EMCON

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July 21, 1998
Project 85740-100.000

Jaspal S. Walia, P.E.
New York State Department of
Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Re: Response to Remedial Design Report Comments
Saginaw-Buffalo Site, Buffalo, NY
NYSDEC Site No. 915152

Dear Mr. Walia:

Wehran-New York, Inc. (EMCON) on behalf of General Motors Corporation (GM) has reviewed the July 14, 1998 comment letter from the New York State Department of Environmental Conservation (NYSDEC) on the Remedial Design Report. The following responses have been prepared based on the NYSDEC comment letter and our July 14, 1998 telephone conversation. The report has also been revised to reflect these changes.

1. ***OU 2 Groundwater, Pgs. 1-3 and 5-4: Monitoring well MW-202 is included in figure 5 but is not mentioned on Pgs. 1-3 and 5-1.***

   Monitoring well MW-202 was shown on Figure 5 since it is an existing feature at the site, but was not included in the list of wells to be monitored on pages 1-3 and 5-1 because it was not included in the monitoring list printed in the Record of Decision (ROD). Based on our conversation of July 14, 1998, GM has added MW-202 to the monitoring and maintenance list.

2. ***Pg. 2-3, 5th paragraph: Please make it clear that the spent carbon will either be sent for regeneration or disposed of at a government-approved facility.***

   The spent carbon will be disposed of in accordance with applicable Federal and State requirements at an off-site permitted facility.

3. ***Section 2.1.3: What action would be taken if, during excavation of PCBs contaminated soils, it is determined that contaminants have migrated underneath the building?***

During the course of the excavation, if PCBs at or above the 10 ppm cleanup goal are found to have migrated below the building or other structure (i.e., aboveground storage tank), further excavation to remove the impacted material will not be possible. The impacted area will be isolated by means of an impervious barrier (clay wall or other comparable material) and GM will consult with the NYSDEC regarding the need for further response action. This scenario is considered unlikely given the suspected source of the PCBs (the clay tile pipe removed during the IRM in March 1995) and the fact that these structures are located upgradient. In view of this, this scenario is listed under the Contingency Plan in Section 4 of the Remedial Design Report.

4. ***Waste bedding material should also be tested for PCBs and lead prior to its disposal.***

   Waste bedding material will be disposed of as a RCRA/TSCA waste along with the other excavated materials and will not be segregated.

5. ***Section 2.1.3, Paragraphs 5 and 6: Post-excavation sampling to confirm the cleanup level is not clear. Post-excavation soil samples from the bottom of the excavation should be collected from 10-feet grid nodes. For each confirmatory soil sample, four nodal samples can be composited. The total number of post-excavation samples from the bottom shall depend upon the number of such grids. Depending on the size of excavation, two to three composite soil samples shall be collected from each wall to be tested in the laboratory. A sufficient number of QA/QC samples should also be collected to ascertain the quality of the data. Post-excavation confirmatory samples shall be collected in the presence of a NYSDEC representative. No backfilling should start until the laboratory confirmatory data is available verifying that no further excavation will be required. The material to be used for backfilling should either be from a reliable clean source or should be tested prior to its use.***

   The confirmatory sampling of the excavation has been amended pursuant to our July 14, 1998 conversation. Post-excavation soil samples from the bottom of the excavation will be collected based on a 25-foot grid. Assuming the excavation is 100 feet by 100 feet, this would create 16 sampling squares. One composite sample will be submitted for analysis from each square. Each composite sample will be generated from five grab samples: one grab sample collected from each grid node (for a total of four) and one collected from the center of each square.

Two composite samples will be generated from each of the side walls (for a total of eight) and sent for laboratory analysis. Duplicate samples will be collected at the rate of 10% and sent for laboratory analysis for QA/QC purposes (two from the floor and once from the walls, based on the current number of samples). All confirmatory sampling will be conducted in the presence of a NYSDEC representative.

Backfill material will be required to be certified by the remedial contractor's supplier as to its contents. Backfilling of the excavation will not begin until results of the confirmatory samples are received. Analyses are being conducted on a 24-hour turnaround basis.

6. ***Pg. 5-2, 1st Paragraph: The storm sewer samples shall also be tested for PCBs along with lead.***

   PCBs were not included in the list of storm sewer monitoring parameters on page 1-3 and 5-2 because it was not included in the monitoring list printed in the ROD. Based on our conversation of July 14, 1998, GM has added PCBs to the storm sewer monitoring and maintenance list.

7. ***Appendix B, Pg. 7, Section 1.12: The noise level during working hours, i.e. between 7 a.m. and 7 p.m., should not exceed 52 dbA.***

   Agreed. The text has been modified to reflect the correct hours of operation.

8. ***Section 01039: NYSDEC should be notified of all the meetings. The minutes of the meetings shall be submitted to NYSDEC within a week after the job or progress meeting.***

   Agreed. Mr. Jaspal Walia of the NYSDEC shall be informed of all meetings and will be provided with minutes of those meetings.

9. ***Section 02203, 1.3: Perhaps it should read:. . .GM approved permitted facility as a TSCA waste. . .***

   Agreed. The text has been modified to reflect this change.

10. ***Appendix F, Pg. 4-1: Please make changes in this section as suggested in the attachment - Citizen Participation Activities.***

Page 4-1 of Appendix F has been modified to reflect the handwritten comments provided by the NYSDEC as an attachment to the July 14, 1998 letter. We understand the term "...at the completion of the Remedial Action" to mean when the NYSDEC accepts the Remedial Construction Certification Report.

Enclosed are one copy of the revised Remedial Design Report reflecting the changes discussed above, along with replacement pages for the additional copies. Please contact us if you have any questions regarding this project.

Sincerely,

EMCON

Katherine B. Galanti
Task Manager (ext. 231)

Kenneth C. Malinowski, Ph.D.
Project Manager (ext. 228)

Attachment

cc: M. Napolitan - GM
A. Thrubis - GM Legal
B. Kogut - Bond, Schoeneck & King, LLP
M. Desmond - NYSDEC Division of Environmental Enforcement
C. O'Connor - NYSDOH Buffalo

EMCON

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July 2, 1998
Project 85740-100.000

Jaspal Walia, P.E.
New York State Department of
Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Re: Remedial Design Report
Saginaw-Buffalo Site, Buffalo, NY
NYSDEC Site No. 915152

Dear Mr. Walia:

On behalf of General Motors Corporation (GM), Wehran-New York, Inc. (EMCON) is pleased to submit four (4) copies of the Remedial Design (RD) Report for the above-referenced site. This is the report required under I(B)(1)(c) - Operable Unit No. 1 (OU1) of the Consent Order, and also addresses Operable Unit No. 2 (OU2).

Please contact us if you have any questions on the enclosed RD report.

Sincerely,

EMCON

Katherine B. Galanti
Task Manager

Kenneth C. Malinowski, Ph.D.
Project Manager

Attachments

cc: M. Napolitan - GM
J. Braun - GM Legal
B. Kogut - Bond, Schoeneck & King, LLP
M. Desmond - NYSDEC
C. O'Connor - NYSDOH
NYSDOH Albany (2)

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REMEDIAL DESIGN REPORT

SAGINAW-BUFFALO SITE

NYSDEC SITE NO 915152

Prepared for

General Motors Corporation
Worldwide Facilities Group
Environmental Remediation and International Environmental Support

Issued July 2, 1998
Revised July 21, 1998

Prepared by

EMCON
1775 Baseline Road, Suite 220
Grand Island, New York 14072

Project 85740-100.000

CERTIFICATION OF PROFESSIONAL ENGINEER

DOCUMENT TITLE: **REMEDIAL DESIGN REPORT FOR SAGINAW-BUFFALO, NYSDEC SITE NO. 915152**

To the best of my knowledge, information, and belief, the information contained in this document is factual and was developed to implement the remedial alternative selected in the Record of Decision issued by the New York State Department of Environmental Conservation, March 1998, for the referenced site.

WEHRAN-NEWARK, INC.

Dennis G. Fenn, P.E.
Vice President
NYS P.E. License No. 50131

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TABLES AND ILLUSTRATIONS

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1 INTRODUCTION

This Remedial Design (RD) Report has been completed for General Motors Corporation (GM) for the Saginaw-Buffalo site in Buffalo, New York, which has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site No. 915152. This report is based on the Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC) in March 1998.

This report details the remedial activities required to address soil and groundwater under Operable Unit 1 (OU1) for PCBs and OU2 for lead.

1.1 Site Location and Background

The Site, a portion of a former GM-Saginaw facility, is located at 1001 East Delavan Avenue in Buffalo, New York. The property and facility are currently owned and operated by American Axle & Manufacturing, Inc. (AAM), which purchased the property and facility from GM on February 28, 1994. The area of investigation (the "Site") consists of seven acres of Parking Lot No. 4, located east of the main facility and separated from the main facility by a Conrail right-of-way (ROW). The original NYSDEC Registry listing was for a one-acre area contaminated with polychlorinated biphenyls (PCBs) around the Wastewater Treatment Plant (WWTP). This area is referred to as Operable Unit 1 (OU1). OU2 addresses the elevated lead concentrations in the fill materials found throughout the seven-acre parking lot. The Site is shown on Figure 1.

The Site was sold to AAM on February 28, 1994, along with the main facility west of the Conrail ROW. As part of this conveyance, a deed restriction was placed on the property limiting it for use for industrial purposes only. A copy of the deed restriction is provided as Appendix A. Under the New York State Uniform Fire Prevention and Building Code (9 NYCRR Part 902.1(a)), buildings other than a one or two family dwelling in which plumbing fixtures are installed, must hook into a public water supply system if one is available. Consequently, the existing deed restriction precluding residential use of the site will prevent the use of on-site groundwater for potable purposes.

1.2 Site Remediation Goals

At a minimum, the remedy selected for the GM site should eliminate or mitigate all significant threats to the public health and the environment presented by hazardous waste disposed of at the site through the proper application of scientific and engineering principles.

The goals set forth in the ROD for the site are as follows:

- To the extent practicable, reduce the potential for human contact with PCB and lead impacted soils.
- Prevent or greatly reduce the potential for migration of contaminants via surface run-off and on-site drain lines.
- Prevent, to the extent possible, the migration of contaminants from the site to the Scajaquada Creek Drain.
- To the extent practicable, provide for attainment of SCGs for groundwater.

1.3 Description of Site Remedy

Based upon the results of the December 1997 Engineering Evaluation of Alternatives (EEA) Report and the evaluation presented in Section 6.2 of the ROD, the NYSDEC chose the following alternatives for the site:

OU1 Soil

"Contaminated soils above the cleanup goal of 10 ppm [PCBs] [will] be excavated. The excavated soils would be loaded directly into lined rail cars and transported for off-site disposal. Any light non-aqueous phase liquid (LNAPL) encountered during excavation would also be sent for off-site disposal. Water found during excavation would be treated and disposed of to the Buffalo Sewer Authority (BSA) sanitary sewer system. Therefore, this alternative indirectly involves a component to address PCB-contaminated groundwater. Prior to backfilling with clean fill, the excavated areas would be tested to ensure that cleanup levels have been met." - ROD at Page 8

OU1 Groundwater

"Selected on-site monitoring wells (identified in Alternative 2G2 [OU2 Groundwater]) would be monitored semi-annually for PCBs for a period to be determined based on the sampling results." - ROD at Page 9

OU2 Soil

"Annual maintenance of the existing pavement [will be performed] to reduce infiltration into lead contaminated soils and aid in the control of migration of contaminants to the groundwater. The alternative would also include evaluation and repair of the existing pavement. Under the long term maintenance plan, the pavement would be annually maintained. A deed restriction would limit use of this site only for industrial purposes." - ROD at Page 10

OU2 Groundwater

"The existing pavement [will] be maintained to prevent infiltration and it [will] undergo annual maintenance. Six downgradient monitoring wells (MW-5, MW-203, MW-205, MW-208, MW-209, and MW-210) and four upgradient wells (MW-1, MW-201, MW-204, and MW-206) would be monitored to check the groundwater conditions at the site... Additionally, storm sewer Manhole 2 would be monitored for lead on a semiannual basis. Monitoring results would be periodically reviewed to assess any further monitoring requirements. If monitoring shows any increase in levels of contamination, the storm sewer would be checked for possible cracks and infiltration and repaired.

The existing deed restriction would ensure that groundwater is not being used for potable purposes." - ROD at Page 11

The design follows the NYSDEC's selected alternatives with the following exceptions:

- For OU1 Soil, rather than loading soil directly into lined rail cars, soil will be loaded directly into lined dump trailers for transport to the Chemical Waste Management (CWM) facility in Model City, New York.

- For OU2 Soil, in addition to evaluation and repair of the existing pavement, the entire seven-acre portion of Parking Lot #4 will be repaved with a total of three inches of new asphalt.

- For OU2 Groundwater, downgradient monitoring well MW-202 has been added to the monitoring list. Additionally, Manhole 2 will be monitored for PCBs as well as lead.

2 REMEDIAL DESIGN

2.1 Remediation of OU1 Soils and Groundwater

This section details the Remedial Action to be completed to address soil and groundwater impacted with PCBs. Groundwater will be addressed through the course of dewatering implemented as part of the remedy for OU1 soils. Technical specifications to complete the remediation are provided as Appendix B.

2.1.1 Detailed Limits of Contamination

Cleanup goals for PCBs were established by the NYSDEC as set forth in Section 5 of the ROD. The cleanup goal for PCBs was based on the NYSDEC Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum (TAGM), Determination of Soil Cleanup Objectives and Cleanup Levels (HWR-64-4046). The subsurface cleanup goal for PCBs is 10 ppm.

The estimated areal extent of cleanup goal exceedences is shown on Figure 2. The area is currently covered with asphalt so surficial soil contamination is not an issue. The area has a vertical limit corresponding to the top of a clay confining layer, which is approximately 6.5 feet below ground surface across the area. The estimated volume of material to be excavated is 2,450 cubic yards (CY).

2.1.2 Dewatering, Water Treatment, and Disposal

The Technical Specifications advise the Remedial Contractor(s) of the presence of LNAPL in the excavation area. The LNAPL is to be collected along with groundwater during dewatering conducted prior to and during excavation. The LNAPL will be separated from the water and transported off-site for disposal. The water will be treated on site and discharged to BSA as discussed later in this section.

Dewatering of the excavation area will begin approximately one week prior to excavation activities. Groundwater will be removed from the area through the use of the existing groundwater collection trench as well as additional pumping wells or trenches installed

along the north and east limits of the excavation area, as determined by the Remedial Contractor's dewatering plan. The Remedial Contractor's dewatering plan will comply with the Technical Specifications and will be reviewed and approved by GM and the Engineer (EMCON). Water will be collected from the trenches and/or wells by pumps operating at a maximum of 50 gallons per minute (gpm) total flow.

The collected water will be treated on site using a mobile treatment unit. Treatment will consist of sedimentation/equalization, oil/water separation, pre-filtration using two 5-micron filters, carbon treatment using two 1,000-pound granular activated carbon (GAC) contactors in series, one 1-micron post filtration unit, five post treatment 20,000 gallon fractionation (frac) tanks for storage of treated water prior to discharge, and associated piping, valves, pumps, and vents. A schematic of the treatment system is provided as Figure 3. As stated above, the collection flowrate will be a maximum of 50 gpm.

It is estimated that the GAC consumption will be approximately 0.1 pounds of carbon per 1,000 gallons of water treated, or approximately 100 pounds of total GAC needed to treat approximately 1.0 million gallons of water. The mobile treatment unit that will be used on-site will contain 1,000 pounds of GAC in each contactor or 2,000 pounds total.

The carbon contactors will be operated in series. Each contactor will contain 1,000 pounds of Calgon F300 granular activated carbon. Each contactor vessel has an internal volume of 354 gallons. The retention time of each vessel will be approximately 14 minutes, based on a flow rate of 50 gpm. The system will operate 24 hours a day, seven days a week for the duration of the excavation project.

Once treated by the carbon, the water will be pumped through a post filtration unit. The post filtration unit will consist of one 1-micron filter. Prior to discharge, the treated water will be stored in five frac tanks.

Treated water will be discharged to the BSA sanitary sewer system via the sanitary sewer manhole located east of AAM's WWTP (in the vicinity of MW-204). EMCON, on behalf of GM, will obtain a discharge permit from BSA.

Prior to initial discharge, the system will treat 20,000 gallons of water and store the treated water in one of the five frac tanks. The initial batch treatment of 20,000 gallons is to evaluate the system's performance on removing PCBs from the water. The initial 20,000 gallons will be sampled and analyzed by a New York State Department of Health (NYSDOH) certified laboratory for pH, base neutral compounds using USEPA Method 625, PCBs using USEPA Method 608, and metals by the USEPA 200 series of methods, specifically arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Provided the analysis of the initial 20,000-gallon batch treatment indicates compliance with the BSA discharge limits, the 20,000 gallons will be

discharged to the sanitary sewer manhole and the system will start continuous batch operation.

Subsequent to the initial sampling, batches of treated groundwater will only need to meet discharge limits for PCBs and lead. The BSA discharge limit for PCBs is non-detect (ND) by USEPA Method 608 with a detection limit of 0.3 ug/l; the discharge limit for lead is 0.43 mg/l (by USEPA 200 series of methods).

The treatment process will begin with filling the frac tanks to 90% capacity on an individual basis. It will take approximately 6 hours to fill each frac tank (18,000 gallons). Once a tank has reached capacity, a grab sample from the tank will be collected. The grab sample will be sent to a NYSDOH certified laboratory for PCB analysis (USEPA Method 608) and lead analysis (USEPA 200 series of methods). Results of the analyses will be available within approximately 12 hours of sample collection. Concurrently, while laboratory analysis of the sample is being conducted, pumping and treatment of the water will continue, with storage of treated water occurring in the remaining frac tanks.

Upon receipt of the laboratory results for the treated water stored in the first frac tank, a determination will be made to discharge the treated water to the BSA. Once compliance with BSA discharge limits has been confirmed, the treated waters will be discharged to the sewer at a rate of 300 gpm. It will take approximately one hour to discharge the 18,000 gallons of treated water. By the time the second frac tank reaches capacity, the first tank will be empty and ready to start receiving treated water.

In the event that compliance with BSA discharge limits is not met, the treated waters would be recirculated through the system for retreatment. As a result, pumping from the source area would either be reduced or discontinued until retreatment activities have been completed. Filling and sampling of the frac tanks as described above will continue until the excavation project is complete.

Collected LNAPL from the water treatment system's oil/water separator will be drummed and transported off-site as a hazardous and TSCA-regulated waste to an approved facility for incineration. The Remedial Contractor(s) will be responsible for disposal of the LNAPL as well as the spent carbon. The spent carbon will be disposed of in accordance with applicable Federal and State requirements at an off-site permitted facility.

After NYSDEC approval of the Remedial Construction Certification Report, pavement maintenance and semi-annual groundwater quality monitoring/well maintenance will be performed. Maintenance and monitoring requirements are discussed in Section 5 of this report.

2.1.3 Excavation

Conventional construction equipment will be utilized to remove soils which exceed the PCB cleanup goal of 10 ppm. The vertical and horizontal limits of exceedences for OU1 reflect proposed limits of excavation. The Remedial Contractor(s) will be required by the Technical Specifications to perform all excavation activities in accordance with OSHA requirements. In areas adjacent to structures, excavation will not be performed within four feet of the building and no material beneath the bearing area of foundations or other significant structures (e.g., piping) will be removed. All material within the mapped limits will be removed as discussed herein. Excavation will proceed down slope to the indicated vertical limit. The specified vertical limit will be to the top of clay as discussed in the previous section.

Excavation will begin at the north end of the proposed limit and will proceed west to east toward the south limit. All excavated material will be loaded into lined dump trailers for off-site disposal. Limited stabilization and/or dewatering of the material for moisture control may be necessary prior to transport to remove any free liquid.

The dump trailers will transport the materials to CWM's Model City, New York facility. All loads will be covered and properly manifested as a hazardous and TSCA regulated (DOO8 and PCB contaminated) material. At CWM, the material will be stabilized (as treatment for lead) and landfilled. Waste asphalt and bedding material will be disposed of as a RCRA/TSCA material and will not be segregated.

Samples of the excavation side walls will be obtained from the excavator bucket. A PCB field screening kit will be used to guide the excavation by developing semi-quantitative PCB concentrations (see the Quality Assurance Project Plan (QAPP), Appendix C). Specifically, PCB measurements will be made at ten foot increments along the proposed excavation side walls. The starting point for sampling will be determined using a random number generator. The samples will be screened using PCB field screening kits to obtain PCB concentrations (i.e., less than or greater than 10 ppm). Based on the results of this testing, areas exhibiting PCB concentrations in excess of 10 ppm will be over excavated by approximately one foot. Additional PCB measurements will then be made and used as a guide for further excavation. Duplicate samples (10%) will be also be collected and field screened.

Two composite samples from each of the excavation side walls (for a total of eight) and one quality control (QC) duplicate sample will be collected for confirmation of compliance with the PCB cleanup goal and sent for off-site laboratory analysis by Method 8082 (non-ASP). Each composite sample will be generated from a minimum of five grab samples. The field screening and laboratory analytical procedures are described in Appendix C.

In addition, samples will be collected from the bottom of the excavation (clay layer) to ensure that PCBs have not impacted the clay. The samples will be collected from within the top six inches of the clay layer. The excavation will be divided into a 25-foot grid. Assuming the excavation is 100 feet by 100 feet, this would create 16 sampling squares. One composite sample will be submitted for analysis from each square. Each composite sample will be generated from five grab samples: one grab sample collected from each grid node (for a total of four) and one collected from the center of each square. The composite samples will be field screened and sent for off-site laboratory analysis by Method 8082. Duplicate samples will be collected at the rate of 10% and sent for laboratory analysis for QA/QC purposes (two from the floor based on the current number of samples). All confirmatory sampling will be conducted in the presence of a NYSDEC representative.

2.1.4 Backfilling and Site Restoration

The excavation will be backfilled with clean fill to within eight inches of existing grade. Backfill material will be required to be certified by the remedial contractor's supplier as to its contents. Backfilling of the excavation will not begin until results of the confirmatory samples are received. Backfill will be placed in 12-inch lifts and compacted. A six-inch layer of crushed stone will be placed to within two-inches of existing grade in preparation of paving. As part of the paving to address OU2, the excavation area will receive an additional two-inch layer of asphalt for a total asphalt thickness of five inches.

2.1.5 Long-Term Groundwater Monitoring

Semi-annual groundwater quality monitoring/well maintenance will be performed. Further discussion of the groundwater monitoring is presented in Section 5.2 of this report.

2.2 Remediation of OU2 Soils and Groundwater

This section discusses the remedial activities to be completed to address soil and groundwater impacted with lead. The affected area is shown on Figure 4.

2.2.1 Paving

The entire seven-acre portion of Parking Lot #4 will be repaved with a total of three inches of new asphalt over the existing asphalt surface. The paving will be completed in

two stages. The southern portion of the site up to the eastern aisle is proposed to be paved in one phase, followed by the remaining portions of the site in a second phase. Paving of the parking lot in phases is being conducted to accommodate the parking needs of AAM employees.

Paving will consist of the following components:

- Core samples from damaged areas of the Parking Lot will be collected to evaluate the thickness of the asphalt and base material and confirm that the base is adequate. EMCON anticipates collecting from 25 to 50 core samples.

- All damaged and settled sewer manholes and catch basins will be repaired and brought to future grade.

- A leveling material (true and level) will be applied to potholes and low areas and to cracked areas.

- A fabric (Petromat or similar material) will be placed over the existing pavement. A thin layer of oil is sprayed on the existing pavement, and the fabric placed on top. As the fabric absorbs the oil and dries, it forms a water-tight seal preventing erosion damage created by freeze/thaw cycles.

- A two-inch base coat and one-inch top coat (2 and 1) of asphalt would be placed over the fabric. After one year, a sealer will be applied (i.e., once the asphalt has had a chance to settle and oxidize).

- Striping would be completed after the asphalt application and again, one year later, after the sealer application.

Annual inspections and maintenance (if necessary) will be conducted on the pavement to ensure integrity of the pavement is maintained. Annual operations and maintenance (O&M) is further discussed in Section 5 of this report.

2.2.2 Long-Term Groundwater/Storm Sewer Monitoring

Semi-annual groundwater quality monitoring/well maintenance and limited storm sewer monitoring/maintenance will be performed. Further discussion of the groundwater and storm sewer monitoring is presented in Section 5.2 of this report.

2.3 Site Control

The Saginaw-Buffalo site is located within Parking Lot No. 4 of AAM, a private industrial facility. The parking lot is fenced to prevent trespassing by the general public. The work areas (i.e., the excavation area, truck staging area, and areas undergoing paving) will be further isolated by temporary fencing or other barriers to prevent access by AAM employees or other unauthorized personnel. Signs will be posted warning of the presence of PCBs and hazardous waste. After hours, the site will be part of the nightly patrol of AAM plant security.

3 CONSTRUCTION QUALITY ASSURANCE PLAN

3.1 Introduction

The Construction Quality Assurance Plan (CQAP) provides a mechanism whereby the remedial action activities, including quality control activities, are systematically monitored in the field and documented for compliance with the requirements of the remedial design contract documents.

Construction Quality Control (CQC) and Construction Quality Assurance (CQA) can be defined as follows:

- CQC consists of those on-going actions by the Remedial Contractor(s) which provide a means to measure, regulate and document the characteristics of an item or service with respect to the contract documents.
- CQA consists of those on-going measurement and documentation actions by a party independent of the Remedial Contractor(s) which provide a means of assuring that construction has occurred in accordance with the contract documents.

3.2 Quality Control Activities

The Remedial Contractor(s) will be required to prepare a CQC Plan (see Specification Section 01300 - Submittals). This Plan will specify the field testing to be done (e.g., for compaction), including testing methods and frequency. This Plan will be reviewed and approved by GM and EMCON, the engineer selected by GM to provide engineering services for this project. During construction, the Remedial Contractor(s) will carry out the activities contained in the approved Plan. The major field CQC activities for this project will include:

- Minimizing uptake of solids during dewatering through the use of fabric filters
- Monitoring pressure drops across the pre-filters for optimal system performance

- Using virgin carbon to achieve optimal adsorptive efficiency
- Conducting the Paint Filter Test (USEPA Method 9095A) to ensure that material meets shipping requirements (i.e., no free liquid) either in the dewatered state or after stabilization
- Providing analysis (i.e., grain size, moisture content, permeability) of soils proposed as backfill materials, before they are brought to the site, as evidence of suitability
- Conducting backfilling operations to achieve required final densities
- Conducting core samples of pavement subbase to determine suitability and providing geotechnical analysis of additional subbase material, if necessary.

In addition to the Remedial Contractor's activities, EMCON will be conducting field analysis of excavated soils as excavation proceeds, using Millipore EnviroGard™ PCB test kits, to determine when the PCB cleanup goal of 10 ppm has been achieved. QC and QA procedures for this activity are discussed briefly in Section 2.1.3 and further in the QAPP provided as Appendix C.

EMCON will also be responsible for effluent testing from the water treatment system for compliance with Buffalo Sewer Authority's effluent discharge limits.

3.3 CQA Management Organization

3.3.1 Personnel

EMCON will provide CQA services and will:

- be responsible for implementation of the CQA Plan
- have a thorough understanding of the project and its CQA requirements and Technical Specifications
- receive and review the Remedial Contractor's submittals for conformance with the contract documents, which will include the Technical Specifications
- be responsible for overall coordination of CQA activities with the Remedial Contractor(s) and laboratories

- be responsible for observing, documenting, and certifying that key activities related to quality assurance of the remedial action conform to the contract documents

- sign and seal the Remedial Construction Certification Report and record drawings certifying that the work has been performed in accordance with the contract documents and the ROD.

3.3.2 Laboratories

The services of the laboratory will be secured by EMCON. The environmental laboratory will have broad experience in the analysis of environmental media (air, water, soils/waste). The environmental laboratory will be NYSDOH certified (refer to Appendix C for requirements).

3.4 CQA Activities

The CQA activities and protocols for this project are summarized on the following table.

ACTIVITY	METHOD/OBSERVATION	FREQUENCY
Dewatering	A. Visual	A. Daily during activity
Groundwater Treatment and Disposal	A. Visual B. One effluent sample per batch for required BSA parameters and analytical methods	A. Daily during activity B. Per batch
LNAPL Storage and Disposal	A. Visual	A. Daily during activity
Excavation	A. Visual for free liquid	A. Continuous
Backfill and Fill	A. Visual B. Test soil proposed for subgrade fill for: Gradation (ASTM D422), Modified Proctor (ASTM D1557) and Atterberg Limits (ASTM D4318) C. Test Field Density (ASTM D2922) and Field Moisture (ASTM D3017)	A. Continuous B. One sample, supplied by Contractor C. One per lift, on a 100 ft. x 100 ft. grid
Paving	A. Visual	A. Continuous

3.5 Documentation and Record Keeping

Records of construction progress and CQA activities will be maintained throughout the construction period. The following reports will be prepared:

- Weekly QA Activities Summary Report
- Monthly QA Activities Report
- Remedial Construction Certification Report

The Weekly Report will be prepared by the Field Manager and will include the following:

- General and specific descriptions, including sketches and drawings, of work activities completed including mark-ups of construction contract drawings
- QA and QC procedures used and the results
- Submittals received from the Remedial Contractor(s) and their review status
- In-field modifications
- Modifications to the Remedial Design approved by NYSDEC.

The Monthly Report will summarize QA and QC testing done and will include a summary of weekly reports for the month. The Monthly Report will be included in the project file and a copy will be forwarded to the Owner and the NYSDEC.

Upon completion of construction activities, a Remedial Construction Certification Report will be prepared. This report will document construction in accordance with the contract documents and the ROD. The report will include the following:

- Narrative description of construction completed at the site
- Description of deviations from the Technical Specifications and reasons for the changes
- Description of QA and QC testing procedures, results, and data
- Drawings showing QA and QC test locations

- Descriptions of procedures used to rework or repair areas with failing QA or QC results
- QA/QC Plans submitted by the QA and QC laboratories
- Photographs of construction, as required by the Technical Specifications
- Record drawings of the completed construction, as required by the Technical Specifications
- Certification statement (signed by a New York State Professional Engineer) of remedial action activities in accordance with the contract documents and ROD
- Remedial Construction Certification Report signed and sealed by a New York State Professional Engineer.

4 CONTINGENCY PLANS

4.1 General Considerations

Contingency situations are those which arise due to 1) unexpected site conditions and require a deviation from the planned course of remediation; 2) release of materials or contaminants due to inadequate dust control, fire, explosion or leakage due to malfunctioning equipment or accidents during construction activities. For the purposes of this report, contingency situations do not include those that arise due to an Act of God, nor those health and safety situations addressed by the Contractor's Health and Safety Plan.

The site has been characterized previously, including subsurface investigations, and therefore contingency situations due to unexpected site conditions should be limited. The orderly progression of construction activities will limit contingency situations due to construction activities. The construction site will be under the control of the Contractor(s), and therefore the Contractor(s) is/are primarily responsible for dealing with contingency situations, should they arise.

The following section discusses potential contingency situations for this site and general actions that should be taken if they arise.

4.2 Potential Contingency Situations and Actions to Be Taken

Potential contingency situations, and general actions that should be taken, in the event of unexpected site conditions, are summarized below:

Potential Contingency Situation	General Action to Be Taken
• Treated water fails to meet BSA discharge requirements	• Reduce or discontinue pumping from excavation • Recirculate water through treatment system and resample • Upgrade treatment system by addition of equipment such as filter units, GAC units, frac tanks, etc.

Potential Contingency Situation	General Action to Be Taken
• Areas of unexpected waste, sludge, and free product uncovered during excavation	• Sample and analyze unexpected materials • Determine appropriate means of removal and disposal (e.g., stabilize excavations, pump out free product) • Monitor for volatile compounds and, if encountered, monitor air concentrations and utilize temporary controls (e.g., foams), if necessary
• PCBs above the 10 ppm cleanup goal found to have migrated below the building or other structure (i.e., aboveground storage tank)	• Isolate the impacted area by means of an impervious barrier (clay wall or other comparable material) and consult with the NYSDEC regarding the need for further response action
• Air monitoring program indicates airborne dust and contaminants not being adequately controlled	• Enhance dust suppression and control activities such as modification of dust delivery systems, reduction of production rates, and wetting reagents and/or granular materials
• Contaminant releases on site due to spilling and leaking (dewatering and groundwater treatment operations, LNAPL storage, loading excavated materials)	• Discontinue operation causing the release • Contain and remove spilled/leaked material and dispose in an appropriate manner • Repair leaking or damaged facilities • Sample contaminated media • Remove, if necessary, and appropriately dispose of contaminated media, and confirm appropriate cleanup standards have been met
• Fire or explosion on site	• Immediately control or suppress all fires • Call 911 for emergency assistance • Control to the extent possible to limit exposure and/or injury to people on-site and surrounding areas and damage to property • Sample and analyze potentially impacted environmental media for PCBs and lead • Advise local emergency responders of results of any air sampling • Remove contaminated media, if necessary, and confirm that appropriate cleanup standards have been met

5 OPERATIONS, MAINTENANCE, AND MONITORING PLAN

5.1 Pavement Maintenance

Inspections and maintenance (when necessary) will be conducted on the pavement to ensure the integrity of the pavement is maintained. At a minimum, the pavement surface will be visually inspected on an annual basis. Cracked areas will be sealed to prevent infiltration of precipitation which could contribute to further deterioration. More severely damaged areas (e.g., potholes) will be cut to remove the damaged asphalt, repaved, and sealed.

5.2 Groundwater and Storm Sewer Monitoring

The monitoring program will consist of selected existing monitoring wells installed prior to and as part of the Site Investigation, as well as three newly installed monitoring wells at the southern property line. The monitoring wells to be sampled are as follows:

Upgradient Wells	Downgradient Wells
MW-1	MW-5
MW-201	MW-202
MW-204	MW-203
MW-206	MW-205
	MW-208
	MW-209
	MW-210
	+ MW-211

Well locations are shown on Figure 5.

The monitoring will provide data to determine the effectiveness of the remedial activities for soils and ensure that contamination is not migrating off site.

Sampling will be conducted on a semi-annual basis for PCBs and total and soluble lead. Samples for soluble lead will be field filtered using a 0.45-micron filter. Groundwater measurements will be obtained from all of the wells. Any necessary maintenance of the monitoring wells will also be conducted. Semi-annual monitoring will be conducted for a

minimum of four consecutive events, at which point the need for or frequency of continued monitoring will be evaluated.

In addition, Manhole 2 (at the southern end of Parking Lot No. 4 as shown on Figure 4) will be sampled on a semi-annual basis along with the groundwater monitoring. Samples from the storm sewer will be analyzed for total lead and PCBs. The storm sewer will also be visually inspected at this time. If uncharacteristically large volumes of sediment are noted in the sewer, or if analytical results show an increase in contaminant levels, the sewers will be inspected for cracks and infiltration and repaired, if necessary.

Semi-annual monitoring of the storm sewers will be conducted for a minimum of four consecutive events, at which point the need for or frequency of continued monitoring will be evaluated. Inspections to certify the sewer's integrity will be continued as part of the pavement O&M.

Semi-annual O&M will begin within 30 days of written NYSDEC approval of the Remedial Construction Certification Report. Reports summarizing the monitoring data will be submitted to the NYSDEC within 30 days of receipt of data. Annual inspection reports will be submitted with the respective semiannual monitoring reports, beginning in the late summer/early fall of 1999. A copy of the inspection form to be used follows.

ANNUAL INSPECTION FORM
SAGINAW-BUFFALO SITE

PAVEMENT (Identify any damaged areas on site sketch)

1. Cracked Areas — Yes _____ No _____
2. Settled Areas — Yes _____ No _____
3. Potholes — Yes _____ No _____
4. Heaving — Yes _____ No _____
5. Plow Damage — Yes _____ No _____
6. Drainage — Good _____ Poor _____ Explain _____
7. Condition of Surface Sealing — Good _____ Poor _____ Explain _____

STORM SEWERS

1. Condition of Manhole Risers — Good _____ Poor _____ Explain _____
2. Sediment in Main — None _____ Avg (1-4") _____ High (>4") _____

   Comments _____

MONITORING WELLS

	MW-1	MW-5	MW-201	MW-203	MW-204	MW-205	MW-206	MW-208	MW-209	MW-210
Is protective casing in good condition?										
Is flush mount casing in good condition?										
Are casings labeled?										
Is concrete surface seal in good condition?										
Is protective pad in good condition?										
Are locks present?										
Are locks in good condition?										
Is riser in good condition?										
Are J-plugs present?										

Comments: _____

6 CONSTRUCTION SCHEDULE

The schedule for implementation of this Remedial Design is provided on Figure 6. This schedule provides approximate timeframes for completion of the work beginning with submittal of this report. As the project progresses, the schedule will be updated based upon the final NYSDEC-approved scope of work. Certain factors are beyond the control of GM, such as weather conditions, NYSDEC review schedules, and additional factors as described on the Force Majeure section of the Consent Order.

7 CONSTRUCTION HEALTH AND SAFETY PLAN

A Health and Safety Plan (HASP) has been developed to protect the health and safety of EMCON employees on the construction site. The HASP is provided as Appendix D to this report. The Remedial Contractor(s) will be required to prepare and submit a HASP for its employees and all visitors to the work site, as discussed in the Technical Specifications.

