FINAL ENGINEERING REPORT

FORMER TAYLOR INSTRUMENTS SITE
ROCHESTER, NEW YORK

VOLUME 1

Part 1 of 3

Report and Appendix A through I

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CERTIFICATION OF CONFORMANCE

This Final Engineering Report for the remediation of the on-site contaminated soil and groundwater, required by Section I.E of the Voluntary Cleanup Agreement (Index No. B8-0508-97-02) between Combustion Engineering (C-E) and the New York State Department of Environmental Conservation (NYSDEC), has been prepared for the Taylor Instruments Site located at 95 Ames Street, Rochester, New York. This report outlines the activities completed to remediate the on-site contaminated soil and groundwater, and has been prepared under the responsible charge of the undersigned Professional Engineer. With the exception of Volume III, Appendix Q (Off-Site Groundwater Monitoring, Final Engineering Report, prepared by Haley & Aldrich of New York on behalf of Apogent Technologies, formerly known as Sybron Corporation), all remedial activities were conducted at the site by MACTEC Engineering and Consulting (formerly known as Harding ESE) personnel and contractors working at the direction of MACTEC. All activities were performed in full accordance with the Remedial Work Plan, dated April 2000, and correspondence included in this document as Appendix A.

STATE OF NEW YORK · RICKY A. RYAN · 060227 · LICENSED PROFESSIONAL ENGINEER

11/21/03

Ricky A. Ryan, P.E.
MACTEC Engineering and Consulting
Representative for Combustion Engineering

TABLE OF CONTENTS

Final Engineering Report
Former Taylor Instruments Site
Rochester, New York

TABLE OF CONTENTS *(Continued)*

Final Engineering Report
Former Taylor Instruments Site
Rochester, New York

TABLE OF CONTENTS *(Continued)*

Final Engineering Report
Former Taylor Instruments Site
Rochester, New York

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

bgs	below ground surface
BR	bedrock monitoring well
BREW	bedrock extraction well
C-E	Combustion Engineering Inc.
CG	cleanup goal
COC	chain of custody
Columbia	Columbia Analytical Services, Rochester, New York
decon	decontamination
Dolomite	Dolomite Facility located at 1075 Buffalo Road in Rochester, New York
DPVE	dual-phase vacuum extraction
ELAP	Environmental Laboratory Accreditation Program
e-mail	electronic mail
EPA	Environmental Protection Agency (United States)
EW	extraction well
FER	Final Engineering Report
ft^2/day	square foot per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
HDPE	high density polyethylene
HLA	Harding Lawson Associates
HSA	hollow-stem auger
MCHD	Monroe County Health Department
MCPW	Monroe County Pure Waters
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL/min	milliliters per minute
MS/MSD	matrix spikes/matrix spike duplicate
MVA	Mercury Vapor Analyzer
NTU	nephelometric unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operations and maintenance
OB	overburden monitoring well

PID	Photo-Ionization Detector
PLC	programmable logic controller
psi	pounds per square inch
PVC	polyvinyl chloride
Q	pumping rate in gallons per minute
RAO	Remedial Action Objective
RWP	Remedial Work Plan
S	storativity
SCG	Standards, Criteria, and Guidance
Site	Former Taylor Instruments Facility located at 95 Ames Street, Rochester, New York
soil	contaminated soil and construction debris
SVOC	semivolatile organic compound
T	transmissivity
TAGM	Technical Assistance Guidance Memorandum (4046)
TCE	trichloroethylene
TCLP	Toxic Characteristic Leaching Procedure
VCA	Voluntary Cleanup Agreement
VOC	volatile organic compound

1.0 INTRODUCTION

Harding ESE, on behalf of Combustion Engineering Inc. (C-E), is submitting this Final Engineering Report (FER) that describes on-site remedial activities performed at the Former Taylor Instruments Facility, 95 Ames Street, Rochester, New York (Site). All work described in this FER was performed in accordance with the *Remedial Work Plan, Taylor Instruments Site, Rochester, New York* (Harding Lawson Associates [HLA], 2000a) (RWP). New York State Department of Environmental Conservation (NYSDEC) approval for the RWP was received on June 3, 2000. This FER is submitted to meet the requirements of the Voluntary Cleanup Agreement (VCA), Index Number B8-0508-97-02 between C-E and the NYSDEC, Subparagraph I.E. (NYSDEC, 1997).

1.1 ON-SITE REMEDIAL ACTIONS COMPLETED

The on-site remedial actions performed that are described in this report consist of the excavation and off-site disposal of shallow soil contaminated with mercury and volatile organic compounds (VOCs) and the installation of a dual-phase vacuum extraction (DPVE) remedial system that will remediate VOC contamination in the groundwater and saturated zone soil. All of this work was performed under the oversight of NYSDEC, New York State Department of Health (NYSDOH), Monroe County Health Department (MCHD), and Monroe County Pure Waters (MCPW).

1.2 REMEDIAL ACTION OBJECTIVES

The overall objective of the remedial activities described herein is to return the Site to a condition that will support its reasonable use for continued commercial or industrial operations. It is the intention of C-E that the Site be redeveloped for commercial or industrial use in the future, with assistance from the Economic Development Office of the City of Rochester. In accordance with the VCA, wherever feasible and technically practicable, this includes meeting and achieving all applicable Standards, Criteria, and Guidance (SCGs) in remediated soil and groundwater. The Remedial Action Objectives (RAOs) for this Site are:

- Provide for the attainment of soil SCGs to the extent practicable;
- Provide for the attainment, over time, of the groundwater SCGs at the Site, to the extent practicable;
- Mitigate and/or reduce the on-site impacts of contaminated groundwater on human health and the environment;
- Eliminate to the extent practicable, the potential for human, animal, and or wildlife exposure to soil containing site-related contaminants; and
- Contain, treat, and or dispose of contaminated soil, including buried debris, in a manner consistent with State and Federal regulation and guidance.

1.3 REPORT ORGANIZATION

This FER is organized into seven major sections. The first section is this Introduction, which includes a brief summary of the on-site remedial actions performed and the RAOs. Section 2.0 presents a description of the preparatory activities that were performed prior to the start of the remedial construction. Section 3.0 presents a detailed description of the soil excavation and associated activities. Section 4.0 presents a description of the drilling, well testing, and subsequent groundwater sampling of the wells that were installed as part of the DPVE remedy. Section 5.0 presents a detailed description of the components and the construction of the DPVE remedial system. Section 6.0 presents a final summary, and Section 7.0 presents references.

The 17 appendices are divided up between three volumes. Volume I contains Appendices A through L. Volume II contains Appendices M through P. Volume III contains Appendix Q, which will be submitted by Sybron Corporation under separate cover.

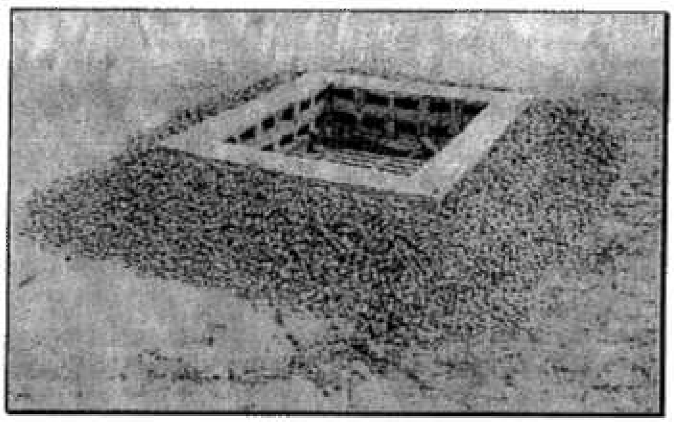
2.0 PREPARATORY ACTIVITIES

2.1 STORM SEWER SEDIMENT CONTROL

Prior to beginning the soil excavation and remediation system construction, a series of measures were implemented to ensure that contamination would not leave the Site either through the on-site storm sewers or from surface runoff.

2.1.1 Sewer Control Structures

Sewer control structures were constructed around each on-site manhole and catchbasin (Picture 2-1). These structures consisted of a double layer of geotechnical fabric placed under each manhole lid and catchbasin grate to prevent sediment from contaminating the on-site sewers. The geotechnical fabric was inspected weekly during construction activities. If the inspection determined the fabric need to be changed then the old fabric was removed and replaced with new fabric. Two rows of concrete block were stacked around each catchbasin and manhole such that the holes in the block were parallel with the ground surface. The rows of block were wrapped on the outside with wire mesh and then crushed stone was placed on the outside of the rows of block to capture larger stormwater-related sediment.



