORATION
BUFFALO, NEW YORK
AREA D - RI/FS

SAMPLING LOCATIONS

Not only is erosion objectionable in itself but erosion can degrade the cover and seriously reduce its effectiveness.

Evaluate Erosion Potential — Step 19

The USDA universal soil loss equation (USLE) is a convenient tool for use in evaluating erosion potential. The USLE predicts average annual soil loss as the product of six quantifiable factors. The equation is:

$$A = R\,K\,L\,S\,C\,P$$

where A = average annual soil loss, in tons/acre
R = rainfall and runoff erosivity index
K = soil erodibility factor, tons/acre
L = slope-length factor
S = slope-steepness factor
C = cover-management factor
P = practice factor

The data necessary as input to this equation are available to the evaluator in a figure and tables included below. Note that the evaluations in Step 8 on soil composition and Steps 25-32 on vegetation all impact on the evaluation of erosion also.

Factor R in the USLE can be calculated empirically from climatological data. For average annual soil loss determinations, however, R can be obtained directly from Figure 20. Factor K, the average soil loss for a given

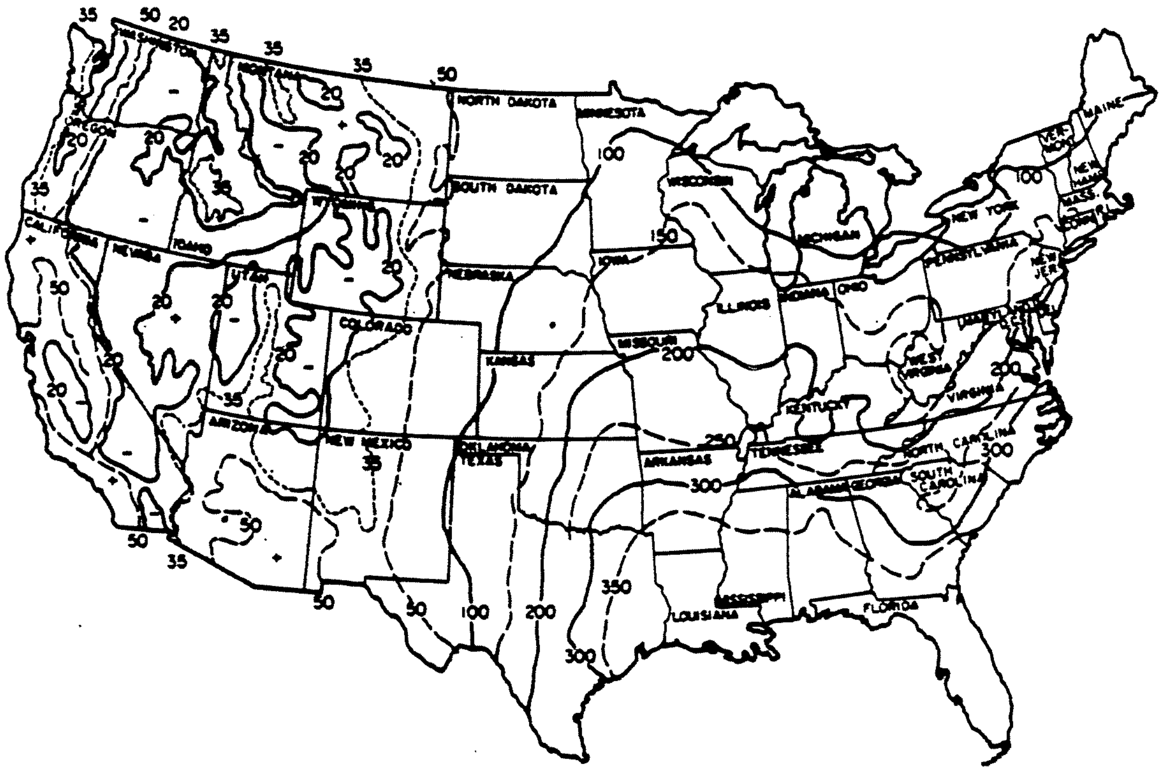


Figure 20. Average annual values of rainfall-erosivity factor R.[11]

soil in a unit plot, pinpoints differences in erosion according to differences in soil type. Long-term plot studies under natural rainfall have produced K values generalized in Table 5 for the USDA soil types.