9 CITIZEN PARTICIPATION PLAN

A Citizen Participation Plan has been developed to inform the community of events occurring at the Saginaw-Buffalo site. The Citizen Participation Plan is provided as Appendix F to this report.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

FIGURES

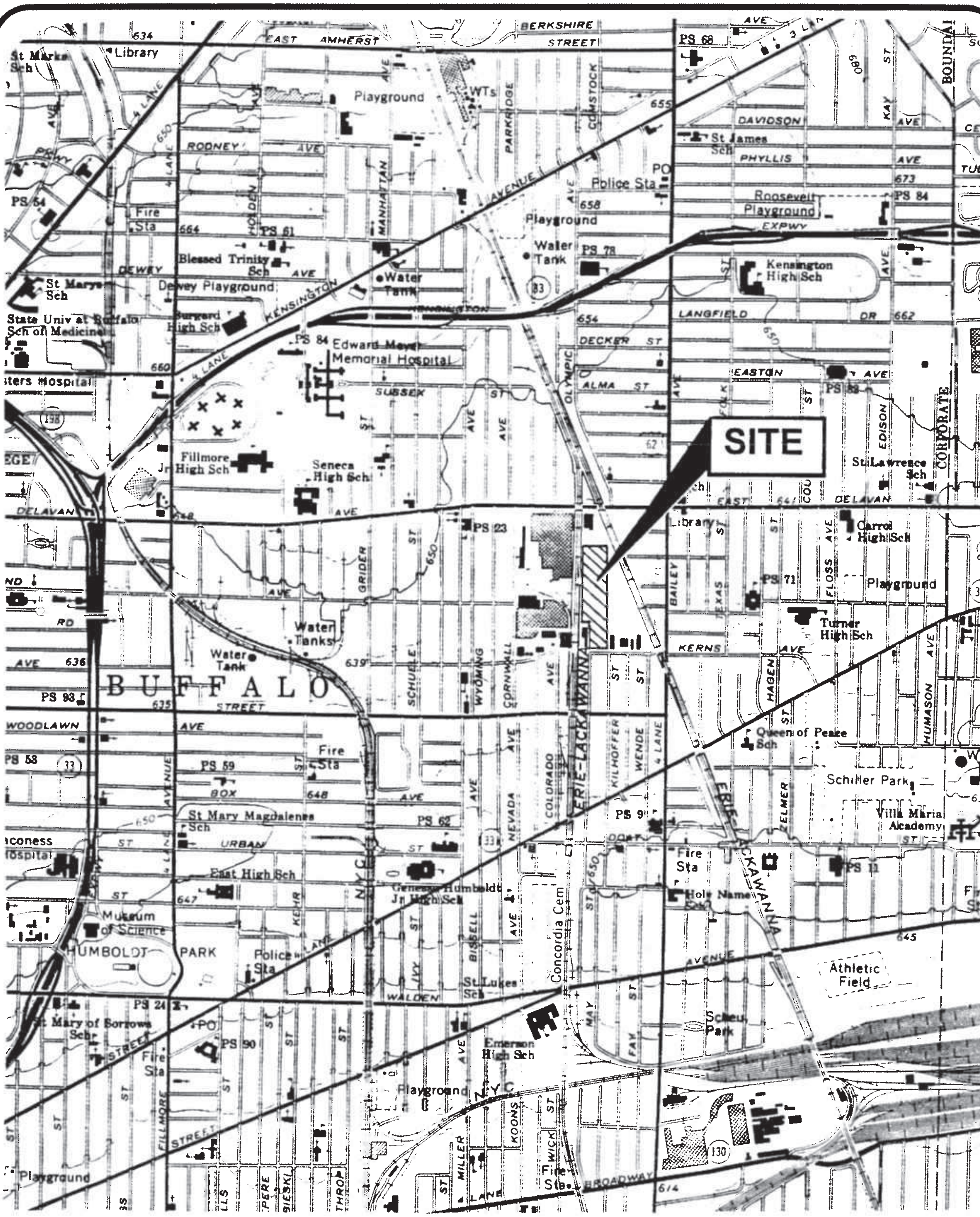

FIGURE 1

SITE LOCATION MAP

FORMER GENERAL MOTORS

SAGINAW DIVISION SITE

REMEDIAL DESIGN REPORT

EMCON

DATE
DWN
APP
REV

PROJECT NO.
85740-100.000

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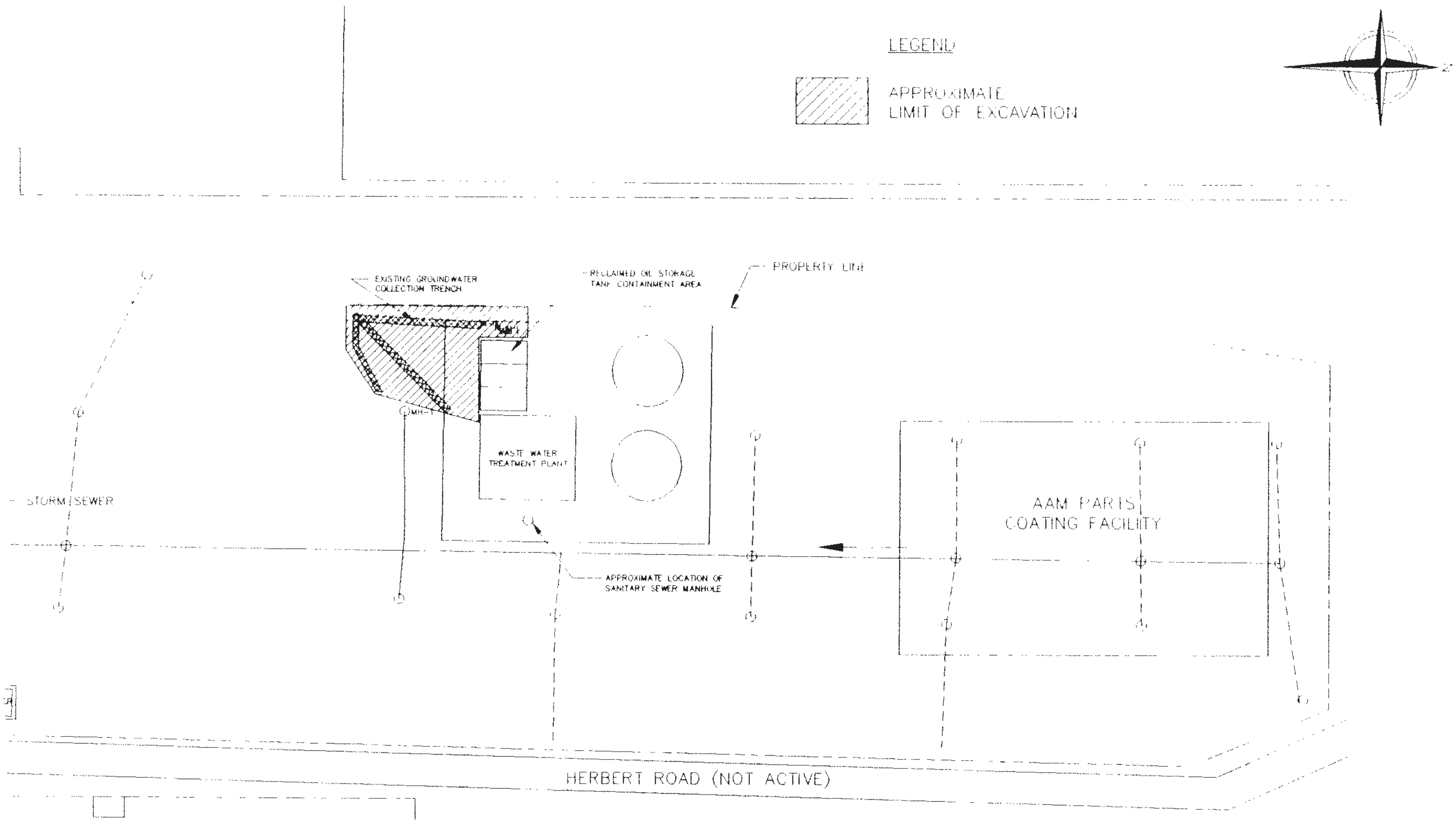

EMCON

DATE	5/98
DWN	
APP	
REV	
PROJECT NO.	85740-100.000

FIGURE 2
APPROXIMATE LIMIT OF EXCAVATION (OU-1)
FORMER GENERAL MOTORS
SAGINAW DIVISION SITE

REMEDIAL DESIGN REPORT

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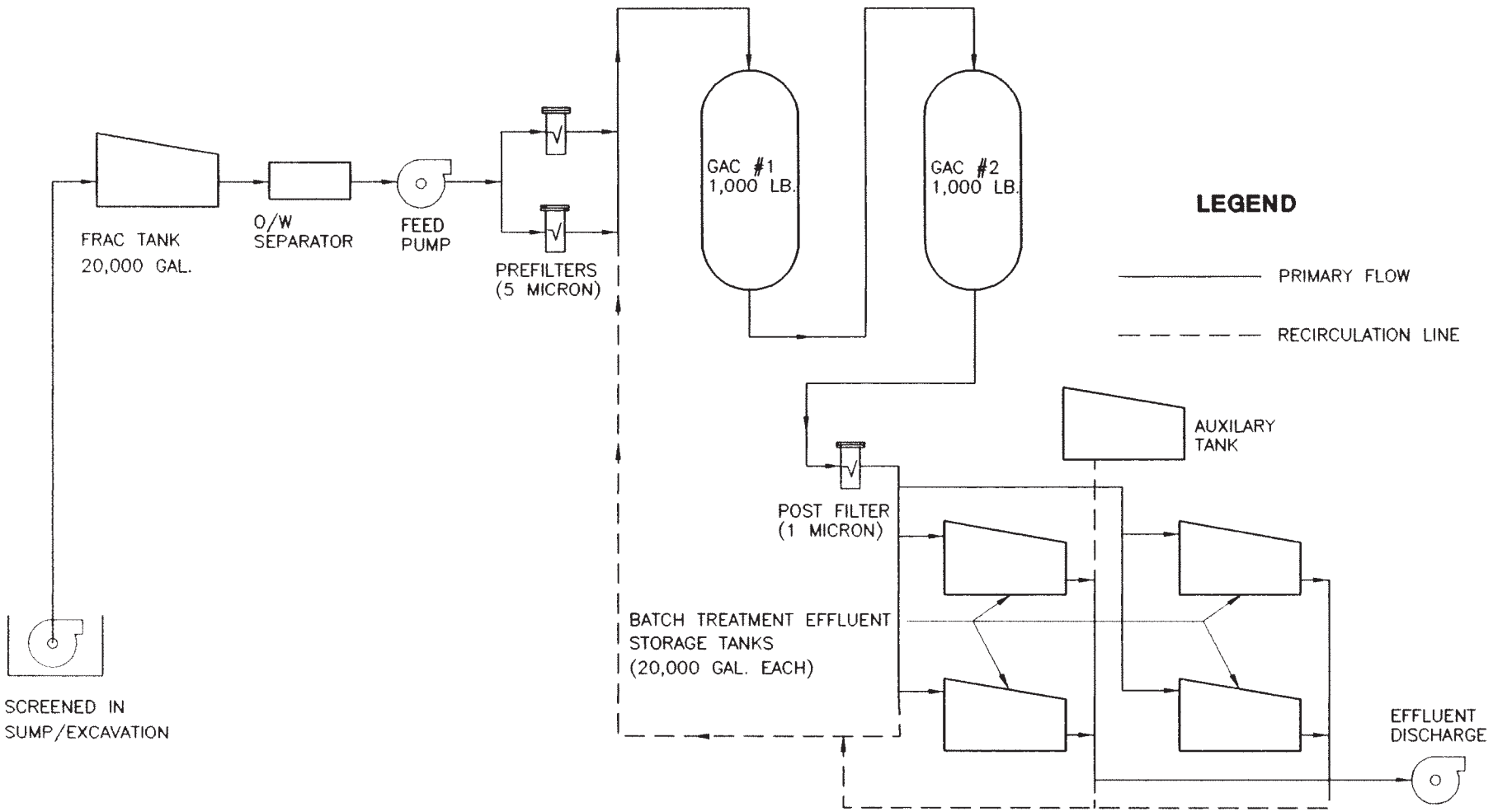

emcon

DATE 6/98
DWN MWP
APP
REV
PROJECT NO.

FIGURE 3
WATER TREATMENT SYSTEM FLOW DIAGRAM
FORMER GENERAL MOTORS
SAGINAW DIVISION SITE

REMEDIAL DESIGN REPORT

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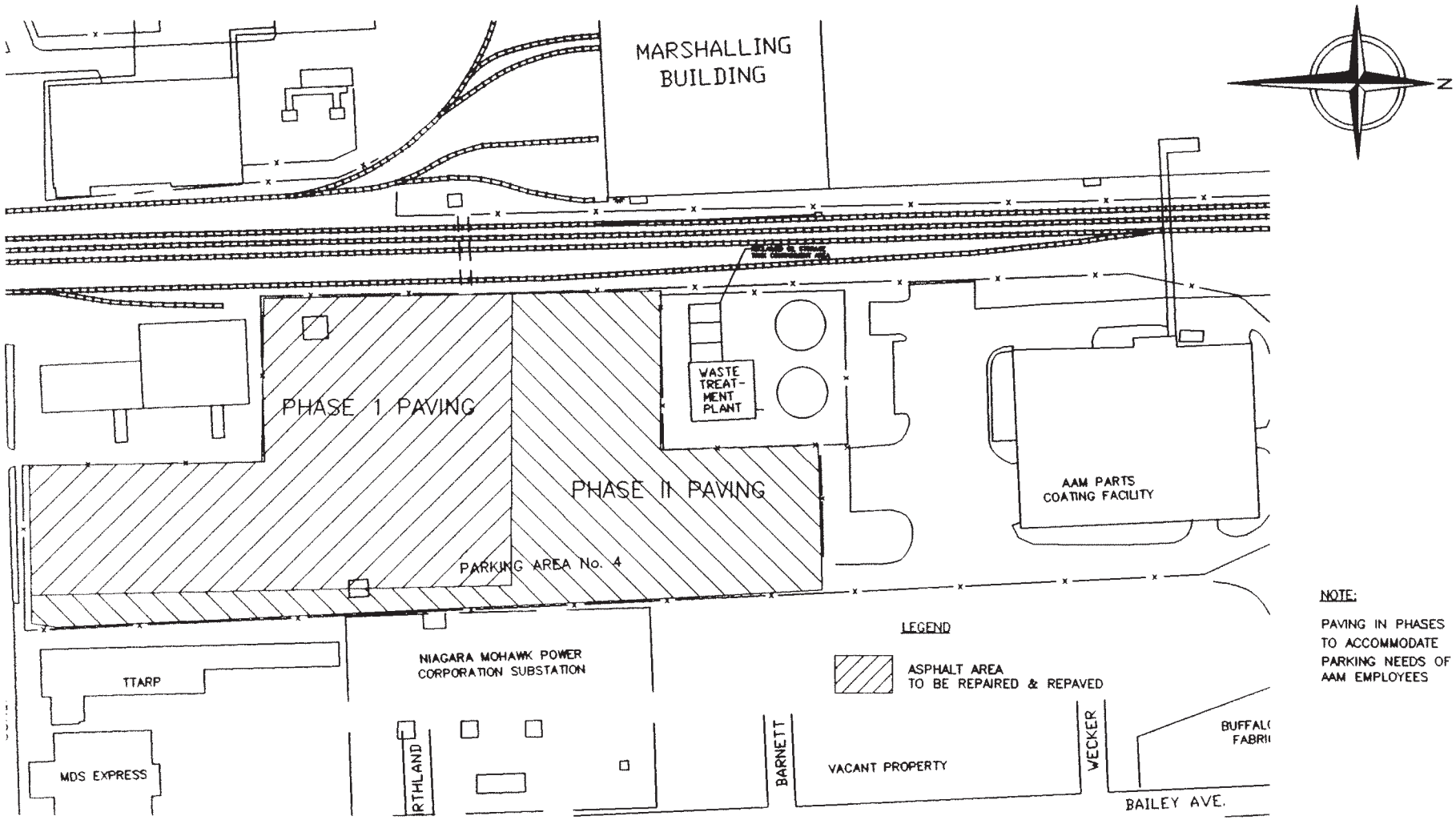

emcon

DATE 5/98
DWN
APP
REV
PROJECT NO.
85740-100.000

FIGURE 4
LIMITS OF ASPHALT REPAIR/REPAVING (OU-2)
FORMER GENERAL MOTORS
SAGINAW DIVISION SITE

REMEDIAL DESIGN REPORT

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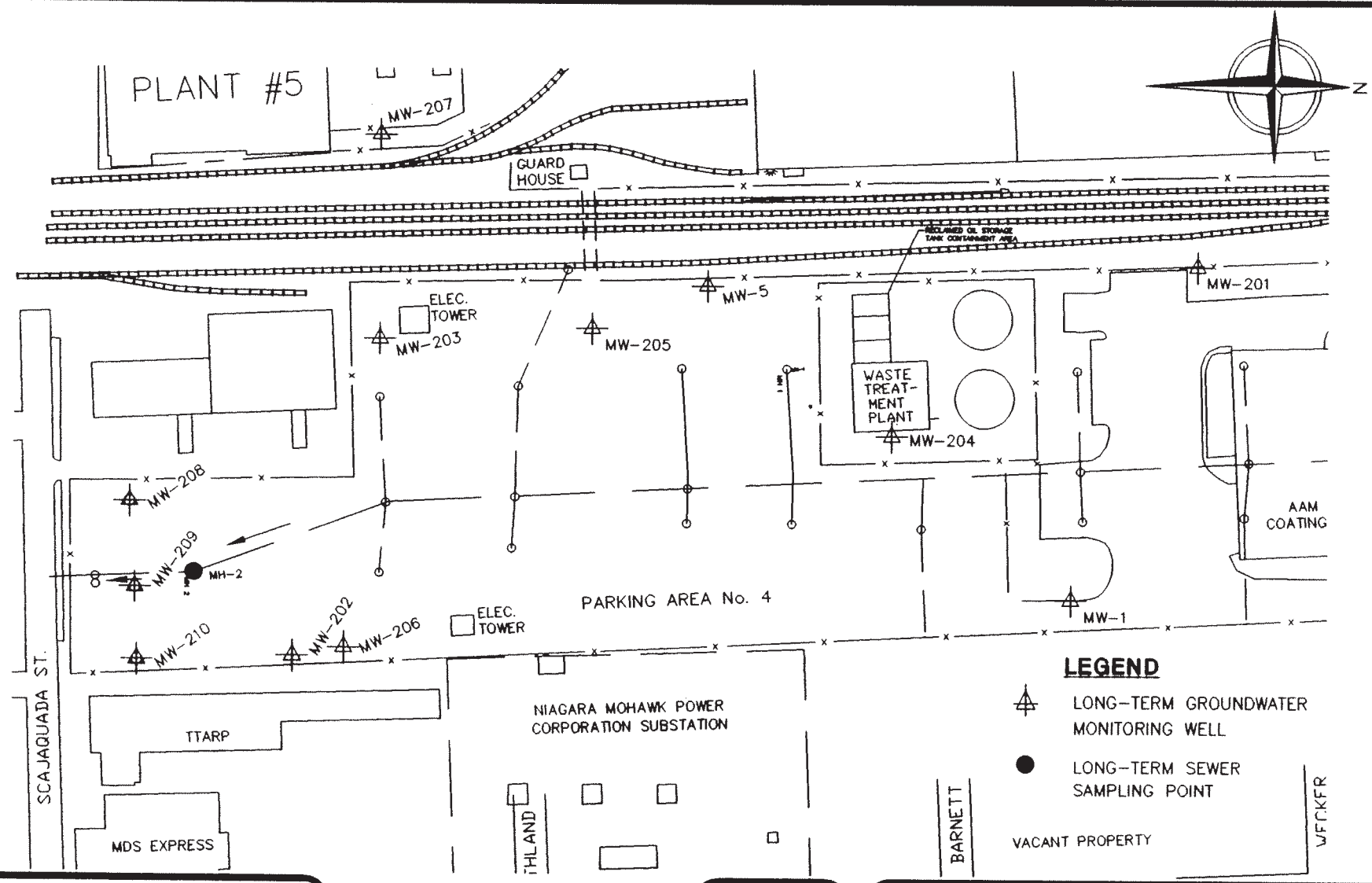

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DATE 5/98
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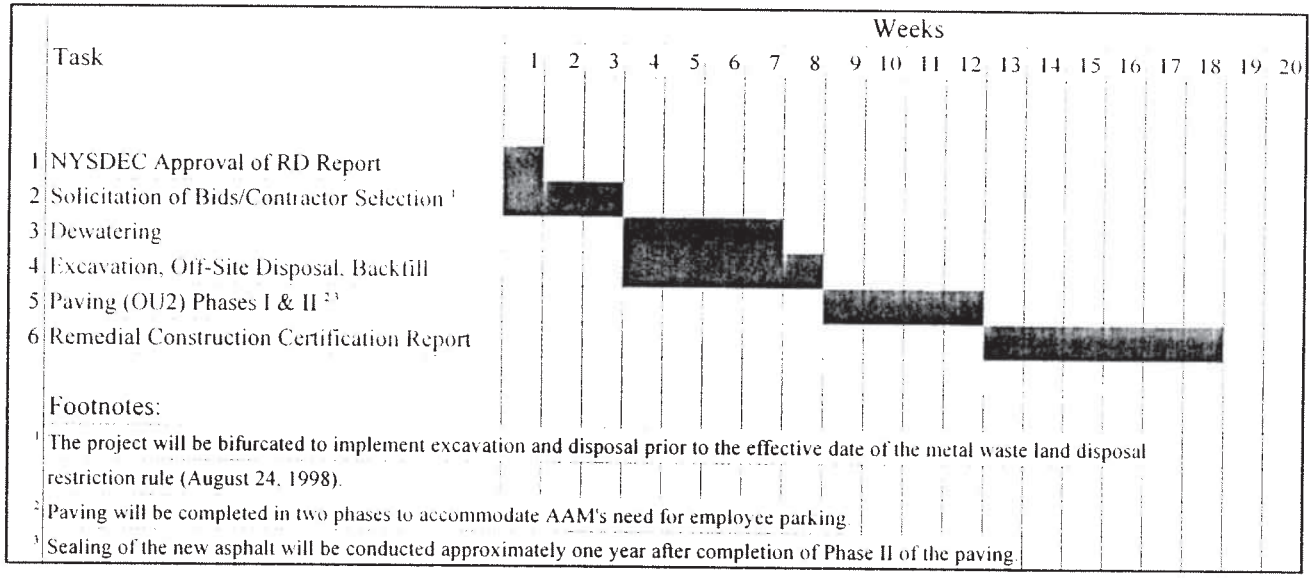
APP
REV
PROJECT NO.
85740-100.000

FIGURE 5
MONITORING WELL LOCATIONS
FORMER GENERAL MOTORS
SAGINAW DIVISION SITE

REMEDIAL DESIGN REPORT

Figure 6
GENERAL MOTORS CORPORATION
REMEDIAL CONSTRUCTION IMPLEMENTATION SCHEDULE



Footnotes:

[1] The project will be bifurcated to implement excavation and disposal prior to the effective date of the metal waste land disposal restriction rule (August 24, 1998).

[2] Paving will be completed in two phases to accommodate AAM's need for employee parking.

[3] Sealing of the new asphalt will be conducted approximately one year after completion of Phase II of the paving.

APPENDIX A

DEED RESTRICTION

Buffalo, New York

BARGAIN AND SALE DEED

THIS INDENTURE ("Deed") is made as of this 28th day of February, 1994, between GENERAL MOTORS CORPORATION, a Delaware corporation, whose address is 3044 West Grand Boulevard, Detroit, Michigan 48202 ("Grantor"), and AMERICAN AXLE & MANUFACTURING, INC., a Delaware corporation, whose address is 1840 Holbrook Avenue, Detroit, Michigan 48212 ("Grantee").

WITNESSETH, that Grantor, in consideration of the sum of $10.00 and other valuable consideration paid by Grantor to Grantee, does hereby grant and release unto Grantee, its successors and assigns, forever, all of that certain plot, piece or parcel of land, with the buildings and improvements thereon erected, situate, lying and being in the County of Erie, State of New York, known and described as follows:

See Exhibit A attached hereto and incorporated herein by reference,

TOGETHER with all right, title and interest, if any, of Grantor in and to any streets and roads abutting the above described premises to the center lines thereof; TOGETHER with the appurtenances and all the estate and rights of Grantor in and to said premises (all of the foregoing being referred to below as the "Premises"); TO HAVE AND TO HOLD the Premises unto Grantee, its successors and assigns forever.

AND Grantor, in compliance with Section 13 of the Lien Law, covenants that Grantor will receive the consideration for this conveyance and will hold the right to receive such consideration as a trust fund to be applied first for the purpose of paying the cost of the improvement and will apply the same first to the payment of the cost of the improvement before using any part of the total of the same for any other purpose.

AND Grantor covenants that it has not done or suffered anything whereby the Premises have been incumbered in any way whatever, except as set forth on Exhibit B attached hereto and incorporated herein by reference.

AND Grantor and Grantee, for themselves and their respective successors and assigns, do further covenant and agree as follows:

1. Grantee acknowledges and agrees that, at any time after the date of this Deed and, except where emergency conditions require otherwise, upon reasonable prior notice, Grantor and its representatives may come upon the Premises pursuant to and in order to exercise its rights under that certain Asset Purchase Agreement, dated February 18, 1994 ("Agreement"), by and between Grantor and Grantee, and to undertake any and all actions authorized to be undertaken by Grantor pursuant to the Agreement, all in accordance with the terms and provisions of the Agreement.

2. Grantee acknowledges, warrants and agrees that it will not treat, store or dispose of any hazardous substances, hazardous wastes or toxic substances as those terms are defined under Environmental Laws (as defined in the Agreement), as may be amended from time to time, on, at or below the Premises and will maintain generator-only status; provided, however, that Grantee may: (i) temporarily, or for a limited time period, accumulate such substances or wastes as allowed under Environmental Laws without the necessity of a license or permit therefor; and (ii) use for lawful purposes and in a safe and environmentally appropriate and lawful manner commercial products which may contain such substances so long as, and to the extent that, Grantee does not adversely affect or impact any property or operation of Grantor which may occur in the vicinity of the Premises.

3. A. Grantee acknowledges, warrants and agrees that any contract, deed, transfer document or other instrument for transfer of any interest in, possession of, or right to use, the whole or any part of the Premises, through sale, lease, license, easement or otherwise will incorporate the obligations of Grantee hereunder and any subsequent user, occupant or transferee of the Premises shall be deemed to have assumed the obligations of Grantee as set forth in this Deed. Grantee further acknowledges that from and after the date of this Deed, the use of the Premises shall be restricted in perpetuity (or, if not permitted in perpetuity under law, then, for such shorter period of time as shall be the maximum period of time permitted under law), except as provided below, to industrial use and without access by members of the general public; provided, however, that customary office and other uses ancillary to the principal use of the Premises for industrial use shall not be deemed prohibited hereby and further provided, however, that such restriction may be eliminated as an encumbrance upon the Premises only with the written consent of Grantor.

B. In the event Grantee transfers all or any part of or any interest in the Premises to a third party, the transferee thereunder shall be deemed to have agreed not to sue Grantor and shall be deemed to have released Grantor from all liability for any environmental matter or condition involving the Premises, and the transferee shall be bound by the provisions of this Deed and shall be deemed to have agreed to be bound by and to have assumed Grantee's obligations under Article VI of the Agreement other than Grantee's indemnification obligations set forth in Section 6.12.3 of the Agreement; provided, however, that in the case of any such transfer of the Premises to an "Affiliate" (as such term is defined in the Agreement) of Grantee (whether or not from Grantee or otherwise), such Affiliate shall be deemed to have agreed to be bound by and to have assumed all of Grantee's obligations under this Deed and under Article VI of the Agreement, including, but not limited to, Grantee's indemnification obligations under Article VI of the Agreement; further, provided, however, that no such transfer (to a third party or to an Affiliate) will relieve Grantee of its obligations under this Deed and/or the Agreement. Grantee will indemnify and defend Grantor against any claims asserted by any transferee against Grantor which are contrary to the provisions of this Deed.

The terms and conditions of this Deed shall be directly enforceable by Grantor against Grantee and any subsequent user, occupant or transferee of the Premises and the same shall be deemed covenants running with the land binding upon Grantee and its successors in title and interest and assigns.

This conveyance is of premises which do not constitute all or substantially all of the assets of Grantor.

IT WITNESS WHEREOF, Grantor and Grantee have duly executed this Deed the day and year first above written.

WITNESSES:

Phyllis Rozof
* Phyllis Rozof

Patricia E. Hanratty
* PATRICIA E. HANRATTY

GENERAL MOTORS CORPORATION,
a Delaware corporation

By: John H. Monk Jr.
* JOHN H. MONK JR

Its: Finance Director, Saginaw Div.

"Grantor"

AMERICAN AXLE & MANUFACTURING, INC.,
a Delaware corporation

A. Jeffrey Beard
B G Mathis
* B. G. MATHIS

By: Richard E Dauch
*

Its: Pres. & C.E.O.

"Grantee"

STATE OF MICHIGAN)
) SS.
COUNTY OF WAYNE)

On this 26th day of February, 1994, before me personally came John H. Monk, Jr., to me known, who, being by me duly sworn, did depose and say that he resides at 3900 Holland Rd, Saginaw, Mich, that he is the Finance Dir. Saginaw Div of General Motors Corporation, the corporation described in and which executed the foregoing instrument; and that he signed his name thereto by order of the Board of Directors of said corporation.

Marie B. Martinez
* MARIE B MARTINEZ, Notary Public
_____ County, _____
My Commission Expires: _____

MARIE B. MARTINEZ
Notary Public, Wayne County, Mich.
My Commission Expires July 17, 1994

STATE OF MICHIGAN)
) SS.
COUNTY OF OAKLAND) * 1700 Rathmoor

On this 26 day of February, 1994, before me personally came RICHARD E. DAUCH, to me known, who, being by me duly sworn, did depose and say that he resides at *BLOOMFIELD HILLS MICHIGAN 48304, that he is the PRESIDENT of American Axle & Manufacturing, Inc., the corporation described in and which executed the foregoing instrument; and that he signed his name thereto by order of the Board of Directors of said corporation.

[signature]
*____________________, Notary Public
________ County, _________
My Commission Expires: ____________

[SEAL]

*Type or print names beneath signatures.

Return by mail to:

Albert T. Adams, Esq.
Baker & Hostetler
3200 National City Center
1900 East Ninth Street
Cleveland, Ohio 44114

RESERVE THIS SPACE FOR USE OF RECORDING OFFICE

A9610A

EXHIBIT A

LEGAL DESCRIPTION

PARCEL "A"

ALL THAT TRACT OR PARCEL OF LAND situate, lying and being in the City of Buffalo, County of Erie and State of New York, being part of Lot Number 53, Township 11, Range 7 of the Holland Land Company's Survey and being more particularly bounded and described as follows:

BEGINNING at the point of intersection of the east right of way line of Cornwall Avenue (60 feet wide) with the south right of way line of East Delavan Avenue (66 feet wide); thence north 89°17'18" east along the south right of way line of said East Delavan Avenue, 801.86 feet to a point in the west line of Conrail (Erie Lackawanna Railroad); thence southerly along the west line of said Conrail the following bearings and distances: 1) south 00°27'30" west, 82.47 feet, 2) south 00°16'10" west 440.05 feet, 3) south 02°30'10" west, 68.84 feet, 4) south 03°47'20" west, 117.14 feet, 5) south 00°10'10" west, 441.45 feet, 6) south 01°58'00" west 391.16 feet, 7) south 00°03'18" west, 1.30 feet, 8) south 81°42'36" west, 52.00 feet, 9) south 02°55'45" east, 150.40 feet, 10) south 00°35'44" west, 274.97 feet to a point in the north right of way line of Scajaquada Street (width varies); thence north 88°35'48" west and along said north right of way line, 131.64 feet to a point in the east right of way line of Colorado Avenue (60 feet wide formerly Norfolk Avenue); thence north 00°05'54" west and along said east right of way line 112.13 feet to a point in the north right of way line of said Colorado Avenue; thence south 89°54'06" west and along said north right of way line, 60.00 feet to a point in the west right of way line of Colorado Avenue; thence south 00°05'54" east and along said right of way line, 113.64 feet to a point in the north right of way line of Scajaquada

Street; thence westerly along the north right of way line of said Scajaquada Street, the following bearing and distances: 1) a curve to the left with a chord bearing of south 75°17'03" west with a radius of 240.36 feet an arc distance of 57.96 feet, 2) south 68°22'26" west, 66.71 feet, 3) north 00°05'54" west, 2.71 feet, 4) south 89°54'06" west, 118.00 feet to a point in the east right of way line of Northumberland Avenue (60 feet wide); thence north 00°05'54" west and along said east right of way line, 187.46 feet to a point in the north right of way line of said Northumberland Avenue; thence south 89°54'06" west and along said north right of way line, 60 feet to a point in the west right of way line of said Northumberland Avenue; thence south 00°05'54" east and along said west right of way line 257.43 feet to a point in the north right of way line of Scajaquada Street; thence westerly along the north right of way line of said Scajaquada Street the following bearings and distances: 1) south 68°22'25" west, 40.85 feet, 2) along a curve to the right, with a chord bearing of south 75°26'05" west, a radius of 180.36 feet, an arc distance of 83.36 feet, 3) north 00°05'54" west, 2.81 feet, 4) south 89°54'06" west, 118.00 feet to a point in the east right of way line of said Cornwall Avenue; thence north 00°05'54" west and along said east right of way line 2103.00 feet to the point or place of beginning.

PARCEL "B"

ALL THAT CERTAIN PIECE OR PARCEL OF LAND situate, lying and being in the City of Buffalo, County of Erie and State of New York, being part of Lot Number 53, Township 11, Range 7 of the Holland Land Company's Survey and being more particularly, bounded and described as follows:

BEGINNING at a point in the east line of Conrail (Erie Lackawanna Railroad), 425.67 feet south of its intersection with the south right of way line of East Delavan Avenue (66 feet wide); thence north 89°17'30" east, 330.19 feet to a point; thence south 21°55'36" east, 128.32 feet to a point; thence south 01°18'00" west, 1446.61 feet to a point in the north right of way line of Scajaquada Street (60 feet wide); thence north 88°42'00" west and along said north right of way line, 172.46 feet to a point; thence north 01°00'00" east, 301.05 feet to a point; thence north 89°00'00" west, 200.00 feet to a point in the east line of said Conrail; thence north 01°00'00" east and along said Conrail, 1252.98 feet to the point or place of beginning.

PARCEL "C"

ALL THAT CERTAIN PIECE OR PARCEL OF LAND SITUATE, LYING AND BEING IN THE City of Buffalo, County of Erie and State of New York, being part of Lot Number 54, Township 11, Range 7 of the Holland Land Company's Survey and being more particularly bounded and described as follows:

BEGINNING at the point of intersection of the north right of way line of East Delavan Avenue (66 feet wide) with the east right of way line of Norfolk Avenue (66 feet wide); thence north 00°01'48" west along the east right of way line of said Norfolk Avenue, 451.86 feet to a point; thence north 89°58'12" east, 108.00 feet to a point; thence north 00°01'48" west, 116.28 feet to a point; thence north 89°58'12" east, 125.50 feet to a point in the west line of Conrail (Erie Lackawanna Railroad); thence southerly along said boundary and curve to the right with a radius of 1877.08 feet, a chord bearing of south 04°48'31" east an arc distance of 380.08 feet to a

point of tangency; thence south 00°59'35" west and along said boundary 186.94 feet to a point in the north right of way line of said East Delavan Avenue; thence south 89°17'18" west and along said right of way line, 261.79 feet to the point or place of beginning.

PARCEL "D"

ALL THAT CERTAIN PIECE OR PARCEL OF LAND situate, lying and being in the City of Buffalo, County of Erie and State of New York, being part of Lot Number 53, Township 11, Range 7 of the Holland Land Company's Survey and being more particularly bounded and described as follows:

BEGINNING at the point of intersection of the west right of way line of Cornwall Avenue (60 feet wide) with the south right of way line of East Delavan Avenue (66 feet wide); thence south 00°05'54" east and along the west right of way line of said Cornwall Avenue, 761.98 feet to a point; thence south 89°54'06" west, 118.00 feet to a point; thence north 00°05'54" west, 760.72 feet to a point in the south right of way line of said East Delavan Avenue; thence north 89°17'18" east and along said right of way line, 118.00 feet to the point or place of beginning.

A9809A

EXHIBIT B

EXCEPTIONS

1. Easement contained in a deed made by Bardol Company, Inc. to Meyer Belinson dated May 1, 1936 and recorded May 7, 1936 in Liber 2526 of Deeds at Page 213.

2. Rights to construct and maintain water and sewer lines reserved in a deed made by the City of Buffalo to General Motors Corporation dated February 17, 1967 and recorded March 31, 1967 in Liber 7337 of Deeds at Page 407.

3. Right of Way for construction and use of a railroad switch contained in a deed made by Lorraine Morrison to Bardol Company, Inc. dated April 8, 1953 and recorded April 8, 1953 in Liber 5301 of Deeds at Page 69.

4. Right of Way reserved in a deed made by Bardol Company, Inc. to Buffalo Gravel Corporation, Inc., a New York corp, date May 1, 1947 and recorded July 8, 1947 in Liber 4150 of Deeds at Page 275, as assigned by assignment of right of way made by Bardol Company, Inc. to Arbee Corporation dated October 21, 1953 and recorded October 22, 1953 in Liber 5423 of Deeds at Page 513.

5. Agreement made between Arbee Corporation with Buffalo Gravel Corporation, a Delaware Corp, dated May 18, 1965 and recorded May 21, 1965 in Liber 7111 of Deeds at Page 49.

6. Easement and right of way contained in a deed made by Buffalo Gravel Corporation to General Motors Corporation dated May 21, 1965 and recorded May 25, 1965 in Liber 7112 of Deeds at Page 29.

7. Easement and right of way contained in a deed made by Bardol Company, Inc. to General Motors Corporation dated May 21, 1964 and recorded May 21, 1964 in Liber 7000 of Deeds at Page 157.

8. Easement made by General Motors Corporation to Buffalo Sewer Authority dated September 26, 1980 and recorded October 27, 1980 in Liber 8957 of Deeds at Page 87.

9. A portion of the premises was formally a part of Northumberland, Colorado, Norfolk and Scajaquada Streets. The same is subject to possible public and private easements.

10. Rights of the public and others in and to that portion of the premises located within the former bounds of Scajaquada Creek, now culverted, enclosed and/or concreted over.

11. Hazardous Waste Index filed in the Erie County Clerk's Office June 30, 1993, list Registry Site name Saginow Buffalo, Number 915152.

12. Those additional documents set forth on Exhibit 4.1.4 to the Asset Purchase Agreement described in this Deed.

13. All matters disclosed on survey prepared by Bissell, Stone Associates dated November 29, 1993, Job No. 47121, as updated.

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2-26-94

APPENDIX B

TECHNICAL SPECIFICATIONS

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PROJECT SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - SITE WORK

SECTION 01000

SCOPE OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

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B. Purpose

C. Background Information and Existing Site Conditions

D. Work to be Done

E. Work Under One Single Contract

F. Items Provided By Owner

G. Contractor Use of Site and Premises

H. Pre-Bid Site Investigation

I. Work Sequence

J. Owner Occupancy

K. Weekend Work

L. Maintenance of Traffic

1.2 PROJECT LOCATION

A. The project is located at Parking Lot No. 4 at the former General Motors Saginaw Buffalo facility (now American Axle & Manufacturing) on East Delavan Avenue in Buffalo, NY.

1.3 PURPOSE

A. The purpose of this project is remediation of contaminated subsurface materials from a portion of Parking Lot No. 4 by excavation and off-site disposal, and repair, repaving and striping of approximately 7 acres of parking Lot No. 4. Other operations to accomplish this remediation are dewatering; separation of Light Non-Aqueous Phase Liquids (LNAPL) from collected groundwater and transportation and off-site incineration of LNAPL; pretreatment of collected groundwater before discharge to the Buffalo Sewer Authority (BSA); coordination with the waste soil transporter to schedule trucks (transporter has guaranteed a minimum of 16 trucks/day [approximately 240 CY/day]);

backfilling the excavated area with fill suitable for final use of the site as a parking area; and extension (and if necessary, repair of) manholes and catch basins.

1.4 BACKGROUND INFORMATION AND EXISTING SITE CONDITIONS

A. The narrative portion of the Remedial Design Report and attached figures provide information on the project background and existing site conditions. Table 1 shows estimated volumes that will be the basis of the lump sum bid.

B. Utilities available during construction include water and electric power at the Wastewater Treatment Plant.

C. There is no topographic base map of the area to be excavated nor of the parking area.

1.5 WORK TO BE DONE

A. The Contractor shall furnish all material, labor, equipment, and incidentals required for remediation of the contaminated fill area, including the following:

1. General Conditions

    a. See Measurement and Payment (Section 01025, 2.1.C) for description of items included.

2. Mobilization and Demobilization

    a. See Measurement and Payment (Section 01025, 2.1.D) for description of items included.

3. Preparatory Site Work

    a. See Measurement and Payment (Section 01025, 2.1 E) for description of items included.

4. Dewatering

    a. The contaminated fill area shall be dewatered to the top of the clay layer. Dewatering shall commence one week prior to excavation of contaminated materials and shall be maintained during the excavation and backfilling operations. An area of approximately 10,800 sq. ft., a groundwater depth of approximately 6.5 feet and thickness of approximately 2.5 feet, with a hydraulic conductivity of the fill material of approximately 2.3x10-3 cm/sec, shall be dewatered to minimize water content of excavated materials.

    b. See Specification Section 02140 - Dewatering for additional requirements.

c. Water from dewatering shall be treated to remove PCB-containing LNAPL, and to meet the BSA pretreatment requirements. Approximately 800 gallons of LNAPL are expected to be collected. The Contractor shall be responsible for transportation and off-site incineration of separated LNAPL as a hazardous and TSCA-regulated waste. See Specification Section 02203 for additional requirements.

d. Treated groundwater shall be disposed to the Buffalo Sewer Authority via a nearby on-site sanitary sewer manhole located in the vicinity of MW-204. The Engineer shall arrange for permits/approvals from BSA and shall pay BSA's discharge fees.

e. See Specification Section 02201 - Groundwater Treatment and Disposal for additional requirements.

5. Excavation

a. Materials containing PCBs > 10 ppm shall be excavated and removed down to silty clay which is approximately 5-6.5 feet below ground surface. The silty clay is generally overlain, from the top, by asphalt and bedding material approximately one foot thick, general fill approximately one foot thick, ash fill approximately two feet thick, and organic silt approximately one foot thick. An area of approximately 10,800 sq. ft. and a volume of approximately 2,500 cu. yd. is expected to require excavation.

b. The asphalt shall be stripped and segregated and the bedding material shall be removed and segregated.

c. The asphalt and bedding material shall be transported and disposed off site as a non-hazardous/non-TSCA regulated waste by the Contractor.

d. All remaining materials down to the silty clay shall be excavated for off-site disposal as a RCRA hazardous waste and a TSCA-regulated waste.

e. The Contractor shall stabilize excavated materials for free liquids so that they will pass the Paint Filter Test (USEPA Method 9095A) prior to loading for off-site transportation and disposal. See Specification Section 02145 for additional requirements.

f. Three existing subsurface groundwater collection drains and a sump located in the contaminated fill area shall also be removed. The drain locations are shown in the Drawings. The drain leg through the center of the excavated area is 115 feet long, 6-inch diameter perforated PVC wrapped in a geotextile filter with sand and No.2 stone backfill (stone backfill to ground surface). This drain leg was installed in 12-foot threaded sections. The two drain legs at the boundaries of the excavated area total 175 feet in length and are 6-inch diameter corrugated,

perforated HDPE, probably backfilled and joined together in a similar manner. The sump is 48-inch diameter concrete, 7 feet deep, with No.1 crushed stone bedding.

g. The Engineer shall direct the Contractor's excavation and shall be doing on-site test kit PCB analysis to determine when the 10 ppm PCB cleanup requirement has been met.

h. Excavation shall not come closer than 4 feet to the Reclaimed Oil Storage Tank containment area at ground surface and an appropriate slope down into the excavation shall be used (see Specification Section 02223). Excavation shall not disturb subsurface piping outside the containment area. Locations of piping shall be provided.

i. There are no known subsurface utilities in the area of excavation, based on previous investigations. However, the Contractor shall locate all existing utilities in work areas prior to commencing any excavation activities.

j. Excavated RCRA and TSCA-regulated materials and the subsurface drains and sump shall be loaded directly into dump trailers, after stabilization if stabilization for moisture control is needed, provided by Chemical Waste Management (CWM). GM shall contract directly with CWM for transportation and disposal; however, the Contractor shall be responsible for coordinating transportation with CWM and shall be responsible for demurrage charges if coordination with CWM is not done. CWM has guaranteed a minimum of 16 loads per day.

k. See Specifications Section 02223 - Excavation for additional requirements.

6. Fill and Backfill

a. Fill shall be provided and backfilled into the excavated area. Backfill materials and placement shall be suitable for final use of the area as a parking area. The backfill shall be brought to the existing fill grade.

b. See Specifications Section 02223 - Backfill and Fill for additional requirements.

7. Parking Area Repair, Paving and Striping

a. Within the existing 7-acre Parking Area, pavement in poor condition shall be repaired. This consists of approximately 4,000 sq. ft. of 4-inch thick asphalt that has cracked or settled. The asphalt shall be removed and disposed. Core samples to one (1) foot depth shall be done to determine the adequacy of the subbase material. If subbase material is inadequate (< 8 inches thick), subbase material shall be provided and placed. A minimum 2-inch binder course shall be placed to bring the repaired area to existing grade in preparation for paving.

b. Seventeen (17) storm sewer manholes/catch basins shall be raised to final paving grade.

c. One (1) collapsed catch basin shall be restored.

d. The existing 7-acre Parking Area shall be repaved by applying AC-5 oil and Petromat fabric over the existing asphalt; applying a 2-inch base coat of asphalt; and applying a 1-inch top coat of asphalt.

e. The 7-acre Parking Area surface shall be sealcoated one year after repaving and repair.

f. The Parking Area shall be striped for 768 parking stalls, once after repaving and repair, and a second time after sealcoating the surface one year later.

g. Seventeen (17) handicap parking stalls shall be marked with a painted pavement symbol and handicap parking signs with posts. Handicap areas will need to be remarked a second time after sealcoating.

h. See Specifications Section 02519 - Parking Area Repair, Paving and Striping for additional requirements.

1.6 WORK UNDER ONE SINGLE CONTRACT

A. The Work To Be Done shall be done under one single contract.

B. The Contractor shall be responsible for coordinating his work with other subcontractors and vendors.

1.7 ITEMS PROVIDED BY OWNER

A. Information or services under the Owner's control will be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the work.

B. The Owner will issue all instructions to the Contractor through the Engineer.

C. Items noted as being handled by GM will be furnished and installed by Owner or other Contractors.

1.8 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:

1. Owner occupancy.

2. Work by Others and Work by Owner.

B. The Contractor shall confine his materials and their storage, and the operation of his workmen to limits indicated by laws, ordinances permits, directions of the Engineer and will not unreasonably encumber the premises with such materials, but shall store them in an orderly fashion so that they will not interfere with the work under this Contract or other contracts, or with the operation of the Owner's facilities. The Contractor shall not load nor permit any part of the work to be loaded with a weight that will endanger its safety or unduly affect the structure or any part thereof. The Contractor shall enforce the instructions of the Engineer regarding signs, fires, and smoking.

C. Contractor staging areas and stockpiles of material shall be in areas approved or designated by the Engineer.

D. Neither the Contractor nor any of his employees shall park any vehicle anywhere on the site, except at such locations as shown or as specifically approved by the Engineer for the purpose.