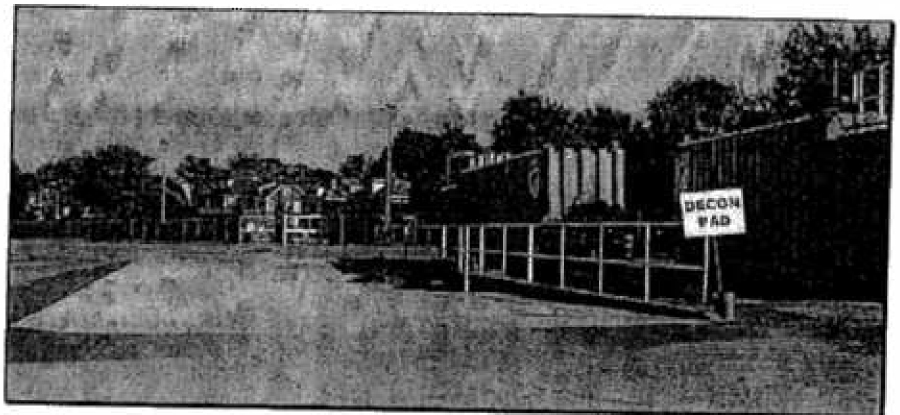
Picture 2-1 Sewer Control Structure

2.1.2 Hay Bales

The Site topographic map was reviewed and areas where on-site stormwater could potentially move off site as stormwater runoff were identified. A double row of hay bales that acted as sediment control structures were placed in these on-site areas (Figure 2-1).

2.2 DECONTAMINATION PAD INSTALLATION

A decontamination (decon) pad was installed in the southwest portion of the Site prior to the start of construction activities (Picture 2-2). The decon pad was situated just prior to the designated vehicle exit point for the site. The decon pad is a 15-foot-wide and 100-foot-long concrete pad that was used to decontaminate trucks, excavation equipment, and drilling rigs. The pad is sloped to drain towards a concrete trench that is 20 feet long, 2 feet wide, and 2 feet deep. This trench captured water and sediment generated during decon activities. The captured water and sediment were pumped to a holding tank adjacent to the decon pad. The sediment settled to the bottom of each tank. After settling occurred, the water was sampled prior to disposition.



Picture 2-2 Decon Pad

2.3 Grid Numbering System

There are three areas listed in the RWP that were identified for excavation based on pre-remedial investigations (BS-27, the location of a soil boring from a previous investigation, also required excavation). A series of 50-foot by 50-foot grids were superimposed over each of these three areas to aid in managing excavation activities. The excavation grids or lifts were given a five character numbering system that was unique to each lift. The first two characters (e.g., A1, A2, and A3) indicated which of the three areas where a specific grid was located (i.e., A1=Area 1, A2=Area 2, and A3=Area 3). BS-27 was given the grid name BS27. The third, fourth, and fifth characters indicted the lift within Area 1, 2, or 3. The lift A1L17 indicates the 50×50 grid number 17 within Area 1 (Figure 2-2).

2.4 Layout of Excavation Area Grids

Upon finalizing the Grid Numbering System (as discussed in Section 2.3) the grid boundaries were marked onto the asphalt pavement at the Site. First, the intersection of the grid corner boundaries were surveyed and marked by Popli Engineers and Surveyors, Rochester, New York. The grid lines were then marked off with paint on the pavement by Harding ESE personnel to establish the area of each 50-foot by 50-foot grid that required excavation.

3.0 CONTAMINATED SOIL EXCAVATION

3.1 ASPHALT REMOVAL AND RECYCLING

The three excavation areas were covered with 6 to 8 inches of asphalt paving that required removal. Upon removal, the asphalt was then inspected for signs of visual contamination and monitored for mercury vapors with a Jerome mercury vapor analyzer (MVA). After this initial inspection, the asphalt was temporarily stockpiled on site. The asphalt was then loaded into trucks and sent to the Dolomite Facility located at 1075 Buffalo Road, Rochester, New York (Dolomite) for recycling. Approximately 1,601 tons of asphalt were sent for recycling.

3.2 SOIL EXCAVATION AND STAGING

After the asphalt was removed from each grid, approximately 6 to 10 inches of subbase gravel was removed along with the underlying contaminated soil and construction debris (soil). Each grid was initially excavated to 4 feet below ground surface (bgs) (as measured from the top of the asphalt surface) with a Kobelco track hoe with a 2-yard bucket (Picture 3-1). The excavated soil was staged temporarily adjacent to each excavated grid on plastic sheeting and then the soil pile was covered with plastic.

Picture 3-1 Asphalt Removal

3.3 CONFIRMATORY SOIL SAMPLE IDENTIFICATION

The confirmatory soil sample identification system utilized seven characters that identified the location of confirmatory soil samples. This system was applicable only for soil excavated from 0 to 4 feet bgs. The first and second character identified the area from which the sample was taken such as A1= Area 1, A2 = Area 2, and A3 = Area 3. The third, fourth, and fifth characters identified the grid within the specific area such as L01 = Lift 1, L33 = Lift 33, etc. The sixth and seventh characters identified where the sample was taken within the excavated grid such as 0N = North, 0S = South, 0E = East, 0W = West, and 0F = Floor, NW = Northwest, etc. For example, the sample A3L050E was taken on the eastern wall of the fifth Lift in the third area.

When soil was excavated from 4 to 8 feet bgs, the sample identification for soil deeper than 4 feet was to add two additional characters to the seven character system described above creating a nine character sample identification. For example, sample A2L01L20E indicates the sample was taken from the east side of the excavation (0E), the second layer (L2 – depth greater than 4 feet; typically 4 to 8 feet), Lift 1 (L01), and Area 2 (A2).

3.4 Confirmatory Soil Sampling

Confirmatory soil sampling consisted of taking one grab sample from each grid wall and floor. The analytical results were then compared with the cleanup goal (CG) for each contaminant to determine if further excavation was required. The confirmatory soil samples were analyzed for VOCs by U.S. Environmental Protection Agency (EPA) Method 8260B, semivolatile organic compounds (SVOCs) by EPA Method 8270, and nine Technical Assistance Guidance Memorandum 4046 (TAGM) metals (NYSDEC, 1994). The nine TAGM metals are cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc (HLA, 2000b). Total mercury was analyzed by EPA Method 7471a. Cyanide was analyzed by EPA Method 9012A. Cadmium, chromium, copper, lead, nickel, silver, and zinc were all analyzed by EPA Method 6010B. A summary of the confirmatory analytical results are listed in Table 3-1. All analytical results are contained in Appendix M (Volume II).

Confirmatory soil samples were collected from each grid sidewall and floor based on visual observations or vapor readings with a Photo-Ionization Detector (PID) or Jerome MVA. The sample from the floor was analyzed for VOCs and nine TAGM metals. The sidewall samples were analyzed for total mercury and VOCs, based on the grid location. When a grid wall abutted an adjacent grid wall such as the north wall of A2L02 and the south wall of A2L06, only one sample was collected at this location (Figure 2-2). This confirmatory soil sample and its associated analytical results represent both sampling locations.

Confirmatory samples from BS27 were split with NYSDEC field personnel on August 30, 2000.

When grid walls extended beyond the three areas of contamination as shown on Figure 2-2, the confirmatory sampling constituents were expanded to include VOCs, SVOCs, and the nine TAGM metals. A chain of custody (COC) was filled out for all samples collected. The samples were placed on ice and submitted to Columbia Analytical Services, Rochester, New York (Columbia) for analyses.

3.5 Disposition Soil Sample Identification

Disposition soil samples were identified in a manner similar to confirmatory samples, but using a nine-character system. The first and second character identified the excavation area from which the sample was taken: A1 = Area 1, A2 = Area 2, A3 = Area 3. The third, fourth, and fifth characters identified the lift within the specific excavation area. For example, L01 was used for Lift 1, L17 was used for Lift 17, etc. The sixth and seventh characters identify the layer, i.e., L1 = Layer 1, and L2 = Layer 2. The eighth and ninth characters D1 or D2 identified the number of the composite sample taken from a particular lift and layer. As an example, the sample A1L01L1D2 indicates the second disposition sample taken from Layer 1 of Lift 01 in Area 1.