TABLE 5. APPROXIMATE VALUES OF FACTOR K FOR USDA TEXTURAL CLASSES[11]

Texture class	Organic matter content		
	<0.5%	2%	4%
	K	K	K
Sand	0.05	0.03	0.02
Fine sand	.16	.14	.10
Very fine sand	.42	.36	.28
Loamy sand	.12	.10	.08
Loamy fine sand	.24	.20	.16
Loamy very fine sand	.44	.38	.30
Sandy loam	.27	.24	.19
Fine sandy loam	.35	.30	.24
Very fine sandy loam	.47	.41	.33
Loam	.38	.34	.29
Silt loam	.48	.42	.33
Silt	.60	.52	.42
Sandy clay loam	.27	.25	.21
Clay loam	.28	.25	.21
Silty clay loam	.37	.32	.26
Sandy clay	.14	.13	.12
Silty clay	.25	.23	.19
Clay		0.13-0.29	

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.

The evaluator must next consider the shape of the slope in terms of length and inclination. The appropriate LS factor is obtained from Table 6. A nonlinear slope may have to be evaluated as a series of segments, each with uniform gradient. Two or three segments should be sufficient for most engineered landfills, provided the segments are selected so that they are also of equal length (Table 6 can be used, with certain adjustments). Enter Table 6 with the total slope length and read LS values corresponding to the percent slope of each segment. For three segments, multiply the chart LS values for the upper, middle, and lower segments by 0.58, 1.06, and 1.37, respectively. The average of the three products is a good estimate of the

TABLE 6. VALUES OF THE FACTOR LS FOR SPECIFIC COMBINATIONS OF SLOPE LENGTH AND STEEPNESS[11]

% Slope	Slope length (feet)											
	25	50	75	100	150	200	300	400	500	600	800	1000
0.5	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.15	0.16	0.17	0.19	0.20
1	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.20	0.21	0.22	0.24	0.26
2	0.13	0.16	0.19	0.20	0.23	0.25	0.28	0.31	0.33	0.34	0.38	0.40
3	0.19	0.23	0.26	0.29	0.33	0.35	0.40	0.44	0.47	0.49	0.54	0.57
4	0.23	0.30	0.36	0.40	0.47	0.53	0.62	0.70	0.76	0.82	0.92	1.0
5	0.27	0.38	0.46	0.54	0.66	0.76	0.93	1.1	1.2	1.3	1.5	1.7
6	0.34	0.48	0.58	0.67	0.82	0.95	1.2	1.4	1.5	1.7	1.9	2.1
8	0.50	0.70	0.86	0.99	1.2	1.4	1.7	2.0	2.2	2.4	2.8	3.1
10	0.69	0.97	1.2	1.4	1.7	1.9	2.4	2.7	3.1	3.4	3.9	4.3
12	0.90	1.3	1.6	1.8	2.2	2.6	3.1	3.6	4.0	4.4	5.1	5.7
14	1.2	1.6	2.0	2.3	2.8	3.3	4.0	4.6	5.1	5.6	6.5	7.3
16	1.4	2.0	2.5	2.8	3.5	4.0	4.9	5.7	6.4	7.0	8.0	9.0
18	1.7	2.4	3.0	3.4	4.2	4.9	6.0	6.9	7.7	8.4	9.7	11.0
20	2.0	2.9	3.5	4.1	5.0	5.8	7.1	8.2	9.1	10.0	12.0	13.0
25	3.0	4.2	5.1	5.9	7.2	8.3	10.0	12.0	13.0	14.0	17.0	19.0
30	4.0	5.6	6.9	8.0	9.7	11.0	14.0	16.0	18.0	20.0	23.0	25.0
40	6.3	9.0	11.0	13.0	16.0	18.0	22.0	25.0	28.0	31.0	..	..
50	8.9	13.0	15.0	18.0	22.0	25.0	31.0	..	..	..	..	..
60	12.0	16.0	20.0	23.0	28.0	..	..	..	..	..	..	..

Values given for slopes longer than 300 feet or steeper than 18% are extrapolations beyond the range of the research data and, therefore, less certain than the others.

overall effective LS value. If two segments are sufficient, multiply by 0.71 and 1.29.

Factor C in the USLE is the ratio of soil loss from land cropped under specified conditions to that from clean-tilled, continuous fallow. Therefore, C combines effects of vegetation, crop sequence, management, and agricultural (as opposed to engineering) erosion-control practices. On landfills, freshly covered and without vegetation or special erosion-reducing procedures of cover placement, C will usually be about unity. Where there is vegetative cover or significant amounts of gravel, roots, or plant residues or where cultural practices increase infiltration and reduce runoff velocity, C is much less than unity. Estimate C by reference to Table 7 for anticipated cover management, but also consider changes that may take place in time. Meadow values are usually most appropriate. See Reference 1 for additional guidance.