1.9 PRE-BID SITE INVESTIGATION

A. The Contractor must satisfy himself as to the nature and location of the Work, the general and local conditions of the site, particularly those bearing upon availability of transportation, access, disposal and handling of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the configuration and conditions of the ground, the character of equipment and facilities needed preliminary to, and during the execution of the Work, and all other matters which can affect the Work or the cost thereof under this Contract.

B. The Contractor must satisfy himself as to the character, quality and quantity of subsurface materials to be encountered from his inspection of the site, and from reviewing information provided by the Owner. Failure by the Contractor to become acquainted with the physical conditions of the site and all available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

C. A mandatory Pre-Bid meeting will be held at the Site. Any bidder not attending the Pre-Bid meeting will have their bid disqualified, unless otherwise approved by the Owner.

1.10 WORK SEQUENCE

A. Construct work in stages to accommodate Owner's occupancy requirements during the construction period, and coordinate construction schedule and operations with Owner and Engineer. Work must be completed within the time frames outlined on the attached schedule (Figure 1).

1.11 OWNER OCCUPANCY

A. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

B. Schedule the work to accommodate this requirement.

1.12 WEEKEND WORK

A. The Contractor will be allowed to work from 7 a.m. to 7 p.m., Monday to Saturday. The Contractor will be allowed to work on Sunday from 7 a.m. to 7 p.m. provided that the following conditions are met:

1. The Owner and Engineer are notified 48 hours in advance of the Contractor's intent to work on Sunday, and

2. Noise levels at the property line do not exceed 52 dbA between 7 a.m. and 7 p.m.

1.13 MAINTENANCE OF TRAFFIC

A. The Contractor shall access the site and route traffic according to plans acceptable to the Engineer. The Contractor shall provide flagmen, as necessary, to facilitate flow of Contractor's traffic at no additional cost to the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

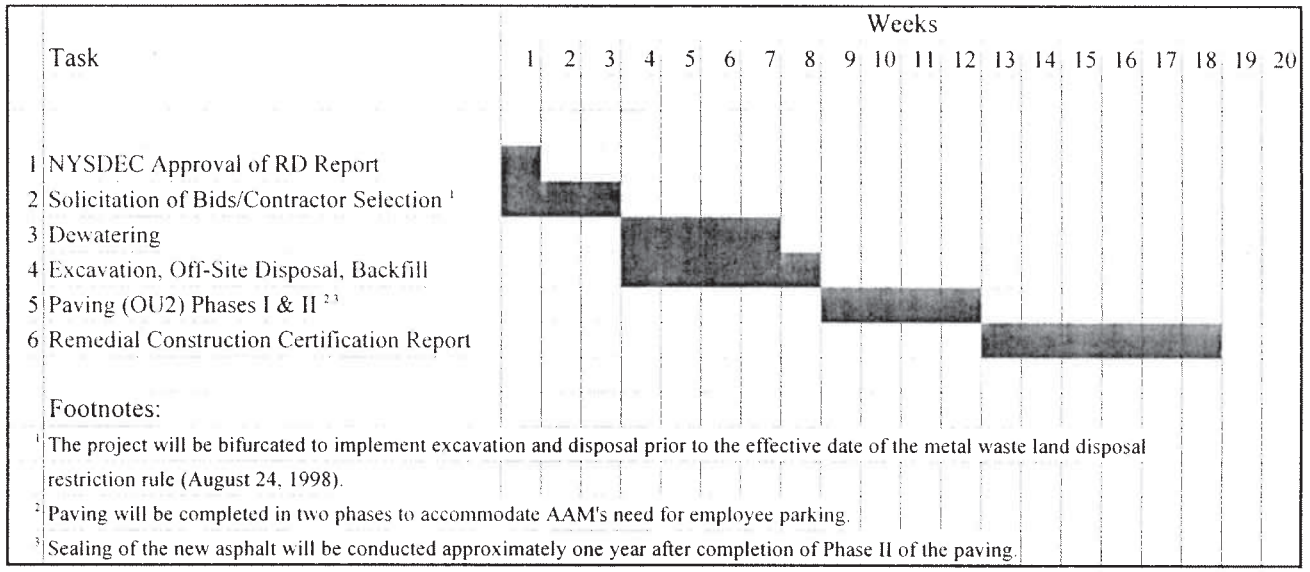
Not Used.

END OF SECTION

Table 1
LUMP SUM BID QUANTITY ESTIMATES
SAGINAW-BUFFALO SITE

	Item	Quantity	Unit
1	Mob/Demob	2	lump sum
2	Dewatering	1	lump sum
3	Water Treatment (@ 50 gpm max)	28	days
4	LNAPL Transportation and Disposal	16	drums
5	Excavation	2500	cy
6	Backfill	3000	cy
7	Catchbasin restoration	1	lump sum
8	Manhole/Catch Basin Extensions	17	units
9	Asphalt repaving	33880	sy
10	Asphalt striping	768	spaces
11	Handicapped markings	17	spaces

Figure 1
GENERAL MOTORS CORPORATION
REMEDIAL CONSTRUCTION IMPLEMENTATION SCHEDULE



Footnotes:

[1] The project will be bifurcated to implement excavation and disposal prior to the effective date of the metal waste land disposal restriction rule (August 24, 1998).

[2] Paving will be completed in two phases to accommodate AAM's need for employee parking.

[3] Sealing of the new asphalt will be conducted approximately one year after completion of Phase II of the paving.

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for measurement and payment for the work to be done.

1.2 RELATED SECTIONS

A. Section 01027 – Applications for Payment

B. Section 01300 – Submittals

C. Section 01700 – Contract Closeout

1.3 GENERAL

A. The following paragraphs describe measurement of and payment for the work to be done under the respective items listed in the itemized bid for this contract.

B. Each lump sum and unit price stated in the itemized bid shall constitute full compensation for not only all labor, equipment and materials necessary and required to complete all work specified under that particular item including cleaning up, but also all costs for doing related work as set forth in these Specifications or implied in carrying out their intent.

C. Requests for payment shall be in accordance with Section 01027 – Applications for Payment. All payment requests must be accompanied by the forms in Appendices G, H, and I (GM1638) of Construction General Conditions.

1.4 COMPUTATION OF QUANTITIES

A. Measurement of quantities expressed as area shall be based upon a horizontal, planimetric projection to the work limits as determined by survey Record Drawings for each item with no additional allowances for slopes.

B. Measurement of quantities expressed as volume shall be based upon comparison of survey Record Drawings performed both prior to and upon completion of each item.

C. Computation of the volume of prismoids shall be by the method of average end areas of surveyed cross-sections recorded at 50-foot stations at the same locations both prior to construction and upon completion of construction of these items. Measurement of length for these items shall be recorded along the top centerline for purposes of volume computations.

D. Measurement of linear items such as piping will be for quantities actually removed, based upon surveyed stations recorded along the straight or curved centerline of each respective item.

E. No partial payments shall be made for items which have not been approved.

F. Payment will be made to the quantities as shown in the Contract Documents. If the constructed quantities are less than the shown quantities, payment will be made for the actual quantities of construction as shown on the Record Drawings. Payment for quantities that exceed the shown quantities limits will only be made with the approval of the Owner/Engineer. The payment for quantities that exceed the shown quantities can only be obtained through an approved change order before contract quantities are exceeded.

PART 2 PRODUCTS

2.1 BASE BID CONTRACT ITEMS

A. Item No. 1 – General Conditions

1. The Lump Sum price for this item shall be payment in full for supervision and management, ongoing project-related expenses such as utilities, dust control, etc.

2. The Lump Sum price shall include, but not be limited to, the following:

   a. Supervision and management expenses, such as:

      1) Salaries of all Contractor's personnel, including but not limited to the Project Manager, Engineer, Superintendent, etc.

      2) Management travel, etc.

   b. On-going project-related expenses, such as:

      1) Dust control

      2) Master mechanic services

      3) Contractor's facilities, all office trailers and their related expenses and furnishings and sheds including, but not limited to telephone/fax usage, office equipment and supplies, express mail, courier and postage, etc.

      4) Vehicles and related maintenance, including fuel

      5) Sanitary facilities and related maintenance

      6) Contractor-provided utilities

      7) Preparation and submission of submittals

8) Soil erosion and sediment control during construction

9) Protection, repair and/or replacement of existing facilities to remain (such as pavement, fencing, utilities) and protection of completed work

10) On-going photo documentation of work

11) On-going maintenance of safety fencing, signage, egress and access for the Owner

12) On-going compliance with health and safety requirements of the Contractor's approved HASP, including, but not limited to, personnel, equipment, training, supplies, decontamination facilities

13) On-going provision of necessary survey controls to properly stake out, install and complete the work

14) On-going maintenance and upkeep of roadways (temporary or permanent)

15) On-going upkeep, preparation and/or modifications to project Record Drawings

16) Off-site disposal of materials such as Contractor's, Owners Representative's, Engineer's trash, protective equipment, etc., including transportation, fees, etc., as may be necessary

c. Any incidental clearing and grubbing as required for staging and parking in areas outside the work area.

3. Payment for this item shall consist of partial payments made monthly based on the percent complete status as determined by the Owner's representative and Engineer.

B. Item No. 2 - Mobilization and Demobilization

1. Mobilization and demobilization of all parts, material and equipment to and from the site.

2. The Lump Sum price shall include, but not be limited to, the following:

a. Transportation and delivery of all parts, material and equipment necessary for the work to and/or from the site

b. Set up of all required offices

c. Hook up of all required utilities

d. Initial pre-construction and final post-construction photo documentation as required

e. Set up and removal of required safety fencing and signage

3. Payment for this item shall be made in two payments: 60 percent with the first month's Request for Payment and 40 percent with the final Request for payment.

C. Item No. 3 – Preparatory Site Work

1. The Lump Sum price for this item shall be payment in full for all Contractor's Preparatory Site Work not specifically included in other bid items.

2. The Lump Sum price shall include, but not necessarily be limited to, the following:

a. Preparation, submittal and revision (as necessary) of all required pre-work submittals, including those listed in Specification Section 01300 - Submittals

b. Initial establishment of all lines, grades, elevations, reference notes to provide horizontal and vertical controls to construct the work and measure quantities

c. Locating existing utilities

d. Initial establishment of erosion and sediment control measures in accordance with the approved pre-work submittal prepared by the Contractor

e. Initial provision for and installation of all necessary temporary access roads

3. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work of this Item as determined by the Owner's Representative and Engineer.

D. Item No. 4 - Dewatering

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.4.a. and b. and Specification Section 02140 - Dewatering.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

E. Item No. 5 - Groundwater Treatment and Disposal

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.4.c., d. and e. and Specification Section 02201 - Groundwater Treatment and Disposal.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

F. Item No. 6 - LNAPL Transportation and Disposal

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.4.c. and Specification Section 02203 - LNAPL Transportation and Disposal.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

G. Item No. 7 - Excavation

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.5. and Specification Section 02220 - Excavation.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

H. Item No. 8 - Fill and Backfill

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.6. and Specification Section 02223 - Backfill and Fill.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

I. Item No. 9 - Catchbasin Restoration

1. The Unit Price per Catchbasin for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.c. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. The approximate locations of restored catchbasins shall be shown on a drawing.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

J. Item No. 10 - Manhole Raising

1. The Unit Price per Manhole for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.b. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. The approximate locations of raised manholes shall be shown on a drawing.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

K. Item No. 11 - Parking Area Paving and Striping

1. The Lump Sum price for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.7.d., e., and f. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. Payment for this item shall consist of partial payments made monthly based on the percent complete status of the Work for this Item as determined by the Owner's Representative and Engineer.

2.2 CONTINGENCY BID CONTRACT ITEMS

A. Item No. 1 - Dewatering

1. The Unit Price per day for this item shall be payment in full for the activities described in Specification Section 01010 - Summary of Work, 1.5.A.4.a and b and Specification Section 02140 - Dewatering for days requiring dewatering in excess of that estimated in the Construction Work Schedule developed in accordance with Specification Section 01300 - Submittals, 1.4.A.5.

2. Payment for this item shall be made monthly based, based on supporting schedule documentation submitted with payment requests.

B. Item No. 2 - Groundwater Treatment and Disposal

1. The Unit Price per day for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.4.c., d. and e. and Specification Section 02201 - Groundwater Treatment and Disposal for quantities above the base bid quantity.

2. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

C. Item No. 3 - LNAPL Transportation and Disposal

1. The Unit Price per gallon for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.4.c. and Specification Section 02203 - LNAPL Transportation and Disposal for quantities above the base bid quantity.

2. Volume shall be measured by the actual volume of oil placed in 55 gallon drums.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

D. Item No. 4 - Excavation

1. The Unit Price per cubic yard for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.5. and Specification Section 02220 - Excavation for quantities above the base bid quantity.

2. Volume shall be measured by survey before and after excavation.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

E. Item No. 5 - Excavated Materials Liquid Stabilization

1. The Unit Price per cubic yard of stabilizing agent for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.5.f and Specification Section 02145 - Excavated Materials Liquid Stabilization.

2. Volume of stabilizing agent shall be measured before stabilization.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

F. Item No. 6 - Fill and Backfill

1. The Unit Price per cubic yard for this item shall be payment in full for the activities described in Specification Section 01000 - Scope of Work, 1.5.A.6. and Specification Section 02223 - Backfill and Fill for quantities above the base bid quantity.

2. Volume shall be measured by survey before and after placement of fill.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

G. Item No. 7 - Parking Area Repair - Remove and Dispose Asphalt

1. The Unit Price per cubic yard for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.a. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. Volume shall be measured by survey.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

H. Item No. 8 - Parking Area Repair - Core Samples

1. The Unit Price per core sample for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.a. and Specification Section 02519 - Parking Area Repair, Paving and Striping, for quantities above the base bid quantity.

2. The approximate locations of test pits shall be shown on a drawing.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

I. Item No. 9 - Parking Area Repair - New Subbase Material

1. The Unit Price per cubic yard for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.a. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. Volume shall be measured by survey.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

J. Item No. 10 - Parking Area Paving

1. The Unit Price per square yard for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7. d. and e. and Specification Section 02519 - Parking Area Repair, Paving and Striping, for quantities above the base bid quantity.

2. Areas shall be measured by survey.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

K. Item No. 11 - Parking Area Striping

1. The Unit Price per parking stall for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.f. and Specification Section 02519 - Parking Area Repair, Paving and Striping, for quantities above the base bid quantity.

2. The number of parking stalls shall be shown on a drawing.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

L. Item No. 12 - Parking Area Handicap Painted Symbol and Sign with Post

1. The Unit Price per parking stall for this item shall be payment in full for the activities described in Specification Section 01000 -Scope of Work, 1.5.A.7.g. and Specification Section 02519 - Parking Area Repair, Paving and Striping.

2. The number of handicap stalls shall be shown on a drawing.

3. Payment for this item shall be made monthly based on supporting documentation submitted with payment requests.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of Applications for Payment.

1.2 RELATED SECTIONS

A. Section 01025 - Measurement and Payment

B. Section 01300 – Submittals

C. Section 01700 – Contract Closeout

1.3 FORMAT

A. EJCDC 1910-8-E – Application for Payment (attached), including continuation sheets when required.

B. The Contractor may submit to the Engineer for approval an alternate request for payment format. All such submittals must be prior to the Contractor's first payment request.

C. For each item, provide a column for listing: Item Number; Description of Work; Scheduled Value, Previous Applications: Work in Place and Stored Materials under this Application: Authorized Change Orders; Total Completed and Stored to Date of Application; Percentage of Completion; Balance to Finish; and Retainage.

1.4 PREPARATION OF APPLICATIONS

A. Present required information on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.

E. Prepare Application for Final Payment as specified in Section 01700 – Contract Closeout.

1.5 SUBMITTAL PROCEDURES

A. Submit one (1) original and two (2) copies of each Application for Payment. The individual documents shall be so marked so as to distinguish the original and the copy.

B. Submit an updated Construction Work Schedule specified in Section 01300 – Submittals with each Application for Payment.

C. Submit Record Drawings showing limits, elevations and grades for work completed as of date of payment request with each Application for Payment.

D. Submit construction photographs specified in Section 01300 – Submittals with each Application for Payment.

E. Payment Period – Submit at intervals stipulated in the Agreement.

F. Submit under transmittal letter specified in Section 01300 – Submittals.

G. Progress payments will not be processed until project Record Documents are up-to-date and complete.

H. Application for Payment will not be processed unless it is complete and contains all of the above specified items for the work covered by the payment request.

1.6 SUBSTANTIATING DATA

A. When Engineer requires substantiating information, submit data justifying dollar amounts in question.

B. Provide one (1) copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

APPLICATION FOR PAYMENT NO. _____

To: _____ (OWNER)
From: _____ (CONTRACTOR)
Contract: _____
Project: _____
OWNER's Contract No. _____ ENGINEER's Project No. _____
For Work accomplished through the date of: _____

1.	Original Contract Price:	$ _____
2.	Net change by Change Orders and Written Amendments (+ or -):	$ _____
3.	Current Contract Price (1 plus 2):	$ _____
4.	Total completed and stored to date:	$ _____
5.	**Retainage (per Agreement):**	
	_____% of completed Work: $ _____	
	_____% of stored material: $ _____	
	Total Retainage:	$ _____
6.	Total completed and stored to date less retainage (4 minus 5):	$ _____
7.	Less previous Application for Payments:	$ _____
8.	DUE THIS APPLICATION (6 MINUS 7):	$ _____

Accompanying Documentation:

CONTRACTOR'S Certification:

The undersigned CONTRACTOR certifies that (1) all previous progress payments received from OWNER on account of Work done under the Contract referred to above have been applied on account to discharge CONTRACTOR's legitimate obligations incurred in connection with Work covered by prior Applications for Payment numbered 1 through _____ inclusive; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to OWNER indemnifying OWNER against any such Lien, security interest or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and not defective.

Dated _____ _____
CONTRACTOR

By: _____

State of _____
County of _____
Subscribed and sworn to before me this _____
day of _____, _____

_____
Notary Public
My Commission expires: _____

Payment of the above AMOUNT DUE THIS APPLICATION is recommended.

Dated _____ _____
ENGINEER

By: _____

EJCDC No. 1910-8-E (1996 Edition)
Prepared by the Engineers Joint Contract Documents Committee and endorsed by The Associated General Contractors of America and the Construction Specification Institute.

Application No. Date:

ITEM	UNIT PRICE	ESTIMATED QUANTITY	SCHEDULE OF VALUES AMOUNT	QUANTITY COMPLETED	AMOUNT	%	MATERIAL STORED	AMOUNT COMPLETED AND STORED
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.								
TOTAL			$		$		$	$

APPLICATION FOR PAYMENT

INSTRUCTIONS

A. GENERAL INFORMATION

The sample form of Schedule of Values is intended as a guide only. Many projects require a more extensive form with space for numerous items, descriptions of Change Orders, identification of variable quantity adjustments, summary of materials and equipment stored at the site and other information. It is expected that a separate form will be developed by Engineer and Contractor at the time Contractor's Schedule of Values is finalized. Note also that the format for retainage must be changed if the Contract permits (or the law provides), and Contractor elects to deposit securities in lieu of retainage. Refer to Article 14 of the General Conditions for provisions concerning payments to Contractor.

B. COMPLETING THE FORM

The Schedule of Values, submitted and approved as provided in paragraphs 2.05.B.3 and 2.07 of the General Conditions, should be reproduced as appropriate in the space indicated on the Application for Payment form. Note that the cost of materials and equipment is often listed separately from the cost of installation. Also, note that each Unit Price is deemed to include Contractor's overhead and profit.

All Change Orders affecting the Contract Price should be identified and included in the Schedule of Values as required for progress payments.

The form is suitable for use in the Final Application for Payment as well as for Progress Payments; however, the required accompanying documentation is usually more extensive for final payment. All accompanying documentation should be identified in the space provided on the form.

C. LEGAL REVIEW

All accompanying documentation of a legal nature, such as Lien waivers, should be reviewed by an attorney, and Engineer should so advise Owner.

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-Bid Meeting

B. Coordination

C. Preconstruction Conference

D. Site Mobilization Conference

E. Progress Meetings

1.2 PRE-BID MEETING

A. A mandatory Pre-Bid meeting will be held at the Site on _____, 1998. Any bidder not attending the Pre-Bid meeting will have their bid disqualified, unless otherwise approved by the Owner.

1.3 COORDINATION

A. The General Contractor shall have primary responsibility to coordinate schedule and the work. However, each Contractor shall be responsible for adhering to the schedule and coordinating submittals and installation of the work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements. Accordingly, each Contractor shall, as applicable, perform the following tasks.

1. Verify that all utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

2. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion and for portions of work designated for Owner's occupancy.

3. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 PRECONSTRUCTION CONFERENCE

A. Owner and Engineer will schedule a conference after Notice of Award.

B. Attendance Required – Owner, Engineer, Contractor, and NYSDEC Representative.

C. Agenda

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, Schedule of Values, and Construction Work Schedule in accordance with Section 01300 – Submittals.
5. Designation of personnel representing the parties in Contract and the Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
7. Scheduling.

1.5 SITE MOBILIZATION CONFERENCE

A. Engineer and Owner will schedule a conference at the Project site prior to Contractor occupancy.

B. Attendance Required – Owner, Engineer, NYSDEC Representative, Special Consultants, and Contractor, Contractor's Superintendent, and major subcontractors.

C. Agenda

1. Use of premises by Owner and Contractor.
2. Owner's requirements and partial occupancy.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner, if any.
5. Survey layout.
6. Security and housekeeping procedures.
7. Schedules.

8. Procedures for testing.

9. Procedures for maintaining Record Documents.

1.6 PROGRESS MEETINGS

A. The Engineer will schedule and administer meetings throughout progress of the work at weekly intervals.

B. The Engineer will make arrangements for meetings, preside at meetings, record minutes, and distribute copies to Owner, Contractor, NYSDEC Representative, participants, and those affected by decisions made.

C. Attendance Required – Job superintendent, major subcontractors and suppliers, Owner, Engineer, and NYSDEC Representative, as appropriate to agenda topics for each meeting.

D. Agenda

1. Review minutes of previous meetings.

2. Review of work progress.

3. Field observations, problems, and decisions.

4. Identification of problems which impede planned progress.

5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.

7. Maintenance of progress schedule.

8. Corrective measures to regain lost progress.

9. Planned progress during succeeding work period.

10. Coordination of projected progress.

11. Maintenance of quality and work standards.

12. Effect of proposed changes on progress schedule and coordination.

13. Other business relating to work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01201

SUPERVISION BY CONTRACTOR

PART 1 GENERAL

1.1 REQUIREMENTS

A. The Contractor shall supervise and direct the work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and safety precautions employed for the work under the Contract.

B. The Contractor shall employ at the site during the performance of the work, or any part thereof, a competent superintendent or foreman who shall be satisfactory to the Engineer and, and who shall not be replaced except with the consent of the Engineer, unless he shall cease to be in the employ of the Contractor. Such superintendent or foreman shall represent and have full authority to act for the Contractor in his absence and all directions given by such superintendent or foreman shall be binding as if given by the Contractor.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures

B. Pre-Work Submittals

C. Construction Work Schedules

D. Construction Photographs

1.2 RELATED SECTIONS

A. Section 01027 - Applications for Payment

B. Section 01400 – Quality Control

C. Section 01700 – Contract Closeout

1.3 SUBMITTAL PROCEDURES

A. Prepare a complete listing of all submittals required for the project noting the number of each submittal and the date each submittal is to be submitted. The Contractor shall identify submittals that are time critical to completion of the project. The listing shall be submitted within 7 days of Award of the Contract and shall be a prerequisite to the first partial payment.

B. Transmit each submittal with Engineer-accepted form. Submit the number of copies which the Contractor requires plus two (2) copies for the Engineer and one (1) copy for the Owner.

C. Sequentially number the submittals using the section and sequential number (e.g., 03300-1, 03300-2). Resubmittals shall have the same submittal number with a sequential letter designation for each succeeding resubmittal (e.g., 03300-1-A, 03300-1-B).

D. Identify Project, Contractor, subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

E. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and Contract Documents.

F. Schedule submittals to expedite the project, and deliver to Engineer's business address. Coordinate submission of related items such that a complete review of the submittal can be performed. Incomplete submittals or submittals not fully coordinated will not be reviewed. The Contractor will be advised in writing of the reasons for the Engineer's action.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed work.

H. Provide space for Contractor and Engineer review stamps.

I. Revise and resubmit submittals as required, identify all changes made since previous submittal.

J. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

K. The Contractor shall allow a minimum of 5 working days for the Engineer to review each submittal. The Engineer will endeavor to complete the review of all submittals as soon as possible in accordance with the Contractor's assigned priority to each submittal. Failure by the Contractor to make submittals on time or failure to allow sufficient time for review of any and all submittals will not relieve him of the responsibility to complete the project in the specified time.

1.4 PRE-WORK SUBMITTALS

A. Pre-work submittals shall be made within 10 days of award and include, but are not necessarily limited to, the following items:

1. List of subcontractors in accordance with Specification Section 01039, 1.5.C.

2. Schedule of Values in accordance with Specification Section 01039, 1.5.C.

3. Listing of all submittals required for the project in accordance with Specification Section 01300, 1.3.A.

4. Construction Work Schedule

    a. The Construction Work Schedule shall be a bar chart (Gantt) schedule showing the beginning and end of each major task involved in the construction from the Notice of Award.

5. Dewatering Plan in accordance with Specification Section 02140 - Dewatering.

6. Groundwater Treatment and Disposal Operations Plan, in accordance with Specification Section 02201 - Groundwater Treatment and Disposal.

7. Site Safety Plan, in accordance with Specification Section 01501.

8. Written Implementation Plan for Environmental Protection, in accordance with Specification Section 01502.

9. Soil Erosion and Sediment Control Plan, in accordance with Specification Section 01502.

10. Dust Control Plan, in accordance with Section 01502.

11. Construction Quality Control Plan in accordance with Specification Section 01400 - Quality Control.

1.5 CONSTRUCTION WORK SCHEDULES

A. Submit initial Construction Work Schedule in duplicate within 5 days after date of Owner-Contractor Agreement for Engineer review.

B. Revise as required and resubmit with each request for payment. Payment requests will not be processed without a revised Construction Work Schedule.

C. Indicate estimated percentage of completion for each item of work at each submission.

D. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and under Allowances.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Photography

1. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Engineer.

2. Take photographs on date for each Application for Payment; to show the following items:

   a. Asphalt and bedding material removal

   b. Dewatering

   c. Groundwater treatment and disposal

   d. LNAPL Collection

   e. Excavation

   f. Backfilling

   g. Parking Area Repairs

h. Parking Area Paving

i. Parking Area Striping

j. Final site condition

B. Prints

1. Color; three (3) prints of each view.

2. Paper – Single weight, neutral black image tone, white base.

3. Finish – Smooth surface, glossy.

4. Size – 8 x 10-inch.

5. Identify each print on back. Identify name of Project, Contract No. orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

C. Negatives

1. Negatives shall be provided to and become the property of the Owner.

D. Technique

1. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

2. Provide factual presentation.

E. Views

1. Provide non-aerial photographs from two (2) views of each construction item at each specified time, until Date of Substantial Completion.

2. Consult with Engineer for instructions on views required.

F. Submittals

1. Deliver prints within three (3) working days of each Application for Payment. Application for Payment will not be processed unless complete and includes construction photographs.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Field samples

B. Inspection and testing laboratory services

C. Manufacturers' field services and reports

1.2 RELATED SECTIONS

A. Section 01300 – Submittals

1.3 SUBMITTALS

A. The Contractor shall prepare a Construction Quality Control Plan which will state the field testing to be done, including test methods and frequency of testing. The Plan shall address, but not necessarily be limited to, the following:

1. Paint Filter Testing of excavated material.

2. Properties of fill proposed for backfill of excavated areas.

3. Backfilling compaction/density requirements.

4. Properties of additional sub-base materials for repairing the Parking Area.

5. Properties of base coat and top coat asphalt used for paving the Parking Area.

1.4 QUALITY ASSURANCE/CONTROL OF WORK

A. Monitor quality control over services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or manufacturer's specified requirements indicate higher standards or more precise workmanship.

C. Work is to be performed by persons qualified to produce workmanship of specified quality.

1.5 REFERENCES

A. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.6 FIELD SAMPLES

A. Collect field samples at the site as required by Engineer's specifications for review. These field samples will include, but not be necessarily limited to, the following:

1. Excavated materials, after stabilization for moisture control, to show that treated materials pass the Paint Filter Test prior to loading for off-site disposal.

B. Acceptable samples represent a quality level for the work.

C. Where field sample is specified in individual Sections to be removed when directed by the Engineer remove the sample and restore the area as specified.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities - Electricity, lighting, heat, ventilation, and sanitary facilities.

B. Temporary Controls - Barriers, enclosures and fencing, protection of the work, and water control.

C. Construction Facilities - Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01501 – Health and Safety Provisions

C. Section 01502 – Environmental Protection

D. Section 01700 – Contract Closeout

1.3 TEMPORARY ELECTRICITY

A. The Contractor shall be responsible for providing temporary electric power for construction. He shall coordinate requirements of other contractors, arrange for payments, and contact the electric utility to provide the service for the temporary power.

B. The Contractor shall install a meter and pay for all expenses for electrical service used during the course of the work.

1.4 TEMPORARY WATER SERVICE

A. Temporary water service will not be necessary as water will be available at the Wastewater Treatment Plant.

1.5 TEMPORARY SANITARY FACILITIES

A. Contractor shall provide at the site suitable enclosed toilet facilities for the use of construction personnel. The Contractor shall observe and enforce all sanitary regulations and maintain satisfactory sanitary conditions around and on all parts of the work.

B. Adequate washing facilities shall be provided for the construction personnel.

C. Contractor shall maintain service and clean and disinfect facilities in a satisfactory manner and enforce proper use of the sanitary facilities.

D. Contractor shall be subject to a fine and prosecution if any human excrement is deposited in or around the construction site.

E. The Contractor shall pay for all expenses associated with temporary sanitary facilities during the course of the work, including furnishing all necessary permits and fees required for temporary sanitary facilities.

F. Comply with all applicable codes and arrange for all necessary inspections and approvals.

1.6 FIRST-AID FACILITIES AND ACCIDENTS

A. First-Aid Facilities

1. The Contractor shall provide, at the site, such equipment and facilities as are necessary to supply first-aid to any of his personnel who may be injured in connection with the work.

B. Accident

1. The Contractor shall within 24 hours report in writing to the Owner and Engineer all accidents and whatsoever arising out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

3. If any claim is made by anyone against the Contractor or a subcontractor on account of any accidents, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

1.7 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Provide temporary control of surface water, stormwater runoff, and discharge from pumping in accordance with Contractor's approved soil Erosion and Sediment Control Plan.

1.8 DUST CONTROL

A. ***Keep dust under control at all times, as described in Section 01502, 3.5.***

1.9 SECURITY

A. Provide security and facilities to protect work, and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

C. Furnish security during the course of the work.

1.10 ACCESS ROADS

A. Maintain temporary roads accessing construction area as needed.

B. Extend and relocate as work progress requires. Provide detours necessary for unimpeded traffic flow.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering public and private streets. Clean all mud and debris from construction traffic at no additional expense to Owner. Comply with all State and local regulations.

E. Designated existing on-site roads may be used for construction traffic, as directed by Owner and Engineer.

1.11 PARKING

A. Provide temporary gravel surface parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

C. Do not allow vehicle parking on existing pavement.

D. Designate 1 parking space for the Owner and one for the Engineer.

1.12 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.

B. Remove underground installations outside of the limit of the landfill to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01501

HEALTH AND SAFETY PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site Health and Safety Requirements for the Work to be performed for the excavation activities at the former GM-Saginaw Buffalo facility (Saginaw-Buffalo site) in Buffalo, NY.

1.2 RELATED SECTIONS

A. Section 01000- Scope of Work

B. Section 01300 - Submittals

C. Section 01502 – Environmental Protection

1.3 GENERAL REQUIREMENTS

A. The Contractor agrees to comply with all the requirements and procedures contained in this document. The requirements and procedures are as follows:

1. The Contractor shall be responsible to maintain a safe workplace and take all prudent environmental, health and safety precautions to protect EMCON employees, all other workers, and the public.

2. Comply with all applicable Federal, State, municipal, local, and any other applicable occupational safety and health regulations and requirements issued to imposed by any governmental authority (including, but not limited to, Title 29, Code of Federal Regulations Parts 1910 and 1926).

3. The Contractor agrees to monitor working conditions at all times during construction and, as necessary, to provide appropriate protective clothing, equipment and facilities for his personnel, and/or to establish workplace procedures to ensure their safety.

4. If, at any time, the Owner or the Engineer is apprised of a safety hazard which demands immediate attention because of its high potential for harm to public travel, persons on or about the work, or public or private property, the Owner or the Engineer shall have the right to order such safeguards to be erected and such precautions to be taken as necessary, and the Contractor shall comply with such orders. If, under such circumstances the Contractor does not or cannot immediately put the work into proper and approved condition, or if the Contractor or his representative is not upon the site so that he can be notified immediately of the insufficiency of safety precautions, then the Owner may put the work into such a

condition that it shall be, in his opinion, in all respects safe, and the Contractor shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the Owner. The fact that the Owner or the Engineer does not observe a safety hazard or does not order the Contractor to take remedial measures, shall in no way relieve the Contractor of the entire responsibility for any costs or claims for loss, damage or injury, by or against any party sustained on account of the insufficiency of the safety precautions taken by him or by the Owner acting under authority of this Section.

5. It is the responsibility of the Contractor to take appropriate safety precautions to meet whether conditions of hazard may be present during the performance of the work, whether reasonably foreseeable or not. The Contractor is altered to the fact that it shall be his sole responsibility to anticipate and provide such additional safety precautions, facilities, personnel, and equipment as shall be necessary to protect life and property from whatsoever conditions of hazard are present or may be present.

6. The Contractor also agrees that EMCON may immediately stop Contractor's work if the Contractor violates any applicable Federal, State, municipal or local, or any other rules regulations and requirements, or other contract terms and conditions regarding environmental safety and health.

7. EMCON may conduct periodic inspections of Contractor operations and document violations. Documented violations will be considered in evaluation of Contractor's performance. The EMCON inspection program in no way relieves the Contractor of the obligation to maintain its own safety program and conduct safety inspections as required by Federal, State, municipal, local and any other rules, regulations, or requirements.

1.4 WASTE HANDLING OPERATIONS

A. Available data indicate that the LNAPL and excavated soils to be removed from the site are hazardous wastes (RCRA regulated) and TSCA-regulated wastes. The requirements of this section apply to the Contractor performing hazardous waste-type activities. This includes operations that pose a potential or reasonable possibility for employee exposure to hazardous waste/chemical contaminants during site investigations, cleanup operations, abatement, or hazardous substance removal work (remedial actions).

1. Training: Contractor personnel conducting work at this project site shall have received training in accordance with 29 CFR 1910.120(e). Documentation of the above-mentioned training must be maintained at the job site and be available for EMCON inspection.

2. Medical Surveillance: Contractor employees must be enrolled in a medical surveillance program prior to performing hazardous waste operations, in accordance with 29 CFR 1910.120(f). Upon request, the Contractor must provide

documentation of medical surveillance for project employees. EMCON does not provide medical surveillance examinations for Contractor employees.

3. Site-Specific Health and Safety Plan: The Contractor shall prepare and implement a written site-specific/task-specific health and safety plan. This plan must meet the requirements of 29 CFR 1910.120(b)(4) – Site-Specific Health and Safety Plans. This plan shall also include safety procedures and guidelines under OSHA 29 CFR 1926 for the work involving subsurface excavation, scraping, and removal of contaminated soils, specifically procedures and guidelines in accordance with 29 CFR 1926.650-654. In addition, the plan shall include a contingency to comprehensively cover safety procedures and guidelines for encountering contaminated soils. The plan shall be submitted for review by the Engineer and must be, at a minimum, as stringent as the Engineer's Site Safety Plan. However, this review and conformance with this plan by the Contractor in no way relieves the Contractor of his responsibility for safety during all work. Before the Contractor begins work at the site, the Site Safety Plan must be distributed to all personnel and discussed with them.

1.5 PERSONNEL PROTECTIVE EQUIPMENT

A. Contractor personnel must obtain and utilize appropriate personal protective equipment for the work performed in accordance with applicable State and Federal OSHA standards. This includes, but is not limited to, the use of eye protection, foot protection, respiratory protection, protective clothing, hearing protection, and head protection:

1. Eye Protection – Safety eyewear meeting ANSI Z87.1 shall be worn in areas designated as "Eye Protection Required," and on all jobs where a potential injury to the eyes is possible, whether or not the area is posted. Special eye protection and/or face protection will be worn when applicable.

2. Foot Protection – Affected employee(s) shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. Safety shoes and boot which meet the ANSI Z41 standard, shall be provided when impact and/or compression hazards exist. Soft shoes including, but not limited to, tennis shoes, athletic shoes, moccasins, sandals, and open-toed or open-heeled shoes shall not be worn.

3. Respiratory Protection – Appropriate MSHA/NIOSH-approved respiratory protective devices must be worn when applicable State and/or Federal action levels or permissible exposure levels are exceeded. Contractor must have fully implemented a respiratory protection program meeting the requirements of Title 29, Code of Federal Regulations, Section 1910.134/1926.103, prior to issuing and using respiratory equipment. Contractor shall supply and maintain appropriate air monitoring and respiratory protection equipment in areas expected to pose such hazards.

4. Protective Clothing – Such as suits, aprons, boots or gloves, shall be worn where there is a hazard to the body through dermal contact with chemicals, dusts, heat or other harmful agents or conditions.

5. Hearing Protection (muffs and/or plugs) – Must be worn in all areas posted to indicate high noise level or where Contractor employees are exposed to noise levels in excess of the OSHA permissible exposure limit.

6. Hard Hats – Will be worn in all areas where there is a danger of impact to the head or hazard from falling or moving objects.

7. Contractor will issue or cause to be issued prior to commencing the job, all necessary personal protective equipment and air monitoring equipment to all its agents and employees, together with full instructions and training on the use of said equipment.

8. Contractor will meet all Federal, State, municipal, and local requirements for protective clothing and equipment. Contractor will properly supervise all its agents and employees to ensure protective clothing and equipment is used in conformance with applicable rules and regulations.

9. Site Safety Briefing – Prior to the commencement of work, a site briefing shall be conducted by each supervisor/site safety person identifying the hazards associated within the scope of work, including a review of the site safety plan.

1.6 CONFINED SPACE ENTRY

A. Contractor must comply with applicable State and Federal OSHA confined space entry requirements if Contractor's employees enter confined spaces; as defined by Title 29, Code of Federal Regulations, Section 1910.146.

B. If Contractor or any other employee must enter a confined space (tank, vat, pit, sewer, etc.) as a result of Contractor's operations, Contractor(s) must conduct the entry in accordance with applicable State and Federal OSHA regulations.

C. To ensure the safety of Contractor personnel during entry into confined spaces (such as tanks, manholes and sewers, vessels, etc.) where access and egress is difficult and the possibility of dangerous air contamination exists, Contractor shall have a written confined space entry program that shall include, but not limited to, the following:

1. Only persons trained in confined space entry will be allowed to enter a confined space or participate in any way on a confined space entry team.

2. Furnish atmosphere monitoring equipment and perform appropriate space monitoring which includes, but is not limited to, testing for oxygen deficiency, explosive gas levels (%LEL), and potential toxic air contaminants (if applicable).

3. Complete a entry permit.

4. Furnish the appropriate retrieval devices and ventilation equipment as needed.

1.7 USE OF HAZARDOUS MATERIALS — HAZARD COMMUNICATION

A. The Contractor personnel shall not bring any hazardous materials (as defined by OSHA onto the site premises unless accompanied by a Material Safety Data Sheets (MSDS). MSDS' must be maintained at the job site.

B. Contractor shall ensure all containers of hazardous materials are labeled in compliance with OSHA regulations with the product name, appropriate hazard warnings, and the name and address of the manufacturer.

C. Contractor shall ensure its employees are trained in the safe handling and use of hazardous materials in accordance with Title 29 CFR 1910.1200 – Hazard Communication.

D. Contractor shall ensure that all applicable employees are medically qualified (as defined by OSHA) to perform the work assigned.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01502

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish all labor, equipment, and materials required for environmental protection during and as the result of construction operations under this Contract except for those measures set forth in other provisions of these Specifications. Environmental protection requires consideration of air, water and land, and involves noise and solid waste management as well as other pollutants.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01300 - Submittals

C. Section 01500 – Construction Facilities and Temporary Controls

1.3 APPLICABLE REGULATIONS

A. In order to prevent environmental pollution and to provide for environmental protection arising from construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws and regulations concerning environmental protection, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

1.4 SUBMITTALS

A. Implementation Plan

Prior to commencement of the work, the Contractor shall:

1. Submit in writing his plans for implementing this Section for environmental protection.

2. Meet with the Engineer to develop mutual understandings relative to compliance with the provisions of this Section and administration of the environmental protection program.

B. Erosion Sedimentation Plan

1. The Contractor shall submit to the Engineer for approval, a detailed erosion and sedimentation plan sufficiently in advance of construction so as not to delay initiation

of work. The plan shall include location and construction details of the Contractor's proposed dikes, basins, etc. In addition, the Contractor shall provide and submit his control measures for stockpile material. No site work may commence without an approved plan. Plan should conform to New York State Guidelines for Urban Erosion and Settlement Control.

C. Dust Control Plan

1. The Contractor shall submit to the Engineer for approval a detailed Dust Control Plan. The plan shall include the dust control equipment and activities that the Contractor will provide and how rapidly they can be deployed when needed. The plan shall be developed in consideration of the objectives for dust control in Section 3.5.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials shall be in accordance with the Contractor's plan for environmental protection.

2.2 MATERIALS

A. Silt Fence

B. Hay

C. Snow Fences

D. Burlap

PART 3 EXECUTION

3.1 PROTECTION OF LAND RESOURCES

A. General – It is intended that the land resources within the project boundaries and outside the limits of permanent work performed under this Contract be preserved in their present condition, or be restored to a condition after completion of construction, that will appear to be natural and not detract from the appearance of the project. The Contractor shall confine his construction activities to areas defined on the Specifications except with written approval of the property owners and the Engineer.

B. Prevention of Landscape Defacement – Limits of working areas include areas for storage of construction material, and shall be cleared in a manner which will enable satisfactory restoration and which will not affect the environment during or after the construction period. The Contractor shall not enter beyond the working limits of the working area except with written approval of the Engineer and Owner.

C. Location of Storage – The location of areas for storage of the Contractor's materials required temporarily in the performance of the work, shall be within the limits of the working area and shall require written approval of the Engineer prior to use. The preservation of the landscape shall be an imperative consideration in the selection of all such sites. Where temporary structures are constructed on sidehills, the Engineer may require cribbing to be used to obtain level foundation. Benching or leveling of earth may not be allowed, depending on the location of the proposed facility.