3.6 Disposition Soil Samples

The disposition of excavated soil was determined by taking two composite soil samples from the soil excavated from a grid. Each composite soil sample was analyzed for total mercury by EPA Method 7471a, Toxic Characteristic Leaching Procedure (TCLP) mercury and TCLP lead. The extraction method utilized for mercury and lead was EPA Method TCLP Extraction Method 1311. Mercury was analyzed by EPA Method 7470 and lead was analyzed utilizing EPA Method 6010B. In the area of overlapping mercury-contaminated soil and trichloroethylene- (TCE-) contaminated soil, as in grids A3L06 and A3L07, two additional composite samples were collected for VOC analyses by EPA Method 8260B. A summary of disposition analytical results are listed in Table 3-2. All analytical results are contained in Appendix M.

3.7 Review of Soil Analytical Results

3.7.1 Review of Confirmatory Analytical Results

The confirmatory analytical results were compared to the CG. The CGs for VOCs, SVOCs, lead and cyanide are based on TAGM 4046. A site-specific CG for mercury was approved by NYSDEC. It was 10 milligrams per kilogram (mg/kg) from 0 to 1 foot bgs and 100 mg/kg from 1 foot bgs and deeper (NYSDEC, 1998). The CGs for cadmium, chromium, copper, cyanide, nickel, silver, and zinc were based on background concentrations of inorganics in on-site soil. These background concentrations of inorganics in on-site soil were submitted to NYSDEC on June 8, 2000 and were used as the CGs for these seven metals (Harding ESE, 2000b).

If the confirmatory analytical results indicated analytical results below the CG, then the excavation was complete. If the analytical results indicated the soil was still above the CG after the initial excavation, then additional excavation was performed. The additional soils were then sampled and analyzed for contaminant that exceeded the CG.

3.7.1.1 NYSDEC Notification

If the confirmatory analytical results were below the CG, then the excavation was stopped and NYSDEC was notified that further excavation was not required for that grid and that backfilling was warranted. The initial notification to NYSDEC and NYSDEC's approval were made either verbally or by electronic mail (e-mail). The soil analytical results were also submitted to NYSDEC as part of each request to backfill the grids.

3.7.1.2 Variance Requests

A chemical-specific Variance Request was submitted to NYSDEC to allow for excavation to be discontinued when multiple excavation and resampling was performed in a grid wall or floor and the confirmatory analytical results were still above the CG. These requests to NYSDEC and their subsequent approvals were made initially either verbally or by e-mail. These requests were later formalized in writing to NYSDEC on August 31, 2000; September 8, 2000; and September 28, 2000. The formal NYSDEC approval for the August 31, 2000 and September 8, 2000 requests was received on September 14, 2000. The formal NYSDEC approval for the September 28, 2000 request was made on October 16, 2000. A summary of the formal requests is included in Table 3-3. Appendix A includes the formal Harding ESE and NYSDEC correspondence related to these Variance Requests.

3.7.2 Review of Disposition Sampling Results

The disposition analytical results were received and were used to classify each soil volume into one of three disposition categories, as described below.

1) Non-hazardous Soil:
   - TCLP mercury <0.2 milligrams per liter (mg/L);
   - TCLP lead<5.0 mg/l;
   - total mercury ≥ 100 mg/kg.

   Non-hazardous soil was disposed of off site at the High Acres Subtitle D Landfill located in Perinton, New York.

2) Hazardous Soil:
   - TCLP mercury ≥0.2 mg/L and total mercury ≥100 mg/kg and <260 mg/kg and/or;
   - TCLP lead ≥5 mg/L and/or;
   - TCE >58 mg/kg*.

   * From Contained-In-Determination request approved by NYSDEC on February 22, 2000.

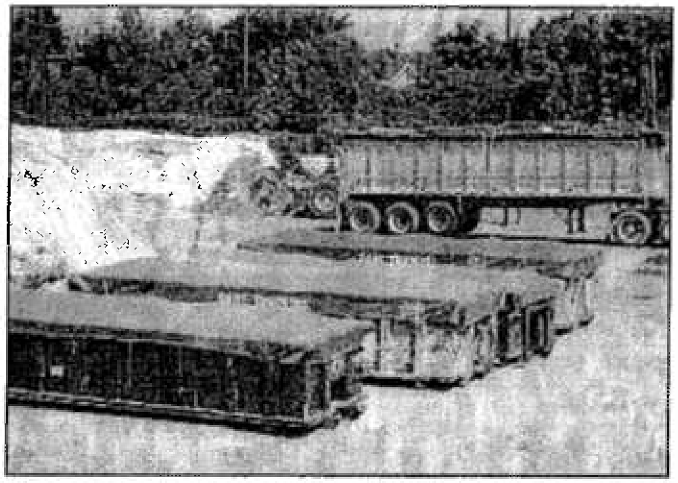
   Hazardous soil subject to the above criteria was disposed of off site at the Model City's Subtitle C Landfill located in Model City, New York.

3) High-Mercury Hazardous Soil:
   - TCLP mercury ≥0.2 mg/L; and
   - Total mercury ≥260 mg/kg.

   High-mercury hazardous soil was treated off site at the Mercury Waste Solutions retorting facility located in Union Grove, Wisconsin. The treated soil was subsequently disposed of at Superior Services Emerald Park Subtitle D Landfill located in Muskego, Wisconsin.

3.8 SOIL LOADING AND TRANSPORTATION

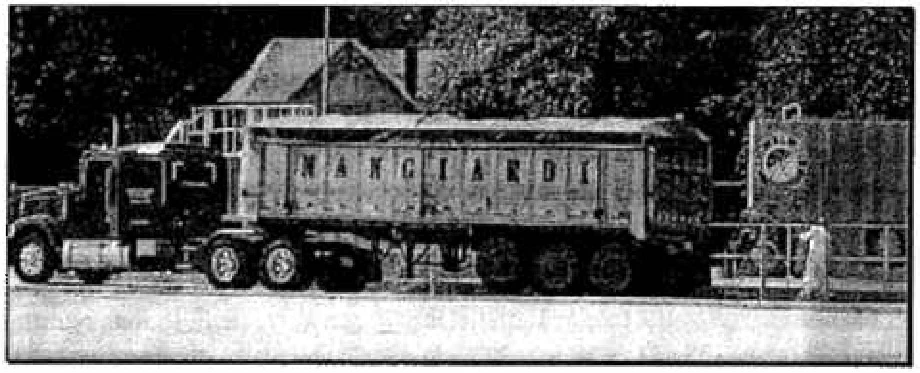
Prior to the beginning of the project, waste profiles had been established with the two landfills and the retorting facility. The soils were initially classified as described in Section 3.7 above. The disposition analytical results were then faxed to the appropriate off-site retorting facility or landfill. The landfills and retorting facility confirmed their acceptance of the soil, and transportation was provided by each disposal facility using licensed waste haulers. All trailers and roll-off boxes used for transportation were lined with plastic. High Acres and Model City provided 35 cubic yard trailers to transport soil. Mercury Waste Solutions provided plastic-lined 15- to 20-cubic yard roll-off boxes.



Picture 3-2 Soil ready for transport

3.8.1 Truck Decon Procedures

Each truck leaving the Site was required to go through decon procedures at the decon pad (Picture 3-3) just prior to exiting the site. Decon consisted of thoroughly power washing all tires, undercarriage, and mud flaps with potable water to remove any soil or dust that may have adhered to the truck during loading. The decon water and sediment was collected in the sump trench and pumped to a holding tank where the water and sediment were tested prior to disposition.



Picture 3-3 Truck decon

3.8.2 Waste Manifests

Manifests for each load of soil leaving the Site was provided to each truck driver at the decon pad. Manifests were signed and dated by Harding ESE personnel (as representatives of C-E) and the transporter. The appropriate copies of each manifest were retained on site by Harding ESE and the appropriate copies were given to the transporter. When indicated on the manifest, Harding ESE forwarded the appropriate copies to the appropriate State agencies. The copies of waste manifests and weight tickets for soil sent to High Acres are contained in Appendix N (Volume II). The copies of waste manifests and certificates of disposal for soil sent to Model City are contained in Appendix O (Volume II). The copies of waste manifests and certificates of recycling for soil sent to Mercury Waste Solutions are contained in Appendix P (Volume II).