Factor P in the USLE is similar to C except that it accounts for additional erosion-reducing effects of land management practices that are superimposed on the cultural practices, e.g., contouring, terracing, and contour strip-cropping. Approximate values of P, related only to slope steepness,

TABLE 7. GENERALIZED VALUES OF FACTOR C FOR STATES EAST OF THE ROCKY MOUNTAINS[11]

Crop, rotation, and management	Productivity level	
	High	Mod.
	C value	
Base value: continuous fallow, tilled up and down slope	1.00	1.00
CORN		
C, RdR, fall TP, conv	0.54	0.62
C, RdR, spring TP, conv	.50	.59
C, RdL, fall TP, conv	.42	.52
C, RdR, wc seeding, spring TP, conv	.40	.49
C, RdL, standing, spring TP, conv	.38	.48
C-W-M-M, RdL, TP for C, disk for W	.039	.074
C-W-M-M-M, RdL, TP for C, disk for W	.032	.061
C, no-till pl in c-k sod, 95-80% rc	.017	.053
COTTON		
Cot, conv (Western Plains)	0.42	0.49
Cot, conv (South)	.34	.40
MEADOW		
Grass & Legume mix	0.004	0.01
Alfalfa, lespedeza or Sericia	.020	
Sweet clover	.025	
SORGHUM, GRAIN (Western Plains)		
RdL, spring TP, conv	0.43	0.53
No-till pl in shredded 70-50% rc	.11	.18
SOYBEANS		
B, RdL, spring TP, conv	0.48	0.54
C-B, TP annually, conv	.43	.51
B, no-till pl	.22	.28
C-B, no-till pl, fall shred C stalks	.18	.22
WHEAT		
W-F, fall TP after W	0.38	
W-F, stubble mulch, 500 lbs rc	.32	
W-F, stubble mulch, 1000 lbs rc	.21	

Abbreviations defined:

B - soybeans
C - corn
c-k - chemically killed
conv - conventional
cot - cotton

F - fallow
M - grass & legume hay
pl - plant
W - wheat
wc - winter cover

lbs rc - pounds of crop residue per acre remaining on surface after new crop seeding
% rc - percentage of soil surface covered by residue mulch after new crop seeding
70-50% rc - 70% cover for C values in first column; 50% for second column
RdR - residues (corn stover, straw, etc.) removed or burned
RdL - all residues left on field (on surface or incorporated)
TP - turn plowed (upper 5 or more inches of soil inverted, covering residues)

are listed in Table 8. These values are based on rather limited field data, but P has a narrower range of possible values than the other five factors.

TABLE 8. VALUES OF FACTOR P[11]

Practice	Land slope (percent)				
	1.1-2	2.1-7	7.1-12	12.1-18	18.1-24
	(Factor P)				
Contouring (P_c)	0.60	0.50	0.60	0.80	0.90
Contour strip cropping (P_{sc})					
R-R-M-M[1]	0.30	0.25	0.30	0.40	0.45
R-W-M-M	0.30	0.25	0.30	0.40	0.45
R-R-W-M	0.45	0.38	0.45	0.60	0.68
R-W	0.52	0.44	0.52	0.70	0.90
R-O	0.60	0.50	0.60	0.80	0.90
Contour listing or ridge planting (P_{cl})	0.30	0.25	0.30	0.40	0.45
Contour terracing (P_t)[2]	[3] $0.6/\sqrt{n}$	$0.5/\sqrt{n}$	$0.6/\sqrt{n}$	$0.8/\sqrt{n}$	$0.9/\sqrt{n}$
No support practice	1.0	1.0	1.0	1.0	1.0

[1] R = rowcrop, W = fall-seeded grain, O = spring-seeded grain, M = meadow. The crops are grown in rotation and so arranged on the field that rowcrop strips are always separated by a meadow or winter-grain strip.

[2] These P_t values estimate the amount of soil eroded to the terrace channels and are used for conservation planning. For prediction of off-field sediment, the P_t values are multiplied by 0.2.

[3] n = number of approximately equal-length intervals into which the field slope is divided by the terraces. Tillage operations must be parallel to the terraces.