D. Post-Construction Cleanup or Obliteration – The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction. The disturbed areas shall be paved as required.

3.2 PROTECTION OF WATER RESORUCES

A. General – The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids, or harmful materials. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State, County, and Municipal laws concerning pollution of rivers, streams and impounded water. All work under this Contract shall be performed in such a manner that objectionable conditions will not be created in streams through, or bodies of water adjacent to, the project area.

B. Erosion – Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity-producing materials are present, be held in suitable sedimentation basins or shall be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures such as berms, dikes, drains, or sedimentation basins, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum.

C. Apply temporary mulch on denuded ground immediately after rough grading is completed. This shall apply to all areas not subject to appreciable traffic during construction, even those that are to receive some form of construction later if ground is to be exposed 30 days or more.

D. Spillages – At all times of the year, special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and cement and surface drainage from entering public waters. Should a spillage into the public waters occur, the Contractor shall immediately notify the proper authorities. The Contractor will be responsible for any and all costs associated with the cleanup of spillages.

E. Washing and Curing Water – Water used for cleaning and other wastewaters shall not be allowed to enter the sewers.

F. Disposal – Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., in areas adjacent to streams or other waterways shall be strictly prohibited. If any waste material is dumped in an unauthorized area, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed of as specified before herein and replaced with suitable fill material, compacted and finished with topsoil, all at the expense of the Contractor.

3.3 PROTECTION OF FISH AND WILDLIFE

A. The Contractor shall at all times perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise disturb native habitat adjacent to the project area which, in the opinion of the Engineer, are critical to fish or wildlife. Fouling or polluting of water will not be permitted. Wash waters and wastes shall be processed, filtered, ponded, or otherwise treated prior to their release into streams or other waterways. Should polluting or fouling the water occur, the Contractor shall immediately notify the proper authorities. The Contractor will be responsible for any and all costs associated with the cleanup of polluted or fouled waters.

3.4 MAINTENANCE

A. The Contractor shall dispose of all discarded debris, and waste from any source whatsoever, in a manner approved by the Engineer. Toilet facilities shall be kept clean and sanitary at all times. Services shall be performed at such a time and in such a manner to least interfere with the operations. Services shall be accomplished to the satisfaction of the Engineer.

B. The Contractor shall frequently remove materials no longer required on the site, such as forms, temporary structures and similar materials and equipment so that, at all times, the site, access routes to the site and any other areas disturbed by his operations shall present a neat, orderly, workmanlike appearance.

C. Before substantial completion inspection, the Contractor shall remove all surplus material, falsework, temporary structures, including foundations thereof, plant of any description, and debris of every nature resulting from his operations, and put the site in a neat, orderly condition; and restore all areas which have been used for storage of materials and equipment, and all areas which have been disturbed by his operations, to their original condition or to a condition satisfactory to and approved by the Engineer.

3.5 DUST CONTROL

A. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent access roads, waste areas, borrow areas, excavated materials stabilization processing and all other work areas within or without the project boundaries free from dust which would cause a hazard or nuisance to others or contaminate surface water.

B. The Contractor shall, at his own expense, keep dust under control at all times on all roadways and other areas adjacent to the work or on the site of the work by the use of at least once a day and at other times when directed, including after working hours, Saturdays, Sundays and holidays, of self-loading motor sweepers, vacuums, spraying water, and/or a combination of these methods.

C. Approved temporary methods of dust control consisting of motor sweepers, vacuums, spraying water, and a combination of these methods, will be permitted to control dust. Spraying water shall be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient suitable equipment on the job to accomplish this. Dust control shall be performed daily as the work proceeds and whenever a dust nuisance or hazard occurs.

D. All areas undergoing excavation, grading, filling, cutting or subject to other dust-producing activities by vehicles should be subjected to dust-inhibiting practices. The use of liquid palliatives and penetrating asphaltic materials will not be permitted. Anchored mulch (asphaltic binders will not be permitted) shall be applied to non-traffic areas subject to blowing as a temporary treatment.

3.6 NOISE CONTROL

A. The Contractor shall use every effort and means possible to minimize or eliminate noise caused by his operation which the Engineer may consider objectionable. The Contractor shall provide working machinery, designed to operate with the least possible noise. The Contractor is responsible for maintaining compliance with all applicable noise regulations and all State and local noise ordinances.

3.7 PESTICIDES AND HERBICIDES

A. Where pesticides or herbicides are to be used in construction operations, data relative to restrictions on the type or types of material available and approved for application to control or eradicate vegetation, insects or organisms shall be obtained from the State or County agriculture departments. The amount of pesticide applied shall be limited to the recommended dosage. Application equipment shall provide an even distribution of the materials in accordance with the approved rate in terms of pounds per acre. Materials delivered to the site shall be covered and protected from the elements. Contents of the containers shall not be exposed. Application equipment or empty containers shall not be rinsed and discharged to the natural drainage channel. The rinse water shall be disposed of in a manner that would not cause pollution of surface or groundwater. Should pollution of the surface or groundwater occur, the Contractor shall immediately notify the proper authorities. The Contractor will be responsible for any and all expenses associated with the cleanup of the pollution of the surface or groundwater.

3.8 PROHIBITED CONSTRUCTION PROCEDURES

A. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and floodplains is strictly prohibited. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

B. The Contractor shall, at a minimum, be strictly prohibited from performing the following construction procedures:

1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters, or at unspecified locations.

2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, any wetlands or surface waters.

3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors or any wetlands.

4. Damaging vegetation adjacent to, or outside of, the access road or the right-of-way.

5. Disposal of trees, brush and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

6. Permanent or unspecified alteration of the flow line of any stream.

7. Open burning of project debris.

8. Location of storage stockpile areas in environmentally sensitive area.

9. Disposal of excess or unsuitable excavation material in wetlands or floodplains even with permission of the property owner.

10. Discharging silty or muddy water from dewatering operations into natural water courses.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout Procedures

B. Final Cleaning

C. Project Record Documents

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 01500 – Construction Facilities and Temporary Controls

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Provide submittals to Engineer and Owner that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Submit final Release of Lien, as well as Partial Release of Liens for payment.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean site, sweep paved areas, rake clean landscaped surfaces.

C. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 PROJECT RECORD DOCUMENTS

A. The following Project Record Documents will be submitted to the Engineer:

1. Contract Drawings with as-built modifications recorded

2. Specifications

3. Addenda

4. Change Orders and other Modifications to the Contract

B. Specifications – Legibly mark and record at each relevant specification section a description of actual products installed, including the following:

1. Substitutions or alternates utilized.

2. Changes made by Addenda and Modifications.

C. Contract Drawings – Legibly mark each item to record actual construction including:

1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.

2. Field changes of dimension and detail.

D. Submit documents to Engineer within 14 days of the Substantial Completion Inspection.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete and maintain the work of lowering and control of groundwater levels, hydrostatic pressures, and surface water to permit all excavations, muck excavations and construction to be performed as shown, specified or required. The control of all surface water, temporary drainage, ice, and snow, shall be considered as part of this work. The Contractor shall correct all damage resulting from inadequacy of the dewatering system or from flooding of the construction site from other causes.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01300 – Submittals

C. Section 01500 – Construction Facilities and Temporary Controls

D. Section 01502 – Environmental Protection

E. Section 02220 – Excavation

F. Section 02223 – Backfill and Fill

1.3 SUBMITTALS

A. Prior to starting the work, the Contractor shall submit a plan of the proposed dewatering systems prepared by a specialist having at least 5 years experience in the field of dewatering. The plan shall indicate the means of removing water, the filter packs or screens to minimize collection of fine solids, the location(s) of collection systems, and the arrangement of conveyance piping. The dewatering shall be coordinated with the shoring and bracing, and other excavation work. Any review or comments by the Engineer shall not relieve the Contractor of his responsibility for dewatering.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials shall conform to those included in the Contractor's plan for dewatering.

PART 3 EXECUTION

3.1 REQUIREMENTS

A. The Contractor shall comply with the following minimum requirements for dewatering:

1. The static water level within the excavation shall be drawn down a minimum of 1 foot below the bottom of the excavation or to the clay layer below the fill so as to maintain the undisturbed state of the foundation soils and allow the installation of the structure and placement of backfill to the required density.

2. The pumping water well(s) or trench(es) shall be provided with filters or screens to prevent loss of fine materials. Water that is pumped out shall be passed through an oil/water separator and sedimentation tank before treatment. No injection of water to areas outside the excavation will be allowed.

3. The system used shall not cause settlement damage to adjacent structures. The Contractor shall carry out the work by the use of other methods which will not endanger adjacent structures; all such work shall be done at the Contractor's expense. The Contractor shall be responsible for correcting, as necessary, any adverse effects his dewatering may have on existing buildings, wells, utilities, and water courses at no additional cost to the Owner.

4. Pumping shall be carefully controlled. The Contractor shall observe the elevation of the groundwater in the trench and shall control the pumping as necessary.

5. The Contractor shall provide sufficient standby equipment for immediate operation. This equipment shall be capable of maintaining dewatering on a continuous basis in the event that all of, or part of, the system should become inadequate or fail, including failure by a power outage.

6. The release of groundwater to its static level shall be performed in a manner as to maintain the undisturbed state of the soils, prevent disturbance of the backfill and prevent flotation or movement of the structures.

7. There shall be NO discharge of silty, muddy or polluted water from construction or dewatering operations to a natural water course. The Contractor shall ensure that all waters are treated and discharged to the BSA sanitary sewer system.

8. The Contractor is responsible for all permits and approvals associated with construction dewatering and temporary surface water control.

END OF SECTION

SECTION 02145

EXCAVATED RCRA/TSCA MATERIALS LIQUID STABILIZATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the on-site work of stabilizing moisture of excavated RCRA/TSCA materials so that they will pass the Paint Filter Test before transportation for off-site disposal.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01300 - Submittals

C. Section 01400 - Quality Control

1.3 SUBMITTALS

A. The Contractor shall prepare a pre-work Excavated TSCA/RCRA Materials Liquid Stabilization Plan (reference also section 01300 - Submittals). This plan shall indicate the proposed equipment to be utilized, the equipment and stabilization agent storage locations on site, a description of the stabilization processing sequence from removal to stabilization to loading for transportation off-site, measures to be used to control dust and runoff from stockpiles and the stabilization process, and testing to be done.

1.4 DESCRIPTION OF EXCAVATED MATERIALS

A. The RCRA/TSCA materials to be excavated consist of general fill underlain by ash fill and organic silt, with approximate thicknesses of 1 foot, 2 feet and 1 foot, respectively. The perched groundwater is generally in the organic silt layer but is probably in the ash fill layer in some locations. Therefore, the organic silt layer and a portion of the ash fill layer will probably require stabilization, even after dewatering is implemented.

PART 2 PRODUCTS

2.1 MATERIALS

A. Commercial Portland Cement from an uncontaminated source shall be used as the stabilizing agent.

PART 3 EXECUTION

3.1 GENERAL

A. Storage or stockpiling of excavated material, Portland Cement, and stabilized materials and the processing operation shall be managed so as not to result in dust or contaminated runoff problems.

B. Portland Cement shall be added as necessary to produce stabilized material that will pass the Paint Filter Test prior to loading for off-site disposal.

C. Stabilized materials that fail the Paint Filter Test shall be retreated to pass the Paint Filter Test.

3.2 FIELD QUALITY CONTROL

A. Paint Filter Tests (USEPA Method 9095A) shall be run as necessary on representative samples to ensure that each materials placed in each 40 cu. yd. dump trailer pass the Paint Filter Test.

END OF SECTION

SECTION 02201

GROUNDWATER TREATMENT AND DISPOSAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Related Sections

B. Description of Work and Site Conditions

C. Submittals

D. Products

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01025 - Measurement and Payment

C. Section 01300 - Submittals

D. Section 01502 – Environmental Protection

E. Section 02140 – Dewatering

F. Section 02203 - LNAPL Transportation and Disposal

1.3 DESCRIPTION OF WORK AND SITE CONDITIONS

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to treat and dispose of water removed from excavations during dewatering operations. The Engineer will obtain permits/approvals from the Buffalo Sewer Authority (BSA), and conduct effluent testing as required by BSA. The Contractor shall provide transportation and disposal of LNAPL, in accordance with Specification Section 02203.

B. Based on previous site investigations, water removed from the excavation is expected to contain PCB-containing LNAPL and lead. BSA's discharge criteria (Maximum Monthly Average) for these contaminants are Non-Detect for PCBs (using USEPA Method 608, with a detection limit of 0.065 ug/l) and 430 ug/l for lead (using USEPA 200 series methods). Therefore, treatment should consist of oil/water separation, filtration and dual carbon adsorption (adsorbers in series).

C. The LNAPL layer in the area to be excavated is very thin to non-distinct. LNAPL and water PCB concentrations have not been measured; however, soils removed from the area to be excavated from an Interim Remedial Measure contained PCB concentrations ranging from 0.027-180 ppm. It has been estimated that approximately 880 gallons of LNAPL may be recovered; using approximately 10,800 sq. ft. for the area to be excavated would yield an average LNAPL thickness of 0.13 inches over this area.

D. Groundwater total lead levels measured in 10 monitoring wells around the entire Parking Lot No. 4 ranged from 5-250 ug/l, but concentrations in the excavated area could be higher and require treatment. Five of the wells contained dissolved (filtered sample) lead at concentrations ranging from 1-5 ug/l.

1.4 SUBMITTALS

A. Groundwater Treatment and Disposal Operations Plan is a pre-work submittal. The plan shall indicate the on-site treatment and disposal equipment to be provided, the locations of treatment and disposal facilities, and a description of operations, monitoring and contingencies to meet the BSA effluent requirements. The plan shall also indicate how LNAPL will be separated and stored on site. Storage shall comply with the TSCA requirements (40 CFR 761.65).

B. Unit price (per day) bid price, assuming treatment at a maximum of 50 gpm, as per Specification Section 01025 - Measurement and Payment.

C. Two (2) copies each of metering records and associated records.

PART 2 PRODUCTS

A. Groundwater treatment and disposal shall be performed in accordance with the Contractor's Groundwater Treatment and Disposal Operations Plan, as approved by the Engineer.

PART 3 EXECUTION

A. Not used.

END OF SECTION

SECTION 02203

LNAPL TRANSPORTATION AND DISPOSAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish, or subcontract, all labor, materials, equipment, tools and appurtenances required to transport and dispose of LNAPL produced from oil/water separation in the groundwater treatment plant. Disposal shall be off-site incineration.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01025 - Measurement and Payment

C. Section 01300 - Submittals

D. Section 01502 – Environmental Protection

E. Section 02140 – Dewatering

1.3 DESCRIPTION OF LNAPL

A. Light Non-Aqueous Phase Liquid (LNAPL) shall be transported and disposed off-site at a GM-approved permitted facility as a TSCA waste, containing PCBs, requiring incineration.

1.4 SUBMITTALS

A. An LNAPL Transportation and Disposal Plan shall be prepared as a pre-work submittal. The plan shall indicate any subcontractors utilized and the location of incineration disposal facilities.

B. Two (2) copies each of manifest record and associated transportation and disposal records.

PART 2 PRODUCTS

A. Not used.

PART 3 EXECUTION

3.1 TRANSPORTATION

A. Transportation of LNAPL shall be done in accordance with Federal and State requirements for manifesting (40 CFR 761.207, 208 and 6 NYCRR 372) and transportation (49 CFR 107, 171, 172 and 178 and 6 NYCRR 364).

3.2 DISPOSAL

A. Disposal of LNAPL shall be by incineration at a facility that meets the requirements of hazardous waste management facilities (40 CFR 761.70 and 6 NYCRR 373).

B. A Certificate of Disposal shall be provided, in accordance with 40 CFR 761.218.

END OF SECTION

SECTION 02220

EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of excavation and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified or required.

B. The Contractor shall locate all existing utilities in work areas prior to commencing any excavation activities.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01502 – Environmental Protection

C. Section 02140 – Dewatering

D. Section 02145 - Excavated Materials Liquid Stabilization

E. Section 02201 - Groundwater Treatment and Disposal

F. Section 02223 – Backfill and Fill

1.3 DEFINITIONS

A. Excavation shall mean the removal from place of all materials and shall include soil, structures above and below ground, rock, pavements, topsoil, demolition waste material, boggy waste, rubbish, tree stumps, boulders, logs, ashes, cinders or organic material such as peat, humus or organic silt.

1.4 PROTECTION OF PEOPLE AND PROPERTY

A. The Contractor shall plan and conduct his operations so as to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, protect the structures to be installed, and provide safe working conditions.

B. Excavations, except as specified hereinafter, shall be adequately sheeted and braced. Where the installation of sheeting is impractical or might cause damage, as a result of, but not limited to, vibration, settlement or lateral movement, the Contractor shall utilize other methods.

C. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction, provided that:

1. Hazards, such as described hereinbefore, do not exist in the proximity of the excavation.

2. Work is not in streets or other paved, landscaped or improved areas.

3. Work can be restricted to the land provided for the Contractor's use.

4. Sheeting and bracing are not specifically required by the Contract Documents.

5. The Contractor shall submit a certification by a Professional Engineer licensed in the State, indicating the maximum slope of the sides of the excavation proposed, and that said slopes will be stable under all normal anticipated weather conditions for the period that the excavation will be open. Such certification shall be based on consideration of the options available to the Contractor such as dewatering, construction equipment, and proximity of spoil area. Any review or comments by the Engineer shall not relieve the Contractor of his responsibility arising from the excavation.

D. In cases where excavation without sheeting and bracing is not permissible solely because of protection of workmen, trench boxes may be used. Such use shall be certified by the Professional Engineer retained by the Contractor.

E. The Contractor shall not stockpile any material without the Engineer's approval.

F. Stockpiles that are approved by the Engineer shall be carefully placed and the surrounding area shall be protected by placement of hay or straw bales, or an equivalent erosion control structure in accordance with the New York Guidelines for Urban Erosion and Sediment Control.

G. The Contractor shall comply with all appropriate OSHA requirements as specified in the Engineer's site-specific Health and Safety Plan.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 LIMITS OF EXCAVATION

A. Excavation shall be as directed by the Engineer for contaminated materials removal and to provide sufficient clearance for the construction and inspection of work.

B. Excavation carried below the depths specified or required, without written directions from the Engineer, shall be refilled to the proper grade with thoroughly compacted subgrade fill material; all work of this nature shall be at the Contractor's expense.

3.2 STORAGE AND DISPOSAL

A. Excavated materials shall be placed directly into lined dump trailers.

B. The Contractor shall drain or stabilize excavated materials moisture prior to loading for off-site disposal. Liquid effluents from draining shall be conveyed to the Groundwater Treatment Plant (see Specification Section 02201). Excavated materials moisture stabilization, either after draining or without draining, shall pass the Paint Filter test prior to loading for off-site disposal (see Specification Section 02145).

3.3 EXCAVATION INSTRUCTIONS

A. No excavation shall commence until the Contractor has staked out and surveyed the proposed work.

3.4 FIELD QUALITY CONTROL

A. The depth and limit of excavation shall be in accordance with these Specifications and the Engineer's direction and will be verified during the course of excavation by the Engineer.

END OF SECTION

SECTION 02223

BACKFILL AND FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of backfill and fill, including backfill, subgrade fill placement, embankments, grading, and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified or required.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 01300 - Submittals

C. Section 01400 - Quality Control

D. Section 02140 – Dewatering

E. Section 02220 – Excavation

1.3 SUBMITTALS

1.4 DEFINITIONS

A. Backfill shall consist of furnishing material, if necessary, and placing, compacting and grading material within excavated areas.

B. Subgrade fill placement shall consist of furnishing material and placing and compacting material within excavated areas.

1.5 PROTECTION OF PEOPLE AND PROPERTY

A. Protection of people and property shall conform to the requirements of Section 02220 – Excavation.

PART 2 PRODUCTS

2.1 MATERIALS — GENERAL

A. All backfill and fill materials, unless otherwise specified, shall consist of suitable selected and approved clean well graded granular soil from stockpiled material.

B. All subgrade fill materials, unless otherwise specified, shall consist of clean, non-plastic, well drained granular soil from stockpiled material or from borrow areas. The subgrade fill material shall meet the approval of the Engineer and the requirements of USCS Classification GW, GP, GM, GC, SW, SP, SM.

C. The maximum particle size shall be no larger than one-half the layer thickness.

D. Because the final use of the backfilled area will be as a paved parking area, a minimum density of 95 percent of maximum dry density shall be attained, as determined by Modified Proctor Test (ASTM D1557), unless otherwise specified.

E. No frozen earth shall be used for backfill or subgrade fill. All backfill and subgrade fill materials shall be free from all perishable and objectionable materials.

F. Backfill materials for piped utilities shall be natural soil, not containing deleterious material, refuse, rubble, muck, metal, wood, etc., and no particle greater than 6 inches in size can be used. The backfill shall be compacted in 12-inch lifts.

G. All required fill materials shall be substantially free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. It shall not contain granite blocks, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted to the specified permeability and/or density. Snow, ice, and frozen soil shall not be permitted.

2.2 SUBGRADE FILL

A. Materials used as subgrade fill shall be provided by the Contractor from an off-site borrow source. The Contractor shall provide appropriate documentation that the proposed fill material passes the following tests: grain size, Modified Proctor, and natural moisture content. Additionally, the Contractor shall not place fill prior to the completion of testing, and only after testing with the approval of the Engineer. Soil from a new source location shall not be included in the work prior to the written acceptance of testing by the Engineer. Depending on the results, the Engineer shall accept or reject the soil or require further testing. The Contractor shall not proceed with construction using this material, prior to acceptance by the Engineer. Should unstable soils be encountered, torvane and pocket penetrometer testing may be performed by the Engineer, and no further material shall be placed in the area in question without the approval of the Engineer.

B. The Contractor is to designate the intended source facility(ies) for the subgrade fill material required to be provided by these Specifications. The Contractor is to provide a copy of the valid mining permit and certification by the holder of the permit that adequate subgrade fill quantities exist.

2.3 TESTING

A. The Contractor shall submit to the Engineer for approval suitable evidence that any soils proposed for subgrade fill are appropriate. This information is to be provided for each individual subgrade fill source or when in the opinion of the Engineer the material is different in any way from the originally tested and approved material. This evidence shall include, but not necessarily be limited to, the following testing:

1.	Gradation	ASTM D422
2.	Atterberg Limits	ASTM D4318
3.	Modified Proctor	ASTM D1557

B. The Contractor shall not proceed with backfill or subgrade fill, borrow, select soil, subangular stone, drainage blanket material sand and/or subsoil operations until the Engineer has approved the proposed material.

C. If in the opinion of the Engineer the Contractor's proposed soil is unsuitable for the proposed application, the Contractor shall submit the above evidence for soil of another type or from another source for consideration by the Engineer.

PART 3 EXECUTION

3.1 PRECAUTIONS

A. Subgrade fill placement shall not:

1. Be performed with frozen materials.

2. Be placed on snow that has a thickness greater than a tenth of an inch.

3. Be placed on ice. Ice shall be defined as frozen water on the surface of in situ soils or previously placed material.

B. Subgrade fill placement will be permitted on frozen underlying layers.

3.2 BACKFILLING

A. Backfill shall not be placed until the structure, pipeline, or other construction component has been inspected in place and approved.

B. Unless otherwise directed, excavations shall be backfilled as soon as possible after structures are constructed, pipes are laid and the work is inspected, tested as required and accepted, and permission to backfill has been given by the Engineer. Immediately prior to backfilling, all rubbish, debris, forms and similar materials shall be removed from the excavations.

C. Backfill shall be brought up evenly on each side of structures, and for their full length. The thickness of each compacted layer shall not exceed that specified under Subpart 2.1 unless specified otherwise or as directed by the Engineer. Care shall be taken to ensure that no damage is done to structures or protective coatings thereon.

D. Where sheeting is withdrawn, all cavities left thereby shall be filled with select soil, hosed or tamped in place so as to fill all voids thoroughly.

3.3 TRENCH BACKFILL PROCEDURES

A. Trenches shall be backfilled by hand to a depth of not less than 12 inches above the top of the pipe, for the full width of the trench. Such backfill shall be uniformly placed in 6-inch maximum layers. Care shall be taken not to damage the pipe. Each layer shall be hand tamped and compacted before the next layer is placed. After the trench has been backfilled to 12 inches above the top of the pipe, backfill may then be placed and compacted in 12-inch lifts.

3.4 COMPACTION OF BACKFILL AND SUBGRADE FILL

A. All backfill and subgrade fill are to be compacted. The density of all backfill and subgrade fill shall be at least equal to that shown or specified. The moisture content of the backfill and subgrade fill material shall be such that proper compaction shall be obtained. Puddling for compacting will not be permitted.

B. Hand-operated plate type vibratory tampers or other suitable equipment may be used in areas not accessible to larger rollers or compactors and to avoid damaging pipes.

3.5 FILLING

A. Areas on which embankments or other fill will be constructed shall be cleared and prepared as for backfilling. Immediately prior to filling, the subgrade shall be proofrolled unless otherwise specified. All unsuitable material as determined by the Engineer shall be removed prior to filling.

B. Fill shall be brought uniformly throughout the area. The thickness of each compacted layer shall not exceed 1 foot unless otherwise specified by the Engineer.

3.6 FIELD QUALITY CONTROL

A. The Contractor is to perform on-site field moisture and density testing on each lift of a 100-foot grid supplied by the Engineer over the entire area of subgrade fill placement. The field density test shall be D2922; the field moisture test shall be D3017.

B. Each on-site moisture density test will be considered to represent a 100-foot x 100-foot area.

C. Any areas not meeting the specified compaction will be reworked or replaced and recompacted and retested until a passing test is achieved at every grid point (at no additional cost to the Owner).

D. On berms or on trench backfill, field density and field moisture testing shall be performed at a frequency of 1 test of each for every 100 linear feet of berm or trench for every lift of fill or backfill.

E. In areas where the degree of compaction is doubtful, or the uniformity of materials is not maintained, additional tests will be made as directed by the Engineer.

F. The Engineer retains the right to perform additional on-site testing at the Owner's cost. The results of such testing are binding and may require the Contractor to perform additional work or reworking of the material at no additional cost to the Owner.

END OF SECTION

SECTION 02519

PARKING AREA REPAIR, PAVING AND STRIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the on-site work of repairing, paving and striping the Parking Area.

1.2 RELATED SECTIONS

A. Section 01000 - Scope of Work

B. Section 02220 – Excavation

C. Section 02223 – Backfill and Fill

1.3 REFERENCES

A. AASHTO M147-65 – Materials for Aggregate and Soil-Aggregate.

B. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12-inch Drop.

D. ANSI/ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.

E. ASTM D4318 – Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

F. New York State Department of Transportation (NYSDOT) – Standard Specifications for Road and Bridge Construction.

1.4 SUBMITTALS

A. Product information on the AC-5 oil, Petromat fabric, sealcoating material, and striping paint proposed to be used.

B. Quality control data for imported subbase material and from asphalt placement.

1.5 DESCRIPTION OF WORK

A. Repairs:

1. Within the existing 7-acre Parking Area, pavement in poor condition shall be repaired. This consists of approximately 4,000 sq. ft. of 4-inch thick asphalt that has cracked and/or settled. The asphalt shall be removed and disposed. Core samples to one (1) foot depth shall be done to determine the adequacy of the subbase material. If subbase material is inadequate (< 8 inches thick), additional subbase material shall be provided and placed. A minimum 2-inch binder course shall be placed to bring the repaired area to existing grade in preparation for paving as discussed in 1.5.B.

2. One (1) collapsed catch basin shall be restored.

B. Paving

1. The existing 7-acre Parking Area shall be repaved by applying AC-5 oil and Petromat fabric over the existing asphalt; applying a 2-inch base coat of asphalt; and applying a 1-inch top coat of asphalt.

2. Paving shall extend as close to the perimeter fencing without removing or modifying the perimeter fencing.

3. The 7-acre Parking Area surface shall be sealcoated one year after repaving and repair.

4. Seventeen (17) storm sewer manholes/catch basins shall be raised to new grade.

C. Striping

1. The Parking Area shall be striped for 768 parking stalls, once after repaving and repair, and a second time after sealcoating the surface one year later.

2. Seventeen (17) handicap parking stalls shall be marked with a painted pavement symbol and handicap parking signs with posts once after repaving and repair, and a second time after sealcoating the surface one year later.

1.6 TIME OF CONSTRUCTION

A. The permanent paving for the roadways and paved areas shall not be placed until the use of heavy equipment is no longer required on the site and until all operations on the site have advanced to a point where no damage to the pavement will result from the Contractor's operations. The use of finished pavement for or during heavy construction operations will not be permitted. Time of construction of permanent paving will be subject to the approval of the Engineer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40°F, or surface is wet or frozen.

B. Comply with paint manufacturer's instructions for application conditions for striping paint.

PART 2 PRODUCTS

2.1 SUBBASE

A. Additional subbase material in the repair areas, if required, shall be crushed stone conforming to Section 304 of NYSDOT Standard Specifications.

2.2 BITUMINOUS CONCRETE

A. The bituminous concrete used shall be composed of a 2-inch binder course in the repair areas and 2-inch binder course and 1-inch top course across the entire Parking Area.

B. The materials for bituminous concrete shall conform to the requirements of Section 403 of the NYSDOT Standard Specifications.

2.3 SEALCOATING

A. A coal tar pitch emulsion shall be used.

2.4 STRIPING

A. Yellow acrylic waterborne paint for striping outside parking areas shall be used.

2.5 HANDICAP STALL SIGNS

A. A 12-inch by 18-inch handicap parking sign, reflectorized, OSHA Standard, with post, shall be provided for each handicap stall.

PART 3 EXECUTION

3.1 SITE PREPARATION

A. The Contractor shall perform all grading necessary in the repair areas to bring the subgrade to lines and grades required for these areas to drain properly.

B. On existing pavement in good condition, a thin layer of AC-5 oil shall be sprayed on and Petromat fabric placed on top and allowed to dry to form a water-tight seal to prevent erosion damage created by freeze/thaw cycles.

3.2 BITUMINOUS CONCRETE

A. After the subbase material has been placed in the repair areas and the AC-5 oil/Petromat fabric has dried in the rest of the Parking Area, the bituminous concrete material shall be laid at an accepted placing temperature.

B. Each course shall be evenly spread as to achieve the required compacted thickness of each respective layer.

C. The bituminous concrete paving shall be constructed according to the methods outlined in the applicable sections found in the NYSDOT Standard Specifications.

3.3 SEALCOATING

A. Sealcoating shall be done one year after paving.

B. Two coats of a coal tar pitch emulsion shall be applied.

3.4 STRIPING

A. A 4-inch wide yellow stripe shall be used.

B. Striping shall be done after paving and again one year later after sealcoating.

C. Handicap areas will be marked twice like striping.

END OF SECTION

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

SAGINAW-BUFFALO SITE

NYSDEC SITE NO. 915152

Prepared for

General Motors Corporation
Worldwide Facilities Group
Environmental Remediation and International Environmental Support

June 17, 1998

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Project 85740-100.000

CONTENTS

TABLES AND ILLUSTRATIONS (Continued)

1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the quality assurance/quality control (QA/QC) measures that will be taken during the collection and analysis of multi-media samples as outlined in the work plan. Procedures for field and laboratory QA/QC and analysis; data reduction; reporting; sample control; and chain-of-custody are outlined in this plan.

Quality assurance objectives are delineated in Section 2.0 and sampling procedures are discussed in Section 3.0. Activities planned that will acquire information requiring quality controlled generation of analytical data include:

- Subsurface soil sampling and characterization;
- Groundwater sampling and characterization;
- Storm sewer sampling and characterization; and
- Data review, validation, and management.

Soil samples will be analyzed for polychlorinated biphenyls (PCBs). Aqueous samples will be analyzed for PCBs, lead and Buffalo Sewer Authority (BSA) required parameters (refer to Section 2.1.2). Analytical protocol is outlined in Section 5.0 of this report.

2 QUALITY ASSURANCE OBJECTIVES

The primary objective of the QA program for this project is to 1) maintain the evidentiary value of the information produced and 2) insure that field investigations, laboratory analysis, and reports are carried out in accordance with approved protocols. The QA Officer for the project, Kenneth C. Malinowski, Ph.D., is responsible for reviewing data to ensure compliance with protocols and that data is complete, representative, compliant, usable, and comparable. The quality of data generated by sampling, monitoring or analysis is defined in terms of the following:

Precision and Accuracy

The objectives for precision and accuracy are indicated in Section 10.0. Results of field and laboratory quality control samples are evaluated against approved criteria which measures the precision and accuracy of a given measurement system.

Duplicate analyses are conducted at a minimum rate of ten percent for batch analyses of ten or more samples or at least one sample per every batch if batches are less than ten. Statistics are calculated for determinations of analytical precision as described in Section 10.0.

Accuracy is monitored by the analyses of accepted reference samples (either reference control samples, spiked control samples or surrogate spikes). The use of reference samples is fully described in Section 10.0.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions. Naturally, the amount of valid data obtained for this study is expected to be virtually complete, based on the use of published sampling and analytical methods. When comparing the amount of valid data obtained to that of a correct, normal condition, deviations may arise that are a result of the sample matrix. For instance, organic analysis requires an extraction and the proposed method may not fully recover the analytes of interest from the matrix. Dilutions may be necessary to reduce the effect of non-target species which extract with the target ones. These dilutions will raise detection limits above those for correct normal conditions. If this in fact occurs, the QA Officer will

review the body of data to provide assurance that the data is adequate for the intended use.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic or environmental condition. By way of the approved work plan, the frequency and location of sampling locations and method of sample acquisition have been designed such that data obtained will be considered representative of site conditions.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. The use of published sampling and analytical methods, standard reporting units, and a program executed in accordance with this QAPP will aid in ensuring this comparability.

3 SAMPLE CONTROL PROCEDURES/CHAIN-OF-CUSTODY

Sample control consists of maintaining sample integrity, providing adequate documentation of all sampling procedures, avoiding sample cross-contamination, and ensuring proper sample custody. Sample control and chain-of-custody procedures are described in the following sections.

3.1 Maintenance of Sample Integrity

All sample containers will be pre-cleaned by the analytical laboratory according to the procedures specified in the USEPA's "Specifications Guidance for Obtaining Contaminant-Free Sample Containers" (April, 1990) or certified clean by the manufacturer providing sample containers. The laboratory will provide manufacturer's certificates attesting to same.

3.2 Field Data and Information Acquisition

The sampler's field records will contain sufficient information such that someone can reconstruct the sampling situation without reliance on the collector's memory. Entries in the field records will include the following:

- Name and address of project;
- Name of sampler;
- Name of others present;
- Location of sampling and address;
- Date and time of collection;
- Type of sample;
- Description of sampling point;
- Quantity of sample collected;

- Parameters requested for analysis;
- Type of sample container used;
- Preservative(s) used;
- Filtering;
- Sample collection procedure and equipment;
- Well evacuation procedure and equipment;
- Sample layering;
- Well specifics such as static water level, depth, and volume purged;
- Sample identification number(s);
- Field observations;
- Pertinent weather factors such as temperature, wind direction, and precipitation; and
- Any field measurements made such as pH, etc.

3.3 Equipment Decontamination/Preparation

All sampling equipment that comes in direct contact with samples will be cleaned prior to use and in the field between sample locations to prevent possible sample contamination and cross-contamination. Decontamination and cleaning will be performed using the procedure outlined below:

- Alconox detergent and potable water scrub;
- Potable water rinse;
- Methanol rinse;
- Ten percent nitric acid rinse;
- Deionized water rinse;
- Air dry; and

- Wrap in aluminum foil or store in sealed polyethylene bags.

Large equipment used during field activities will be decontaminated on-site. All wash water from decontamination activities will be collected and treated through granular activated carbon treatment system, with ultimate disposal to the Buffalo Sewer Authority sanitary sewer system.

3.4 Sample Custody

Chain-of-custody records for all samples, beginning with the cleaning and numbering of the sample containers at the laboratory, shall be maintained. A written record of container decontamination procedures shall be kept as well as the source of such containers. A sample shall be considered to be "in the custody" of an individual if said sample is either in direct view of, or otherwise directly controlled by, the individual in custody. Storage of samples during custody shall be accomplished according to established preservation techniques in appropriately sealed and numbered storage containers. Chain-of-custody shall be accomplished by the exchange of the samples or sealed sample shuttle (e.g., shipping cooler) being directly transferred from one individual to the next with the transferrer witnessing the signature of the recipient upon the chain-of-custody record.

The chain-of-custody records will contain the following information:

- Sample number;
- Signature of collector;
- Date and time of collection;
- Sample type (e.g., groundwater or soil);
- Identification of well or sampling point;
- Number of containers;
- Parameters requested for analysis;
- Signature of person(s) involved in the chain of possession;
- Description of sample bottles and their condition; and
- Problems associated with sample collection (i.e., breakage, no preservatives).

The laboratory chain-of-custody procedures, at a minimum, will include the following:

- Designate a sample custodian/chain-of-custody officer;
- Have set and detailed written procedures for sample tracking through the lab from the time of receipt to final disposition of the sample; and
- Have set procedures to ensure sample holding times are not exceeded.
- All sample containers will be labeled with the sample identification number, the preservative (if any), and the parameter(s) requested for analysis. Labels will be affixed to sample containers prior to or at the time of sampling and should be filled out at the time of collection.

Sample seals are used to detect unauthorized tampering of samples following sample collection. The paper seal will include the following information:

- Name of sample;
- Date and time of sampling; and
- Place of collection.

The seal will be attached in such a way that it is necessary to break it in order to open the sample shipping cooler. These seals will be affixed to the sample shipping containers before the samples leave the custody of the sampling personnel.

4 CALIBRATION PROCEDURES AND FREQUENCY

There are two areas where calibration procedures and frequency are important: 1) for field equipment; and 2) for laboratory analytical equipment. Each of these areas is discussed below.

Field

Field equipment such as a photoionization detector and pH/conductivity meter will require daily calibration. Equipment log forms are maintained for each piece of equipment used in the field. The forms include the following information:

- Instrument identification/serial number;
- Date and time of calibration;
- Identification of calibrant/standard used;
- Personnel performing calibration;
- Calibration results; and
- Corrective action, if necessary.

In addition, problems encountered and corrective measures taken with a piece of field equipment will be documented on the log forms.

Laboratory

All laboratory instruments will be calibrated according to the specified methodology in Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020; March 1983) and Test Methods for Evaluating Solid Waste, SW-846, Third Edition (USEPA, Office of Solid Waste and Emergency Response).

5 ANALYTICAL PROCEDURES

All laboratory chemical analyses will be performed by a New York State Department of Health (NYSDOH) approved laboratory. Analytical procedures for soil and water matrices will follow the methodologies outlined in Methods for Chemical Analysis of Water and Wastes (EPA 60014-79-020; March 1983), and/or Test Methods for Evaluating Solid Waste (SW-846), Third Edition.

Sections 2.0 and 5.0 of the Remedial Design Report detail the samples to be collected, the analytical protocol for each sample, and the field QC check samples. QC samples are further described in Section 7.0. Contract required quantitation limits (CRQLs) for this project are listed below:

		CRQLs[1]		Media Target Limit[3]	
PCBs	CAS Number	Water (ug/L)	Soil/Sediment[2] (ug/Kg)	Water (ug/L)	Soil (ug/Kg)
AROCLOR-1016	12674-11-2	1.0	33	10	1000
AROCLOR-1221	11104-28-2	2.0	67	10	1000
AROCLOR-1232	11141-16-5	1.0	33	10	1000
AROCLOR-1242	53469-21-9	1.0	33	10	1000
AROCLOR-1248	12672-29-6	1.0	33	10	1000
AROCLOR-1254	11097-69-1	1.0	33	10	1000
AROCLOR-1260	11096-82-5	1.0	33	10	1000

	CRQL[1]		Media Target Limit[3]	
	Water ug/L	Soil/Sediment ug/Kg	Water (ug/L)	Soil (ug/Kg)
Lead	3.0	300	10.0	100,000.0

1 Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

2 Quantitation Limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculate on dry weight basis, as required by the protocol, will be higher.

3 The media Target Detection Limits were selected based upon analytical results from previous on-site investigations.

6 DATA REDUCTION, VALIDATION AND REPORTING

This section addresses the requirements for data reduction, validation and reporting for each major measurement parameter. There are two separate areas where data reduction, validation and reporting apply. These areas are in the field investigation and in the analytical laboratory. Each is discussed separately below.

6.1 Field Procedures

6.1.1 Field Recordkeeping

Field measurements (whether analytical or other) will be recorded in the field team member's logbook. This book will have consecutively numbered pages, will be written only in ink, and will be signed at the bottom of each page. The data recorded in the logbook will be spot-checked frequently by the site manager/project manager to ensure that proper procedures for sampling, analysis, and measuring (detailed in other sections of the QAPP) are being followed.

6.1.2 Field Measurements

Field measurements will include screening for PCBs using an immunoassay field test kit (Millipore or equivalent). The field procedures for PCB screening are provided in Appendix A. Specific QA/QC procedures for this method are provided in the respective SOPs.

6.2 Laboratory Procedures and Reporting

The appropriate data and reporting forms outlined in the analytical laboratory's QA/QC Plan for sample analyses will be reviewed. Once the entire data package has been reviewed, a narrative report and deliverables summary will be prepared describing data reduction and reporting procedures.

7 INTERNAL QUALITY CONTROL CHECKS

There are two segments to internal QC checks; those initiated in the field and those initiated in the laboratory. The internal QC checks performed by the laboratory will follow the laboratory's QA/QC Plan. Field QC checks will consist of the collection of the following samples:

- **Field Blanks** are collected to check the effectiveness of decontamination procedures for sampling equipment. Following a sampling event, sampling equipment will be decontaminated. Deionized water then will be passed through the sampler into the designated container. The field blank should be transported to the laboratory and analyzed for the appropriate parameters with the other samples. At a minimum, one field blank should be collected for each sampling event or for each different type of sampling equipment used.

- **Duplicates** can provide indications of the precision of the analytical system. A duplicate sample is a second sample collected at the exact same location and depth and time as the original sample. A duplicate sample serves to check accuracy and reliability of laboratory instruments and procedures, and field activities. Duplicates should be collected for each matrix at a frequency of ten percent.

8 PERFORMANCE AND SYSTEM AUDITS

Field audits from NYSDEC when required will be allowed. A review of field notes and discussions with field team members will verify that field activities were performed according to the work plan and QAPP. The field team leader will provide documentation of all work performed in the form of narrative and checklist tasks.

The laboratory QA/QC director or laboratory project manager will observe work being performed during the time that samples from this project are being processed and analyzed. The laboratory QA/QC director will certify in a short narrative report, and by means of signature approval on any QC reports, that the appropriate work has been performed.