3.9 WATER DISCHARGE

On August 18, 2000, Harding ESE received a Sewer Use Permit Number, P.I. 020, from MCPW to discharge water collected during construction activities to MCPW's off-site combined sewer on Hague Street. All water was sampled for VOCs and total mercury. The analytical results and an estimate of the water volume to be discharged were submitted to MCPW with each discharge request. Faxed or verbal permission for each discharge request was received from MCPW prior to discharge. After the water was discharged, the remaining sediment in the tank was containerized in 55-gallon drums, tested, and disposed of at High Acres. All correspondence relating to the Sewer Use Permit is contained in Appendix B. Analytical results are contained in Appendix M (Volume II).

3.10 DISPOSITION SUMMARY

The amount of soil and construction debris excavated and disposed of off site is summarized below:

- 27,681 tons and 44 drums (55 gallons each) of non-hazardous soil were disposed of off site at High Acres Subtitle D Landfill;
- 1,449 tons of hazardous soil was disposed of off site at Model City's Subtitle C landfill; and
- 340 tons of high-mercury hazardous soil was retorted off site at Mercury Waste Solution's retorting facility.

Figure 3-1 shows the final horizontal and vertical extent of excavation.

3.11 BACKFILLING AND PAVING

After receipt of NYSDEC approval (based on confirmatory sampling), each grid was backfilled with Number 57 crushed limestone (stone). The stone was typically dumped directly into the excavated grid. The stone was then compacted using a vibratory roller. Number 2 "crusher-run" limestone was then added to the top of the backfilled number 57 stone, graded, and compacted. The "crusher-run" was brought up to within 3 inches below finished grade. The source of the stone used for all backfilling at the Site was from Dolomite. Approximately 3 inches of bituminous concrete pavement was added on top of the "crusher run", to form a finished pavement.

4.0 Remedial Well Installation

4.1 Remedial Well Installation

Parratt-Wolff Inc. was subcontracted by Harding ESE for the drilling and installation of 58 wells within and surrounding the North and South TCE Source Areas at the site. The wells were drilled using hollow-stem auger (HSA), spun casing, and air-rotary drilling methodologies. Well types and quantities are listed below.

- 21 Vent wells within the overburden
- 21 DPVE wells within the overburden
- 14 Monitoring wells: 4 within the overburden and 10 in bedrock
- 2 Bedrock extraction wells

4.1.1 Well Identification

A site-specific well naming protocol was established. The vent well names begin with VW, followed by an N or S, denoting if it is in the North or South TCE Source Area, followed by a number, e.g., VW-N-7. The DPVE wells follow the same protocol, except they begin with EW, denoting that the well is an extraction well, e.g., EW-S-3. Bedrock extraction wells begin with bedrock extraction well (BREW), followed by an N or an S, denoting which TCE source area the well is located within, followed by a number, e.g., BREW-N-1. The monitoring well names begin with overburden monitoring well (OB) if they are within the overburden and BR if they are in bedrock, followed by a number, e.g., OB-07 and BR-13. Wells are numbered sequentially. If a well is the first of its kind to be installed at the Site, the number begins at one. If it is not the first of its kind at the site, the numbering picks up after the last number of the previously installed wells of that type.

4.1.2 Well Locations

Wells were installed within or surrounding the North and South TCE Source Areas. The following wells were installed within the North TCE Source Area or its surrounding area: five bedrock monitoring wells (four shallow, one deep); one bedrock extraction well; six DPVE wells; two overburden monitoring wells; and seven vent wells. The following wells were installed within the South TCE Source Area or its surrounding area: five bedrock monitoring wells (four shallow, one deep); one bedrock extraction well; fifteen DPVE wells; two overburden monitoring wells; and fourteen vent wells. Figure 4-1 provides well locations.

4.1.3 Decontamination Procedures

Drilling and development equipment was decontaminated by the drilling subcontractor using potable water and a high-pressure steam generator before initial use, between well locations and after each use. Decontamination fluids were contained in a frac-tank and samples were collected from the frac-tanks and were analyzed to determine their disposition as listed in Section 3.9.

4.2 Vent Wells

Twenty-one vent wells were installed within the overburden material. Spun casing methodology was used to drill a 6-inch-diameter borehole to bedrock to an approximate depth of 25 feet bgs. The vent wells were constructed of 20 feet of 2-inch-diameter Schedule 40 PVC, 0.020-inch continuous-slot screen with a 0.25-foot sump, and approximately 5 feet of 2-inch-diameter Schedule 40 PVC riser within the borehole.

Morie #00N filter pack was installed around each well to approximately 0.5 foot above the top slot of the screen material. Six inches of bentonite was added to the top of the filter pack. This was followed by another filter pack, which extended to the ground surface. Wells were finished with a permanent 8-inch manhole cover and flush-mount surface completion. The surface completion was later removed and replaced with a well vault due to the fact that these wells are part of the conveyance and treatment system. Boring logs and well construction diagrams are located in Appendices C and D, respectively.

4.3 Dual-Phase Vacuum Extraction Wells with Piezometers

Twenty-one DPVE wells were installed within the overburden material to an approximate depth of 25 feet bgs. Spun casing methodology was used to drill an 8-inch-diameter borehole to bedrock. The DPVE wells consisted of 20 feet of 4-inch-diameter Schedule 316 stainless-steel, 0.020-inch continuous-slot screen with a 1-foot sump, and approximately 5 feet of 4-inch-diameter Schedule 40 PVC riser. A piezometer consisting of 20 feet of 1-inch-diameter 0.010-inch cut-slot Schedule 40 PVC screen with a 0.25-foot sump and approximately 5 feet of 1-inch-diameter Schedule 40 PVC riser was placed beside the well within the annulus of the borehole.

Morie #00N filter pack was installed around the well to approximately 0.5 foot above the top slot of the screen material. Six inches of bentonite was added to the top of the filter pack. This was followed by sand to the ground surface. Wells were finished with a permanent 8-inch manhole cover and flush-mount surface completion. The surface completion was later removed and replaced with a well vault due to the fact that these wells are part of the conveyance and treatment system. Boring logs and well construction diagrams are located in Appendices C and D, respectively.

4.4 Overburden Monitoring Wells

Four monitoring wells were installed within the overburden material to depths ranging from 17 to 25 feet bgs. HSA methodology was used to drill a 6.25-inch-diameter borehole. The overburden monitoring wells were constructed of 10 feet of 2-inch-diameter Schedule 40 PVC, 0.020-inch cut-slot screen with a 0.25-foot sump, and approximately 5 to 15 feet of 2-inch-diameter Schedule 40 PVC riser.

Morie #00N filter pack was installed around the well to approximately 1 foot above the screen material. Two feet of bentonite were added to the top of the filter pack. This was followed by grout to approximately 2 feet bgs. Wells were finished with a permanent manhole cover and flush-mount surface completion. Boring logs and well construction diagrams are located in Appendices C and D, respectively.

4.5 Bedrock Monitoring Wells

Ten monitoring wells were installed within the bedrock. Of the 10 bedrock monitoring wells, 8 were installed at an approximate depth of 65 feet bgs, which are referred to as shallow bedrock monitoring wells, and two were installed at an approximate depth of 75 feet bgs, which are referred to as deep bedrock monitoring wells. The bedrock monitoring well specifications are addressed in the following sections.

4.5.1 Shallow Bedrock Monitoring Wells

Eight shallow monitoring wells were drilled in the bedrock. HSA methodology was used to drill an 8.5-inch borehole within the overburden to bedrock, and air rotary with a downhole hammer was used to advance an 8-inch borehole to 3 feet below the occurrence of bedrock. A 6-inch-diameter permanent steel casing was installed in the overburden borehole, socketed 3 feet into bedrock and grouted in place using a tremmie pipe. This was allowed to set for a minimum of 24 hours.

After the grout was allowed to set, a 5 7/8-inch borehole was drilled through the interior of the permanent casing and into bedrock using air rotary with a downhole hammer. Well depths ranged from 47 to 67.5 feet. These wells were left as open boreholes. The wells were finished at the surface with permanent 12-inch-diameter manhole covers. Boring logs and well construction diagrams are located in Appendices C and D, respectively.

4.5.2 Deep Bedrock Monitoring Wells

Two deep monitoring wells were drilled in the bedrock. As with the shallow bedrock wells, HSA methodology was used to drill an 8.5-inch borehole within the overburden to bedrock, and air rotary with a downhole hammer was used to advance an 8-inch borehole to 3 feet below the top of bedrock. A 6-inch-diameter permanent steel casing was installed in the overburden borehole, socketed 3 feet into bedrock and grouted in place using a tremmie pipe. This was allowed to set for a minimum of 24 hours.