Example: An owner/operator proposes to close one section of his small landfill with a sandy clay subsoil cover having the surface configuration shown in Figure 21. The factor R has been established as 200 for this locality. The evaluator questions anticipated erosion along the steep side and assigns the following values to the other factors in the USLE after inspecting Tables 5 through 8:

$$K = 0.14 \quad LS = 8.3 \quad C = 1.00 \quad P = 0.90$$

The rate of erosion for the steep slope of the landfill is calculated as follows:

$$A = 200\ (0.14\ \text{tons/acre})\ (8.3)\ (1.00)\ (0.90) = 209\ \text{tons/acre}$$

This erosion not only exceeds a limit recommended by the permitting authority but also indicates a potential

APPENDIX E.2

CALCULATION OF CONTAMINANT LOADINGS TO THE BUFFALO RIVER VIA MECHANICAL EROSION

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY DJD DATE 4/12/89 SHEET NO. 1 OF

CHKD. BY DATE JOB NO. 1115-03-1

SUBJECT CONTAMINANT LOADINGS TO BUFFALO RIVER

BUFFALO COLOR
LOADINGS TO BUFFALO RIVER DUE TO EROSION

1.) EROSION LOSS BASED UPON CALCULATIONS USING UNIVERSAL SOIL LOSS EQUATION (SEE attached Table 7-2)

2.) SOIL DENSITY: 75 LB/FT³

3.) SOIL CONTAMINANT CONCENTRATIONS BASED UPON WEIGHTED AVERAGES OF SOIL SAMPLES WITHIN EACH AREA OF THE SITE. FOR SAMPLE LOCATIONS WITH MORE THAN ONE SAMPLE ACROSS THE THICKNESS OF THE FILL, THE INDIVIDUAL SAMPLES WERE WEIGHTED ON A PER FOOT BASIS. FOR EXAMPLE, AT MW-7-88, 3 SAMPLES WERE COLLECTED:

A - 0-30'	30/34 = 0.88	WEIGHTING FACTORS
B - 30-32'	2/34 = 0.06	
C - 36-38'	2/34 = 0.06	
TOTAL SAMPLE LENGTH = 34'	34/34 = 1.00	

IF MORE THAN ONE SAMPLE LOCATION IS PRESENT WITHIN THE AREA OF INTEREST, THE WEIGHTED CONCENTRATION FROM EACH LOCATION WAS GIVEN EQUAL WEIGHT TO DETERMINE THE AVERAGE CONTAMINANT CONCENTRATION WITHIN AN AREA. FOR EXAMPLE, IN THE INCINERATION AREA, THERE WERE FOUR SAMPLE LOCATIONS, THEREFORE THE AVERAGE LOADING FROM THIS AREA WAS CALCULATED USING THE WEIGHTED CONCENTRATION FROM EACH OF THE FOUR LOCATIONS

THE FOLLOWING SAMPLE LOCATIONS WERE USED TO DETERMINE AVERAGE CONTAMINANT CONCENTRATIONS FOR EACH AREA:

IRON OXIDE SLUDGE LAGOONS	MW-7-88
INCINERATION	MW-4-88, MW-9-88, B-1, B-2
WEATHERING	MW-1-88
SOUTHWEST BANK	MW-2-88, MW-3-88, MW-5-88, MW-6-88, B-4
BETWEEN LAGOONS AND INCINERATION AREA	MW-9-88
BETWEEN WEATHERING AND INCINERATION AREAS	MW-10-88

THE 1-2-3 SPREADSHEET WAS SET UP AS FOLLOWS:

SEMIVOLATILE ORGANICS

WEIGHTED SUM = SUM OF EA ANALYTE WITHIN ONE SAMPLE

WEIGHTED AVERAGE = SUM OF WEIGHTED SUMS @ ONE LOCATION

CONTAMINANT LOAD $\left(\frac{KG}{YR}\right)$ = EROSION CY/YR × 75 LB/CF × 27 CF/CY × 0.4356 KG/LB × CONC MG/KG × 10^{-6} = $\frac{KG}{YR}$ CONTAMINANT

AVERAGE LOAD = $\frac{\Sigma \text{ CONTAMINANT LOADS}}{\text{NO. SAMPLE LOCATIONS}}$

EXAMPLE: IRON OXIDE SLUDGE LAGOON

SAMPLE:	A	B	C
DEPTH:	0-30	30-32	36-38
WEIGHT:	30/34	2/34	2/34

SEMIVOLATILES (mg/kg)

0

8.7

WEIGHTED SUM:	$8.7 \times \frac{30}{34}$ 7.7	$0 \times \frac{2}{34}$ 0	$0 \times \frac{2}{34}$ 0	MG/KG
WEIGHTED AVERAGE:	7.7 + 0 + 0			MG/KG

CONTAMINANT LOAD: 100 CY/YR × 75 LB/CF × 27 CF/CY × 0.4356 KG/LB × 7.7 MG/KG × 10^{-6} $\frac{KG}{MG}$
= 0.71 KG/YR

AVERAGE LOAD: $\frac{0.71 \text{ KG/YR}}{1 \text{ SAMPLE LOCATION}}$ = 0.71 KG/YR