The laboratory chosen for this project will be a NYSDOH approved laboratory for environmental analyses. The laboratory QAPP will be provided once the final laboratory selection is made.

The field sampling team will be required to document all field activities in a bound log book. The QA Officer will review the field book to ensure the following information has been recorded:

Groundwater Well Evacuation/Sampling

- Date and time;
- Type of purging equipment used;
- Type of sampling equipment;
- Total depth of the well;
- Volume of water purged;
- Well or sampling point identification number;
- Water level prior to evacuating and prior to sampling for each well;
- Appearance of water and change, if any;
- Odor of water, if any;
- Amount of water removed;
- Presence of more than one phase;
- Time of sampling; and
- Field measurement results: pH, conductance.

Soil Sample Collection

- Date and time;
- Sampling point identification number/sample number;
- Sample depth and surface area;
- Soil description/characteristics; and
- Collection device.

General

- Duplicate sample locations;
- Location of equipment blanks; and
- Equipment decontamination procedures.

The contractor will ensure that the laboratory is informed of any unusual sample characteristics.

9 PREVENTIVE MAINTENANCE

Preventive maintenance is primarily a function performed by the laboratory on their analytical equipment to ensure accurate results and to minimize equipment breakdowns/failure. While this is the case, there are a number of items used in field investigations for which preventive maintenance is an important consideration. Specific considerations for laboratory and field equipment are discussed below.

9.1 Field Equipment

Field monitoring equipment (e.g., photoionization detector, pH/conductivity meter) will be checked and maintained according to the standard maintenance schedule. These instruments are normally under contract to be checked/overhauled once annually or whenever problems arise. Batteries for all the equipment should be charged to full capacity prior to use.

A log which documents problems experienced with the instruments, corrective measures taken, battery replacement dates, and when used and by whom for each field instrument will be maintained. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement, when necessary, in the field.

All equipment to be utilized during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manuals and the instructions with each instrument to ensure that all maintenance items are being observed. Field notes from previous equipment usage and the maintenance log will be reviewed so that any prior equipment problems are not overlooked and all necessary repairs to equipment have been carried out.

In the field, each field instrument will be visually inspected prior to field activities to detect any damages or operational problems. Instrument responses will be checked against known standards prior to beginning field work. The instrument operation manuals will be referred to for trouble-shooting methods should equipment check-out indicate a problem. Instrumentation problems identified in the field should be relayed to the Project Manager.

9.2 Laboratory

Laboratory equipment is monitored by means of a log book for each instrument recording any maintenance activities and schedule. Daily and weekly tasks serve to maintain instrumentation in proper working order. Validation of optimal instrument performance by acceptable calibration and tuning criteria further support satisfactory data quality. Review of these logs and communication between QA/QC personnel allow for discovery and timely correction of problems. Since most analytical laboratories have sufficient inventory of supplies and equipment, downtime is not anticipated to occur.

10 DATA MEASUREMENT ASSESSMENT PROCEDURES

Data assessment procedures are employed to ascertain how reliably the concentration reported by the laboratory reflects the actual concentration of a given analyte in the sampled media. Precision and accuracy are two characteristics of data which can be examined to determine the reliability of results.

Precision is a measure of the mutual agreement among individual measurements of the same property. Reference control samples and analytical replicate control samples are used to determine that the results from an analytical batch of samples are within a known range of precision. The acceptance limits for the reference control samples reflect the precision under conditions with no matrix interferences. The acceptance limits for the analytical replicate control samples reflect the precision that can be obtained. Precision is expressed as either relative percent difference (% RPD) or relative standard deviation (% RSD).

Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Reference control samples, spiked control samples, and surrogate spikes are used to determine that the results from an analytical batch of samples are within a known range of accuracy. The means of the reference control samples reflect the accuracy under conditions with no matrix interferences. The mean recoveries for the spiked control samples and surrogate spikes reflect the accuracy that can be obtained where there may be matrix interferences. Accuracy is expressed as percent recovery.

11 CORRECTIVE ACTION

Corrective action is required when field and laboratory generated data are not within the predetermined limits for data acceptability. In most field related instances, data acceptability is determined by, and referenced to, manufacturer specifications during calibration. Once calibrated and operational, data generated by the field instrumentation is assumed to be representative of the field condition measured.

In the event of erratic readings which do not stabilize during the critical usage of the equipment, corrective action will be implemented to identify the problem and its source. Appropriate documentation of this action will be recorded in the field log book and project file.

The laboratory selected to perform the analytical work detailed in the work plan has set protocols for corrective actions. These protocols are the responsibility of the laboratory QA Officer and are specified in the laboratory's QA/QC Plan.

Regardless of whether a problem arises in the laboratory or the field, all proposed corrective actions must be approved by the Project Manager prior to their implementation (unless the problem contains the elements of an emergency).

12 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QA Officer of the laboratory provides periodic assessments of measurement data accuracy and precision to the Laboratory Director, who distributes them to appropriate laboratory staff. Results of the performance audits and system audits are received by the Laboratory Director and also passed on to the lab staff. Other significant QA problems which may be detected throughout the review process of the analytical data are brought to the attention of the Laboratory Director and other appropriate individuals as they arise. The Laboratory Director will immediately notify the Consultant's Project Manager/QA Officer of problems detected, if any, and a mutual solution to the problem will be developed. A written report detailing problems, solutions taken to resolve the problems and impacts on analytical data will be provided to the Consultant with the actual sample analyses data.

APPENDIX A

IMMUNOASSAY FIELD SCREENING PROCEDURE

METHOD 4020

SCREENING FOR POLYCHLORINATED BIPHENYLS BY IMMUNOASSAY

1.0 SCOPE AND APPLICATION

1.1 Method 4020 is a procedure for screening soils and non-aqueous waste liquids to determine when total polychlorinated biphenyls (PCBs) are present at concentrations above 5, 10 or 50 mg/kg. Method 4020 provides an estimate for the concentration of PCBs by comparison with a standard.

1.2 Using the test kit from which this method was developed, 95% of soil samples containing 0.625 ppm or less of PCBs will produce a negative result in the 5 ppm test configuration. Using another commercially available test kit, 97% of soil samples containing 0.25 ppm or less of PCBs will produce a negative result in the assay and greater than 99% of the samples containing 1.0 ppm or more will produce a positive result. Tables 2-5, 7, 10, and 11 present false positive and false negative data generated from commercially available test kits. Using a test kit commercially available for screening non-aqueous waste liquids, >95% of samples containing 0.2-0.5 ppm or less of PCB will produce a negative result.

1.3 In cases where the exact concentrations of PCBs are required, quantitative techniques (i.e., Method 8082) should be used.

1.4 This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

2.1 Test kits are commercially available for this method. The manufacturer's directions should be followed.

2.2 In general, the method is performed using a sample extract. Sample and an enzyme conjugate reagent are added to immobilized antibody. The enzyme conjugate "competes" with PCB present in the sample for binding to immobilized anti-PCB antibody.

2.3 The test is interpreted by comparing the response produced by testing a sample to the response produced by testing standard(s) simultaneously.

3.0 INTERFERENCES

Chemically similar compounds and compounds which might be expected to be found in conjunction with PCB contamination were tested to determine the concentration required to produce a positive test result. These data are shown in Tables 1A, 1B, 1C, and 1D.

4.0 APPARATUS AND MATERIALS

4.1 Immunoassay test kit: PCB RISc™ (EnSys, Inc.), EnviroGard™ PCB in Soil (Millipore, Inc.), D TECH ™ PCB test (Strategic Diagnostics Inc.), PCB RISc™ Liquid Waste Test System (EnSys, Inc.), or equivalent.

4.2 Each commercially available test kit will supply or specify the apparatus and materials necessary for successful completion of the test.

5.0 REAGENTS

Each commercially available test kit will supply or specify the reagents necessary for successful completion of the test.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 See the introductory material to this chapter, Organic Analytes, Section 4.1. Also refer to Reference 9 for the collection and handling of non-aqueous waste liquids.

6.2 Samples may be contaminated, and should therefore be considered hazardous and handled accordingly.

7.0 PROCEDURE

7.1 Follow the manufacturer's instructions for the test kit being used.

7.2 Those test kits used must meet or exceed the performance specifications indicated in Tables 2-11.

8.0 QUALITY CONTROL

8.1 Follow the manufacturer's instructions for the test kit being used for quality control procedures specific to the test kit used. Additionally, guidance provided in Method 4000 and Chapter One should be followed.

8.2 Use of replicate analyses, particularly when results indicate concentrations near the action level, is recommended to refine information gathered with the kit.

8.3 Do not use test kits past their expiration date.

8.4 Do not use tubes or reagents designated for use with other test kits.

8.5 Use the test kits within their specified storage temperature and operating temperature limits.

8.6 Method 4020 is intended for field or laboratory use. The appropriate level of quality assurance should accompany the application of this method to document data quality.

9.0 METHOD PERFORMANCE

9.1 A study was conducted with the PCB RISc™ test kit using fourteen standard soils and three soil samples whose PCB concentration had been established by Method 8082. Replicates were performed on seven of the standard soils and on one of the soil samples for a total of 25 separate analyses. Each of two different analysts ran the 25 analyses. Results indicated that "<" assignments are accurate with almost 99% certainty at the 50 ppm level while ">" assignments can be up to about 96% inaccurate as the sample concentration approaches that of the testing level. Corresponding certainties at the 5 ppm level are 92% and 82% respectively. Tables 2 and 3 summarize these results.

9.2 Table 4 presents method precision data generated using the PCB RISc™ test kit, comparing immunoassay test results with results obtained using Method 8082.

9.3 Method precision was determined with the EnviroGard PCB in Soil test kit by assaying 4 different soils (previously determined to contain 5.04, 9.78, 11.8, and 25.1 mg/kg by Method 8082), at three different sites, using three different lots of assay kits, three times a day for 9 days. A total of 81 analyses were performed for each soil. Error attributable to site, lot, date, and operator were determined. Separately, the relative reactivity of Aroclors 1242, 1248, 1254, and 1260 were determined. Based on Aroclor heterogeneity, and method imprecision, concentrations of Aroclor 1248 were selected that would result in greater than 99% confidence for negative interpretation. A study was conducted (Superfund SITE demonstration) on 114 field samples whose PCB concentration were also determined by Method 8082. 32 of the field samples were collected in duplicate (as coded field duplicates) and assayed by standard and immunoassay methods. The results for all 146 samples are summarized in Tables 5 and 6.

9.4 Grab samples were obtained from sites in Pennsylvania, Iowa and Illinois using a stainless steel trowel. Each sample was homogenized by placing approximately six cubic inches in a stainless steel bucket and mixing with the trowel for approximately two minutes. The soils was aliquotted into 2 six ounce glass bottles. The samples were tested on site using the D TECH PCB test kit, and sent to an analytical laboratory for analysis by Method 8082. These data are compared in Table 7.

9.5 Tables 8 and 9 present data on the inter- and intra-assay precision of the PCB RISc™ Liquid Waste Test System. The data were generated using 11 samples, each spiked at 0, 0.2 and 5 ppm, and assayed 4 times.

9.6 Tables 10 and 11 provide data from application of the PCB RISc™ Liquid Waste Test System to a series of liquid waste samples whose PCB concentration had been established by Method 8082.

10.0 REFERENCES

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2. PCB RISc™ Users Guide, Ensys Inc.

3. R.W. Counts, R.R. Smith, J.H. Stewart, and R.A. Jenkins, "Evaluation of PCB Rapid Immunoassay Screen Test System", Oak Ridge National Laboratory, Oak Ridge, TN 37831, April 1992, unpublished

4. EnviroGard PCB in Soil Package Insert, Millipore Corp. 2/93.

5. Technical Evaluation Report on the Demonstration of PCB Field Screening Technologies, SITE Program. EPA Contract Number 68-CO-0047. 2/93.

6. D TECH™ PCB Users Guide , SDI/Em Sciences

7. Melby, J.M., B.S. Finlin, A.B. McQuillin, H.G. Rovira, J.W. Stave, "PCB Analysis by Enzyme Immunoassay", Strategic Diagnostics Incorporated, Newark, Delaware, 1993

8. Melby, J.M., B.S. Finlin, A.B. McQuillin, H.G. Rovira, "Competitive Enzyme Immunoassay (EIA) Field Screening System for the Detection of PCB", 1993 PCB Seminar, EPRI, September 1993

9. T.A. Bellar and J.J Lichtenberg. The Analysis of Polychloringated Biphenyls in Transformer Fluid and Waste Oils. U.S. EPA Research and Development, EPA/EMSL-ORD, Cincinnati, Ohio (June 24, 1980). Revised June 1981, EPA 600/4-81-045.

10. PCB RISc™ Liquid Waste Test System, User's Guide, EnSys Environmental Products, Inc.

TABLE 1A

CROSS REACTIVITY OF DIFFERENT COMPOUNDS[a]

Compound	Soil Equivalent Concentration (ppm) Required to Yield a Positive Result
1-Chloronaphthalene	10,000
1,2,4-Trichlorobenzene	10,000
2,4-Dichlorophenyl-benzenesulfonate	1,000
2,4-Dichloro-1-naphthol	>10,000
Bifenox	500
Diesel fuel	>10,000
Pentachlorobenzene	>10,000
2,5-Dichloroaniline	>10,000
Hexachlorobenzene	>10,000
Gasoline	>10,000
Dichlorofenthion	10,000
Tetradifon	125

(a) PCB RISc™ test kit, Ensys, Inc. publication

TABLE 1B

CROSS REACTIVITY OF DIFFERENT COMPOUNDS[a]

Compound	% Cross Reactivity
Aroclor 1248	100
Aroclor 1242	50
Aroclor 1254	90
Aroclor 1260	50
1,2-, 1,3-, & 1,4-Dichlorobenzene	<0.5
1,2,4-Trichlorobenzene	<0.5
biphenyl	<0.5
2,4-dichlorophenol	<0.5
2,5-dichlorophenol	<0.5
2,4,5-trichlorophenol	<0.5
2,4,6-trichlorophenol	<0.5
Pentachlorophenol	<0.5

[a] EnviroGard PCB Test Kits (Millipore Corporation)

TABLE 1C

CROSS REACTIVITY OF DIFFERENT COMPOUNDS[a]

Compound	MDL[b] (ppm)	IC 50[c] (ppm)	% Cross Reactivity[d]
Aroclor 1016	5.7	83	12
Aroclor 1221	25.5	300	3
Aroclor 1232	9.0	105	10
Aroclor 1242	1.5	31	32
Aroclor 1248	0.8	24	42
Aroclor 1254	0.5	10	100
Aroclor 1260	0.75	10	100
Aroclor 1262	0.5	10	100
Aroclor 1268	3.8	40	25

METHOD: The compounds listed were assayed at various concentrations and compared against an inhibition curve generated using Aroclor 1254. The concentration of the compound required to elicit a positive response at the MDL as well as the concentration required to yield 50% inhibition compared to the standard curve were determined.

[a] D TECH™ PCB test kit

[b] The Minimum Detection Limit (MDL) is defined as the lowest concentration of compound that yields a positive test result.

[c] The IC_{50} is defined as the concentration of compound required to produce a test response equivalent to 50% of the maximum response.

[d] % Cross reactivity is determined by dividing the equivalent Aroclor 1254 concentration by the actual compound concentration at IC_{50}

TABLE 1D

CROSS REACTIVITY OF DIFFERENT COMPOUNDS[a]

Compound	% Cross-Reactivity	Soil Equivalent Concentration (ppm) Required to Yield a Positive Result
1-Chloronaphthalene	0.05%	10,000
1,2,4-Trichlorobenzene	0.05%	10,000
2,4-Dichloro-1-naphthol	<0.20%	>10,000
Bifenox	<0.10%	500
Pentachlorobenzene	<0.05%	>10,000
2,5-Dichloroaniline	<0.05%	>10,000
Hexachlorobenzene	<0.05%	>10,000
Dichlorofenthion	0.05%	10,000
Tetradifon	<0.10%	125

(a) PCB RISc™ Liquid Waste Test System, Ensys, Inc.

TABLE 2

ESTIMATED ERROR RATES FOR 5 PPM DILUTION[a]

True Value (ppm)	0	1	2	3	4	5	6	7	8	9	10	20
Estimated Rate of False Positives (%)	1.3	13.2	39.2	65.2	82.3	.	.	.	.	.	.	.
Estimated Rate of False Negatives (%)	.	.	.	.	.	8.5	4.1	2.0	1.0	0.5	0.3	<0.1

TABLE 3

ESTIMATED ERROR RATES FOR 50 PPM DILUTION[a]

True Value (ppm)	0	5	10	15	20	30	40	50	60	70	80	100
Estimated Rate of False Positives (%)	1.0	7.9	24.5	46.0	65.0	87.3	95.6	.	.	.	.	.
Estimated Rate of False Negatives (%)	.	.	.	.	.	.	.	1.7	0.7	0.3	0.2	<0.1

(a) PCB RISc™ test kit

TABLE 4

Comparison of PCB RISc™ Test Kit with GC

Sample ID	Screening Test Results	GC Results (Method 8082)	Agreement[a] Y, FP, FN
101	<5 ppm	<0.5 ppm	Y
284	<5 ppm	<0.5 ppm	Y
292	<5 ppm	<0.5 ppm	Y
199	<5 ppm	0.5 ppm	Y
264	<5 ppm	1 ppm	Y
257	<5 ppm	1.8 ppm	Y
259	<5 ppm	4 ppm	Y
265	<5 ppm	4.5 ppm	Y
200	<5 ppm	5 ppm	Y
170	5-50	5.8 ppm	Y
198	<5 ppm	2.2-5.8 ppm	Y
172	5-50	6.2 ppm	Y
169	5-50	7.2 ppm	Y
171	5-50	7.2 ppm	Y
202	<5 ppm, 5-50	1.3-7.2 ppm	Y
163	5-50	8.7 ppm	Y
165	5-50	9 ppm	Y
168	5-50	9 ppm	Y
166	5-50	9.3 ppm	Y
164	5-50	11.9 ppm	Y
204	5-50	12.8 ppm	Y
253	5-50	13 ppm	Y
203	5-50	13.5 ppm	Y
258	5-50	15 ppm	Y
106	5-50	15-19 ppm	Y
161	5-50	15.3 ppm	Y
167	5-50	16.2 ppm	Y

TABLE 4 (cont.)

Sample ID	Screening Test Results	GC Results (Method 8082)	Agreement[a] Y, FP, FN
247	5-50	18 ppm	Y
148	>50	18-34 ppm	FP
205	5-50	20 ppm	Y
162	5-50	20.4 ppm	Y
175	5-50	21.2 ppm	Y
176	5-50	21.6 ppm	Y
197	5-50	32 ppm	Y
243	5-50	32 ppm	Y
252	5-50	32 ppm	Y
178	5-50	43.7 ppm	Y
201	5-50	43 ppm	Y
254	5-50, >50	56 ppm	Y
238	>50	46-60 ppm	Y
248	5-50	44-60 ppm	Y
250	>50	68 ppm	Y
242	5-50	30-69 ppm	Y
256	>50	73 ppm	Y
249	>50	96 ppm	Y
245	>50	102 ppm	Y
241	5-50	154 ppm	FN
246	>50	154 ppm	Y
261	>50	204 ppm	Y
240	>50	251 ppm	Y
267	>50	339 ppm	Y
239	>50	460 ppm	Y
104	>50	200-3772 ppm	Y
108	>50	531-1450 ppm	Y

[a] Y=Yes, FN=False Negative, FP=False Positive

TABLE 5

Comparison of EnviroGard™ PCB Kit with GC

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
001	>10	5.98	FP[g]
002	>10	1.27	FP
003	<10	0.11	Y
004	>10	6.71	FP[g]
005	>10	1.37	FP
006	>10	0.68	FP
007	>10	0.55	FP
008	>10	2.00	FP
009	>10	1.30	FP
010	>10	0.17	FP
011	>10	1.15	FP
012	<10	ND[f]	Y
013	<10	1.13	Y
014	<10	0.18	Y
015	>10	9.13	FP[g]
015	>10	9.84	FP[g]
016	>10	2110	Y
017	>10	2.55	FP
018	>10	45.4	Y
019	>10	6.70	FP[g]
020	<10	0.07	Y
021	<10	0.06	Y
022	<10	0.54	Y
022	<10	0.72	Y
023	>10	20.8	Y
024	<10	0.06	Y

TABLE 5 (cont.)

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
024D	<10	0.05	Y
025	>10	11.7	Y
026	<10	1.96	Y
027	<10	0.06	Y
028	<10	0.22	Y
028D	<10	0.22	Y
029	<10	0.23	Y
030	<10	1.15	Y
031	<10	0.26	Y
032	>10	47.6	Y
033	>10	6.00	FP[g]
034	>10	34.0	Y
035	<10	ND[f]	Y
035D	<10	ND[f]	Y
036	>10	816	Y
037	<10	0.06	Y
037D	<10	0.04	Y
038	>10	1030	Y
039	<10	0.68	Y
040	>10	4.25	FP
041	<10	ND[f]	Y
042	>10	0.52	FP
042D	>10	0.47	FP
043	>10	1.69	FP
043D	>10	1.74	FP

TABLE 5 (cont.)

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
044	<10	0.59	Y
045	<10	ND[f]	Y
046	<10	ND[f]	Y
046D	<10	ND[f]	Y
047	<10	0.09	Y
047D	<10	0.10	Y
048	<10	ND[d]	Y
049	<10	ND[d]	Y
050	>10	3.60	FP
050D	>10	4.41	FP
051	<10	ND[f]	Y
052	>10	4.21	FP
053	<10	0.96	Y
054	<10	0.52	Y
055	<10	2.40	Y
056	<10	0.51	Y
057	<10	ND[f]	Y
058	<10	0.69	Y
059	>10	7.86	FP[g]
060	>10	0.62	FP
060D	<10	0.58	Y
061	>10	580	Y
062	>10	2.35	FP
063	<10	0.09	Y
063D	<10	0.15	Y

TABLE 5 (cont.)

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
064	>10	19.0	Y
065	>10	3.08	FP
066	<10	1.98	Y
067	<10	0.08	Y
068	<10	0.50	Y
069	<10	ND[f]	Y
069D	<10	ND[f]	Y
070	<10	ND[f]	Y
071	<10	0.05	Y
071D	<10	ND[f]	Y
072	<10	0.04	Y
073	>10	15.8	Y
074	>10	13.3	Y
075	>10	23.0	Y
076	>10	46.7	Y
077	<10	ND[f]	Y
078	>10	2.27	FP
079	>10	42.8	Y
080	<10	3.77	Y
081	<10	0.69	Y
081D	<10	0.45	Y
082	<10	ND[f]	Y
082D	<10	0.24	Y
083	<10	0.48	Y
083D	<10	0.41	Y
084	>10	1.16	FP

TABLE 5 (cont.)

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
084D	>10	1.08	FP
085	>10	428	Y
085D	>10	465	Y
086	<10	1.42	Y
086D	<10	1.25	Y
087	<10	0.08	Y
087D	<10	ND[f]	Y
088	>10	2.70	FP
088D	>10	1.77	FP
089	>10	45.0	Y
090	<10	1.01	Y
090D	<10	1.40	Y
091	>10	1630	Y
091D	>10	1704	Y
092	<10	1.21	Y
092D	<10	ND[f]	Y
093	<10	0.30	Y
094	<10	0.36	Y
095	>10	17.5	Y
095D	>10	31.2	Y
096	<10	0.06	Y
097	<10	1.23	Y
097D	<10	0.29	Y
098	>10	1.17	FP
098D	>10	0.83	FP
099	<10	ND[f]	Y

TABLE 5 (cont.)

Sample Number	Screening Result[c,d]	GC Result[c] [8082]	Agreement[e] Y, FN, FP
100	>10	177	Y
100D	>10	167	Y
101	>10	1.21	FP
102	>10	293	Y
102D	>10	177	Y
103	>10	40.3	Y
104	>10	7.66	FP[g]
105	<10	0.21	Y
106	<10	2.50	Y
107	>10	14.1	Y
108	>10	3.84	FP
109	<10	ND[f]	Y
109D	<10	ND[f]	Y
110	<10	ND[f]	Y
111	<10	ND[f]	Y
112	>10	315	Y
113	>10	14.9	Y
114	>10	66.3	Y

[c] mg/kg (ppm)

[d] Screening Calibrator is 5 mg/kg Aroclor 1248

[e] Y=Yes, FN=False Negative, FP=False Positive

[f] ND = Not Detectable

[g] Expected Result Based on Calibrator Concentration

TABLE 6

EnviroGard™ PCB Kit Field Performance Summary

Specificity:	[1-(Reported Positives/True Negatives)] = [1-(37/109)] = 66%
Note 1:	8 of the 37 reported positive samples had PCB contamination levels between 5 and 10 mg/kg. Soils in this range should test "positive" because the assay calibrator is 5 mg/kg Arodor 1248. A positive assay bias is necessary to prevent false negative results. Eliminating these samples from the calculations produces a Specificity of: [1-(Reported Positives/True Negatives)] = [1-(29/101)] = 71%
Note 2:	The distribution of false positives is not random ($p < 0.05$), with a clustering at the beginning of the sample set. This observation was included in *Developers Comments* which were added to the final draft of the Technical Evaluation Report. One explanation for the higher frequency of false positive results at the beginning is inexperience of the operator with the method. If the first 20 samples are eliminated from the Specificity analysis, the following result is obtained: [1-(Reported Positives/True Negatives)] = [1-(20/86)] = 77% In the SITE demonstration, the PCB Immunoassay had a 77% positive predictive value.
Sensitivity:	[1-(Reported Negatives/True Positives)] = [1-(0/31)] = 100% In the SITE demonstration, the PCB Immunoassay had a 100% negative predictive value.

TABLE 7

Comparison of D TECH™ PCB Test Kit with GC

Sample	D TECH™ (ppm)	GC (8082) (ppm)	Agreement[a] Y, FN, FP
J1	4.0-15	5.0	Y
J2	>50	147	Y
J3	15-50	54	Y
J5	15-50	160	FN
J6	>50	1200	Y
J7	4.0-15	12	Y
J8	4.0-15	28	FN
J9	>50	463	Y
J10	>50	1760	Y
J11	>50	28	FP
J12	15-50	17	Y
J13	>50	1300	Y
J14	>50	186	Y
J15	15-50	31	Y
J16	15-50	36	Y
J17	>50	31	FP
J18	>50	130	Y
J19	>50	1310	Y
J20	>50	2620	Y
J21	>50	111000	Y
J22	1.0-4.0	0.01	FP
J23	1.0-4.0	0.60	Y
J24	<0.5	0.10	Y

[a] Y=Yes, FN=False Negative, FP=False Positive

TABLE 7 (cont.)

Sample	D TECH™ (ppm)	GC (8082) (ppm)	Agreement[a] Y, FN, FP
J25	0.5-1.0	0.12	FP
J26	<0.5	0.01	Y
J27	1.0-4.0	1.8	Y
J28	<0.5	0.18	Y
J29	0.5-1.0	0.54	Y
J30	>50	21	FP
J31	4.0-15	13	Y
J32	0.5-1.0	0.72	Y
J33	0.5-1.0	0.32	Y
J34	1.0-4.0	0.36	FP
J35	1.0-4.0	0.26	FP
J36	>50	70	Y
J37	<0.5	0.12	Y
J38	0.5-1.0	0.81	Y
J39	0.5-1.0	0.33	Y
J40	<0.5	0.19	Y
J41	<0.5	0.01	Y
J42	1.0-4.0	0.43	FP
J43	1.0-4.0	0.31	FP
J44	15-50	503.4	FN
J45	15-50	5.6	FP
J46	<0.5	0.02	Y
J47	<0.5	0.22	Y

[a] Y=Yes, FN=False Negative, FP=False Positive

TABLE 7(cont.)

Sample	D TECH™ (ppm)	GC (8082) (ppm)	Agreement[a] Y, FN, FP
G1	15-50	18	Y
G2	4.0-15	11	Y
G3	1.0-4.0	3.4	Y
G4	15-50	6.5	FP
G5	<0.5	0.01	Y
G6	1.0-4.0	1.4	Y
G7	1.0-4.0	0.30	FP
G8	15-50	7.5	FP
G9	4.0-15	33	FN
G10	15-50	8	FP
G11	4.0-15	11	Y
G12	4.0-15	24	FN
G13	4.0-15	4.3	Y
G14	0.5-1.0	1.3	Y
G15	<0.5	0.01	Y
G16	1.0-4.0	3.2	Y
G17	4.0-15	18	Y
G18	4.0-15	4.6	Y
G19	1.0-4.0	2.3	Y
G20	>50	37	FP

[a] Y=Yes, FN=False Negative, FP=False Positive

TABLE 7(cont.)

Sample	D TECH™ (ppm)	GC (8082) (ppm)	Agreement[a] Y, FN, FP
W1A	4.0-15	9.1	Y
W2A	4.0-15	11	Y
W3A	1.0-4.0	2.8	Y
W4A	4.0-15	13	Y
W5A	>50	29	FP
W6A	>50	1200	Y
W7A	>50	57	Y
W8A	4.0-15	18	Y
W9A	1.0-4.0	1.3	Y
W10A	0.5-1.0	0.44	Y
W11A	15-50	120	FN
W12A	15-50	48	Y
W13A	15-50	19	Y
W14A	4.0-15	2.7	Y
W15A	1.0-4.0	1.3	Y
W16A	1.0-4.0	0.3	FP
W17A	4.0-15	1.4	FP
W18A	1.0-4.0	2.2	Y
W19A	4.0-15	8.2	Y
W20A	>50	9.3	FP
W21A	>50	110	Y
W22A	1.0-4.0	0.6	Y
W23A	>50	46	Y

[a] Y=Yes, FN=False Negative, FP=False Positive

TABLE 8

Intraassay Precision of the PCB RISc™ Liquid Waste Test System

PCB 1248 Spike Concentration (ppm)	Signal %RSD (OD_{450nm}) N=44 (11 data sets)	Statistical Percentage of False Results Compared to Standards
0	6.4%	<0.02%
0.2	5.9%	4.1%
5	7.9%	1.4%

TABLE 9

Interassay Precision of the PCB RISc™ Liquid Waste Test System

PCB 1248 Spike Concentration (ppm)	Signal %RSD (OD_{450nm}) N=44 (11 data sets)
0	6.4%
0.2	8.3%
5	8.5%

TABLE 10

Comparison of PCB RISc™ Liquid Waste Test with Method 8082

Sample ID	Sample Matrix	GC Results		IA Results	
		Aroclor	Conc. ppm	Test Results	Corr. with GC Results
302	Condensate	ND[b]	ND	<5	yes
303	Condensate	ND	ND	<5	yes
304	Condensate	1242	25	≥5	yes
306	Condensate	1242	5	≥5	yes
307	Condensate	1242	<10	<5	yes
308	Condensate	1242	58	≥5	yes
310	Condensate	1254	25	≥5	yes
311	Condensate	1242	200	≥5	yes
331	Transformer Oil	1260	183	≥5	yes
380	Transformer Oil	PCB[c]	20	≥5	yes
381	Transformer Oil	PCB	38	≥5	yes
382	Transformer Oil	PCB	163	≥5	yes
383	Transformer Oil	PCB	176	≥5	yes
384	Transformer Oil	PCB	336	≥5	yes
385	Transformer Oil	PCB	6400	≥5	yes
387	Coolant	PCB	10	≥5	yes
388	2,4-D Rinse Water	1254	<10	<5	yes
389	Waste Solvent	1242	29	≥5	yes
390	Herbicide	ND	<2	<5	yes
391	Paint/Solvent	1254	9	≥5	yes
394	Waste Solvent	1242/1260	11/17	≥5	yes
395	Waste Solvent	1242/1260	2/2	<5	yes
396	Waste Oil	1260	323	≥5	yes
398	Chlor. Solvent	ND	<5	<5	yes
399	Paint	ND	<50	<5	yes
400	Pump Oil	ND	<50	<5	yes
401	Waste Solvent	ND	<35	<5	yes
402	Herbicide	ND	<50	<5	yes
403	Paint/Solvent	ND	<5	<5	yes
404	Printing Solvent	ND	<5	<5	yes
405	Waste Solvent	ND	<50	<5	yes

TABLE 10 (cont.)

Sample ID	Sample Matrix	GC Results		IA Results	
		Aroclor	Conc. ppm	Test Results	Corr. with GC Results
407	Waste Oil	ND	ND	≥5	FP[d]
408	Waste Oil	ND	ND	<5	yes
409	Waste Oil	ND	ND	<5	yes
410	Waste Oil	ND	ND	<5	yes
411	Waste Oil	ND	ND	<5	yes
412	Waste Oil	ND	ND	<5	yes
413	Waste Oil	ND	ND	<5	yes
414	Waste Oil	ND	ND	<5	yes
415	Waste Oil	ND	ND	<5	yes
416	Waste Oil	PCB	50	>5	yes
417	Waste Oil	ND	ND	<5	yes
418	Waste Oil	ND	ND	<5	yes
419	Waste Oil	ND	ND	<5	yes
420	Waste Oil	ND	ND	<5	yes
421	Waste Oil	ND	ND	<5	yes
422	Waste Oil	ND	ND	<5	yes
423	Waste Oil	ND	ND	<5	yes
424	Waste Oil	ND	ND	<5	yes
425	Waste Oil	ND	ND	<5	yes
Number of False Positive Results				1/32	
Rate				3.1%	
Number of False Negative Results				0/18	
Rate				0.0%	

[a] Trial 1 data

[b] ND = Not Detectable

[c] PCB = Aroclor was not determined

[d] FP = False positive

TABLE 11

Correlation of PCB RISc™ Liquid Waste Test and Method 8082 Results
Using Spiked and Unspiked Liquid Waste Field Samples

ID	Matrix	GC Results Unspiked ppm	Immunoassay Result		Interp.
			Unspiked ppm	Spiked (5 ppm 1248)	
001	Aromatic solvent	<5	<5	≥5	
002	Aviation gas	<5	<5	≥5	
003	Chiller oil	<5	<5	≥5	
004	Compressor oil	<5	<5	≥5	
005	Coolant + water	<5	<5	≥5	
006	Coolant oil	NR[b]	NR	≥5	
007	Coolant oil	NR	<5	≥5	
008	Cutting oil	<5	<5	≥5	
009	Cutting oil	<5	<5	≥5	
010	Degreaser still bottom	<5	<5	≥5	
011	Dope oil	<5	<5	≥5	
012	Draw Lube oil	<5	<5	≥5	
013	Fleet crankcase oil	<5	<5	≥5	
014	Floor sealer	<5	<5	≥5	
015	Fuel oil	<5	<5	≥5	
016	Hi-BTU oil	<5	<5	≥5	
017	Honing oil	<5	<5	≥5	
018	Hydraulic oil	<5	<5	≥5	
019	Hydraulic oil	<5	<5	≥5	
020	Hydraulic oil	<5	<5	≥5	
021	Machine oil	NR	<5	NR	
022	Mineral oil	<5	<5	≥5	
023	Mineral spirits	<5	<5	≥5	
024	Mineral spirits + ink	<5	≥5	≥5	FP
025	Mixed flammables	<5	<5	≥5	
026	Mixed solvents	<5	<5	≥5	
027	Naphtha	<5	<5	≥5	
028	Oil	<5	<5	≥5	
029	Oil	<5	<5	≥5	
030	Oil	<5	<5	≥5	
031	Oil	<5	<5	≥5	

TABLE 11 (cont.)

ID	Matrix	GC Results Unspiked ppm	Immunoassay Result		Interp.
			Unspiked ppm	Spiked (5 ppm 1248)	
032	Oil	<5	<5	≥5	
033	Oil	<5	<5	≥5	
034	Oil + 1,1,1-trichloroethane	<5	<5	≥5	
035	Oil sludge	<5	≥5	≥5	FP
036	Oil + freon	<5	<5	≥5	
037	Oil + mineral spirits	<5	<5	≥5	
038	Oil + scum solution	<5	<5	≥5	
039	Oily water	<5	<5	≥5	
040	Paint thinner	<5	<5	≥5	
041	Paint thinner	<5	<5	≥5	
042	Paint thinner	<5	<5	≥5	
043	Paint waste	<5	<5	≥5	
044	Paint waste + thinner	<5	<5	≥5	
045	Perce + oil	<5	<5	≥5	
046	Petroleum distillates	<5	≥5	≥5	FP
047	Petroleum naphtha	<5	<5	≥5	
048	Pumping oil	<5	<5	≥5	
049	RAC-1 SKOS	<5	<5	≥5	
050	Sk oil	NR	<5	≥5	
051	Sk oil	<5	<5	≥5	
052	Smog Hog	<5	<5	≥5	
053	Toluene + hexane	<5	<5	≥5	
054	Toluene + stain	<5	<5	≥5	
055	1,1,1-Trichloroethane	<5	≥5	≥5	FP
056	1,1,1-Trichloroethane	<5	<5	≥5	
057	1,1,1-Trichloroethane	<5	<5	≥5	
058	1,1,1-Trichloroethane	<5	<5	≥5	
059	1,1,1-TCE + methanol	<5	<5	≥5	
060	Trichloroethylene	<5	<5	≥5	
061	Trichloroethylene	<5	<5	≥5	
062	Trichloroethylene	<5	<5	≥5	
063	Turpentine	<5	<5	≥5	

TABLE 11 (cont.)

ID	Matrix	GC Results Unspiked ppm	Immunoassay Result		Interp.
			Unspiked ppm	Spiked (5 ppm 1248)	
064	Used n-butylacetate	<5	<5	≥5	
065	Used oil + freon	<5	<5	≥5	
066	Used oil + freon	<5	<5	≥5	
067	Used oils	<5	<5	≥5	
068	Used petroleum	<5	<5	≥5	
069	Used petroleum	<5	<5	≥5	
070	Used synthetic oil	<5	<5	≥5	
071	Varnish + stain	<5	<5	≥5	
072	Varsol	<5	<5	≥5	
073	Waste coolant + oil	<5	<5	≥5	
074	Waste ink + solvent	<5	<5	≥5	
075	Waste naphtha	<5	<5	≥5	
076	Waste oil	<5	<5	≥5	
077	Waste oil	<5	<5	≥5	
078	Waste oil	<5	<5	≥5	
079	Waste oil	<5	<5	≥5	
080	Waste oil	<5	<5	≥5	
081	Waste oil	<5	<5	≥5	
082	Waste oil	<5	<5	≥5	
083	Waste oil	<5	<5	≥5	
084	Waste oil	<5	<5	≥5	
085	Waste oil + kerosene	<5	<5	≥5	
086	Waste oil + gas	<5	<5	≥5	
087	Waste paint	<5	<5	≥5	
088	Waste paint	<5	<5	≥5	
089	Waste paint	<5	<5	≥5	
090	Waste paint	<5	<5	≥5	
091	Waste paint	<5	<5	≥5	
092	Waste paint	<5	<5	≥5	FP
093	Waste SC-49 solvent	<5	<5	≥5	
094	Waste solvent	<5	<5	≥5	
095	Waste stoddard	<5	<5	≥5	
096	Waste toner	<5	<5	≥5	

TABLE 11 (cont.)

ID	Matrix	GC Results Unspiked ppm	Immunoassay Result		Interp.
			Unspiked ppm	Spiked (5 ppm 1248)	
097	Waste tramp oil	<5	<5	≥5	
098	Waste transmission fluid	<5	<5	≥5	
099	Xylene	<5	≥5	≥5	FP
100	Not Recorded	<5	<5	NR	
No. of False Positive Results		6/99			
Rate		6.1%			
No. of False Negative Results				0/98	
Rate				0.0%	

[a] Trial 2 data

[b] NR = not run

APPENDIX D

CONSTRUCTION HEALTH AND SAFETY PLAN FOR EMCON EMPLOYEES

SITE-SPECIFIC HEALTH AND SAFETY PLAN

SAGINAW-BUFFALO SITE

NYSDEC SITE NO. 915152

Prepared for

General Motors Corporation
Worldwide Facilities Group
Environmental Remediation and International Environmental Support

June 8, 1998

Prepared by

EMCON
1775 Baseline Road, Suite 220
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Project 85740-100.000

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1 PURPOSE

Wehran - New York, Inc. (EMCON) has prepared this site-specific Health and Safety Plan (HASP) for General Motors Corporation (GM) to provide specific guidelines and establish procedures for the protection of EMCON personnel performing the scope of activities described in Section 3.0 of this HASP, at the Saginaw-Buffalo site, NYSDEC Site No. 915152. The information in this HASP has been developed in accordance with applicable standards and is, to the extent possible, based on previous studies and information available to date. This HASP is a living document and, as such, must be continually updated to reflect the most recent changes in the scope of work, activities, and site conditions.

1.1 Personnel Requirements

All personnel conducting activities on site for which potential exposure exists must be in compliance with all applicable Federal/State rules and regulations, including OSHA 29 CFR 1910.120, and OSHA 29 CFR 1926. On-site personnel must also be familiar with the procedures and requirements of this HASP. In the event of conflicting safety procedures/requirements, personnel must implement those safety practices which afford the highest level of protection.

The Health and Safety Officer (HSO) and the Project Manager (PM) shall sign the title page of this HASP to verify that the content is factual, acceptable to both parties, and shall be implemented for all on-site EMCON activities covered under the HASP.

A pre-entry briefing, given by the HSO or the PM will serve to familiarize on-site personnel with the procedures, requirements, and provisions of this HASP. In addition, all on-site EMCON personnel shall sign a Plan Acceptance Form to document that they have: 1) attended a pre-entry briefing; 2) received and read a copy of the HASP; and 3) agreed to comply with the HASP.

1.2 Designation of Responsibilities

Corporate Health and Safety Manager (CHSM)

The CHSM shall have overall QA/QC responsibility for the development and implementation of the HASP. In cases where the HSO and the project management/ personnel do not agree with the contents and/or implementation of the HASP, the CHSM shall be contacted to make the necessary evaluation.

Health and Safety Officer (HSO)

The HSO is a Health and Safety Professional and is responsible for the development of the HASP and for providing any health and safety technical assistance and guidance to the PM and on-site personnel. Any significant changes in site operations, conditions, or other issues that may require alterations to the HASP, shall be discussed and approved by the HSO. When project personnel and the HSO cannot reach a solution agreeable to all parties, the CHSM will be contacted to resolve the conflict.

The HSO is also responsible for conducting periodic field audits to ensure compliance with OSHA regulations and EMCON Health and Safety Programs and Policies.

Project Manager/Task Manager (PM/TM)

The Project Manager (PM) or Task Manager (TM) shall be responsible for the overall implementation of the HASP and for ensuring that all health and safety procedures and policies are carried out in conjunction with this project. This shall include, but is not limited to:

- Review and approval of the HASP.
- Communication of site requirements to EMCON on-site personnel and EMCON subcontractors by means of a pre-entry briefing.
- Consultation with the HSO regarding appropriate changes to the HASP.
- Relating any changes to the site personnel.