After the grout was allowed to set, a 5 7/8-inch borehole was drilled through the interior of the permanent casing and into bedrock using air rotary with a downhole hammer to an approximate depth of 40 feet below the top of bedrock. A second, 6-inch-diameter, permanent steel casing was then installed in the bedrock borehole to segregate deep bedrock groundwater from shallow bedrock groundwater. This casing was seated at an approximate depth of 40 feet below the top of bedrock and then grouted in place using a tremmie pipe. This casing was also allowed to set for a minimum of 24 hours.

A 3 7/8-inch borehole was then installed through the permanent casings and further into bedrock utilizing air rotary with a downhole hammer to an approximate depth of 50 feet below the initial occurrence of bedrock, or approximately 75 feet bgs. These wells were left as open boreholes. The wells were finished at the surface with permanent 12-inch-diameter manhole covers. Boring logs and well construction diagrams are located in Appendices C and D, respectively.

4.6 BEDROCK EXTRACTION WELLS WITH PIEZOMETERS

Two extraction wells were drilled into bedrock to depths of 62 and 76 feet bgs in the South and North TCE Source Areas, respectively. HSA methodology was used to drill a 4.25-inch pilot hole within the overburden to bedrock. HSA methodology was then used to drill a 10.25-inch-diameter borehole within the overburden to bedrock. Once bedrock was reached, air rotary with a downhole hammer was used to drill an 8-inch pilot hole 3 feet into bedrock, followed by spun casing methodology, widening the hole to 9 7/8 inches. An 8-inch-diameter permanent steel casing was installed in the overburden borehole, socketed 3 feet into bedrock, and grouted in place using a tremmie pipe. The grout was allowed to set for a minimum of 24 hours.

After allowing the grout to set, a downhole air rotary hammer was used to advance a 7 7/8-inch borehole to approximately 40 feet below the occurrence of bedrock. The bedrock extraction wells were constructed of 30 to 45 feet of 6-inch-diameter Schedule 316 stainless steel, 0.020-inch continuous-slot screen with a 5-foot sump, and approximately 30 feet of 6-inch-diameter Schedule 40 PVC riser. A piezometer consisting of 20 feet of 0.75-inch-diameter 0.010-inch cut-slot Schedule 40 PVC screen and approximately 25 feet of 0.75-inch-diameter Schedule 40 PVC riser was placed beside the well within the annulus of the borehole. Morie #1 filter pack was installed around the well and piezometer to approximately 2 feet above the screen material. The BREWs were completed with a permanent 12-inch manhole cover and surface completion. The surface completion was later removed due to the fact that the wells are part of the conveyance and treatment system. Boring logs and well construction diagrams for each well are located in Appendices C and D, respectively.

4.7 WELL DEVELOPMENT

The wells were allowed to set for a minimum of 24 hours after installation to let the grout and bentonite set. Wells were then developed in order to enhance specific capacity and remove fines. The development method for bedrock monitoring wells consisted of surging with a surge block for approximately 30 minutes, followed by purging. The development method for the remaining wells consisted of introducing potable water to the wells, alternated with pumping with a centrifugal pump to remove potable water, sands, and fines within the wells. When the majority of the sands and fines appeared to have been removed from the wells, the wells were mechanically surged and pumped with a submersible pump.

Throughout development, field measurements of turbidity, temperature, pH, and specific conductivity were recorded. The goal of well development was to develop the well until the turbidity of the discharge water was 50 nephelometric units (NTUs) or less. Well development logs are located in Appendix E. All well development water was handled as described in Section 3.9.

4.8 PACKER TESTING

Bedrock beneath the site has been mapped as the Lockport Dolomite. Regionally this formation consists of light- to medium-gray, fine- to medium-grained, siliceous dolomite with flat to gently dipping, thin to medium bedding. Depth to competent bedrock is approximately 20 to 30 feet bgs. Depth to groundwater in bedrock wells on site ranges from approximately 7 to 22 feet bgs. Prior to installing the well screens and casings, Harding ESE personnel, in conjunction with Parratt-Wolf, Inc., performed packer tests on the two borings, which were intended to serve the bedrock recovery wells – one in the South TCE Source Area and one in the North TCE Source Area, in accordance with the RWP. The packer tests were conducted to evaluate groundwater flow characteristics in the bedrock underlying the Site. These two locations were drilled for the installation of two bedrock recovery wells. The packer tests provided data that aided in determining if the location and depth of the boring were suitable for the installation of a recovery well that could provide adequate capture in TCE source areas.

On July 17, 2000, packer tests were conducted in the boring, now referred to as BREW-N-1, located in the North TCE Source Area. The packer tests were conducted on the following intervals: 26 to 39, 40 to 53, 53 to 66, and 66 to 76 feet bgs. Packer test results indicated that there are two distinct fracture zones within the boring. One fracture zone occurs at 66 to 76 feet bgs and a second one in the upper portion of the bedrock boring at approximately 26 to 39 feet bgs. The testing indicated that the interval 40 to 66 feet bgs has zero permeability. Due to fact that these two distinct zones exist, modifications were made to the screen length. The length of the screen material was extended from 30 feet to 45 feet in length to encompass the two permeable zones. Packer test data specific to this boring is located in Appendix F.

On July 18, 2000, packer tests were conducted in the boring located in the South TCE Source Area now known as BREW-S-1. The packer tests were conducted on the following intervals: 27 to 40, 40 to 53, and 53 to 61 feet bgs. Packer test results indicated that the entire extent of the bedrock boring was permeable. Therefore, the screen material remained at 30 feet in length, as originally specified. Packer test data specific to this boring is located in Appendix F.

4.9 Pumping Tests

Pumping tests were performed on BREW-S-1 and BREW-N-1. The principal objective of these tests was to determine aquifer response to pumping stress and to compute aquifer properties such as transmissivity (T). Results were used to guide the initial pumping rates of the extraction wells during the extraction system startup phase. Data collection included the continuous electronic measurement of water levels in the pumping wells and selected observation wells. Electronic data were used to create graphs of drawdown response versus time. These graphs were analyzed by published methods to compute aquifer properties. The full technical evaluation of the pumping test data, and associated conclusions, is contained in Appendix G.

Based on the testing results described in Appendix G, individual pumping of both BREW-S-1 or BREW-N-1 produces a radial drawdown response in the surrounding bedrock aquifer. Pumping these wells, therefore, should be effective in controlling deep groundwater flow at each of the South and North TCE Source Areas.

The constant-rate pumping test at BREW-N-1 generated a calculated bedrock T of about 5,800 gallons per day per foot (gpd/ft) in the vicinity of the North TCE Source Area.

The stepped-rate pumping test at BREW-S-1 generated a calculated T of 20,000 gpd/ft or less. The higher T calculated at the South TCE Source Area is likely due to a combination of factors. Packer testing of this well indicated high yields throughout the borehole. This suggests that the boring penetrated a vertical bedrock joint with high transmissivity. Since the calculated T is based on drawdown in the pumping well, it reflects conditions in the immediate vicinity of the test well rather than overall conditions in this part to the site. It is expected that long-term pumping will reveal a lower bulk bedrock T, more similar to that calculated at the North TCE Area.

4.10 BASELINE SAMPLING

Harding ESE personnel performed a baseline groundwater sampling event to provide an inclusive set of groundwater analytical data prior to the start-up of the groundwater conveyance and treatment system. Seventy-seven samples were collected and submitted to Columbia Analytical Services, a NYSDEC Environmental Laboratory Accreditation Program (ELAP) certified laboratory located in Rochester, New York. All 77 samples were submitted for volatile organic analyses by EPA SW-846 Method 8260B. Fifty-nine of the seventy-seven samples were environmental samples collected from monitoring, extraction, and recovery wells located on the Site. Eighteen of the seventy-seven samples were associated with quality control efforts (i.e., field duplicates, matrix spikes/matrix spike duplicate (MS/MSD), trip blanks, field blanks, and equipment rinsates). All environmental samples, including field duplicates and MS/MSD samples, were collected using low-flow peristaltic pumps at flow rates <400 milliliters per minute (mL/min). Field measurements of pH, conductivity, temperature, turbidity, oxidation reduction potential, and dissolved oxygen were collected during purging. Purge and sample data are presented on the field data records located in Appendix H. A summary of analytical results for the overburden and bedrock monitoring wells are presented in Figures 4-2 and 4-3, respectively. A summary of analytical results for the extraction wells located in the South TCE Source Area are presented in Figure 4-4. A summary of analytical results for the extraction wells located in the North TCE Source Area are presented in Figure 4-5. Laboratory reports for all samples are located in Appendix M.