TABLE 7-2

BUFFALO COLOR CORPORATION
AREA "D"

SUMMARY OF EROSION POTENTIAL CALCULATIONS

AREA DESCRIPTION(1)	EROSION POTENTIAL	
	cubic yards/year	inches/year
Iron Oxide Sludge Pond Area	100	4.3
Incineration Area	170	2.5
Weathering Area	32	2.3
Southwest Bank Area	195	1.2
Area Between Iron Oxide Pond and Incineration Areas	32	5.8
Area Between Weathering and Incineration Areas	50	5.3
TOTAL	579	-
AVERAGE	-	3.6(2)

NOTES:

(1) See figure in Appendix E.1 for locations

(2) Along entire length of River bank.

TABLE 7-3: LOADING TO RIVER DUE TO EROSION OF SOILS

FOR DOCUMENTATION ONLY

SITE LOCATION	IRON OXIDE SLUDGE LAGOON			<<<<<<<<<INCINERATION AREA>>>>>>>>>>>>>>>>>>>>					<<<<<<<WEA
SAMPLE NUMBER	MW-7-88	MW-7-88	MW-7-88	MW-4-88	B-1-88	B-1-88	B-2-88	MW-9-88	MW-1-88
SAMPLE ZONE	A	B	C	A	A	B	A	A	A
DEPTH OF SAMPLE	0-30′	30-32′	36-38′	0-20′	0-26′	26-28′	6-28′	6-18′	0-6′
WEIGHTING FACTOR	0.88	0.06	0.06	1.00	0.93	0.07	1.00	1.00	0.60
ANNUAL EROSION LOSS (cy/yr)	100	100	100	170	170	170	170	170	32
SEMIVOLATILE ORGANICS (mg/kg)									
1,4-DICHLOROBENZENE				11	13				
1,2-DICHLOROBENZENE				27	110	1.8			
NITROBENZENE	8.7				1100	2		0.21	
1,2,4-TRICHLOROBENZENE					150	1.2			
2-NITROANILINE									
2,4-DINITROTOLUENE									
WEIGHTED SUM (mg/kg)	7.7	0.0	0.0	38.0	1274.9	0.4	0.0	0.2	0.0
WEIGHTED AVERAGE (mg/kg)	7.7			38.0	1275.3		0.0	0.2	0.0
CONTAMINANT LOAD (kg/yr/location)	0.71			5.93	199.14		0.00	0.03	0.00
AVERAGE LOAD (KG/YR/AREA)	0.71			51.28					0.00
PAH/PHTHALATES (mg/kg)									
NAPHTHALENE	4.3					2.8			
2-CHLORONAPHTHALENE					140	0.55			
ACENAPHTHYLENE					0.41				
ACENAPHTHENE								0.4	
FLUORENE								0.5	
PHENANTHRENE	1.6				5.7			4.6	
ANTHRACENE					1.3			1.3	
DI-n-BUTYLPHTHALATE								0.76	
FLUORANTHENE					1.2			4.8	
PYRENE	0.83				0.93			3.9	
BENZO(a)ANTHRACENE								1.9	
BIS(2-ETHYLHEXYL) PHTHALATE								0.29	
CHRYSENE								2.1	
DI-N-OCTYL PHTHALATE									
BENZO(b)FLUORANTHENE								3.1	
BENZO(a)PYRENE								1.7	
INDENO(1,2,3-cd)PYRENE								0.76	
DIBENZO(a,h)ANTHRACENE								0.43	
BENZO(g,h,i)PERYLENE								0.78	
WEIGHTED SUM (mg/kg)	5.9	0.0	0.0	0.0	138.9	0.2	0.0	27.3	0.0
WEIGHTED AVERAGE (mg/kg)	5.9			0.0	139.1		0.0	27.3	0.1
CONTAMINANT LOAD (kg/yr/location)	0.55			0.00	21.72		0.00	4.27	0.00
AVERAGE LOAD (KG/YR/AREA)	0.55			6.50					0.00
EOX (mg/kg)	220	160		14				53	68
WEIGHTED SUM (mg/kg)	194.117	9.41176	0	14	0	0	0	53	40.8
WEIGHTED AVERAGE (mg/kg)	203.5			14.0	0.0		0.0	53.0	44.8
CONTAMINANT LOAD (kg/yr/location)	18.69			2.19	0.00		0.00	8.28	1.32