Site Safety Officer (SSO)

The SSO shall be appointed by the PM and approved by the Health and Safety Department prior to the commencement of field activities. The SSO need not be a Health and Safety Professional.

The SSO is the person who, under the supervision of the PM/TM, is responsible for ensuring that: 1) all on-site personnel receive a copy of the HASP, understands its contents, and comply with the contents; 2) all necessary maintenance and decontamination of safety equipment is conducted by on-site personnel; 3) local emergency services are contacted in the event of an on-site emergency; 4) all the forms attached to the HASP are completed and submitted to the HSO upon completion of field activities, including the Plan Acceptance Form, Instrument Calibration Form, and the Medical Data Sheet; and, 5) the Medical Data Sheet is completed and kept on site (this form need not be submitted to the HSO at the end of the project).

During on-site activities the SSO has the authority to: 1) suspend field activities or otherwise limit exposures if the health or safety of any person appears to be endangered; 2) direct company or subcontractor personnel to alter work practices that endanger human health or the environment; and 3) suspend an individual from field activities for significant infraction of the requirements of the Health and Safety Plan.

Occupational Physician

EMCON's Occupational Physician, who has been certified by the American Board of Preventive Medicine, is responsible for developing the Health and Safety Medical Surveillance Program protocol in accordance with OSHA 29 CFR 1910.120(f) and good health and safety practices.

1.3 Training Requirements

1.3.1 General Training

All personnel conducting the site work shall have completed at least 40 hours of classroom-style health and safety training and 3 days of on-site training, as required by OSHA 29 CFR 1910.120.

In addition, the SSO and the PM shall receive an additional eight hours of supervisory training. All site employees shall receive a minimum of eight hours of refresher training annually.

1.3.2 Site-Specific Training

1.3.2.1 Initial Training

An initial site-specific training session or briefing shall be conducted by the HSO or PM prior to commencement of work and/or entering the site. During this initial training session, EMCON employees shall be instructed on the following topics:

- Personnel responsibilities.
- Content and implementation of the HASP.
- Site hazards and controls.
- Site-specific hazardous procedures (i.e., confined space entry, etc.).
- Medical and training requirements.
- Use of direct reading monitoring equipment.
- Levels of protection.
- Action levels for upgrading/downgrading levels of PPE.
- Emergency information, including local emergency response team phone numbers, route to nearest hospital, and emergency response procedures.
- Instruction in the completion of required forms.

1.4 Medical Surveillance Requirements

A medical surveillance program is required for all EMCON personnel conducting activities at the site. The medical surveillance program must be in compliance with the provisions set forth in OSHA 29 CFR 1910.120, and other applicable Federal and State regulations.

1.4.1 Frequency of Medical Exams

All on-site EMCON personnel conducting activities shall participate in the medical surveillance program and have a baseline examination. Under the medical surveillance program, EMCON employees shall have a periodic exam (usually annually, but may be more often or less often according to exposure history), and upon termination of employment. The complete exit exam may be deferred if the employee has successfully

completed an exam within six months of termination. Exposure-related exams shall be done regardless of the date of the last exam. Medical exams shall also be given when an employee has developed a lost-time injury or illness, or has been accidentally exposed to a chemical contaminant in concentrations which exceed the exposure limit.

1.4.2 Content of Examinations

The content of the baseline exam should include:

- A medical and occupational history questionnaire with emphasis on the following systems: nervous, skin, lung, blood forming, cardiovascular, gastrointestinal, reproductive, as well as ears, nose, and throat.

- A complete physical exam, including at least the following:

  - Height, weight, temperature, pulse, respiration, and blood pressure.

  - Head, nose, and throat.

  - Eyes.

  - Ears (audiometric testing at 500, 1,000, 2,000, 3,000, 4,000, 6,000, and 8,000 Hz, including an otoscopic examination of the ear for wax and a questionnaire).

  - Chest (heart and lungs).

  - Peripheral vascular system.

  - Abdomen (liver, spleen, and kidney).

  - Musculoskeletal system.

  - Genitourinary system.

  - Skin.

  - Nervous system.

  - Pelvic, breast, and rectal (Guaiac) examination for women.

  - Testicular and rectal (Guaiac) examination for men.

- Laboratory tests should include:
  - Chemistry Panel – 24 items, including the following: Calcium, Phosphorus, Sodium, Potassium, Chloride, LDH, AST (SGOT), ALT (SGPT), T. Bili, GGTP, ALK, Phos, HDL, Cholesterol, Triglycerides, T. Protein, Globulin, Albumin, A/G Ratio, BUN, Creatinine, Uric Acid, Glucose, Iron, T4.
  - Complete blood count with differential.
  - Microscopic urinalysis.

- Other tests include:
  - Chest x-ray, PA.
  - Standard 12-lead resting electrocardiogram (EKG).
  - Pulmonary function test to include, at a minimum: forced vital capacity (FVC); forced expiratory volume, one second (FEV1); and the FEV1:FVC ratio.

The annual medical exam is similar to the baseline, with the following exceptions:

- An Annual Medical History Questionnaire is administered in place of the Baseline Medical History Questionnaire.
- Chest x-rays are not performed annually, but less frequently, depending upon age and regulatory requirements (every 3 years for age 40 and under, every 2 years for ages 41 through 50, annually for age 50 and over, annually for smokers).

The EKG is performed on the same timetable as the chest x-ray.

1.4.3 Certification of Employee Fitness

The CHSM shall obtain a copy of the physician's written opinion about the employees' ability to perform hazardous waste site work and wear respiratory protection.

The opinion shall contain:

- Recommended limits upon the employee's assigned work (e.g., no heavy lifting).
- Any possible increase of risk to employee's health resulting from work.
- A statement that employee has been informed and advised about the results of the examination.

2 SITE INFORMATION

2.1 Site Location and Description

The site is located in the east central portion of Buffalo, approximately one-half mile south and one mile east of the Kensington Expressway. The site is bounded on the north by American Axle & Manufacturing, Inc.'s Parts Coating Facility, on the west by a Conrail right-of-way, on the south by Scajaquada Street, and to the east by Niagara Mohawk Power Corporation property and other industrial property.

2.2 Site History

An area adjacent to the oily wastewater treatment building at the facility contains oil impacted with PCBs. A number of investigatory efforts have been undertaken in the area to first verify the presence and nature of the oil contamination, and subsequently to assess the extent of the contamination. Through the course of the investigation, elevated concentrations of lead were detected in the fill materials.

This project was initiated in 1986 with the intent of satisfying the "Conditions for Major Petroleum Facility License." A study was completed in October 1986 that provided a preliminary characterization of area soils and groundwater. In the spring of 1987, an investigation was performed to assess the permeability of soils underlying the existing above-ground reclaimed oil storage tank containment area adjacent to the oily wastewater treatment building. The results of the investigation indicated that oil, discharged onto the ground in the tank containment areas, had penetrated the underlying fill material and migrated beyond the limits of the containment walls. As a result, the fill layer and groundwater in the vicinity of the tanks became contaminated with oil.

A hydrogeologic investigation was performed by Wehran in August, 1987 to assess the extent of oil contamination. The investigation concluded that an oil plume was present extending southwest from the tank storage area.

A test pit excavated near the western end of the collection trench exposed a clay tile pipe (six-inch inside diameter) surrounded by gravel approximately four feet below ground surface. Orientation of the pipe appeared to be northeast-southwest, placing it directly

within the limits of the previously established oil-contaminated area. The pipe contained a significant amount of oil and it appeared that the gravel bedding surrounding the pipe had acted as a preferential pathway for the oil within the ground. Oil observed seeping out of the pipe was subsequently sampled and tested for PCBs by both GM and the NYSDEC. Analytical results from both sets of analyses indicated the presence of PCBs (8,420 ppm and 2,678 ppm, respectively).

Following discovery of the pipe and the possibility that residue in the pipe could be a source of PCBs, a series of staged investigations were performed to assess the lateral extent and orientation of the buried pipe. In conjunction with the pipe investigation, further sampling of the oil, fill, and groundwater was conducted. These investigations were completed by Wehran in March, 1990.

Results of the investigation indicated the clay tile pipe did not extend further than originally thought (i.e., total length of the pipe was within the oil-impacted area). The additional sampling confirmed the presence of PCBs in all media tested. Additionally, lead was detected in the fill materials across the site at concentrations ranging from ND to 23,900 ppm. 8 out of 12 samples tested failed the TCLP tests for lead (i.e., > 5 mg/l).

In 1995 the clay pipe was excavated and removed along with much of the PCB impacted soil surrounding it. A 100 foot long perforated pipe was installed in the excavated trench and connected to a manhole to collect the oil and impacted groundwater. The trench was backfilled and paved over.

3 SCOPE OF WORK

The following is a summary of site activities to be conducted by EMCON personnel and EMCON subcontractors at site.

Field activities to be conducted include:

- Subsurface soil impacted with PCBs greater than 10 ppm will be removed. The excavation is anticipated to be approximately 100 feet x 100 feet and extend to a depth of approximately 6.5 feet below grade. Excavation will proceed from north to south until all material with PCBs > 10 ppm are removed.
- EMCON personnel will be conducting PCB field screening to guide the excavation.
- A temporary water treatment system will be set up on site to treat groundwater generated from dewatering prior to discharge to the Buffalo Sewer Authority sanitary sewer system.
- Excavated materials will be placed directly into lined dump trailers for transport to Chemical Waste Management in Model City, NY for treatment and disposal.
- Upon removal of all materials above the PCB cleanup goal, the excavation will be backfilled.
- The excavation area as well as the remaining 7-acre parking lot will be repaved.
- Since the excavation exceeds four feet in depth, it is considered to be a confined space. Confined space entry is not included in this HASP. Thus, no EMCON personnel shall be allowed to enter the excavation for any reason.

If the scope of work is altered or if additional tasks are assigned, an addendum to this HASP shall be developed to address the specific hazards associated with these changes.

4 HAZARD EVALUATION

This section identifies and evaluates the potential chemical, physical, and/or biological hazards which may be encountered during all intrusive activities. Specific hazards and associated protective measures for each of these activities are outlined in Table 4-1.

4.1 Chemical Hazards

The key contaminants found on this site include PCBs and lead. Exposure to PCBs occurs primarily by direct contact with contaminated media and secondarily through inhalation of airborne sediments containing PCB particles. Exposure to lead occurs primarily through inhalation of airborne dusts and water droplets containing lead.

In previous sampling programs, PCB concentrations in soil have ranged up to 377 ppm with most detected concentrations less than 200 ppm.

Total lead concentrations in soil samples range up to about 24,000 ppm with most concentrations typically less than 5,000 ppm. Table 4-2 lists the properties of the site contaminants.

4.1.1 Organic/Inorganic Vapor Inhalation

Exposure to organic/inorganic vapors shall be controlled by:

- Monitoring air concentrations for organic vapors shall be conducted in the breathing zone with an HNu or OVM photoionization detector (PID). Monitoring can reduce risks by indicating when action levels have been exceeded, and personal protective equipment must be upgraded.

- Using respiratory protection in areas known to have concentrations above the action level.

TABLE 4-1
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
TASK-SPECIFIC HAZARD ASSESSMENT

Task	Hazards	Controls
Impacted Soil Removal	Utility Clearances	Call utilities (Section 4.2.3)
	Heavy Equipment	Distancing, safe work practices, inspections (Section 4.2.1)
	Excavation Development Cave-ins	Sloping/shoring practices distancing personnel from excavation (Section 4.2.4)
	Exposure to Chemical Hazards	Monitoring/respiratory protection/PPE (Sections 6.3, 6.4, 7.0)
	Temperature Stress	Sections 4.2.5
	Slip/Trip/Hit/Fall	Section 4.2.8
Soil Sampling	Exposure To Chemical Hazards	Monitoring/respiratory protection/PPE (Sections 6.3, 6.4, 7.0)
	Temperature Stress	Sections 4.2.5
	Slip/Trip/Hit/Fall	Section 4.2.8
	Splash Hazards	Wear safety glasses and gloves. Emergency eyewash available (Section 6.0 and 7.0)

TABLE 4-2
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
PROPERTIES OF SITE CONTAMINANTS

Chemical Name	Exposure Limits	Route of Entry	Symptoms/Health Effects	Chemical Properties
Polychlorinated Biphenyls (54%) (PCBs)	TLV: 0.5 mg/m^3 PEL: 0.5 mg/m^3 STEL: NA IDLH: 5 mg/m^3	Inhalation Absorption Ingestion Contact	Irritated eyes, skin; chloracne, dermatitis, liver damage; liver carcinogen.	(FP) NA (VP) NA (IP) NA
Polychlorinated Biphenyls (42%) (PCBs)	TLV: 1.0 mg/m^3 PEL: 1.0 mg/m^3 STEL: NA IDLH: 10 mg/m^3	Inhalation Absorption Ingestion Contact	Irritated eyes, skin; chloracne, dermatitis, liver damage; liver carcinogen.	(FP) NA (VP) NA (IP) NA
Polyaromatic Hydrocarbons	TLV: 0.2 mg/m^3 PEL: 0.2 mg/m^3 STEL: NA IDLH: NA	Inhalation Contact	Dermatitis, bronchitis, cancer of lungs, skin, bladder, and kidneys, skin carcinogen	(FP) NA (VP) <1 mm (IP) NA
Lead	TLV: 0.15 mg/m^3 PEL: 0.05 mg/m^3 STEL: 0.1 $mg.m^3$ IDLH: NA	Inhalation Ingestion Contact	Insomnia, lassitude, anxiety tremor, pallor, nausea, anorexia, low weight, convulsions, coma: "lead line" on the gum, decreased hand-grip strength, intense periodoc cramping.	(FP) 200^0F (VP) 0.2 mm (IP) NA

NA - Information Not Available
FP - Flash Poing
VP - Vapor Pressure
IP - Ionization Potential

TLV - ACGIH Threashold Limit Value
PEL - OSHA Permissable Exposure Limit
STEL - Short Term Exposure Limit
IDLH - Immediately Dangerous to Life and Health

4.1.2 Respirable Dust Inhalation

Inhalation of respirable dust-containing particles (metals and PCBs) is possible when using heavy equipment or conducting intrusive activities. Contaminated particulate (e.g., soil, pavement) may become suspended in air due to a combination of factors, including lack of vegetative cover and windy conditions.

Control of exposure to dust shall be obtained as follows:

- When possible, dust control measures may be utilized to suppress the dust. These include wetting the area and providing artificial ground cover.
- When dust suppression control is not possible, respirators with a HEPA filter must be used to prevent against inhalation of dust.

4.1.3 Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of the proper personnel protective equipment (PPE) and good housekeeping procedures. The proper PPE (e.g., Tyvek, gloves) as described in Section 6.6, shall be worn for all activities where contact with potentially contaminated media or materials are expected.

4.2 Physical Hazards

Physical hazards that may be present during these site activities include potential for proximity to heavy equipment; trenching/excavation cave-ins; underground utilities; slip/trip/fall hazard; temperature stress and other adverse weather conditions; and splash hazards. In addition, personnel must be aware that the protective equipment worn during certain activities may limit dexterity and visibility and may increase the difficulty of performing some tasks.

4.2.1 Heavy Equipment

Heavy equipment to be utilized at the site shall include a variety of backhoes, dozers, track loaders, and off-road trucks.

The following practices shall be followed when using heavy equipment:

- Equipment should be inspected daily to ensure that there are no exposed moving belts, fans, etc.

- When not in use, hydraulic and pneumatic components should be left in down or "dead" position.

- Roll-over protection shall be provided on hilly sites.

- No riding on vehicles or equipment except in fixed seats.

Steel-toed shoes and hard hat shall be worn for all work conducted near heavy equipment. Foot traffic shall be restricted while heavy equipment is in operation. Workers remaining around any heavy equipment shall be kept to a minimum. Heavy equipment can produce high noise levels. Personnel shall protect themselves from such noise levels in one of two ways – distancing from the source or the use of hearing protection. If using distance as a means of noise abatement, remain at least 12 feet from the equipment during all high noise operations. If using hearing protection, plugs/muffs should be used during all operations utilizing heavy equipment.

4.2.2 Utility Clearances

The following work practices will be adhered to:

- Elevated superstructures (e.g., backhoe) shall remain a distance of 20 feet away from utility lines and 50 feet away from power lines. Distance from utility lines may be adjusted by the SSO depending on actual voltage of the lines.

- During all intrusive activities (e.g., drilling, excavating, probing), GM should be contacted to mark underground lines before any work is started.

- Personnel involved in intrusive work shall determine the minimum distance from marked utilities which work can be conducted with the assistance of GM.

4.2.3 Excavation and Trenching

The Remedial Contractor is to conduct all excavation and trenching operations in compliance with OSHA 29 CFR 1926.650 through 653 (see Appendix A).

4.2.3.1 Excavation Development

Prior to opening an excavation, effort shall be made to determine whether underground installation; i.e., sewer, telephone, water, fuel electric lines, etc., will be encountered and the estimated location. When the excavation approaches the estimated location of such installation, the exact location shall be determined and when it is uncovered, proper

supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

Barriers shall be erected around excavations in remote work locations. Cover all wells, pits, shafts, and caissons. Backfill temporary wells, pits, and shafts when work is completed.

Vehicular traffic and heavy equipment shall remain at least four feet from the face of the excavation. All excavated or other materials shall be stored and retained at least two feet from excavation.

The work area shall be monitored for the presence of any hazardous conditions and/or atmospheres during excavation activities.

A copy of OSHA 29 CFR 1926.653 Excavation and Trenching Standards is located in Appendix A.

4.2.4 Heat Stress

4.2.4.1 Recognition and Symptoms

Temperature stress is one of the most common illnesses at hazardous waste sites. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat stress. Personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

- ***Heat Rash*** – Redness of skin. Frequent rest and change of clothing.
- ***Heat Cramps*** – Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly-salted water by mouth, unless there are medical restrictions.
- ***Heat Exhaustion*** – Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids.
- ***Heat Stroke*** – Hot dry skin; red, spotted or bluish; high body temperature of 104°F, mental confusion, loss of consciousness, convulsions or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning, sponge with cool liquid while fanning; treat for shock. **DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.**

4.2.4.2 Work Practices

The following procedures will be carried out to reduce heat stress:

- Heat stress monitoring
- Acclimatization
- Work/rest regimes
- Use of ice packet vests
- Shower sprinklers on site
- Liquids that replace electrolytes/salty foods available during rest regimes
- Air conditioned trailer, if possible
- Use of buddy system

4.2.4.3 Acclimatization

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with the heat stress. Work/rest regimes will be partially determined by the degree of acclimatization provided.

4.2.4.4 Work/Rest Regimes

The work/rest regime for heat stress is shown in Table 4-3.

4.2.4.5 Worker Information and Training

All new and current employees who work in areas where there is a reasonable likelihood of heat injury or illness should be kept informed, through continuing education programs of:

- Heat stress hazards.
- Predisposing factors and relevant signs and symptoms of heat injury and illness.

TABLE 4-3
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
WORK/REST REGIME FORHEAT STRESS

WGBT	Acclimatization (days)	Work/Rest Regime/hour (percent) Level D	Work/Rest Regime/hour (percent) Level C*	Work/Rest Regime/hour (percent) Level B**
77°F	0 to 3 >3	Continuous	Continuous	75/25 Continuous
84°F	0 to 3 >3	Continuous	75/25 Continuous	50/50 75/25
88°F	0 to 3 >3	75/25 Continuous	50/50 75/25	25/75 50/50
90°F***	0 to 3 >3	50/50 75/25	25/75 50/50	No work 25/75
94°F****	0 to 3 >3	25/75 50/50	No Work 25/75	No Work
98°F*****	0 to 3 >3	No Work 25/75	No Work	No Work

WBGT Wet Bulb Global Temperature
* Used also for all Level B work using Saranex/Tyvek suits and ice vests.
** Used also for all Level B work using Saranex/Tyvek suits, no ice vests.
*** No Level B work conducted in temperatures above 90°F.
**** No Level C work conducted in temperatures above 94°F.
***** No Level D work conducted in temperatures above 98°F.

- Potential health effects of excessive heat stress and first aid procedures.
- Proper precautions for work in heat stress areas.
- Worker responsibilities for following proper work practices and control procedures to help protect the health and safety of themselves and their fellow workers, including instruction to immediately report to the employer the development of signs or symptoms of heat stress overexposure.
- The effects of therapeutic drugs, over-the-counter medications, or social drugs, may increase the risk of heat injury or illness by reducing heat tolerance.

4.2.5 Adverse Weather Conditions

The SSO shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, tornado warnings, and strong winds are examples of conditions that would call for the discontinuation of work and evacuation of site.

4.2.6 Slip/Trip/Hit/Fall

Slip/trip/hit/fall (S/T/H/F) injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards.
- Establish and utilize a pathway which is most free of slip and trip hazards.
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- Carry only loads which you can see over.
- Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- Communicate hazards to on-site personnel.
- Secure all loose clothing, ties, and remove jewelry while around machinery.
- Report and/or remove hazards.

- Keep a safe buffer zone between workers using equipment and tools.

4.2.7 Heavy Lifting

When lifting objects, use the following proper lifting techniques:

- Keep your feet shoulder width apart to get the best footing possible.
- Bend at the knees, not at the waist.
- Tighten stomach muscles to offset the force of the load.
- Grasp the object at opposite corners.
- Lift with the legs instead of the back muscles.
- Keep the back upright and avoid twisting.
- Most importantly, think before lifting.

4.2.8 Motor Vehicle Hazards

4.2.8.1 Driver Safety

The following motor vehicle operator regulations shall be employed when operating a vehicle.

The driver shall:

- Review all pertinent information such as manufacturer's operating instructions, company procedures, and maintenance records.
- Review safe operating techniques and signals.
- Wear seat belts at all times.
- Confirm that the mobile equipment safety devices are functional.
- Operate only his or her own vehicle or a company vehicle.
- Operate only properly maintained vehicles.

Personnel may not operate any vehicle after having consumed alcohol and/or drugs, including legal drugs, which may impair their ability to operate that motor vehicle.

4.2.8.2 Use of a Spotter

Personnel shall act as a spotter for trucks and large vehicles as they back and navigate through tight spaces. Spotting shall be conducted as follows:

- Personnel (driver and spotter) shall know and use standard hand signals when directing the traffic (see attached figure).
- The spotter is to be in position to see both the immediate hazard area and be seen by the driver.
- The area shall be cleared to the rear of the truck before backing.
- The spotter will review with the driver the areas that the spotter is watching.
- If any person, vehicle or object enters the hazard area, immediately give the stop signal to the driver and warn persons away or move objects.
- Be certain the hazard area is clear before signaling the driver to resume the maneuver.
- Spotters should avoid walking backward, and remain clear of the line of movement of the vehicle.
- Be aware of and avoid hazards, such as other vehicles, that may approach from the spotter's back.
- If the spotter must change position during the maneuver, signal to the driver to stop, and move to the new position before the maneuver is to continue.
- The spotter should be positioned so as to keep the hazard area in clear view and maintain visual contact with the driver.

4.2.8.3 Worker Safety While Working in Proximity to Motor Vehicles

- Continuously check the activities of the vehicles operating nearby which may present a hazard.
- Refrain from activities that might distract vehicle operator.

- Use high visibility clothing. Reflective or high visibility clothing should be worn by personnel exposed to moving traffic or equipment hazards such as work collection in heavy traffic areas, in times of darkness or reduced lighting, under rainy or foggy conditions, when spotting in transfer stations, landfills, etc.

4.3 Biological Hazards

4.3.1 Blood Poisoning

Blood poisoning is a term used to indicate a large number of bacteria present in the circulating blood. The most common symptom of blood poisoning is the reddening of skin which advances towards the heart. For example, if the point of contact is the hand than a red line will appear at the hand and extended up the arm.

Personnel protective equipment shall be worn to prevent direct contact with media which may be contaminated with bacteria or viral agents.

Signs and symptoms include swelling, stiffness and tenderness in the affected area, fatigue, chills and fever, pustules, and abscesses. If allowed to progress, the organisms may multiply and cause an overwhelming infection and death.

5 ACCIDENT PREVENTION

A vital element of the Site and Health and Safety program is the implementation of an accident prevention program. An accident prevention program, as applicable to this site, includes the following measures:

- Communicate the contents of this HASP to all EMCON personnel who work on the site.
- Educate EMCON personnel as to the requirements of the HASP.
- Eliminate unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions.
- Reduce unsafe acts. Personnel shall make a conscious efforts to work safely. A high degree of safety awareness must be maintained so that safety factors involved in a task become an integral part of the task.
- Inspect frequently. Regular safety inspections of the work site, materials, and equipment by qualified persons ensures early detection of unsafe conditions. Safety and health deficiencies shall be correct as soon as possible, or site activities shall be suspended.

The following guidelines describes those specific measures personnel shall take to minimize the occurrence of accidents on site:

- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the evacuation of site personnel and re-evaluation of the hazard and the level of protection.
- Eating, drinking, chewing gum or tobacco, and smoking are prohibited while working in area where the potential for chemical and/or explosive hazards may be present. Personnel must wash thoroughly before initiating any of the aforementioned activities.
- All field investigation activities must be coordinated through the HSO, SSO and the PM.

- Contact lenses will not be worn with any type of respirators.
- Facial hair must not interfere with the fit of the respirator.
- Site activities will not be conducted without adequate lighting.

6 PERSONAL PROTECTIVE EQUIPMENT

6.1 General

The purpose of personal protective equipment (PPE) is to shield or isolate individuals from the chemical and physical hazards that may be encountered during work activities. Full-faced respirators protect lungs, gastrointestinal tract, and eyes against airborne contaminants. Chemical resistant clothing protects the skin from contact with skin destructive and absorbable materials.

The level of protection must correspond to the level of hazard known, or suspected, in the specific work area. PPE has been selected with specific considerations to the hazards associated with the removal of contaminated soil. The specific PPE to be used for each level of protection is located in Table 6-1.

6.2 PPE for Visitors

Appropriate safety equipment and sets of PPE ensembles per day shall be kept in the support zone in order to provide the proper protection for personnel who require access to the exclusion zone.

6.3 Air-Purifying Respirators

The air-purifying respirator cartridges selected for use during all Level C work at this site are MSA GMC-H, which have the ability to protect against total organic vapor concentration up to 1,000 ppm, 10 ppm chlorine, 30 ppm formaldehyde, 50 ppm hydrogen chloride, and 50 ppm sulfur dioxide. The cartridges contain an attached HEPA filter which will protect against dust mist and fumes having a TWA greater than 0.05 mg/m^3, asbestos-containing dusts and mists, and radionuclides.

6.3.1 On-Site Respirator Fit Test

All personnel who may be required to wear a negative-pressure, air-purifying respirator shall be fitted properly and tested for a face seal at least annually. Employees shall have

TABLE 6-1
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
LEVELS OF PROTECTION

Level D will consist of the following:

Tyvek, steel-toed boots, safety glasses, hard hat (if overhead hazards exists), latex gloves (if contacting any soil or water) hearing protection.

Modified Level D will consist of all the element of Level D above, plus the following:

Saranex coveralls, neoprene outer gloves, inner Nitrile gloves, chemical-resistant boot covers.

Level C will consist of the following:

Saranex coveralls, steel-toed boots, safety glasses, MSA full-faced air-purifying respirator equipped with organic vapor/acid gas combination cartridge with attached HEPA filter, Nitrile outer gloves, surgical inner gloves, chemical-resistant boot covers, hard hat (if overhead hazards exists), hearing protection.

the opportunity to handle the respirators, and wear them in normal air for a long familiarity period. Following the familiarity period, employees shall test the piece-to-face seal by use of the positive and negative pressure fit checks:

- ***Positive Pressure Fit Check*** – with the exhaust port(s) blocked, the positive pressure of slight exhalation should remain consistent for several seconds.

- ***Negative Pressure Fit Check*** – with the intake ports blocked, the negative pressure of slight inhalation should remain constant for several seconds.

Air-purifying respirators shall not be worn when conditions prevent a seal of the respirator to the wearer. Such conditions may be the growth of a beard, sideburns, a skull cap that projects under the face-piece, or temple pieces on glasses. No employee may wear a beard if it interferes with the fit of the respirator. Also, the absence of one or both dentures can seriously affect the fit of a face-piece, and should be worn at all times that respirators are being used. The worker's diligence in observing these factors shall be evaluated by periodic checks.

6.3.2 Cartridge Changes

All cartridges will be changed a minimum of once daily. Changes will also be made when personnel begin to experience increased inhalation resistance or breakthrough of a chemical warning property.

6.3.3 Respirator Cleaning, Maintenance, and Inspection

All respirators used on site shall be cleaned and maintained in the following manner:

- Remove filters and cartridges.

- Visually inspect face piece and parts, discard faulty items.

- Remove all elastic headbands.

- Remove exhalation cover and inhalation valves.

- Wash, sanitize, and rinse face piece. Wash any parts that were removed separately.

- Dry the mask. Wipe face pieces and valves.

- Disassemble and clean the exhalation valve.

- Wash, sanitize, and rinse face piece. Wash any parts that were removed separately.
- Dry the mask. Wipe face pieces and valves.
- Disassemble and clean the exhalation valve.
- Visually inspect face piece and all parts for deterioration, distortion, or other faults that might affect the performance of the respirator.
- Replace any questionable or faulty parts.
- Reassemble mask and visually inspect completed assembly.
- Seal mask in plastic bag.

6.4 Levels of Protection

Each activity conducted on-site presents different hazards and therefore required different levels of protection. There are four basic levels of protection, established by EPA field operating procedures. They are A, B, C and D, with Level A being the highest level of protection and Level D being the lowest.

Personnel working within the excavation will begin in Level C, until results of personal air monitoring for PCBs are received. At that time, personnel may be able to downgrade to Level D. The initial level of protection for other activities is Modified Level D as described in Table 6-1. Action levels for upgrading or downgrading of PPE from the initial level are discussed in Table 7-2.

7 EXPOSURE MONITORING

Inhalation hazards are caused from the exposure to vapors and contaminated dust. Air monitoring shall be performed within all work areas to detect the presence and relative concentration of those air contaminants which are inhalation hazards.

The data collected throughout the monitoring effort shall be used to determine the appropriate levels of protection.

7.1 Exposure Monitoring

Air monitoring equipment to be used during site activities described in Section 3.1, shall consist of a photoionization detector (PID) with a 10.2 electron Volt (eV) lamp, and a respirable dust meter.

7.1.1 Personal Air Sampling

Personal air samples will be collected from all personnel for an 8-hour duration. The samples will be analyzed for PCBs. Until results are received, personnel within the excavation area will be in Level C respiratory protection. If the samples are less than 0.025 mg/m^3 PCBs, the level of protection will be downgraded to modified Level D.

7.1.2 Photoionization Detector

Exposure to volatile organic compounds (VOCs) shall be monitored with a photoionization detector (PID) with a 10.2 eV lamp, such as an HNu. The HNu has the ability to detect organic vapor concentrations from 1 part per million (ppm) to 2,000 ppm. All PID monitoring shall be conducted in the breathing zone.

7.1.3 Respirable Dust Meter

The Respirable Dust Meter measures the concentrations of small-sized, airborne particulates. It has the ability to detect particles in the size range from 0.1 to 10 micrometers in diameter momentarily, as a time-weighted average or 8-hour

equivalent shift averages. Concentrations are evaluated by two scales which reads from 0.01 to 10 mg/m^3, and 0.1 to 100 mg/m^3, respectively. All respirable dust monitoring shall be conducted in the breathing zone. Due to the potential of PCB contaminated soil and possible exposure to dust containing PCBs, a respirable dust meter will be used to determine the proper action level and personal protective equipment.

7.1.4 Monitoring Frequency

Monitoring with the PID and Respirable Dust Monitor, shall be conducted initially, during any change in conditions, and every 30 minutes, and/or continuously during Level C activities.

Dust monitoring shall also be conducted continuously any time where windy or dusty conditions exist. Upgrades and downgrades shall be dependent on readings obtained with the direct reading instruments. All readings on the PID shall be recorded on Direct Reading Monitoring Forms, shown in the Attachment section, and submitted to the HSO.

Table 7-1 summarizes direct monitoring equipment capabilities for instruments to be used at the GM site.

7.1.5 Health and Safety Action Levels

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. All activities shall be initiated in Level C. Personal air sampling will be conducted (as described in Section 7.1.1), and based on the results the level of protection may be downgraded to modified Level D. The appropriate actions to be taken at designated action levels, is described in Table 7-2.

In addition to Table 7-2, an upgrade to Level C is required if:

- Any symptoms occur, as described in Table 4-1.
- Requested by an individual performing the task.
- Any irritation to eye, nose, throat, or skin occurs.

A work stoppage and evacuation (cease and desist) at the specific work area is required if concentrations of organic vapors recorded in the work area are greater than 25 ppm.

TABLE 7-1
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
AIR MONITORING REQUIREMENTS

Monitoring Instrument	Monitoring Frequency	Working Range
HNU with 10.2 eV lamp	Initially, during change in conditions, half-hourly, and continuously during dusty or windy conditions or during Level C activities.	1 to 2,000 units
Respirable Dust Monitor	Initially, during change in conditions, half-hourly, and continuously during dusty or windy conditions or during Level C activities.	0.01 to 10 mg/m^3 0.1 to 100 mg/m^3
Personal Air Samples	Initially, for an 8-hour duration	Detection lilmit of 0.01 mg/m^3

TABLE 7-2
GENERAL MOTORS CORPORATION
SAGINAW-BUFFALO SITE
ACTION LEVELS FOR FIELD ACTIVITIES

Monitoring Instrument	Hazard	Instrument Reading	Level of PPE
PID	Organic Vapor*	<5 ppm If not contacting environmental media (e.g., soil, water)	Level D
		<5 ppm If contacting environmental media	Modified Level D
		5 – 25 ppm	Level C
		>25 ppm	Cease and Desist all Activities
Respirable Dust Monitor	Respirable Dust	0 - .025 mg/m^3 If not contacting environmental media	Level D
		0 – 0.025 mg/m^3 If contacting environmental media	Modified Level D
		0.025 – 1 mg/m^3	Level C
		> 1 mg/m^3	Cease and Desist all Activities

* Above background, measured in breathing zone.

8 SITE CONTROL AND WORK ZONES

The purpose of site control is to minimize potential contamination of workers and protect the public from hazards found on site. Site control is especially important in emergency situations.

8.1 Work Zones

A three-zone approach shall be used during site operations in order to contain the potential spread of contamination. The three zones include the Exclusion Zone, the Contamination Reduction Zone, and the Support Zone. Delineation of these three zones should be based on sampling and monitoring results, evaluation of potential routes, and the amount of contaminant dispersion in the event of a release. Movement of personnel and equipment among these zones should be minimized and restricted to necessary personnel and equipment.

8.1.1 The Exclusion Zone

The Exclusion Zone is the area where the primary activity occurs such as backhoeing, sampling, etc. This area must be clearly marked with hazard tape or by other means. Only personnel involved in the work activities will be allowed in the Exclusion Zone.

Prior to entering the Exclusion Zone, the following conditions must be met: personnel shall be suited in the designated level of protection, a decontamination station shall be established at the entrance to the exclusion zone, and all personnel leaving the area shall decontaminate and dispose of all disposable garments.

The Exclusion Zone shall be marked off during mobilization activities, and prior to the commencement of intrusive activities. The size of the Exclusion Zone shall be a 30-foot circumference around the particular intrusive activity (e.g., borings, excavation, and trenches). If necessary, the size of the exclusion zone may be increased to allow more working area or to incorporate greater area for higher levels of protection due to volatile organic emissions.

8.1.2 The Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in the area. This area must also be clearly marked with hazard tape or by other means, and personnel involved in the work activities or decontamination. A contamination reduction zone will be established surrounding all of the work areas involving field investigation activities. A contamination reduction corridor containing a decontamination pad will be located in this zone. A contamination reduction corridor is a pathway in which decontamination occurs. One pathway will be established for heavy equipment and one for personnel decontamination. This area will also serve as an access control point for personnel entering the Exclusion Zone.

8.1.3 The Support Zone

The Support Zone is an uncontaminated zone which is the location of administrative and other support functions such as first aid, telephones, equipment supply, and emergency information. The support zone would have negligible potential for exposure to contaminants and is equivalent to that of background.

The majority of site operations will be controlled from the field office trailer as well as access to the site. The support trailers will provide for team communications and emergency response, and sanitary facilities (i.e., Porta-John). Appropriate safety and support equipment also will be located in this zone.

The support trailer will be located upwind of site operations, if possible, and would be used as a potential evacuation point, if appropriate. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/ decontaminated and labeled samples. Meteorological conditions shall be observed and noted from this zone as well as those factors pertinent to heat and cold stress.

8.2 Communication

Each member of the site entry team will be able to communicate with another entry team member at all times. Communications may be by way of the following methods:

- Air horn
- Walkie-talkies
- Telephones

- Hand signals

The primary means for external communication are telephones and radio. If telephone lines are not installed at a site, all team members should:

- Know the location of the nearest telephone.
- Have correct change.
- Have the necessary telephone numbers readily available in the Support Zone.

The following standard hand signals will be mandatory for all employees to understand regardless of other means of communication:

- Hand gripping throat – Out of air, cannot breath.
- Hands on top of head – Need assistance.
- Thumbs up – OK, I'm all right, I understand.
- Thumbs down – No, negative.
- Gripping partner's wrist, or gripping both of your own hands on wrist (if partner is out of reach) – Leave area immediately.

8.3 Buddy System

8.3.1 Responsibilities

A buddy system shall be implemented when conducting Level C with an Air Purifying Respirator activities on this site. This buddy shall be able to:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical exposure or temperature stress.
- Periodically the integrity of his or her partner's protective clothing.
- Notify emergency personnel if emergency help is needed.

8.4 Site Security

Site security is necessary to prevent the exposure of unauthorized, unprotected people to site hazards and to avoid interference with safe working procedures. Security shall be maintained in the Support Zone. Barriers and warning signs should be placed surrounding the work zones.

9 DECONTAMINATION

It is the responsibility of the SSO to ensure that all personnel and pieces of equipment coming off site are properly decontaminated according to the procedures outlined below. Documentation of decontamination must be made in the field log notebook that will become part of the permanent project file.

9.1 Contamination Prevention

One of the most important aspects of decontamination is the prevention of the spread of contamination. Good contamination prevention will minimize employee and public exposure, and help ensure valid sample results by eliminating cross-contamination. Proper decontamination procedures and the following procedures of contamination avoidance shall reduce the potential spread of contamination include:

- Do not walk through areas of obvious or known contamination.
- Do not handle or touch contaminated materials directly.
- Fasten all closures on suits, covering with tape if necessary.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contaminants, when possible.

9.2 Personal Decontamination

A personnel decontamination area will be established in the Contamination Reduction Zone for all field activities. Decontamination procedures will be followed by all personnel exiting the Exclusion Zone directly into the Contamination Reduction Zone. Under no circumstances (except emergency evacuation or other medical emergencies) will personnel be allowed to leave the site prior to decontamination.

All PPE will be disposed of and/or decontaminated at the conclusion of each work day as described below. Decontamination procedures will follow the concept of deconning the most contaminated PPE first.

All disposable equipment shall be doffed before meal breaks and at the conclusion of the work day and replaced with new equipment prior to commencing work. In addition, respirator cartridges will be changed as breakthrough is obtained, as directed by the SSO. Designated containers for Tyvek suits and other disposables will be located in the Contamination Reduction Zone.

Respiratory equipment and other non-disposables will be fully decontaminated and then placed in a clean storage area. Respirator decontamination will be conducted daily. Taken from the drop area, the facepieces will be disassembled, the cartridges set aside, and all other parts placed in a cleansing solution. After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Facepieces will be allowed to air dry before placing in sanitized bags. Personnel will inspect their respirator on a daily basis to ensure its proper operation.

9.2.1 Level D Decontamination

Level D decontamination procedures to be utilized when leaving the Exclusion Zone are as follows:

- ***Step 1:*** Remove all visible contamination and loose debris by washing with clean de-ionized water.
- ***Step 2:*** Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse.
- ***Step 3:*** Remove protective clothing; dispose of in disposable container.
- ***Step 4:*** Wash and rinse hands.

9.2.2 Level C Decontamination

Level C decontamination procedures to be utilized when leaving the Exclusion Zone are as follows:

- ***Step 1:*** Remove all visible contamination and loose debris by washing with clean de-ionized water.
- ***Step 2:*** Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse.

- ***Step 3:*** Remove protective clothing; dispose of in disposable container.
- ***Step 4:*** Remove respirator, sanitize prior to reuse.
- ***Step 5:*** Remove inner gloves; dispose of in disposable container.
- ***Step 6:*** Wash and rinse hands.

The decontamination layout for Levels D and C are shown in Figures 9-1 and 9-2, respectively.

9.3 Personal Hygiene Facilities

The following equipment shall be provided for all on-site personnel.

9.3.1 Toilets

One toilet seat, one urinal, and a washbasin shall be provided per every 40 employees conducting field activities on site.

Sites not provided with a sanitary sewer shall be provided with the following toilet facilities, unless prohibited by local codes:

a. Chemical toilets

b. Recirculating toilets

c. Combustion toilets

d. Flush toilets

Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.

9.4 Equipment Decontamination

9.4.1 Sampling Equipment

Small equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic

without hindering the operation of the unit. As necessary, air monitoring equipment will be placed in clear plastic bags that allow reading of the scale and operation of the knobs.

Contaminated equipment will be taken from the drop area and shall be decontaminated as follows:

- The protective coverings shall be removed and disposed in the appropriate containers.
- Monitoring equipment will be wiped down with a disposal paper wipe.

9.4.2 Heavy Equipment

Heavy equipment (e.g., drill rig, backhoe, bulldozer) will be decontaminated after each boring using, at a minimum, high-pressure steam cleaning:

- When possible, vehicles should be parked off site or in a non-contaminated area of the site to minimize contamination and thus, avoid the need to decontaminate.
- If the vehicle is potentially contaminated, appropriate deconning procedures must be used before leaving the site. Deconning includes flushing visible dirt from the tires and high-pressure steam cleaning all heavy equipment.
- All vehicles will be decontaminated on a vehicle decontamination unit.
- Upon completion of the equipment decontamination, the equipment decontamination pad shall be thoroughly washed down and sediments and liquids removed from the collection trough and slump.

9.5 On-Site Contaminated Equipment Area

The Contractor shall provide an on-site contaminated equipment storage area at the entrance point to the Contamination Reduction Zone from the Exclusion Zone. The on-site contaminated equipment storage area shall be lined with polyethylene. The contaminated equipment storage area shall include the following:

- Boot racks for washing and storage.
- Drums or sealed containers for the disposal of protective clothing.
- A 10-foot by 10-foot temporary structure for the storage of contaminated materials and equipment used daily.