5.0 Remedial System Installation

Construction of the DPVE remedial system occurred from August 2000 to January 2001. The construction activities included the installation of well vaults around each system well, trenching and installation of underground conveyance piping, treatment system building construction, system mechanical equipment installation and piping, and utility installation.

5.1 Permits

Prior to construction activities, permits were obtained from the City of Rochester and Monroe County. These permits included a building permit for the treatment system building, electric permit for equipment power, plumbing permit for building water lines and indoor fixtures, and a Monroe County sewer use permit for discharge of treated groundwater.

5.2 Well Vault Installation

These system-related wells have been constructed with flush-mount concrete vaults and H20 (heavy traffic) loading lids to protect the wells and to provide access to piping, valving, and process equipment and instrumentation. The vaults for the DPVE and vent wells are approximately 36 inches long by 36 inches wide by 48 inches high. The vaults for the BREWs are approximately 48 inches long by 48 inches wide by 48 inches high. Each vault is constructed of 3,500 pounds per square inch (psi) concrete with 6-inch-thick walls. The floors for the DPVE well vaults were poured after installation of the vaults. The vent wells and BREW well vaults were not completed with a concrete floor.

The vault lid hatches were constructed separately from the main vault and are approximately 30 inches by 38 inches for BREW wells and 30 inches by 30 inches for DPVE and vent wells. The lids are built of aluminum and provided with a self-lifting arm, hold-open arm, and lock. They also contain an interior lock handle in case the lid closes while personnel are in the vault. The lids are Syracuse Casting model EC-4HD.

To install the vaults, soil was excavated from around each well casing to a depth of approximately 5 feet below grade. Six inches of crushed stone was then placed into the excavation and compacted for a stable vault base. The preformed vaults were then put in place. After conveyance piping was installed to the vaults, the excavation around each vault was backfilled with crushed stone to the surface and compacted.

5.3 Piping Installation

High density polyethylene (HDPE) piping was used for all DPVE, vent, and BREW underground process piping between the treatment system building and system well vaults. A 1 1/2-half-inch Schedule 40 polyvinyl chloride (PVC) pipe was used for electric conduit for the BREW submersible pump. Schedule 80 PVC piping was used for DPVE process piping within the vaults. HDPE was chosen for its lightweight, flexibility, chemical resistance, reduced friction loss characteristics, and ease of installation.

The DPVE process for the North TCE Source Area utilized a 6-inch-diameter main header pipe with 3-inch-diameter piping extending from the main header to each individual well. The South TCE Source Area utilized an 8-inch-diameter main header pipe. The 3-inch piping was extended into each well vault. A 1 1/2-inch-diameter pipe was used for conveyance piping between the treatment system and the BREW well.

The HDPE pipe was shipped in 40-foot sections with the exception of the 1 1/2-inch pipe, which was shipped in 500-foot rolls. The pipe was joined using a heat fusion process. This process used heat and pressure to join two sections of pipe together creating a highly reliable joint.

Within the DPVE well vaults, the 3-inch HDPE pipe was transitioned to Schedule 80 PVC before reducing to 1 1/2-inch-diameter pipe. Ball valve and globe valves were installed in-line. The extraction piping then turned down into the well casing and terminated approximately 2 feet above the bottom of the well. The 1 1/2-inch-diameter piping terminates approximately 2 feet above the bottom of each well.

The BREW HDPE piping penetrates the well vault wall and transitions to Schedule 80 PVC where a ball valve was installed in-line. The Schedule 80 PVC was then coupled to 1 1/2-inch chemical resistant hose that extends to the submersible pump within the well.

The vent wells were piped between the treatment system building and the well casings with 2-inch-diameter HDPE pipe. Within the vaults, ball valves were installed in-line before piping was coupled to the well casing.

Pipe trenches were excavated to a depth of 5 1/2 feet below grade. The trenches were then backfilled with 6 inches of crushed stone for a stable base. After pipe installation, the piping system was pressure tested for 2 hours at a pressure of 50 psi. The excavation was then backfilled with crushed stone and compacted to the surface. All underground piping was stubbed up into the treatment system building through a common pipe chase.

5.4 Treatment Building Construction

The remedial treatment system is housed within a 30-foot by 50-foot building located in the Northwest corner of the site. A footing and foundation wall that extends 5 feet below grade supports the structure and its concrete floor slab. The structure walls are load-bearing walls and the roof is supported by trusses. The walls and roof are insulated and the exterior is covered with aluminum siding.

The building floor slab is 6 inches thick with 12 inches of subbase gravel. The slab slopes to a floor sump located in the center of the floor slab. The slab was also constructed with a 3-inch curb along its perimeter to act as a secondary containment for spilled process water. Three equipment pads were also poured for the vacuum pumps, equalization tank, and low profile tray stripper.

There are two entrances into the building. One door entrance is located in the southeast corner of the structure and one rollup door is located along the north wall. The building is heated with electric space heaters located in each corner and ventilated with one main control fan and two dampers. The building is lighted throughout and has exterior lighting above both entrances. There are also exit and emergency lights inside. Other utilities include water, sewer, and telephone service.

5.5 REMEDIAL SYSTEM CONSTRUCTION

The remedial system was designed and constructed to remove contaminants from subsurface soils and groundwater. The main process components of the remedial system are vacuum pumps, air/water separators, equalization tank, low profile air stripper, and various transfer pumps. These components are located in the treatment building. A layout of the system equipment is shown in an as-built drawings (Drawing S-201 located in Appendix J). The system has been constructed to operate with minimal on-site support.

Groundwater and soil vapors are extracted from DPVE wells by vacuum pumps. There are two 25-horsepower vacuum pumps installed in parallel that are connected to the seventeen South TCE Source Area DPVE wells and one 20-horsepower vacuum pump connected to the six North TCE Source Area DPVE wells. The main header pipes from both well fields, as discussed earlier, enter the treatment building and transition to Schedule 80 PVC. The North and South TCE Source Area header pipes connect to their respective air/water separator where the moisture drops out and flows into the tank and air is transported through the vacuum pump and discharged to atmosphere. The collected groundwater in each air/water separator tank is then pumped to the system equalization tank.

The BREW submersible pumps transfer groundwater from the wells located in the North and South TCE Source Area well fields to the system equalization tank. The combined groundwater from the BREW and DPVE processes is pumped from the equalization tank to the low profile air stripper for treatment. The treated groundwater is then discharge to MCPW's sewers at MH-24 located in the northwest corner of the Site.

All system piping within the building is Schedule 80 PVC. Overhead piping is supported every 10 lateral feet or where necessary to ensure the integrity of the piping. The piping connections are sealed with PVC glue for slip joint connections and Teflon™ tape for threaded connections.

The entire system is controlled by a programmable logic controller (PLC) that turns pumps on and off as needed and/or responding to alarm conditions. The PLC also collects system flow data and can be accessed remotely via modem by Harding ESE. The control system is also equipped with an autodialer to inform various operations and maintenance (O&M) personnel of alarm conditions that are encountered during normal operation. The system has been constructed to operate with minimal on-site support.

5.6 REMEDIAL SYSTEM STARTUP

Initial startup activities began on December 12, 2000. Potable water was initially processed through the system to test control equipment, pumping equipment, and pipe leaks. The vacuum pumps and BREW pumps were then brought on line and all treatment equipment controls set to automatic operation mode. As groundwater was collected from the on-site extraction wells and processed through the treatment system, adjustments were made to level control devices, pumping rates, and air stripper efficiencies to maximize system performance. The system operated with continued Harding ESE oversight until January 6, 2001. The system was then placed in automatic mode and is currently being monitored remotely. Harding ESE personnel or subcontractors will be on-site monthly to collect operational data, make system performance adjustments, and perform normal operation and maintenance activities.

6.0 SUMMARY

All activities outlined in the NYSDEC-approved on-site *Remedial Work Plan* (HLA, 2000a) have been successfully completed. Throughout the project, various requirements, codes, and regulations of the State of New York, Monroe County, and City of Rochester were met or exceeded.