TABLE 7-3: LOADING TO RIVER DUE TO EROSION OF SOILS

SITE LOCATION	IRON OXIDE SLUDGE LAGOON			<<<<<<<<<INCINERATION AREA>>>>>>>>>>>>>>>>>>>					<<<<<<<WEA
SAMPLE NUMBER	MW-7-88	MW-7-88	MW-7-88	MW-4-88	B-1-88	B-1-88	B-2-88	MW-9-88	MW-1-88
SAMPLE ZONE	A	B	C	A	A	B	A	A	A
DEPTH OF SAMPLE	0-30′	30-32′	36-38′	0-20′	0-26′	26-28′	6-28′	6-18′	0-6′
WEIGHTING FACTOR	0.88	0.06	0.06	1.00	0.93	0.07	1.00	1.00	0.60
ANNUAL EROSION LOSS (cy/yr)	100	100	100	170	170	170	170	170	32
AVERAGE LOAD (KG/YR/AREA)	18.69			2.62					1.32
TOTAL METALS (mg/kg)									
ANTIMONY	4				0.91				
ARSENIC	84	13	15	16	27	14	16	133	23
BERYLLIUM		1	1.1			0.99			
CADMIUM				5	1.5		1.6		0.93
CHROMIUM	37	32	39	19	48	31	22	319	118
COPPER	4630	32	32	601	575	34	209	319	14500
LEAD	187	29	35	9.2	410	25	51	719	1640
MERCURY	0.24				0.28			1.8	6
NICKEL	467	60	64	25	20	34	48	104	57
SELENIUM								9.6	
SILVER	3			2.2				0.82	
THALLIUM								9.6	
ZINC	473	86	97	500	39	82	270	267	349
WEIGHTED SUM (mg/kg)	5192.85	14.8823	16.6529	1177.4	1040.7242	15.785	617.6	1882.82	10016.358
WEIGHTED AVERAGE (mg/kg)	5224.4			1177.4	1056.5		617.6	1882.8	10169.5
CONTAMINANT LOAD (kg/yr/location)	479.88			183.85	164.98		96.44	294.01	298.92
AVERAGE LOAD (KG/YR/AREA)	479.88			184.82					298.92
IRON	264000	28700	31500	19800	15500	29100	15100	78600	32700
WEIGHTED SUM (mg/kg)	232941	1688	1853	19800	14393	2079	15100	78600	19620
WEIGHTED AVERAGE (mg/kg)	236482			19800	16471		15100	78600	26280
CONTAMINANT LOAD (kg/yr/location)	21722			3092	2572		2358	12274	772
AVERAGE LOAD (KG/YR/AREA)	21722			5074					772

TABLE 7-3: LOADING TO RIVER DUE TO EROSION OF SOILS

SITE LOCATION	THERING AREA>>>>>>>>		<<<<<<<<<<<<<<<<<<<<<SOUTHWEST BANK >>>>>>>>>>>>>>>>>>>>>>>>>>>>					
SAMPLE NUMBER	MW-1-88	MW-1-88	MW-2-88	MW-5-88	MW-5-88	MW-6-88	MW-6-88	MW-3-88
SAMPLE ZONE	B	C	A	A	B	B	C	A
DEPTH OF SAMPLE	6-8'	12-14'	0-16'	12-16'	16-18'	2-4'	8-10'	4-18'
WEIGHTING FACTOR	0.20	0.20	1.00	0.50	0.50	0.50	0.50	1.00
ANNUAL EROSION LOSS (cy/yr)	32	32	195	195	195	195	195	195
SEMIVOLATILE ORGANICS (mg/kg)								
1,4-DICHLOROBENZENE								
1,2-DICHLOROBENZENE								
NITROBENZENE			5.9					
1,2,4-TRICHLOROBENZENE								
2-NITROANILINE								
2,4-DINITROTOLUENE								2.6
WEIGHTED SUM (mg/kg)	0.0	0.0	5.9	0.0	0.0	0.0	0.0	2.6
WEIGHTED AVERAGE (mg/kg)			5.9	0.0		0.0		2.6
CONTAMINANT LOAD (kg/yr/location)			1.06	0.00		0.00		0.47
AVERAGE LOAD (KG/YR/AREA)			0.40					
PAH/PHTHALATES (mg/kg)								
NAPHTHALENE			8.2					5.5
2-CHLORONAPHTHALENE								
ACENAPHTHYLENE			1.6					
ACENAPHTHENE								
FLUORENE			2.5					
PHENANTHRENE			9.9			2.1		0.72
ANTHRACENE			4.8					
DI-n-BUTYLPHTHALATE		0.54		0.6	0.36			
FLUORANTHENE			14			2.5		
PYRENE			13			2.1		
BENZO(a)ANTHRACENE			6.7			1.1		
BIS(2-ETHYLHEXYL) PHTHALATE				0.62	0.23			
CHRYSENE			8.2			1.4	0.35	
DI-N-OCTYL PHTHALATE								
BENZO(b)FLUORANTHENE			9.7			1.6		
BENZO(a)PYRENE			5.5		0.09	0.84	0.17	
INDENO(1,2,3-cd)PYRENE			2.9			0.49		
DIBENZO(a,h)ANTHRACENE			0.83					
BENZO(g,h,i)PERYLENE			2.6			0.48		
WEIGHTED SUM (mg/kg)	0.0	0.1	90.4	0.6	0.3	6.3	0.3	6.2
WEIGHTED AVERAGE (mg/kg)			90.4	1.0		6.6		6.2
CONTAMINANT LOAD (kg/yr/location)			16.20	0.17		1.18		1.11
AVERAGE LOAD (KG/YR/AREA)			3.95					
EOX (mg/kg)		20	89	11	17			
WEIGHTED SUM (mg/kg)	0	4	89	5.5	8.5	0	0	0
WEIGHTED AVERAGE (mg/kg)			89.0	14.0		0.0		0.0
CONTAMINANT LOAD (kg/yr/location)			15.94	2.51		0.00		0.00