10 EMERGENCY RESPONSE/CONTINGENCY PROCEDURES

10.1 Emergency Equipment/First Aid

Basic first aid supplies (bandages, gauze, tape) will be located in the first aid box. The first aid box, along with first aid manuals and Medical Data Sheets, will be located in the Support Zone. Other on-site emergency equipment includes emergency alarm, portable emergency eyewash, and a fire extinguisher.

10.2 Emergency Procedures for Contaminated Personnel

Whenever possible, personnel should be decontaminated before administering first aid. In the contamination reduction zone there will be a separate decontamination line for emergency use only in order to reduced the risk of exposure.

- ***Skin Contact*** – Remove contaminated clothing, wash immediately with water, use soap if available.

- ***Inhalation*** – Remove victim from contaminated atmosphere. Remove any respiratory protection equipment. Initiate artificial respiration if necessary. Transport to the hospital, if necessary.

- ***Ingestion*** – Remove from contaminated atmosphere. Do not induce vomiting if victim is unconscious. Also never induce vomiting when acids, alkalis, or petroleum products are suspected. Transport to the hospital, if necessary.

If site personnel have unexplainably collapsed, all personnel must evacuate work area. Rescue personnel must don supplied air respiratory protection before evacuating victim from work area.

In case of fire, all personnel must evacuate work area and contact local fire department.

10.3 Site Evacuation

If site evacuation is necessary, an alarm shall be sounded and site personnel shall be

notified. Upon the sounding of the alarm, all employees shall leave the site through the Scajaquada Street entrance.

10.4 Emergency Telephone Numbers

EMERGENCY INFORMATION		
Contact	**Phone Number**	**Hospital Directions**
Local Police	911	**Erie County Medical Center:** Exit the facility on Scajaquada Street, turn left onto Scajaquada St. and proceed to Bailey Ave. At Bailey Ave. turn left and proceed approximately 1/2-mile to East Delavan Street. Turn left onto East Delavan St. and proceed approximately 1 mile to Grider Street. At Grider St. turn right, go about 1/4-mile and the Medical Center is on the left.
Fire Department	911	
Ambulance	911	
Local Hospital	(716) 898-3161	
Safety Officer – S. Wilsey Work	(716) 773-1801	
Corporate Health & Safety Manager – C. Andrews Work	(201) 512-5758	
Project Manager – K. Malinowski Work	(716) 773-1801	

FIELD TEAM REVIEW

Each employee conducting field work shall sign this form after the pre-entry briefing is completed and before being permitted to work on site. A copy of this signed form shall be kept at the site, and the original sent to the HSO.

SITE PERSONNEL SIGN-OFF:

I have attended a pre-entry briefing outlining the specific health and safety provisions on this site. I have received and read a copy of the Site-Specific Health and Safety Plan and will comply with the provision contained therein.

EMCON PROJECT MANAGER:

EMCON SAFETY OFFICER:

MEDICAL DATA SHEET

This brief Medical Data Sheet will be completed by all personnel potentially working on-site and will be kept in the Support Zone during the conductance of site operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to the hospital facilities is required:

Site: _____

Name: _____ Home Telephone: _____

Address:

_____

_____

Age: _____ Height: _____ Weight: _____

Person to Contact in Case of Emergency:

_____ Phone No. _____

Drug or other Allergies: _____

_____

Particular Sensitivities: _____

Do You Wear Contacts? YES NO

Provide a Checklist of Previous Illnesses or Exposures to Hazardous Chemicals:

_____

_____

_____

What Medications are you Presently using? _____

_____

Do you have any Medical Restriction? _____

_____

_____

Name, Address, and Phone Number of Personal Physician:

_____

_____

_____

DIRECT READING AIR MONITORING FORM

DATE: _____

PROJECT: _____

PROJECT #: _____

WEATHER CONDITIONS: _____

WIND DIRECT/SPEED: _____

USER: _____

CALIBRATION: (Good, Bad)_____

CALIBRATED BY: _____

COMMENTS: _____

ACTIVITY	INSTRUMENT	WORKING RANGE	TIME	READING	COMMENTS

APPENDIX A

EXCAVATION AND TRENCHING STANDARDS

PART 1926—[AMENDED]

Subpart M—[Amended]

1. By revising the authority citation for subpart M of part 1926 to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

2. By revising subpart P of part 1926 to read as follows:

Subpart P—Excavations

Sec.

Subpart P—Excavations

Authority: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state wh the work is to be performed. Howev professional engineer, registered in a state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated da to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth position and in turn are supported b other members of the shoring syster

Shield (Shield system) means a structure that is able to withstand th forces imposed on it by a cave-in an thereby protect employees within th structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields ca either premanufactured or job-built accordance with § 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring syste that supports the sides of an excava and which is designed to prevent ca ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees fro cave-ins by excavating to form side an excavation that are inclined awa from the excavation so as to preven cave-ins. The angle of incline requir prevent a cave-in varies with differences in such factors as the so type, environmental conditions of exposure, and application of surcha loads.

Stable rock means natural solid mineral material that can be excava with vertical sides and will remain intact while exposed. Unstable roc considered to be stable when the ro material on the side or sides of the excavation is secured against cavin or movement by rock bolts or by an protective system that has been designed by a registered profession engineer.

Structural ramp means a ramp bu steel or wood, usually used for veh access. Ramps made of soil or rock not considered structural ramps.

Support system means a structur such as underpinning, bracing, or shoring, which provides support to adjacent structure, underground

installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 General requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.* (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress.*—(1) *Structural ramps.* (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with § 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres.*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50–1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually

attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (b)(1) and (b)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) *Fall protection.* (1) Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

(2) Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

§ 1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support.*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P

Soil Classification

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in § 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in § 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653–85 and D2488: The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS–121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 tsf (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses

shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P

Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B–1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B–1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK TYPE A [2] TYPE B TYPE C	VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½: 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

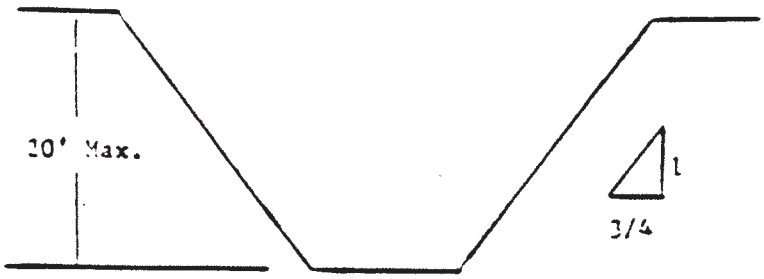
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

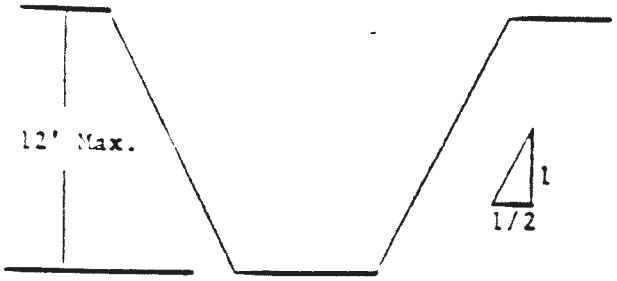
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



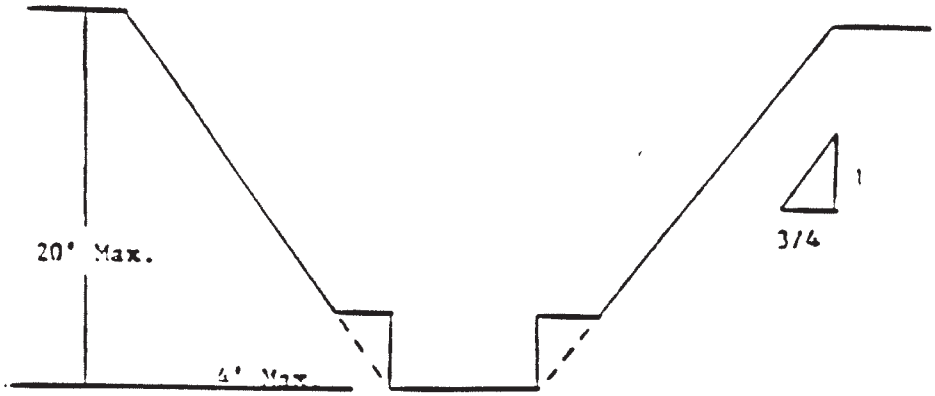
Simple Slope—General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

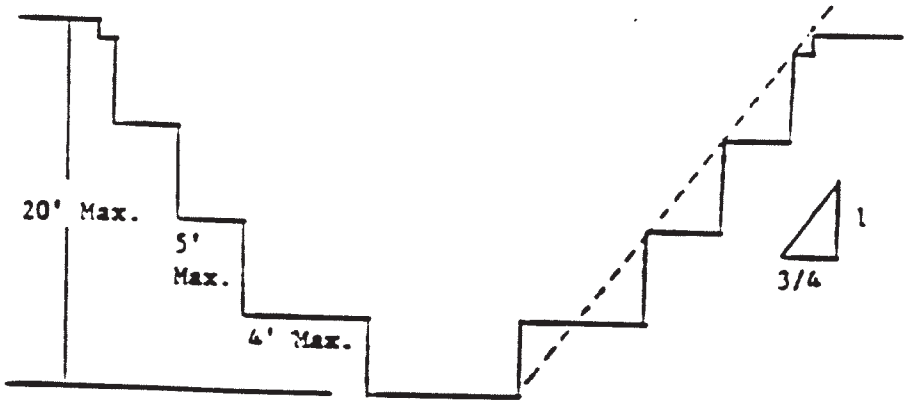


Simple Slope—Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

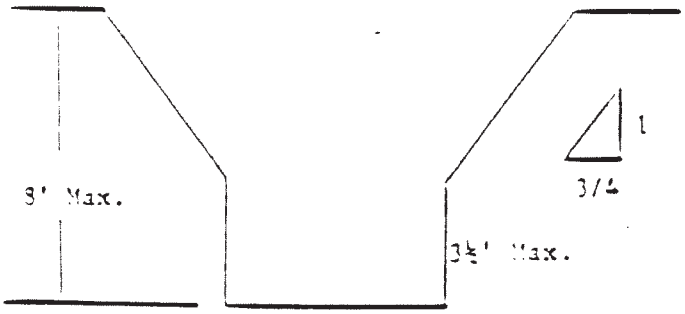


Simple Bench



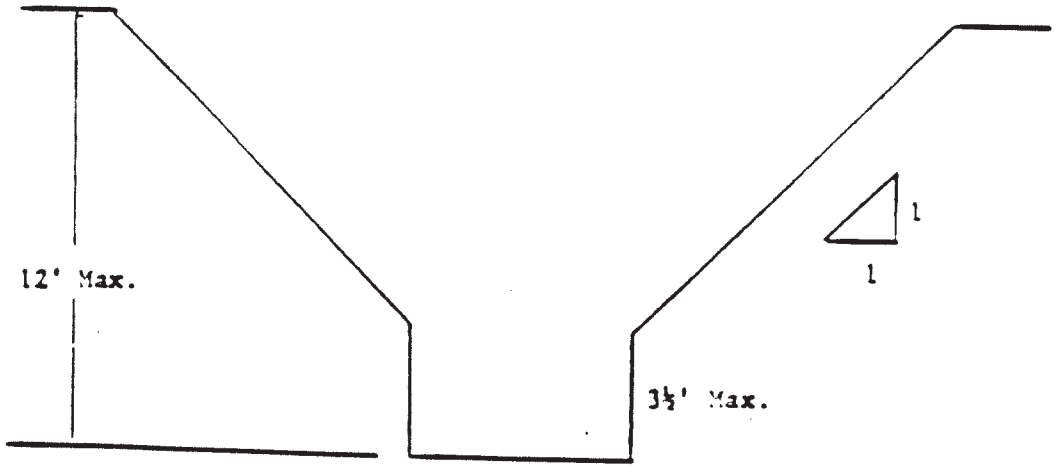
Multiple Bench

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



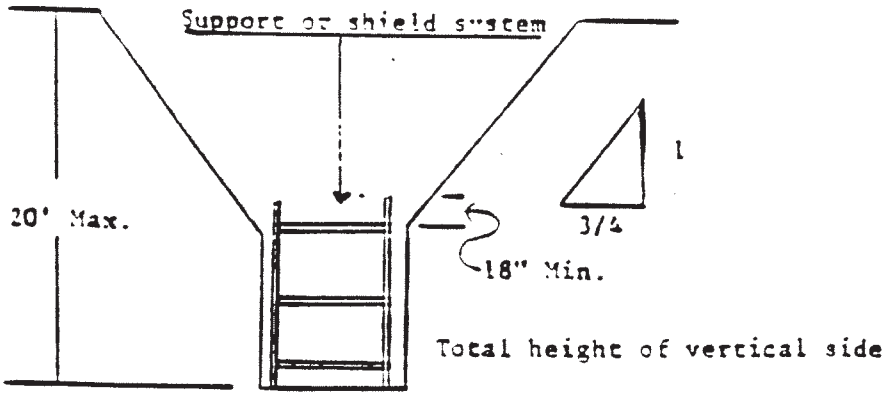
Unsupported Vertically Sided Lower Portion—Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

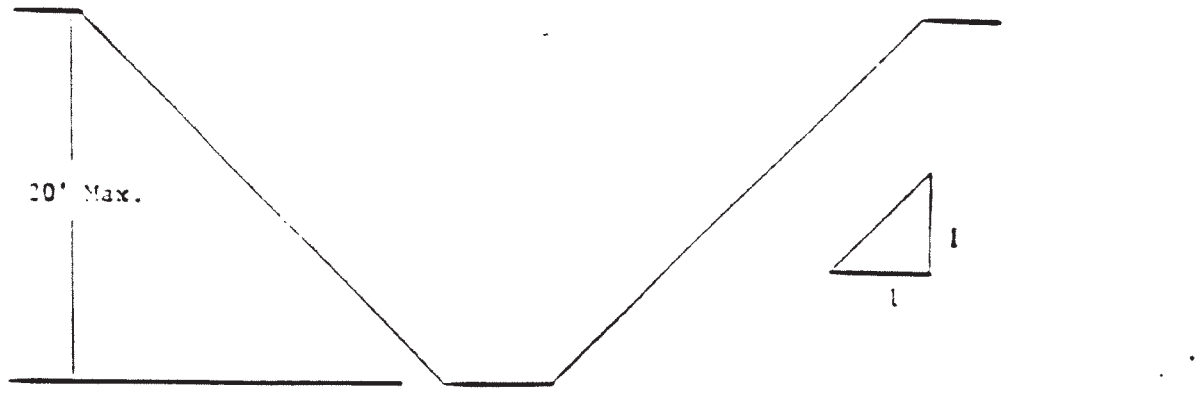


Suported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

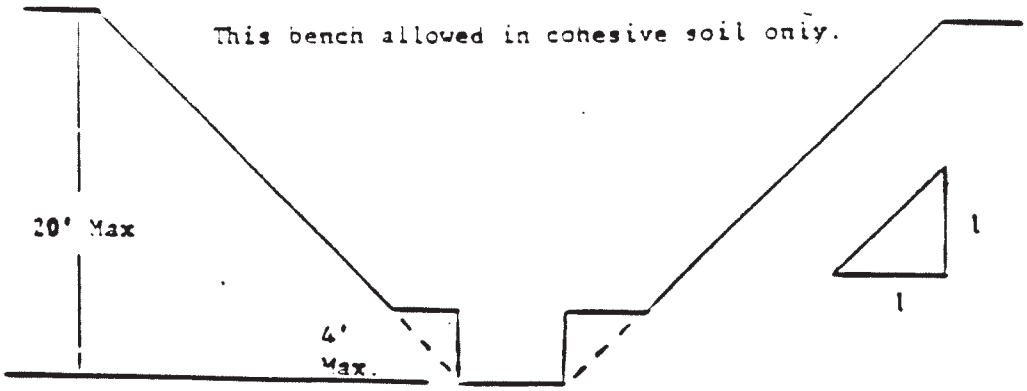
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

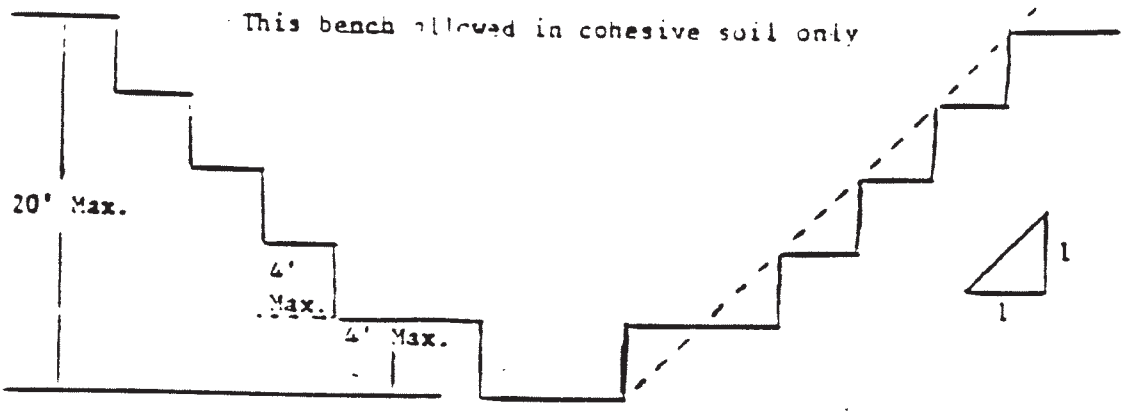


Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

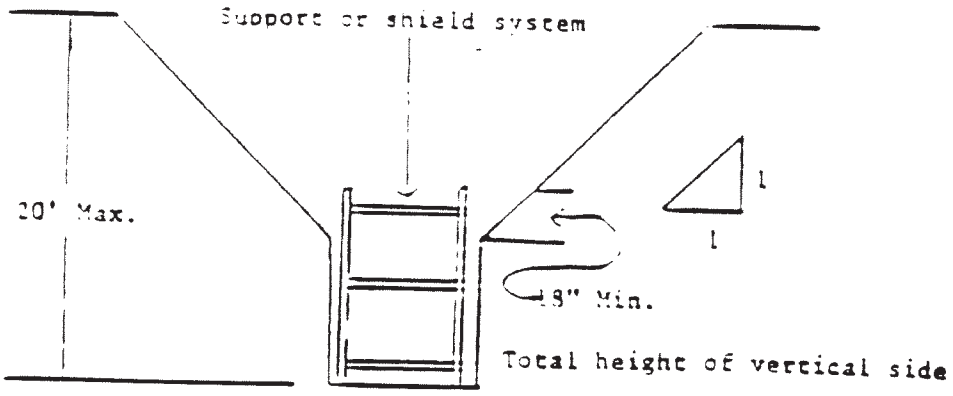


Single Bench



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

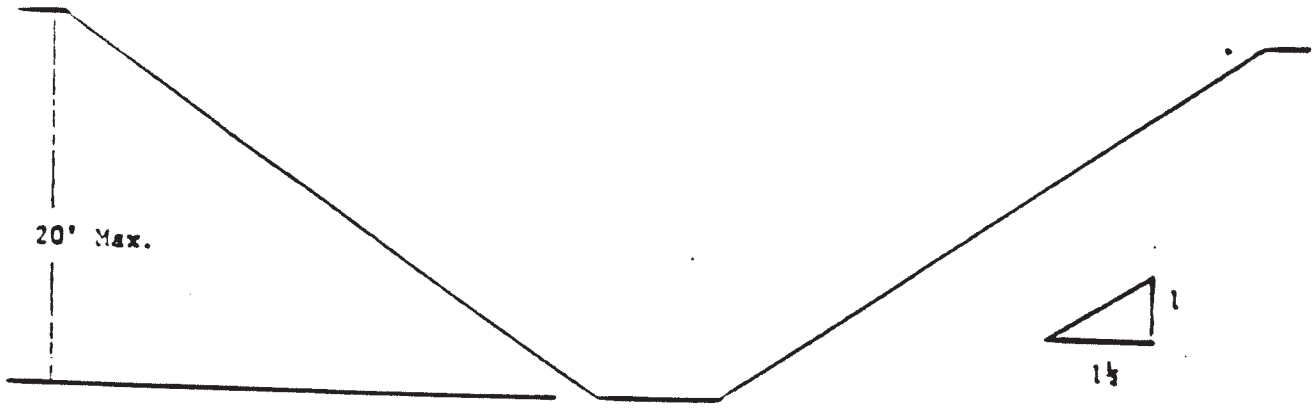


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

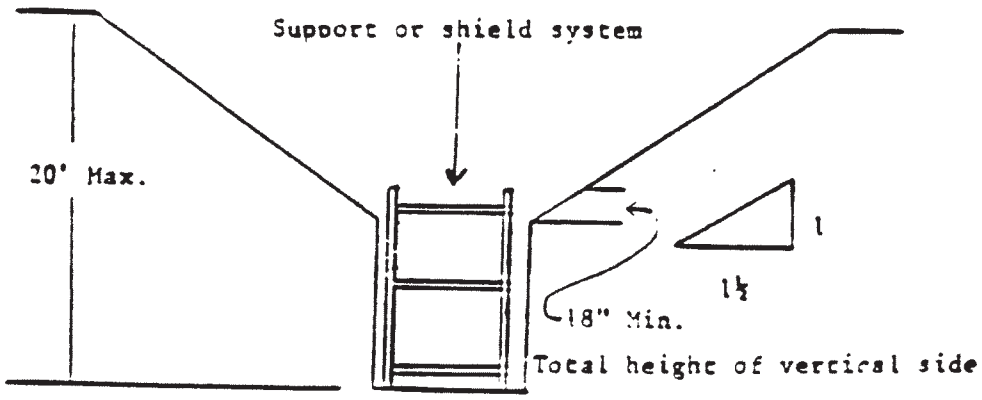
B–1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

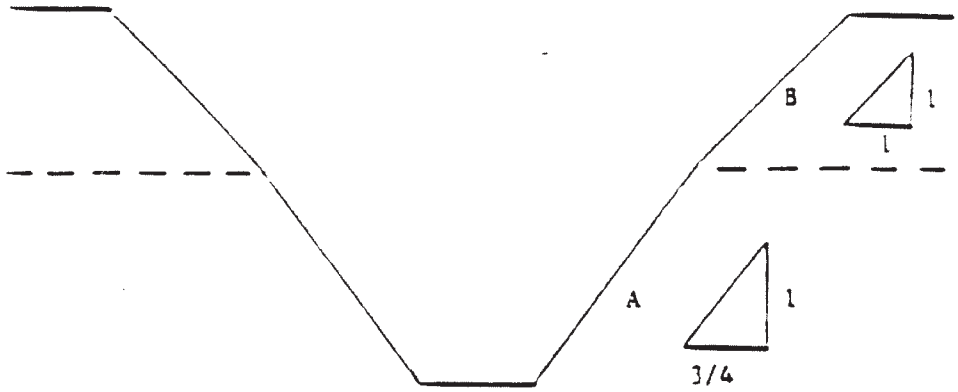


Vertical Sided Lower Portion

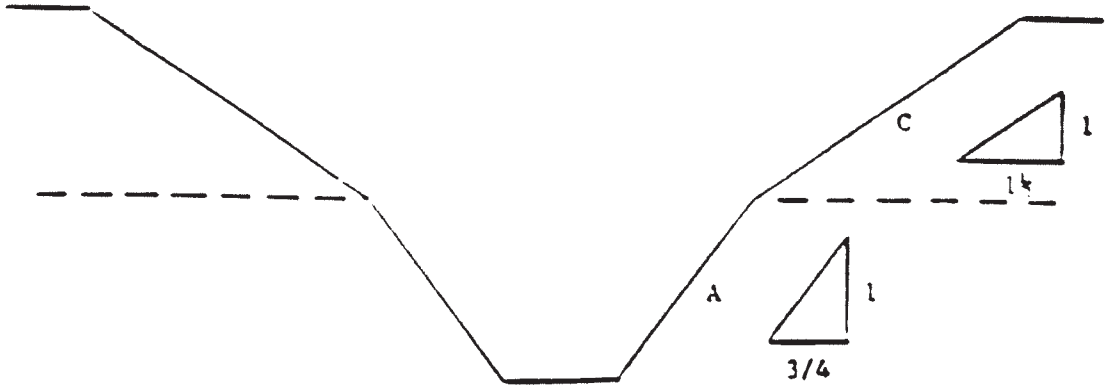
3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

B–1.4 Excavations Made in Layered Soils

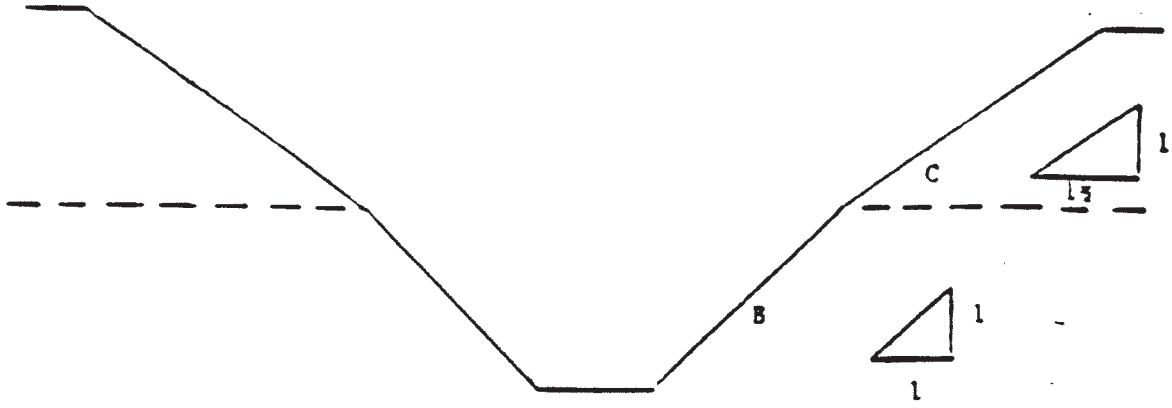
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



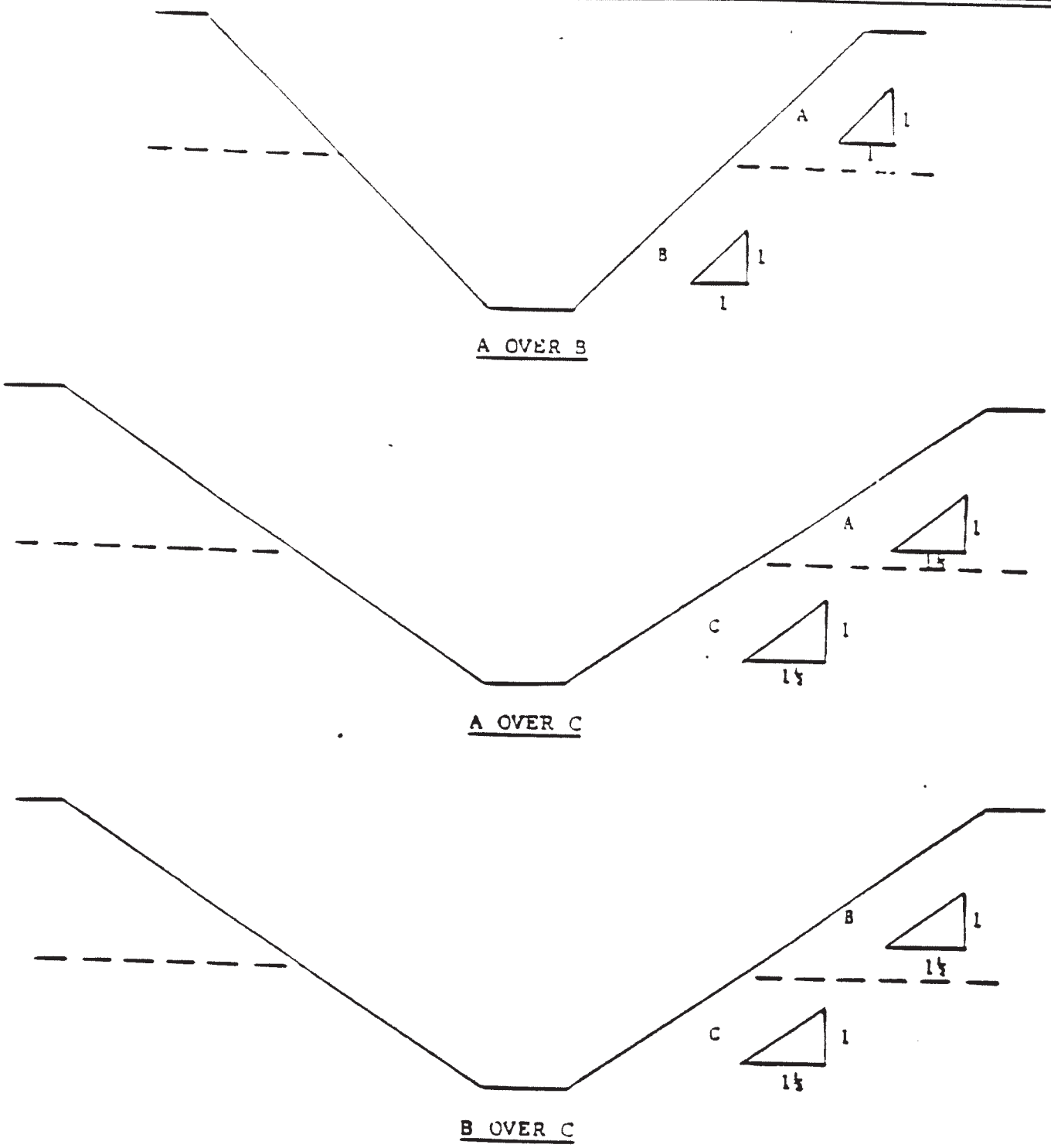
B OVER A



C OVER A



C OVER B



2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

Appendix C to Subpart P

Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with § 1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil

classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C–1.1, C–1.2 and C–1.3, and Tables C–2.1, C–2.2 and C–2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C–1.1*, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 6×6 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 6×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C–1.2 three acceptable arrangements of members are listed.

Arrangement #1

Space 6×6 crossbraces at six feet horizontally and five feet vertically.

Space 6×8 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #2

Space 6×6 crossbraces at eight feet horizontally and five feet vertically.

Space 10×10 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C–1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C–1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C–2.1 through C–2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in § 1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

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TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_d = 25 X H + 72 psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**														
	CROSS BRACES									UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed Oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *
SOIL TYPE A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **														
	CROSS BRACES							WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6				
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6				
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6				
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

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Appendix D to Subpart P

Aluminum Hydraulic Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with § 1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal wale systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 16,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with § 1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D–1.1, D–1.2, D–1.3 and D–1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D–1.1 and D–1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D–1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically. plywood (per footnote (g)(7) to the D–1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D–1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D–1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D–1.1, D–1.2, D–1.3, and D–1.4.*

(1) For applications other than those listed in the tables, refer to § 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to § 1926.652(c)(2) and § 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5×3.5×0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 16,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

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ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

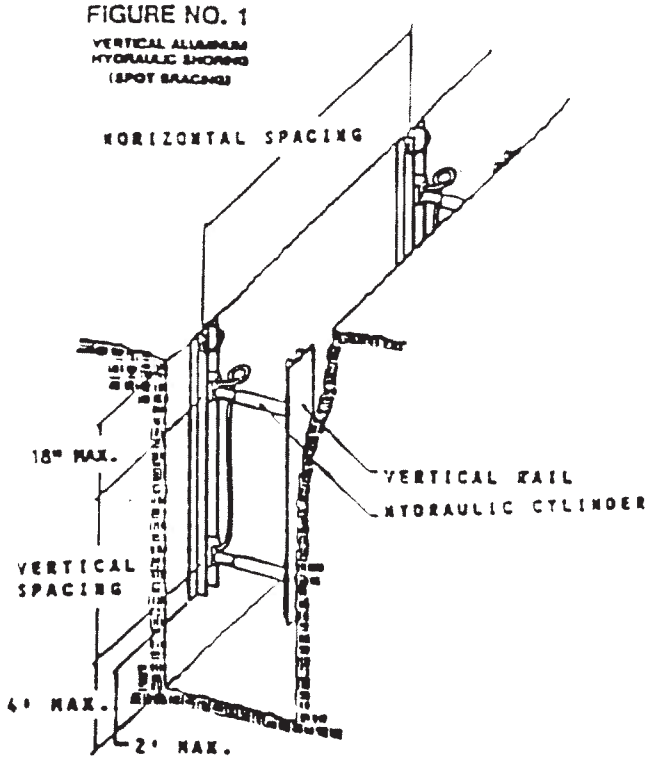


FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

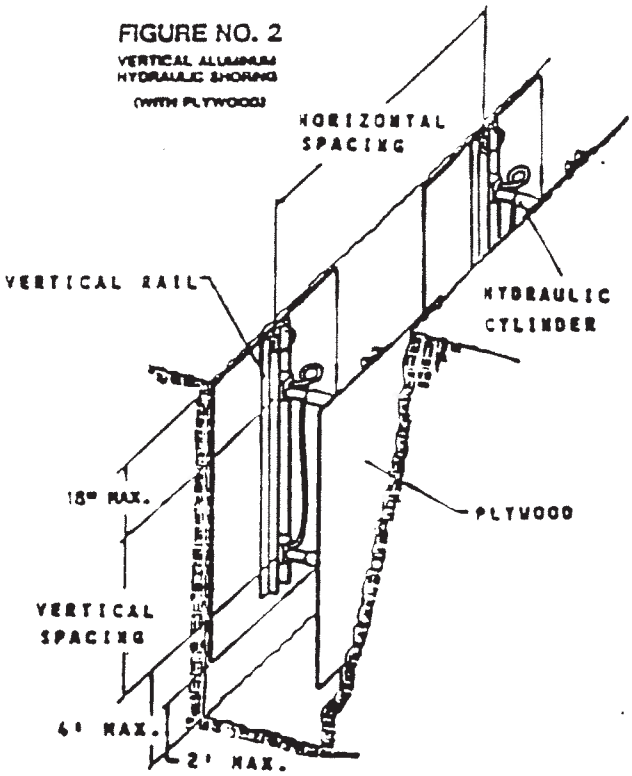


FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

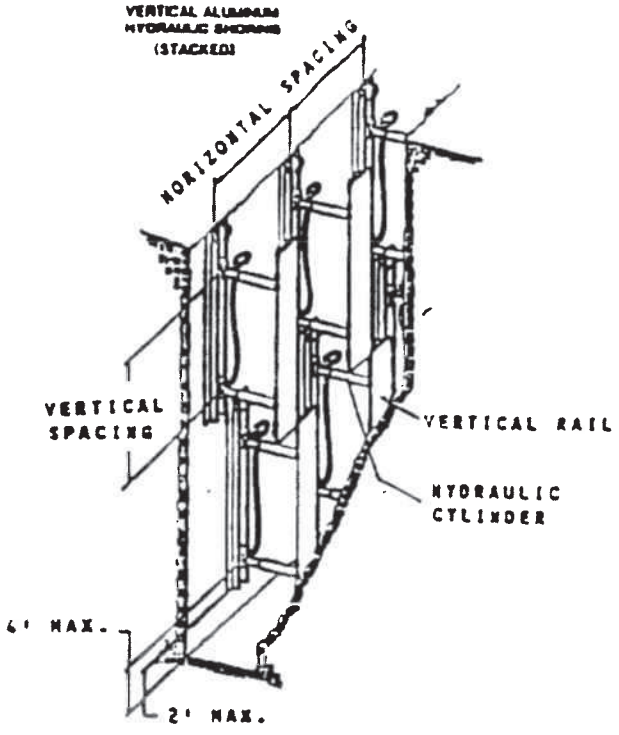


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)

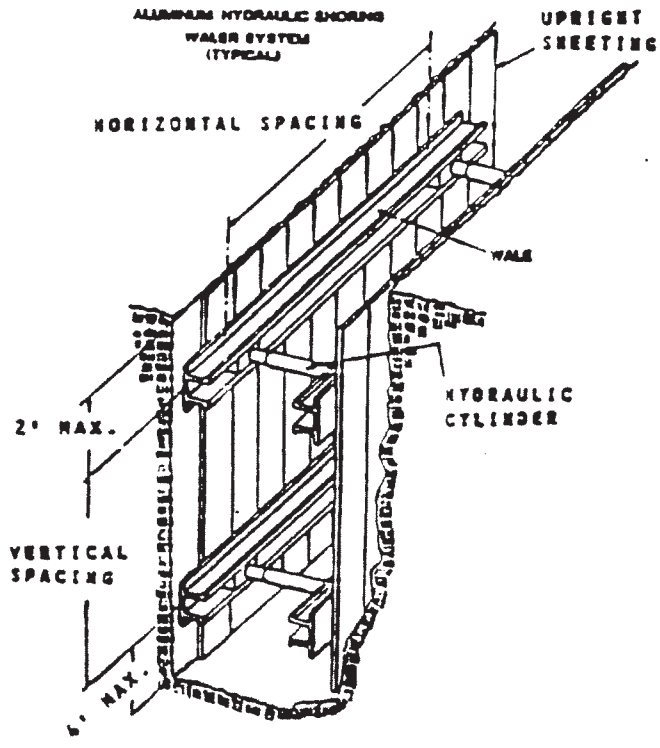


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15				
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN³) *	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	SOLID SHEET	2 FT.	3 FT
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, Item (g) (1)

Notes (2): See Appendix D, Item (g) (2)

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15				
	VERTICAL SPACING (FEET)	SECTION MODULUS (IN^3)	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	SOLID SHEET	2 FT.	3 FT
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, Item (g) (1)

Notes (2): See Appendix D, Item (g) (2)

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

BILLING CODE 4510-26-C

Appendix E to Subpart P—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

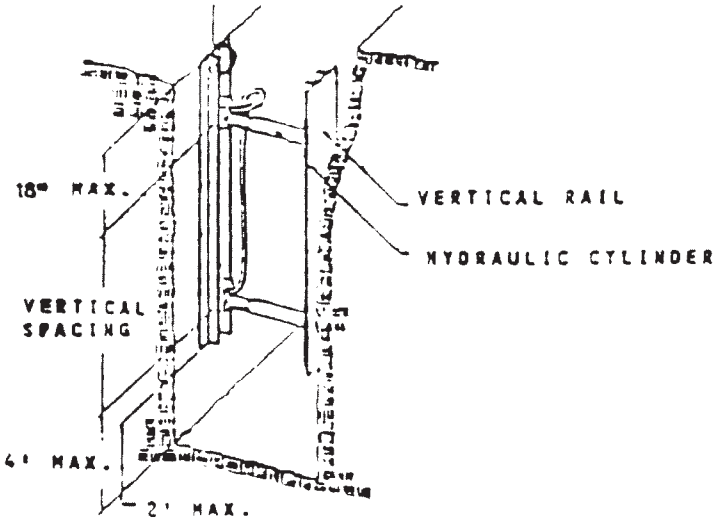
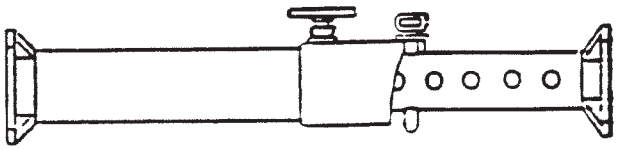


Figure 2. Pneumatic/hydraulic Shoring



BILLING CODE 4510-26-M

Figure 3. Trench Jacks (Screw Jacks)

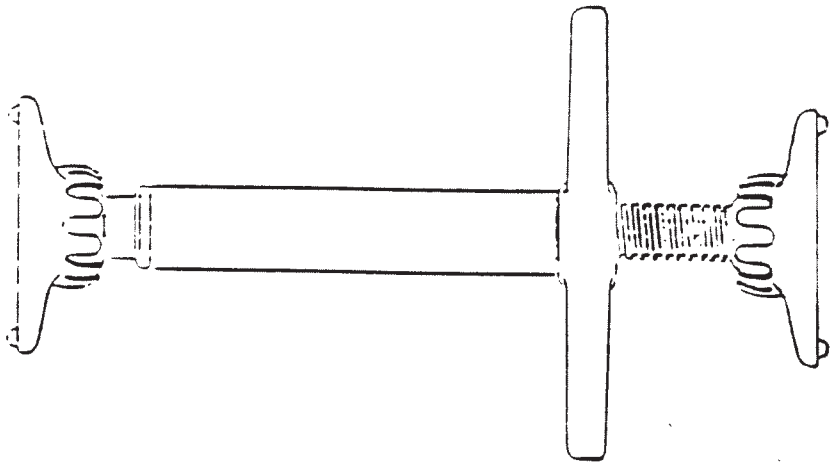
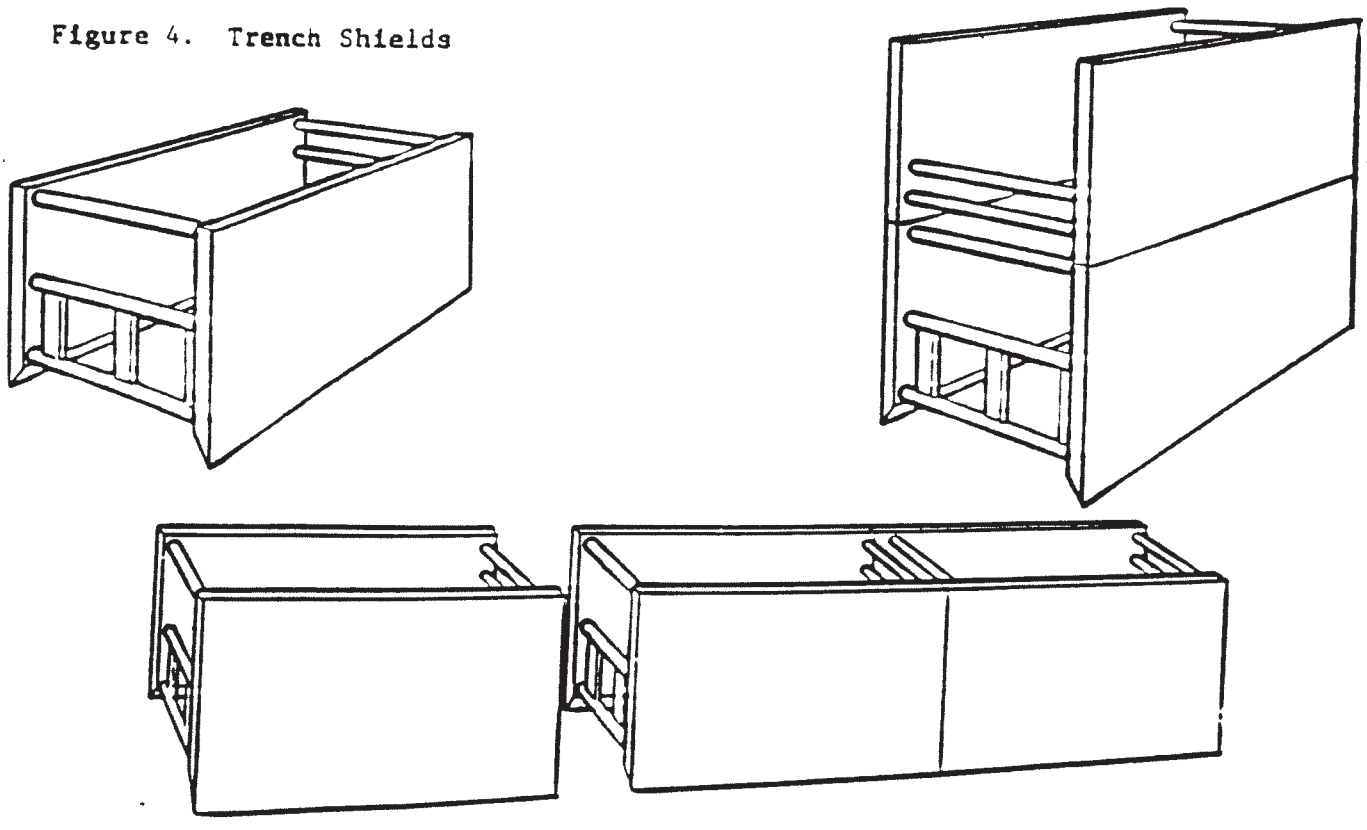