As a part of this project, approximately 30,000 tons of contaminated soil were excavated and removed for off-site disposal and/or treatment and disposal; a groundwater extraction and remediation was installed that recovers and treats contaminated groundwater and soil vapor. Fifty-eight wells were installed for remediation and monitoring purposes; and all excavated areas were backfilled with clean backfill and then repaved.

The remedial activities performed as described in this FER have met the project objectives by: (1) removal of soil contamination above the CGs, and (2) installation and operation of the groundwater extraction and treatment system that will provide for the attainment, over time of all VOC-related SCGs to the extent practicable. All remedial work performed as described in this FER contained, treated, and/or disposed of contaminated soil, including buried debris, in a manner consistent with State and Federal regulations and guidance.

7.0 REFERENCES

Driscoll, F.D., 1986. *Groundwater And Wells*, Johnson Filtration Systems.

Harding Lawson Associates, 2000a. *Remedial Work Plan, Former Taylor Instruments Site, Rochester, New York* (June).

Harding ESE, 2000b. *May 2000 Progress Report, Defined Site Soil Background Levels for TAGM 4046 Inorganic Soil Constituents Former Taylor Instruments Site, Rochester New York* (June).

Harding ESE, 2000c. *Confirmatory Sampling Results and Request for Technical Impracticability Waiver/ Equivalency Determination, Former Taylor Instruments Site, Rochester, New York* (August).

Harding ESE, 2000d. *Grid A1L18, Confirmatory Sampling Results and Request for Technical Impracticability Waiver/Equivalency Determination, Former Taylor Instruments Site, Rochester, New York* (September).

Harding ESE, 2000e. *BS27, Confirmatory Sampling Results and Request for Technical Impracticability Waiver/Equivalency Determination, Former Taylor Instruments Site, Rochester, New York* (September).

NYSDEC, 2000a. Correspondence regarding "Contained-In Determination, Former Taylor Instruments Site, Voluntary Cleanup Agreement Index #B8-0508-97-02" (February 22).

NYSDEC, 2000b. Correspondence regarding NYSDEC approval for letters dated August 31, 2000 and September 8, 2000 regarding grid-specific approval for backfilling, Taylor Instruments #028028a (September).

NYSDEC, 2000c. Correspondence regarding September 28, 2000 grid-specific approval for backfilling grid BS27 (October).

NYSDEC, 1998. Correspondence regarding the Proposal for Remediation of the Taylor Instruments Site, Taylor Instruments Site #828028a (June 17).

NYSDEC, 1997. Voluntary Cleanup Agreement regarding the Taylor Instruments Site, Number B8-0508-97-02 (November).

NYSDEC 1994, *Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels.* Division of Hazardous Substances Regulation, Bureau of Technical Support, TAGM 4046 (January).

FIGURES

APPENDIX A

SOIL CLEANUP GOAL VARIANCE REQUESTS

Harding Lawson Associates
1400 Centerpoint Boulevard, Suite 158
Knoxville, TN 37932
Telephone: 865/531-1922
Fax: 865/531-8226

Engineering, Environmental, and Construction Services

August 31, 2000

David Pratt, P.E.
NYSDEC
Region 8
6274 East Avon-Lima Road
Avon, New York 14414

RE: Confirmatory Sampling Results and
Request For Technical Impracticality Waiver/Equivalency Determination
Former Taylor Instruments Site
Rochester, New York 14611
Voluntary Cleanup Agreement (VCA) Index #B8-0508-97-02

Dear Dave:

As requested in your August 22, 2000 e-mail, this letter contains a formal request for grid-specific variances from the site-specific cleanup goals at the subject site. This request is divided into two parts:

- Part 1 contains most of the copper related requests. The majority of these requests have already been submitted by e-mail and/or via phone. Based on your approval, these grids have been backfilled. To insure a complete and formal record, these prior requests are also included in this letter. Also included in Part I are similar copper related requests for three additional cells for which analytical results were recently received; and

- Part II of this letter contains an Technical Impracticability Request Waiver/TAGM Equivalency determination request for three grids for which data has not yet been submitted to New York State Department of Environmental Conservation (DEC). In addition to copper, there are several SVOCs whose levels are slightly higher than TAGM 4046 levels. These grids have been excavated beyond the extent presented in the RWP. We request your concurrence that further remediation is technically impracticable and grant a determination that will allow us to backfill these cells. We believe our completed action will still leave the remediated site in a state which is equivalent (in terms of short and long term environmental safety) to that which would have been achieved if the TAGM-based clean up numbers had been achieved. See Remedial Work Plan ("RWP") Section 1.3 and 6 NYCRR S375-1.10 (C) (1)(c) and (d).

I. Copper Variance Requests

As we have previously discussed with you several times, the additional copper data we gathered during earlier investigations at the site has demonstrated that our current site-specific copper background level (which then became the TAGM 4046-based cleanup goal) is lower than the actual background concentration. As detailed in our submittal entitled "Defined Site Soil Background Levels To Meet TAGM 4046 For Inorganic Soil Constituents Former Taylor Instrument Site Rochester, NY" the Defined Site Background Levels, based on 10 data points, was 15 mg/kg. Because this was lower than the TAGM 4046 level (25 mg/kg or site background), 25 mg/kg was set as the clean up goal. However, during remediation, numerous samples collected at the site have indicated that the site background soil copper level is variable. As indicated in our "Defined Site Background" submittal, the USGS has indicated that the range of soil copper levels in the Eastern US is from <1 to 700 mg/kg. Based on the more extensive site data we believe that for the cells listed below, (as well as all the cells where Copper levels were 25 mg/kg or less) we have achieved the TAGM 4046 "soil background" clean up goal.

AREA 1

A1L03: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 46.7 mg/kg and the background number is 25 mg/kg. Based upon our previous conversations, we are requesting that 46.7 mg/kg be considered the grid specific background concentration for copper.

The E-mail notification above was sent to the DEC on 8/14/00 and the analytical results were sent by Federal Express on 8/14/00 to the DEC. HLA has backfilled this grid.

A1L05: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 66 mg/kg and the background number is 25 mg/kg. HLA is requesting a variance in the background number for copper.

The E-mail notification above was sent to the DEC on 8/1/00 and the analytical results were sent by Federal Express on 8/1/00 to the DEC. HLA has backfilled this grid.

A1L06: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 48.7 mg/kg and the background number is 25 mg/kg. HLA is requesting that this grid be considered below the TAGM for copper.

The e-mail notification above was sent to the DEC on 8/1/00 and the analytical results were sent by Federal Express on 8/1/00 to the DEC. HLA has backfilled this grid.

A1L08: Confirmatory sample results are below the TAGM with the exception of copper in the southwest wall. The copper concentration in the initial southwest lift wall was 65 mg/kg. Excavation of one additional foot on the southwest wall and resampling for copper yielded a concentration of 104 mg/kg. A third excavation of 4 feet along the southwest wall and resampling for copper yielded a concentration of 132 mg/kg.

HLA is requesting a variance in the background concentration for copper on this grid wall. The analytical results above are to be sent to the DEC by Federal Express to DEC.

A1L12: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 60.6 mg/kg and the background number is 25 mg/kg. As above, we are requesting that 60.6 mg/kg be considered the grid specific background concentration for copper this grid.

The e-mail notification above was sent to the DEC on 8/14/00 and the analytical results were sent by Federal Express to the DEC on 8/14/00. HLA has backfilled this grid.

A1L13: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 33.1 mg/kg and the background number is 25 mg/kg. Based upon our previous conversations, we are requesting that 33.1 mg/kg be considered the grid specific background concentration for copper.

The e-mail notification was sent to DEC on 8/21/00 and the analytical results were sent to DEC by Federal Express on 8/21/00. HLA has backfilled this grid.

A1L16: Confirmatory sample results are below the TAGM with the exception of copper in the northeast wall. The copper concentration is 34.3 mg/kg and the background number is 25 mg/kg. As above, we are requesting that 34.3 mg/kg be considered the grid specific background concentration for copper.

The e-mail notification was sent to the DEC on 8/21/00 and the analytical results were sent to the DEC by Federal Express on 8/21/00. HLA has backfilled this grid.

AREA 2

A2L06: Confirmatory samples are below the TAGM with the exception of copper in the north wall with a concentration of 77.3 mg/kg and 39.2 mg/kg in the floor of the 8 feet deep section.

HLA is requesting a variance in the background copper concentrations of 25 mg/kg for this grid.