TABLE 7-3: LOADING TO RIVER DUE TO EROSION OF SOILS

SITE LOCATION	THERING AREA>>>>>>>>		<<<<<<<<<<<<<<<<<<<<SOUTHWEST BANK >>>>>>>>>>>>>>>>>>>>>>>>>>>					
SAMPLE NUMBER	MW-1-88	MW-1-88	MW-2-88	MW-5-88	MW-5-88	MW-6-88	MW-6-88	MW-3-88
SAMPLE ZONE	B	C	A	A	B	B	C	A
DEPTH OF SAMPLE	6-8'	12-14'	0-16'	12-16'	16-18'	2-4'	8-10'	4-18'
WEIGHTING FACTOR	0.20	0.20	1.00	0.50	0.50	0.50	0.50	1.00
ANNUAL EROSION LOSS (cy/yr)	32	32	195	195	195	195	195	195
AVERAGE LOAD (KG/YR/AREA)			8.85					
TOTAL METALS (mg/kg)								
ANTIMONY			7.4	0.71		0.81	0.89	
ARSENIC	8.1	5	84	38	34	54	61	69
BERYLLIUM			0.93	0.76	0.7		1	
CADMIUM					4.9		2	
CHROMIUM	15	14	364	17	16	57	47	113
COPPER	47	168	341	31	29	121	84	86
LEAD	331	21	77	22	24	276	151	66
MERCURY		0.68				1.6	0.89	0.73
NICKEL	19	20	164	28	41	35	35	68
SELENIUM			14	21	12	15	20	11
SILVER			2.1			0.7		1.3
THALLIUM			19	6.3			1.4	
ZINC	58	59	716	82	106	316	397	305
WEIGHTED SUM (mg/kg)	95.62	57.536	1789.43	123.385	133.8	438.555	400.59	720.03
WEIGHTED AVERAGE (mg/kg)			1789.4	257.2		839.1		720.0
CONTAMINANT LOAD (kg/yr/location)			320.51	46.07		150.30		128.97
AVERAGE LOAD (KG/YR/AREA)			160.10					
IRON	21600	11700	300000	17900	17300	33000	27400	26500
WEIGHTED SUM (mg/kg)	4320	2340	300000	8950	8650	16500	13700	26500
WEIGHTED AVERAGE (mg/kg)			300000	17600		30200		26500
CONTAMINANT LOAD (kg/yr/location)			53735	3152		5409		4747
AVERAGE LOAD (KG/YR/AREA)			14502					