Figure 4. Trench Shields



BILLING CODE 4510-26-C

Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

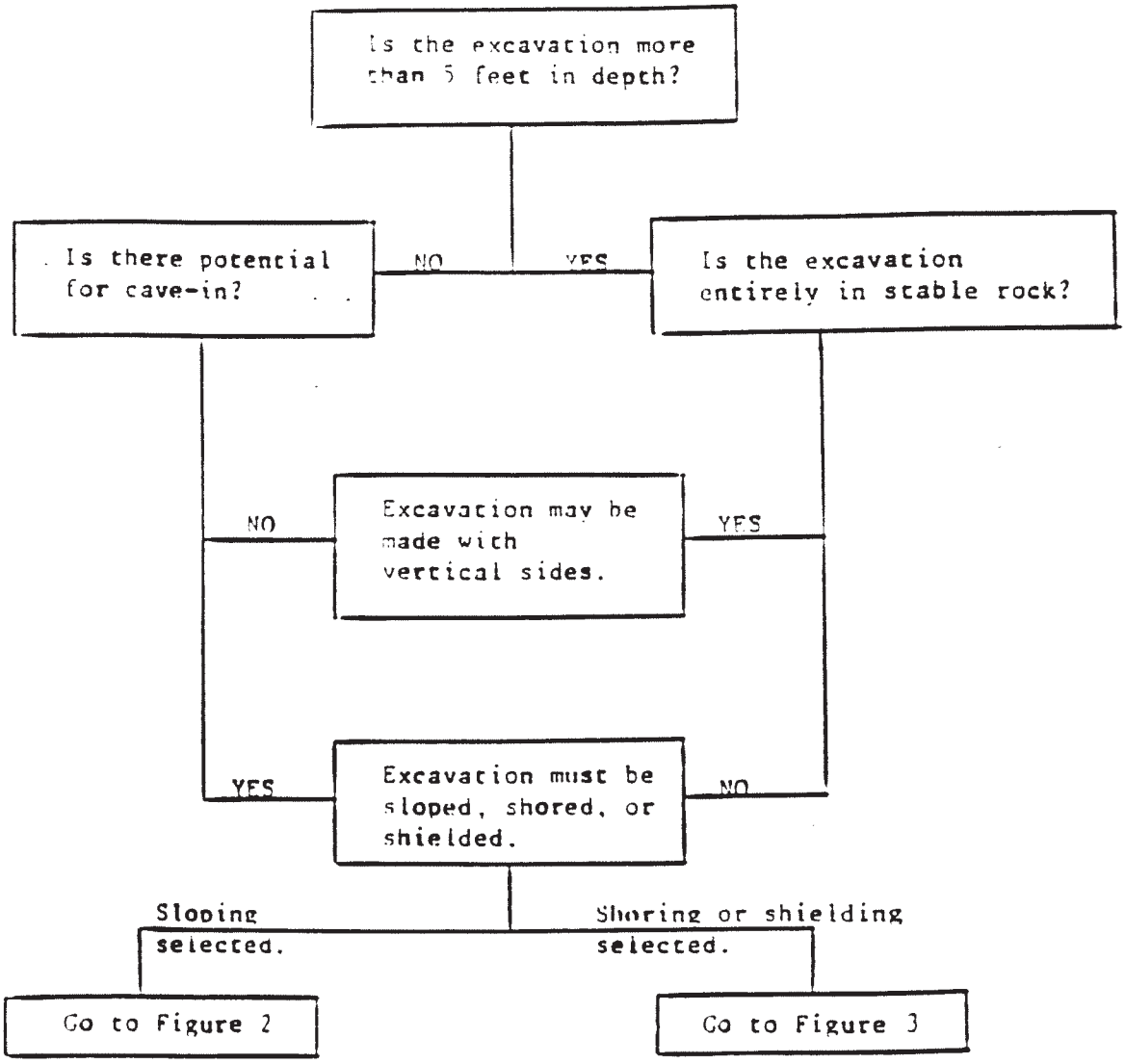


FIGURE 1 - PRELIMINARY DECISIONS

BILLING CODE 4510-26-M

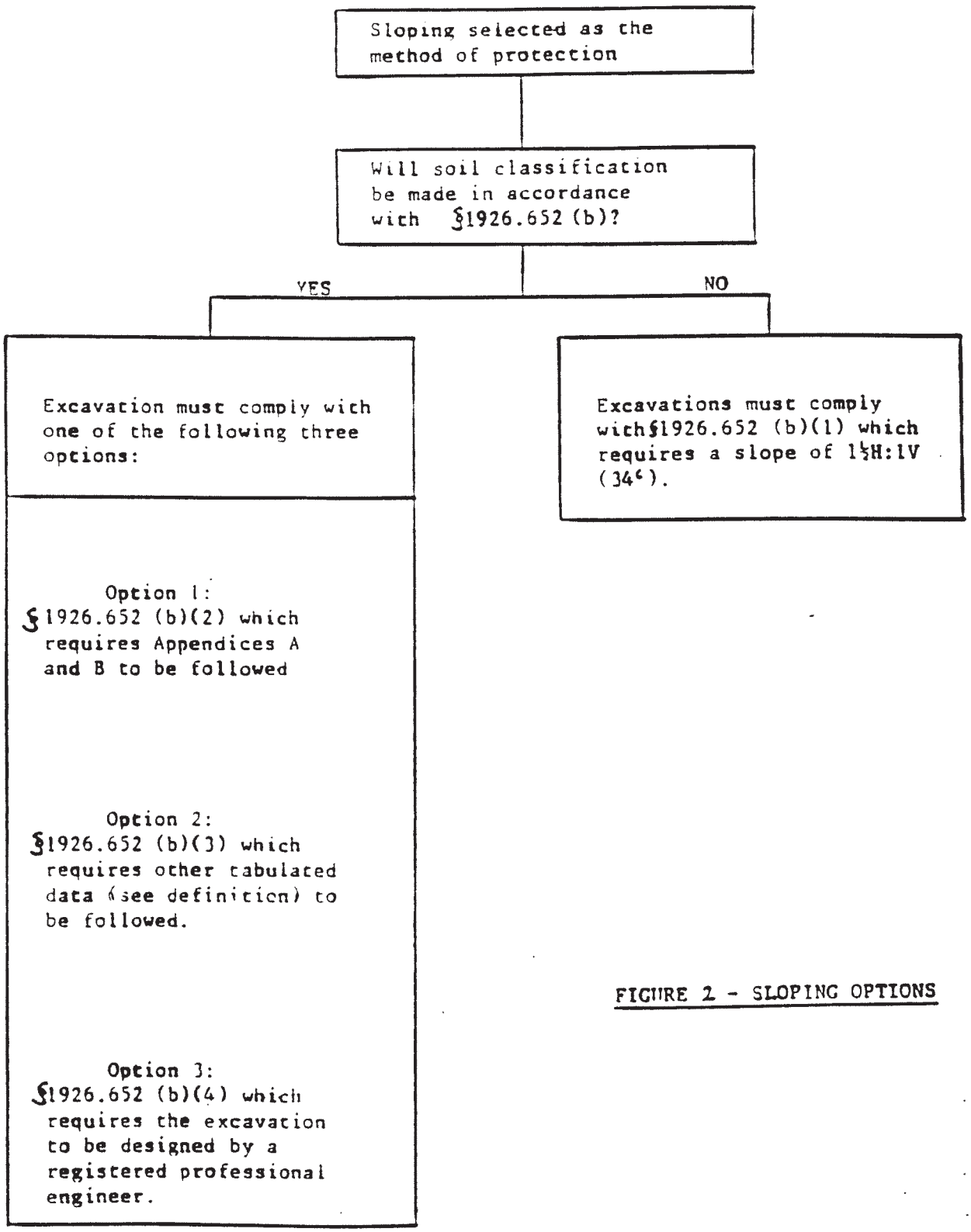


FIGURE 2 - SLOPING OPTIONS

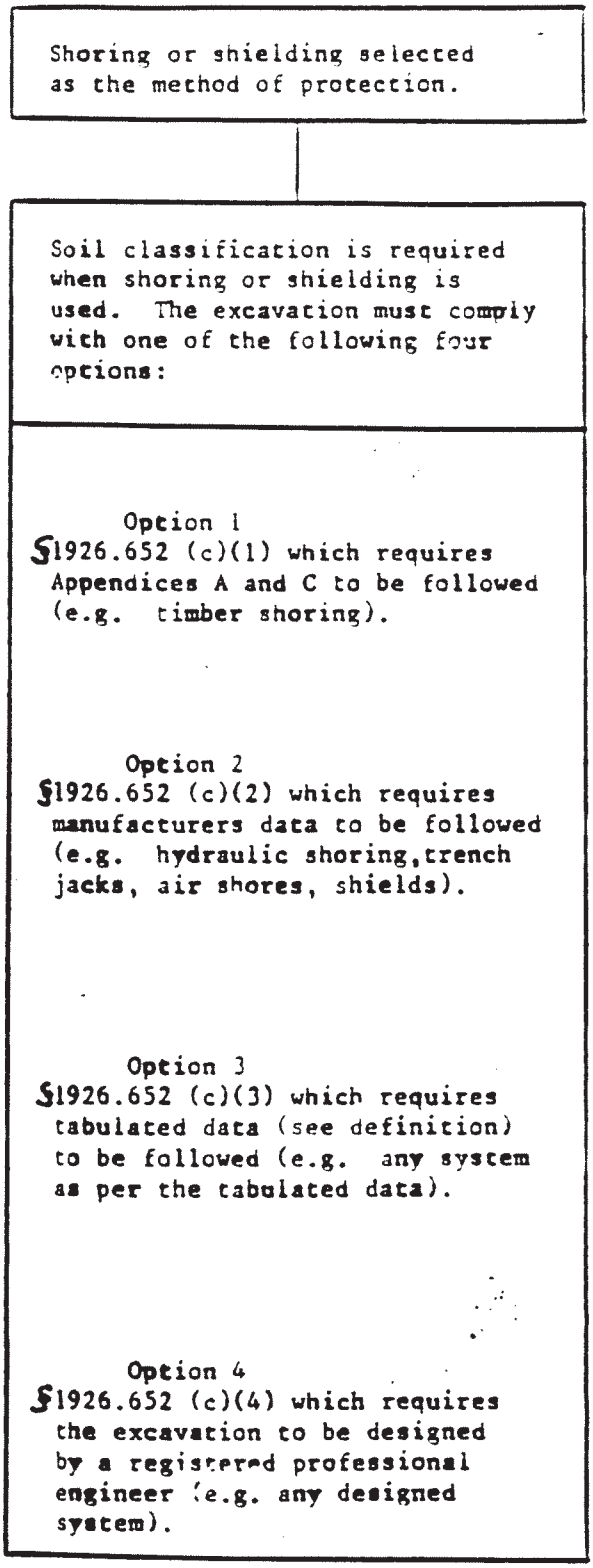


FIGURE 3 - SHORING AND SHIELDING OPTIONS

[FR Doc. 89-25217 Filed 10-30-89; 8:45 am]
BILLING CODE 4510-26-C

APPENDIX E

COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN

SAGINAW-BUFFALO SITE

NYSDEC SITE NO. 915152

Prepared for

General Motors Corporation
Worldwide Facilities Group
Environmental Remediation and International Environmental Support

June 10, 1998

Prepared by

emcon
1775 Baseline Road, Suite 220
Grand Island, New York 14072

Project 85740-100.000

COMMUNITY AIR MONITORING

In addition to employee health and safety, this community air monitoring plan has been developed which includes the collection of perimeter air samples to be analyzed by a NYSDOH and/or American Industrial Hygiene Association (AIHA) approved laboratory and direct reading field instrumentation both at the perimeter and within the work area. The purpose of the community air monitoring program is to document airborne levels of lead, polychlorinated biphenyls (PCBs), and respirable dusts at the perimeter of the site and evaluate the effectiveness of the dust control measures being used.

METHODS

Air monitoring and analysis for lead will be performed utilizing the NIOSH 7300 Analytical Method. Sampling will be performed using battery operated low volume sampling pumps operated at a rate of 2 to 5 liters of air per minute. Based on the projected samplings' duration (full-shift), the detection limit is expected to be 4.0 ug/m^3 of lead which is well below the OSHA PEL of 0.050 mg/m^3 (50 ug/m^3) and the OSHA Action Level of 0.030 mg/m^3 (30 ug/m^3).

Air monitoring and analysis for PCBs will be performed utilizing the NIOSH 5503 Analytical Method. Sampling will be performed using battery operated low volume sampling pumps operated at a rate of 0.05 to 0.2 liters of air per minute. Based on the projected samplings' duration (full-shift), the detection limit is expected to be 4.0 ug/m^3 of PCBs which is well below the OSHA PEL of 0.5 mg/m^3 (500 ug/m^3).

In addition, dust levels within the work area will be monitored using a mini-RAM respirable dust meter, as well as visually to minimize dust plumes.

PERIMETER SAMPLING

Prior to the start of work, baseline samples for each parameter will be collected at four locations (north, south, east, and west) around the perimeter of the construction site at the fence line in Parking Lot No. 4. These samples will be used to document existing airborne lead and PCB concentrations prior to the start of activities which will disturb the

contaminated soils and will provide background conditions based on wind direction for each work period.

Sampling will begin at the start of intrusive construction activities and daily thereafter. Sampling will only be performed when intrusive construction activities are occurring or on days when substantial precipitation does not occur. In addition, should it be demonstrated during the project that airborne lead or PCBs are not being detected at the perimeter of the site, perimeter monitoring may be reduced. In this case, the number of samples collected will vary depending on the particular activity taking place and the variability of wind speed and direction. As it is not anticipated that the PCBs will become airborne, PCB sampling will stop if each of the initial samples are ND.

WORK AREA SAMPLING

Continuous work area sampling will be performed for respirable dust using a mini-RAM direct reading instrument throughout the work area and periodically throughout the work shift at the established perimeter sampling points. Sampling will occur during days of construction activities. A site specific Action Level of 1 mg/m^3 total dust has been established for the work area and 0.15 mg/m^3 total dust at the perimeter of the site.

The following procedure has been used to develop a site-specific lead Action Level. The maximum concentration of lead detected in the planned excavation location is 23,900 parts per million (ppm) based on laboratory analysis. Being conservative, a value of 25,000 ppm, or 2.5%, total lead in the fill has been used. Using this information, if the mini-RAM total dust reading is 1 mg/m^3 (Action Level for dust), it is possible for 2.5% of that dust to contain lead or 0.025 mg/m^3 total lead which is below the OSHA Action Level for lead; therefore, if the dust action level is not exceeded, then the lead action level will not be a concern.

Likewise, the following procedure has been used to develop a site specific PCB Action Level. The maximum concentration of PCBs detected in the excavation area is 377 ppm based on laboratory analysis. Being conservative, a value of 500 ppm, or 0.05%, total PCBs in the oil contaminated fill has been used. Using this information, if the mini-RAM total dust reading is 1 mg/m^3 (Action Level for dust), it is possible for 0.05% of that dust to contain PCBs or 0.0005 mg/m^3 total PCBs, which is below the OSHA action level; therefore, if the dust action level is not exceeded, it is unlikely that the PCB action level will be a concern.

Due to the nature of the PCB contamination (oil contaminated soil) it is unlikely that any airborne concentrations of PCBs will be detected. In the event that any detection of PCBs occurs above the OSHA permissible exposure limit (PEL) of 0.5 mg/m^3, construction activities will cease until levels can be reduced.

A concentration at the perimeter of the site of 0.05 mg/m^3 total dust will trigger an action level and require increased dust suppression or reduction of production activities. A concentration at the perimeter of the site of 1 mg/m^3 total dust will require work stoppage until levels can be reduced.

DUST SUPPRESSION

Excavation at the site will be performed in a progressive manner such that a minimal area will be exposed at any time and minimal equipment traffic will pass through the excavation area. Water will be utilized on an as-needed basis to rinse equipment contact areas before exiting the construction site. Other dust control measures may include:

- Continuous sweeping of the construction area
- Wetting of truck routes
- Covering waste containers prior to or after stabilization
- Covering reagent piles prior to use
- Using alternate delivery methods for bulk stabilizing reagents such as pneumatic tanker trucks as opposed to bulk piles
- Wetting or misting of stabilization reagents

Effectiveness of the dust control measures will be monitored by the mini-RAM and visual observation as detailed above.

If required, additional dust suppression measures will be initiated.

REFERENCES

American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, Ohio 45240-1634. "1997 TLVs and BEIs," Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices. 1997.

U. S. Department of Health and Human Services, Public Health Service, Centers of Disease Control, National Institute for Occupational Safety and Health, Superintendent of Documents, U. S. Printing Office, Washington DC 20402. "NIOSH Pocket guide to Chemical Hazards". June 1990.

APPENDIX F

CITIZEN PARTICIPATION PLAN

CITIZEN PARTICIPATION PLAN

SAGINAW-BUFFALO SITE

NYSDEC SITE NO. 915152

Prepared for

General Motors Corporation
Worldwide Facilities Group
Environmental Remediation and International Environmental Support

June 8, 1998

Prepared by

EMCON
1775 Baseline Road, Suite 220
Grand Island, New York 14072

Project 85740-100.000

CONTENTS

TABLES AND ILLUSTRATIONS

Figures

1 INTRODUCTION

The New York State Department of Environmental Conservation (NYSDEC), in partnership with the New York State Departments of Health (NYSDOH) and Law (NYSDOL), is responsible for seeing that hazardous waste sites across the State are investigated, and, if necessary, remediated. Under the State's Inactive Hazardous Waste Site Remedial Program, the process follows a path of thorough investigation. Throughout this process, the NYSDEC conducts a citizen participation program.

In many instances, the NYSDEC is able to identify and enter into legal agreements with companies who owned or operated, or currently own or operate the property identified as containing hazardous waste. These companies are called Potentially Responsible Parties, or PRPs.

The NYSDEC is working with General Motors Corporation (GM) on the Saginaw-Buffalo site. GM formerly owned the property that is now owned by American Axle & Manufacturing (AAM). The property is divided by a Conrail Railroad right-of-way, (ROW), running in a north-south direction, and an area located to the east of the ROW has been listed as a NYSDEC Class 3 Inactive Hazardous Waste Site, Site No. 915152 (the Site). A Class 3 site is a site determined not to be a significant threat to human health or the environment. Prior to GM ownership, the Site was owned by a variety of companies/individuals including Buffalo Gravel Corporation. Two hazardous wastes, PCBs and lead, have been identified at the Site and available information indicates that they were disposed at the Site prior to GM's purchase of the property.

Citizen participation is aimed at increasing public understanding of NYSDEC and GM's responsibilities and the remedial activities at the site. The citizen participation program also opens up two-way communication, thus providing: 1) an opportunity for NYSDEC and GM to obtain site information from you that will enable us to develop a comprehensive remedial plan which is protective of both public health and the environment, and 2) a mechanism for us to learn your concerns and answer your questions about the site and the remedial process. The NYSDEC and GM are committed to the citizen participation process at the Saginaw-Buffalo site.

2 SITE BACKGROUND INFORMATION

2.1 Facility Description

The former Saginaw-Buffalo site, located at 1001 East Delavan Avenue in Buffalo, New York, is currently owned and operated by AAM which purchased the property and facility in February, 1994. A site location map is presented on Figure 1.

The property is divided into two major areas by a Conrail ROW. The property west of the ROW is comprised of the main manufacturing facility and consists of approximately 40 acres (+/-). The property east of the tracks consists of a paved parking area, Parking Lot No. 4, the Waste Water Treatment Plant (WWTP), and the Parts Coating Facility, and totals approximately 12 acres. Three (3) tanks are situated adjacent to the WWTP, two for the storage of reclaimed oil, and a third for storage of sulfuric acid. Only the southern 7-acre portion of the property (south of the Parts Coating Facility) is considered the Site.

The Site is mostly paved with asphalt. Beneath the pavement is three to nine feet of fill materials including an "ash-like" fill deposit. Natural silty clay, a low permeability deposit, underlies the fill and covers bedrock.

Water in the fill zone apparently travels laterally toward the south-southwest. The potential for vertical migration is hindered by the silty clay.

2.2 Site History

GM purchased the Site in 1965 from Buffalo Gravel Corporation (BGC). While owned by BGC, the property was used for stone crushing to make gravel. Additionally, it is suspected that concrete was made on the site. BGC owned and operated the site from 1947 to 1965. Prior to 1947, the property was owned by the Bardol Corporation. Based on aerial photograph review from 1927 to 1938, no buildings or structures were noted. However, the 1927 aerial photograph indicates access roads were prevalent and material mounds were noted immediately north of the Site.

2.3 Project Background

This project was initiated in 1986 with the intent of satisfying the "Conditions for Major Petroleum Facility License" related to the two reclaimed oil storage tanks. An investigation was performed to assess the permeability of soils underlying the existing above-ground reclaimed oil storage tank containment area adjacent to the WWTP. The results of the investigation indicated that oil had penetrated the underlying fill material. As a result, the fill layer and groundwater in the vicinity of the tanks became contaminated with oil. .

A hydrogeologic investigation was performed to assess the extent of oil contamination. The investigation concluded that an oil plume was present, extending southwest from the tank storage area to the Conrail ROW. Groundwater collection and on-site treatment of the oil-contaminated groundwater was selected as the original remediation program for the Site. Construction of the collection trench was undertaken in the fall of 1988. The construction involved two arms of the trench along the southern and western sides of the plume and the installation of a manhole which would act as a sump and collection point for the oil/water. The system has yet to be completed due to results of further sampling and analysis which indicated the presence of PCBs.

A test pit excavated near the western end of the collection trench exposed a clay tile pipe (six-inch inside diameter) surrounded by gravel approximately four feet below ground surface. Orientation of the pipe appeared to be northeast-southwest, placing it directly within the limits of the previously established oil-contaminated area. Oil from the pipe was sampled and tested for PCBs by both GM and the NYSDEC. Analytical results from both sets of analyses indicated the presence of PCBs.

Following discovery of the pipe and the possibility that residue in the pipe could be a source of PCBs, a series of staged investigations were performed to assess the lateral extent and orientation of the buried pipe. In conjunction with the pipe investigation, further sampling of the oil, fill, and groundwater was conducted.

The significant findings of subsequent work indicates the following:

- PCBs and oil are limited to an approximate one-acre (+/-) area near the WWTP.
- Lead was detected in the "ash-like" fill materials in an approximate two-acre area near the WWTP. The extent of the "ash-like" fill is unknown. The lead appears unrelated to the presence of oil or PCBs.

- The PCB and lead contaminants are limited to the subsurface below the paved parking area of Parking Lot No. 4. Furthermore, the area of contamination does not appear to extend west of the Conrail ROW.

The Site Investigation was conducted in 1995 to determine the extent of lead and PCB contamination and included excavation of two test pits and installation of 16 soils borings, five overburden monitoring wells, and one bedrock monitoring well. Soil and groundwater samples were collected for lead and PCB analysis. Sampling of the site storm sewers for lead and PCBs was also conducted. The Site Investigation indicated that lead contamination was randomly distributed across the entire site. PCB contamination was localized to the area south of the WWTP with the exception of a detection in groundwater in one monitoring well (MW-203).

Further investigation of the area around MW-203 as well as sampling of the Scajaquada Creek Drain were completed in 1996 under the Supplemental Site Investigation. Water and sediment samples were collected from the site storm sewers and from three locations in the Scajaquada Creek Drain (one upstream and two downstream of the site storm sewer inlet) and tested for PCBs and lead. In addition, seven soil borings and three monitoring wells were installed, with soil and groundwater samples tested for lead and PCBs. Two of the wells were installed in the former Scajaquada Creek channel to determine whether an off-site source of PCB contamination was present.

An engineering evaluation of remedial alternatives was completed in 1997 to evaluate potential remedies to address environmental conditions at the site. Based on the Engineering Evaluation of alternatives Report, submitted to the NYSDEC in December 1997, the NSYDEC developed the Proposed Remedial Action Plan (PRAP). After receiving public comment on the PRAP in March 1998, the NYSDEC issue its Record of Decision (ROD) outlining the remedial activities to completed at the site. The Remedial Design Report presents the details as to how GM will complete the remediation.

3 PROJECT OBJECTIVE

GM is prepared to proceed with this remediation project by separating the site into two operable units. The first Operable Unit, OU-1, is for the PCBs. The second Operable Unit, OU-2, is for the lead. These two issues have been separated based on the nature of the sources. For the PCBs, the apparent source is the oil in the clay tile pipeline. The oil is located in a localized area near the WWTP extending to the Conrail ROW. For the lead, the apparent source is the "ash-like" fill materials found in the area studied inside Parking Lot No. 4. While there is overlap between the two operable units (i.e., oil/PCB area falls within the "ash-like" fill materials), the majority of the lead area falls outside the bounds of the oil/PCB area.

The objectives of the remedial program are:

- To the extent practicable, reduce the potential for human contact with PCBs and lead impacted soils.
- Prevent or greatly reduce the potential for migration of contaminants via surface run-off and on-site drain lines.
- Prevent, to the extent possible, migration of contaminants at the site to the Scajaquada Creek Drain.
- To the extent practicable, provide for attainment of SCGs for groundwater.

3.1 Project Description

To achieve these objectives, the following work has been or will be performed at the site:

- Excavate PCB-contaminated soils above 10 ppm from the source area and dispose of these materials at an approved off-site facility;
- Remove PCB-contaminated groundwater in the source area during excavation, treat the water on-site, and discharge to the Buffalo Sewer Authority sanitary sewer system;

- Remove the oil from the groundwater, collect this oil, and transport it off-site for incineration at an approved facility;
- Collect soil samples from the excavation to ensure remaining soils are less than 10 ppm PCBs;
- Repair and repave the existing asphalt pavement of Parking Lot #4;
- Conduct long-term semi-annual groundwater monitoring of selected wells for PCBs and total and dissolved lead, as well as monitoring of water from the storm sewers for total lead;
- Conduct inspections and maintenance on the monitoring wells, storm sewers, and asphalt pavement.
- A deed restriction is already in place preventing use of this property for anything other than industrial purposes and precluding the use of groundwater as a source of drinking water.

3.2 Schedule for Remedial Program

The schedule for implementation of this remedial program is provided on Figure 2. This schedule is approximate based on current conditions. As the project progresses, the schedule will be updated based upon the actual scope of work and conditions within the control of GM.

4 CITIZEN PARTICIPATION ACTIVITIES

GM will prepare public notice of the completion of the remedial construction activities following the completion of activities described in the Remedial Design Report. This will include all pertinent public meeting information (date, time, place, etc.), and the process for completing required remedial activity. NYSDOH and NYSDEC will review and approve the contents of the public mailing.

GM will make necessary meeting room arrangements with the approval of NYSDEC. Depending on the magnitude of public interest, GM will arrange for a legal transcript of the public meeting to be taken. Copies of the transcript will be placed in the document repositories. NYSDEC will conduct the public meeting, with the participation of NYSDOH and GM.

Additional Citizen Participation activities will be conducted as the project progresses through the remedial process into the Operation and Maintenance phase including:

- Issuing a Fact Sheet and holding an Availability Session prior to the start of the Remedial Action,
- Issuing a Fact Sheet and holding an Availability Session at the completion of the Remedial Action, and
- Issuing a Fact Sheet every six months during the Remedial Action.

GM will maintain the contact list for all mailings.

5 CONTACT LIST

The contact list includes at the minimum the following:

- Adjacent property owners;
- Erie County representatives on the list maintained by NYSDEC Region 9;
- The Buffalo News;
- State Assembly and Senate representatives for the area of the Site (NYSDEC input);
- Any company or regulatory agency representative who will receive mailings (as provided by NYSDEC).

A copy of the contact list is provided as Appendix A.

6 COMPANY AND REGULATORY AGENCY CONTACTS

NYSDEC Contacts:

- Mr. Martin Doster, Regional Hazardous Waste Remediation Engineer
- Mr. Michael Podd, Citizen Participation Specialist

GM Contacts:

- Mr. Mark Napolitan, GM, Project Manager

NYSDOH Contacts:

- Mr. Cameron O'Connor, Regional NYSDOH contact
- Ms. Nina Knapp, NYSDOH Health Liaison Program, Albany

7 DOCUMENT REPOSITORIES

NYSDEC Region 9 Headquarters
Division of Hazardous Waste Remediation
270 Michigan Avenue
Buffalo, New York 14203-2999
(716) 851-7220
BY APPOINTMENT ONLY

Buffalo Public Library
Lafayette Square
Buffalo, New York 14203

8 GLOSSARY OF TERMS AND MAJOR PROGRAM ELEMENTS

Definitions of Commonly Used Citizen Participation Terms

Availability Session – Scheduled gathering of the Department staff and the public in a setting less formal than a public meeting. Encourages "one-to-one" discussions in which the public meets with Department staff on an individual or small group basis to discuss particular questions or concerns.

Citizen Participation – A process to inform and involve the interested/affected public in the decision-making process during identification, assessment, and remediation of hazardous waste sites. This process helps to assure that the best decisions are made for environmental, human health, economic, social and political perspectives.

Citizen Participation Plan – A document that describes the site-specific citizen participation activities that will take place to complement the "technical" (remedial) activities. It also provides site background and rationale for the selected citizen participation program for the site. A plan may be updated or altered as public interest or the technical aspects of the program change.

Citizen Participation Specialist – A Department staff member within the Division of Hazardous Waste Remediation who provides guidance, evaluation and assistance to help the Project Manager carry out his/her site-specific Citizen Participation program.

Contact List – Names, addresses and/or telephone numbers of individuals, groups, organizations and media interested and/or affected by a particular hazardous waste site. Compiled and updated by the Department. Interest in the site, stage of remediation and other factors guide how comprehensive the list becomes. Used to assist the Department to inform and involve the interested/affected public.

Document Repository – Typically a regional NYSDEC office and public building, such as a library, near a particular site, at which documents related to remedial and citizen participation activities at the site are available for public review. Provides access to documents at times and a location convenient to the public. Environmental Management Councils (EMCs), Conservation Advisory Committees (CACs) as well as active local groups often can serve as supplemental document repositories.

Information Sheet – A written discussion of a site's remedial process, or some part of site, prepared by the Department for the public in easily understandable language. May be prepared for the "general" public or a particular segment. Uses may include, for example: discussion of an element of the remedial program, opportunities for public involvement, availability of a report or other information, or announcement of a public meeting. May be mailed to all or part of the interested public, distributed at meetings and availability sessions or sent on an "as requested" basis.

Project Manger – A Department staff member within the Division of Hazardous Waste Remediation (usually an engineer, geologist, or hydrogeologist) responsible for the day-to-day administration of activities, and ultimate disposition of, one or more hazardous waste sites. The Project Manager works with the Citizen Participation staff, as well as Department fiscal and legal staff and the New York State Department of Health (NYSDOH) staff to accomplish site-related goals and objectives.

Public – The universe of individuals, groups, and organizations: (a) affected (or potentially affected) by an inactive hazardous waste site and/or its remedial program; (b) interested in the site and/or its remediation; (c) having information about the site and its history.

Public Meeting – A scheduled gathering of the Department staff and the public to give and receive information, ask questions and discuss concerns. May take one of the following forms: large-group meeting called by the Department; participation by the Department at a meeting sponsored by another organization such as a Town Board or Department of Health; working group or workshop; public availability session.

Public Notice – A written or verbal informational technique for telling people about an important part of a site's remedial program coming up soon (examples: announcement that the report for the RI/FS is publicly available; a public meeting has been scheduled).

The public notice may be formal, such as a paid legal advertisement in a newspaper circulated widely in the geographic area of the site.

Public notices may also be more informal (examples: paid newspaper advertisement; telephone calls to key citizen leaders; targeted mailings).

Responsiveness Summary – A formal or informal written or verbal summary and response by the Department to public questions and comments. Prepared during or after important elements in a site's remedial program. The responsiveness summary may list and respond to each question, or summarize and respond to questions in categories.

Toll-Free "800" Telephone Information Number – Provides cost-free access to the NYSDEC or NYSDOH to members of the public who have questions, concerns, or

information about a particular hazardous waste site. Calls are taken and recorded 24 hours a day and a Department Albany-based staff member contacts the caller as soon as possible (usually the same day).

NYSDEC's Toll Free Number: 800-458-9296

NYSDOH's Toll Free Number: 800-458-1158

Ext. 308 – NYSDOH Technical Staff

Ext. 402 – NYSDOH Health Liaison Pgm.

Definitions of Significant Elements and Terms of the Remedial Program – Note: The first eight definitions represent major elements of the remedial process. They are presented in the order in which they occur, rather than in alphabetical order, to provide a context to aid in their definition.

Site Placed on Registry of Inactive Hazardous Waste Disposal Sites – Each inactive site known or suspected of containing hazardous waste must be included in the Registry. Therefore, all sites which state or county environmental or public health agencies identify as known or suspected to have received hazardous waste should be listed in the Registry as they are identified. Whenever possible, the Department carries out an initial evaluation at the site before listing.

Phase I Site Investigation – Preliminary characterizations of hazardous substances present at a site; estimates pathways by which pollutants might be migrating away from the original site of disposal; identifies population or resources which might be affected by pollutants from a site; observes how the disposal area was used or operated; and gathers information regarding who might be responsible for wastes at a site. Involves a search of records from all agencies known to be involved with a site, interviews with site owners, employees and local residents to gather pertinent information about a site. Information gathered is summarized in a Phase I report.

After a Phase I investigation, NYSDEC may choose to initiate an emergency response; to nominate the site for the National Priorities List; or, where additional information is needed to determine site significance, to conduct further (Phase II) investigation.

Phase II Site Investigation – Ordered by NYSDEC when additional information is still needed after completion of Phase I to properly classify the site. A Phase II investigation is not sufficiently detailed to determine the full extent of the contamination, to evaluate remedial alternatives, or to prepare a conceptual design for construction. Information gathered is summarized in a Phase II report and is used to arrive at a final hazard ranking score and to classify the site.

Preliminary Site Assessment (PSA) – NYSDEC's first investigation of a site where hazardous waste has or may have been disposed of illegally or improperly. The goal of the PSA is to determine whether a site meets the state's definition of a hazardous waste site by confirming the presence of hazardous waste and determining if the site poses a significant threat of the former Phase I and Phase II investigations, enabling NYSDEC to conduct more efficient site investigations. The three steps are: 1) a records search, 2) sampling/surveys, and 3) groundwater monitoring.

Remedial Investigation (RI) – A process to determine the nature and extent of contamination by collecting data and analyzing the site. It includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessary for, and proposed extent of, a remedial program for the site.

Feasibility Study (FS) – A process for developing, evaluating and selecting remedial actions, using data gathered during the remedial investigation to: define the objectives of the remedial program for the site and broadly develop remedial action alternatives; perform an initial screening of these alternatives; and perform a detailed analysis of a limited number of alternatives which remain after the initial screening stage.

Remedial Design – Once a remedial alternative has been selected, technical drawings and specifications for remedial construction at a site are developed, as specified in the final RI/FS report. Design documents are used to bid and construct the chosen remedial actions. Remedial design is prepared by consulting engineers with experience in inactive hazardous waste disposal site remedial actions.

Construction – NYSDEC selects contractors and supervises construction work to carry out the designed remedial alternative. Construction may be as straightforward as excavation of contaminated soil with disposal at a permitted hazardous waste management facility. On the other hand, it may involve drum sampling and identification, complete encapsulation, leachate collection, storage and treatment, groundwater management, or other technologies. Construction costs may vary from several thousand dollars to many millions of dollars, depending on the size of the site, the soil, groundwater and other conditions, and the nature of the wastes.

Monitoring/Maintenance – Denotes post-closure activities to insure continued effectiveness of the remedial actions. Typical monitoring/maintenance activities include quarterly inspection by an engineering technician; measurement of the level of water in monitoring wells; or collection of groundwater and surface water samples and analysis for factors showing the condition of water, presence of toxic substances, or other indicators of possible pollution from the site. Monitoring/maintenance may be required indefinitely at many sites.

Consent Order – A legal and enforceable negotiated agreement between the Department and responsible parties where responsible parties agree to undertake investigation and cleanup or pay for the costs of investigation and cleanup work at a site. The Order includes a description of the remedial actions to be undertaken at the site and a schedule for implementation.

Contract – A legal document signed by a Contractor and the Department to carry out specific site remediation activities.

Contractor – A person or firm hired to furnish materials or perform services, especially in construction projects.

Delisting – Removal of a site from the State Registry based on a study which shows the site does not contain hazardous wastes. This limited definition suggests that successful remediation of a site is insufficient to have the site "delisted".

Potentially Responsible Party (PRP) Lead Site – A hazardous waste site at which those legally liable for the site have accepted responsibility for investigating problems at the site, and for developing and implementing the site's remedial program. PRPs include: those who owned the site during the time wastes were placed, current owners, past and present operators of the site, and those who generated the wastes placed at the site. Remedial programs developed and implemented by PRPs generally result from an enforcement action taken by the State and the costs of the remedial program are generally borne by the PRP.

Ranking System – The United States Environmental Protection Agency (USEPA) uses a hazard ranking system (HRS) to assign numerical scores to each hazardous waste site. The scores express the relative risk or danger from the site.

Responsible Parties – Individuals, companies, (e.g., site owners, operators, transporters or generators of hazardous waste) responsible for or contributing to the contamination problems at a hazardous waste site. PRP is a potentially responsible party.

Site Classification – The Department assigns sites to classifications established by State law, as follows:

- **Classification 1** – A site causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment — immediate action required.

- **Classification 2** – A site posing a significant threat to the public health or environment — action.

- **Classification 2a** – A temporary classification for a site known or suspected to contain hazardous waste. Most likely the site will require a Phase I and Phase II investigation to obtain more information. Based on the results, the site then would be reclassified or removed from the State Registry if found not to contain hazardous wastes.

- **Classification 3** – A site which has hazardous waste confirmed, but not a significant threat to the public health or environment — action may be deferred.

- **Classification 4** – A site which has been properly closed — requires continued management.

- **Classification 5** – A site which has been properly closed, with no evidence of present or potential adverse impact — no further action required.

State-Lead Site – A hazardous waste site at which the Department has responsibility for investigating problems at the site and for developing and implementing the site's remedial program. The Department uses money available from the State Superfund and the Environmental Quality Bond Act of 1986 to pay for these activities. The Department has direct control and responsibility for the remedial program.

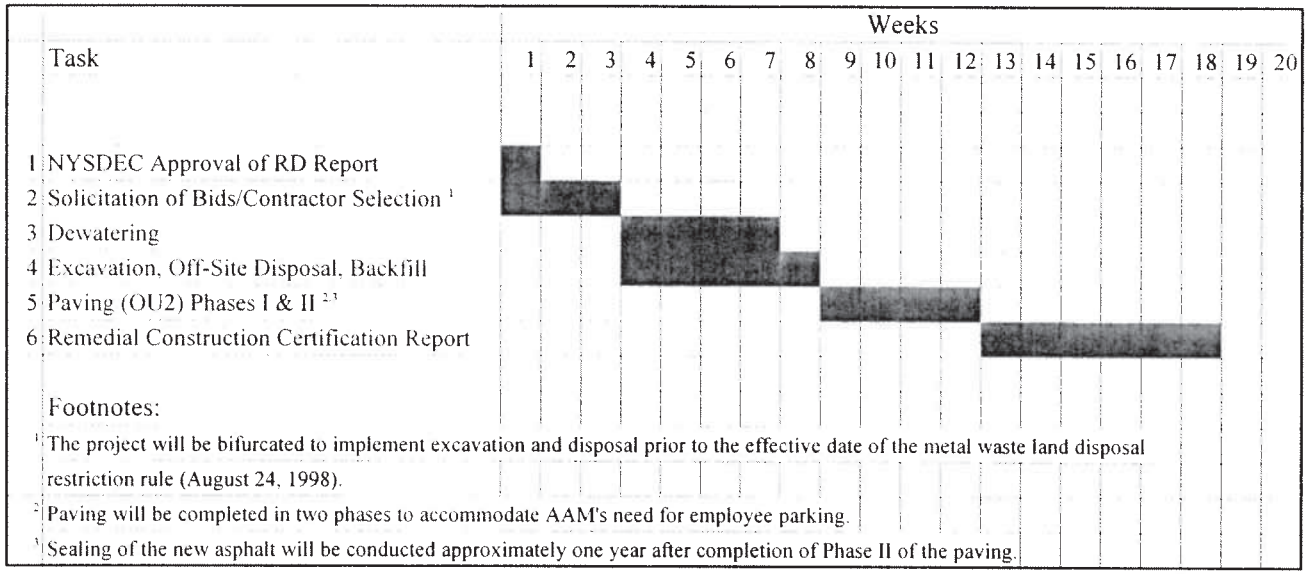
FIGURES

EMCON

FIGURE 1
SITE LOCATION MAP
SAGINAW-BUFFALO SITE

CITIZEN'S PARTICIPATION PLAN

Figure 2
GENERAL MOTORS CORPORATION
REMEDIAL CONSTRUCTION IMPLEMENTATION SCHEDULE



Footnotes:

[1] The project will be bifurcated to implement excavation and disposal prior to the effective date of the metal waste land disposal restriction rule (August 24, 1998).

[2] Paving will be completed in two phases to accommodate AAM's need for employee parking.

[3] Sealing of the new asphalt will be conducted approximately one year after completion of Phase II of the paving.

APPENDIX A

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