SITE LOCATION	>>>>>>>>>>>>>>>>		weather/incin		lagoon/inc
SAMPLE NUMBER	B-4-88	B-4-88	MW-10-88	MW-10-88	MW-9-88
SAMPLE ZONE	A	B	B	C	A
DEPTH OF SAMPLE	6-24′	24-26′	0-2′	6-8′	6-18′
WEIGHTING FACTOR	0.90	0.10	0.50	0.50	1.00
ANNUAL EROSION LOSS (cy/yr)	195	195	50	50	32
SEMIVOLATILE ORGANICS (mg/kg)					
1,4-DICHLOROBENZENE					
1,2-DICHLOROBENZENE					
NITROBENZENE					0.21
1,2,4-TRICHLOROBENZENE					
2-NITROANILINE					
2,4-DINITROTOLUENE					
WEIGHTED SUM (mg/kg)	0.0	0.0	0.0	0.0	0.2
WEIGHTED AVERAGE (mg/kg)	0.0		0.0		0.2
CONTAMINANT LOAD (kg/yr/location)	0.00		0.00		0.01
AVERAGE LOAD (KG/YR/AREA)			0.00		0.01
PAH/PHTHALATES (mg/kg)					
NAPHTHALENE			2.7		
2-CHLORONAPHTHALENE					
ACENAPHTHYLENE					
ACENAPHTHENE					0.4
FLUORENE					0.5
PHENANTHRENE			2.4		4.6
ANTHRACENE					1.3
DI-n-BUTYLPHTHALATE				0.56	0.76
FLUORANTHENE			1.7		4.8
PYRENE			1.6		3.9
BENZO(a)ANTHRACENE					1.9
BIS(2-ETHYLHEXYL) PHTHALATE					0.29
CHRYSENE					2.1
DI-N-OCTYL PHTHALATE					
BENZO(b)FLUORANTHENE					3.1
BENZO(a)PYRENE					1.7
INDENO(1,2,3-cd)PYRENE					0.76
DIBENZO(a,h)ANTHRACENE					0.43
BENZO(g,h,i)PERYLENE					0.78
WEIGHTED SUM (mg/kg)	0.0	0.0	4.2	0.3	27.3
WEIGHTED AVERAGE (mg/kg)	0.0		4.5		27.3
CONTAMINANT LOAD (kg/yr/location)	0.00		0.21		0.80
AVERAGE LOAD (KG/YR/AREA)			0.21		0.80
EOX (mg/kg)	160		360	24	53
WEIGHTED SUM (mg/kg)	144	0	180	12	53
WEIGHTED AVERAGE (mg/kg)	144.0		192.0		53.0
CONTAMINANT LOAD (kg/yr/location)	25.79		8.82		1.56

SITE LOCATION	>>>>>>>>>>>>>>>>		weather/incin		lagoon/inc
SAMPLE NUMBER	B-4-88	B-4-88	MW-10-88	MW-10-88	MW-9-88
SAMPLE ZONE	A	B	B	C	A
DEPTH OF SAMPLE	6-24'	24-26'	0-2'	6-8'	6-18'
WEIGHTING FACTOR	0.90	0.10	0.50	0.50	1.00
ANNUAL EROSION LOSS (cy/yr)	195	195	50	50	32
AVERAGE LOAD (KG/YR/AREA)			8.82		1.56
TOTAL METALS (mg/kg)					
ANTIMONY	0.91		39		
ARSENIC	7.6	43	276	2860	133
BERYLLIUM		1.3			
CADMIUM		7			
CHROMIUM	13	27	440	42	319
COPPER	11	27	936	186	319
LEAD	36	32	538	38	719
MERCURY	0.48		1.3		1.8
NICKEL	3.9	35	331	31	104
SELENIUM	10	19			9.6
SILVER	1.8	5.7	4.3	0.71	0.82
THALLIUM			1.9	66	9.6
ZINC	43	88	1160	84	267
WEIGHTED SUM (mg/kg)	114.921	28.5	1863.75	1653.855	1882.82
WEIGHTED AVERAGE (mg/kg)	143.4		3517.6		1882.8
CONTAMINANT LOAD (kg/yr/location)	25.69		161.55		55.34
AVERAGE LOAD (KG/YR/AREA)			161.55		55.34
IRON	1750	24400	360000	35300	78600
WEIGHTED SUM (mg/kg)	1575	2440	180000	17650	78600
WEIGHTED AVERAGE (mg/kg)	4015		197650		78600
CONTAMINANT LOAD (kg/yr/location)	719		9077.47		2310.31
AVERAGE LOAD (KG/YR/AREA)			9077.47		2310.31

TABLE 7-3: LOADING TO RIVER DUE TO EROSION OF SOILS

SUMMARY

AVERAGE LOAD (KG/YR/AREA)

SITE LOCATION ANNUAL EROSION LOSS (cy/yr)	IRON OXIDE 100	INCIN 170	WEATHER 32	SW BANK 195	WTHR/INCIN 50	LGN/INCIN 32
PAH/PHTHALATES	0.55	0.00	0.00	3.24	0.19	0.80
OTHER SEMIVOLATILE ORGANICS	0.71	1.48	0.00	0.21	0.00	0.01
EOX	17.83	0.55	1.20	3.19	8.27	1.56
TOTAL METALS	476.98	45.96	294.41	64.10	85.60	55.34
IRON	21397	773	577	10747	8266.86	2310.31

APPENDIX F.1

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