AREA 3

A3L02: Confirmatory samples are below the TAGM with the exception of copper in the south wall with a concentration of 53.2 mg/kg and the floor with a concentration of 59 mg/kg. DEC notification and approval for a variance in the copper background number was made via telephone by HLA.

Analytical results were sent to the DEC on 7/26/00 and 7/28/00. HLA has backfilled this grid.

A3L03: Confirmatory samples are below the TAGM with the exception of copper in the south wall with a concentration of 67.2 mg/kg. DEC notification and approval for a variance in the copper background number was made via telephone by HLA

Analytical results were sent to the DEC on 7/26/00 and 7/28/00. HLA has backfilled this grid.

A3L06: Confirmatory sample results are below the TAGM with the exception of copper in the east wall with a concentration of 70.3 mg/kg and the south wall with a concentration of 67 mg/kg.

DEC Notification and approval for this variance was made via telephone by HLA. The analytical results were faxed to the DEC on 7/26/00. HLA has backfilled this grid.

II. Requested Waiver Based On Technical Impracticability

HLA has determined that additional excavation in the areas discussed below is technically impracticable and that backfilling these cells now would result in a remedy that was substantively equivalent to one that had reached the TAGM numbers in adjacent grids. The rationale for approving this request is: 1) multiple excavations performed for each grid has failed to yield concentrations of those few persistent SVOCs (and perhaps copper in one location) below the TAGM based cleanup level; 2) the observed lack of copper or these SVOCs in groundwater samples from previous investigations indicating their lack of mobility; 3) the remaining low concentrations do not pose a significant increased risk to human health or the environment when compared to the TAGM 4046 levels; and 4) the distance below ground surface (bgs) of these chemicals is at, or greater than, 5 feet bgs, thus preventing human and most wildlife contact with the residuals.

AREA 1

A1L14: Confirmatory sampling results indicate concentrations of chemicals above the TAGM as shown in Table 1. The floor, after multiple excavations, is at a depth of 9 feet bgs. Groundwater is found at approximately 6 feet bgs. The southeast wall has been excavated twice beyond the original boundary. The On-site Sampling Round 1 sampling results from 1997 and found in the Final Investigation Report (FIR) show no detections in groundwater for the SVOCs shown in Table 1.

HLA is requesting a Technical Impracticality Waiver/TAGM Equivalency Determination For the semi-volatile organic compounds (SVOCs) and copper in the floor and for copper in the southeast wall where these constituents are above TAGM 4046 levels.

A1L17: Confirmatory sample results are below the TAGM with the exception of copper in the floor. The copper concentration is 300 mg/kg. Currently the floor excavation is eight feet bgs and the water table six feet bgs.

Based upon the information above, we are requesting a grid-specific waiver/background number for copper of 300 mg/kg (which is still at levels in the lower half of the USGS eastern US soil typical range.)

AREA 2

A2L07: Confirmatory sample results are below the TAGM with the exception of SVOCs and copper in the floor. HLA is requesting a variance for the few SVOCs and copper that are above the TAGM in this grid. The SVOCs and their cleanup goals are as follows: benzo (a) anthracene 0.8 mg/kg and the TAGM is 0.224 mg/kg; benzo (a) pyrene 0.850 mg/kg and the TAGM is 0.061 mg/kg; and chrysene 0.780 mg/kg and the TAGM is 0.4 mg/kg. HLA believes that the request should be approved because the SVOCs in groundwater samples as shown in the On-site Sampling Round 1 performed in 1997 and found in the Final Investigation Report (FIR) show no detections in groundwater for SVOCs. The copper concentration in the floor is 65.8 mg/kg and the cleanup goal for copper is 25 mg/kg. The current depth of the excavation floor is 5 feet bgs.

We are requesting a Technical Impracticability Waiver/TAGM Equivalency Determination for the SVOCs and copper in the floor.

III. Closing

For the reasons set fourth above, HLA requests that the Site Background Level for copper be revised to a range (25-300 mg/kg) to reflect the actual site data and that a Technical Impracticability Waiver/TAGM Equivalency Determination be granted allowing HLA to backfill grids A1L14, A1L17, and A2L07.

Further, because the requested recognition of the inherent variability of site copper background levels and the requested Technical Impracticality Waiver/Equivalency Determinations do not change the fundamental nature of the approved remedy or amount to a significant modification of the approved remedy, these changes should be deemed "minor" in terms of TAGM 4059.

HLA is requesting, after review and approval of this letter, that verbal permission to backfill these grids be granted to allow field activities to continue and that formal approval in writing will follow.

If you have any additional questions, please contact me at (865) 531-1922.

Sincerely,

HARDING LAWSON ASSOCIATES

Ricky Ryan, P.E.
Principal Project Manager

[054]

TABLE 1

Soil Analytical Results Summary for Grid A1L14
Former Taylor Instruments Facility
Rochester, New York

	CG	A1L14										
		NW	SW	NE	NE2	Lift 1 NE3	SE	SE2	SE3	FLR	Lift 2 FLR2	Lift 3 FLR3
SVOCs (mg/kg)												
Benzo(a)anthracene	**0.224**	NA	NA	**0.97**	**0.71**	BDL	**1.3**	**0.99**	BDL	**0.46**	**1.2**	**3.000**
Benzo(a)pyrene	**0.061**	NA	NA	**0.9**	**0.77**	BDL	**1.1**	**0.94**	BDL	**0.42**	**1.2**	**2.500**
Benzo(b)fluoranthene	**1.1**	NA	NA	0.76	0.63	BDL	1.0	0.78	BDL	BDL	**1.1**	**2.000**
Benzo(k)fluoranthene	**1.1**	NA	NA	0.790	0.61	BDL	0.96	0.79	BDL	BDL	1.0	**2.100**
Chrysene	**0.4**	NA	NA	**1.1**	**0.79**	BDL	**1.4**	**1.1**	BDL	**0.55**	**1.4**	**3.000**
Dibenzo(a,h)anthracene	**0.014**	NA	NA	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.660
METALS (mg/kg)												
Copper	**25**	NA	NA	**68.6**	**680**	24.9	**38.4**	**36.4**	**33.9**	**107**	**61**	**264**
Cyanide	**5**	NA	NA	BDL	NA	NA	BDL	NA	NA	BDL	NA	NA
Lead	**270**	NA	NA	53.6	NA	NA	29	NA	NA	41.1	NA	NA
Mercury	**100**	76.3	239	4.98	NA	NA	2.87	NA	NA	0.777	NA	NA

NW - Northwest Grid Wall
SW - Southwest Grid Wall
NE - Northeast Grid Wall
SE - Southeast Grid Wall
FLR - Floor
FLR2 - Indicates excavation beyond the initial grid boundaries
SVOCs - Semi-volatile Organic Compounds
BDL - Below Detection Limit
AGW - Adjacent Grid Wall
NA - Not Applicable (not analyzed)
CG - Cleanup Goal

Harding ESE
A MACTEC COMPANY

1400 Centerpoint Boulevard, Suite 158
Knoxville, TN 37932
865/531-1922
Fax: 865/531-8226

September 28, 2000

David Pratt, P.E.
NYSDEC
Region 8
6274 East Avon-Lima Road
Avon, New York 14414

RE: BS27
Confirmatory Sampling Results and
Request For Technical Impracticality Waiver/Equivalency Determination
Former Taylor Instruments Site
Rochester, New York 14611
Voluntary Cleanup Agreement (VCA) Index #B8-0508-97-02

Dear Mr. Pratt:

As requested in your August 22, 2000 e-mail, this letter contains a second formal request for a grid-specific variance in grid BS27 from the site-specific cleanup goals at the subject site.

BS27 Confirmatory sample results are below the TAGM with the exception of copper in the south, north, and east walls and chromium and copper in the west wall. These concentrations are found after excavating beyond the original area proposed in the Remedial Work Plan (Table 1). Harding ESE (formerly Harding Lawson Associates) is requesting a variance for the copper and chromium that are above the TAGM in this grid. The TAGM for copper is 25 mg/kg and the concentration of copper in the north wall is 49.8 mg/kg, in the south wall 100 mg/kg, in the west wall 80.1 mg/kg, and in the east wall 41.7 mg/kg. Also chromium is above the TAGM of 35 mg/kg with a concentration of 36.2 mg/kg found in the west wall and 51.8 mg/kg in the floor. The current depth of the excavation is 12 feet and well below the water table. Harding ESE believes that the request should be approved for the same reasons given in our letter requesting a Technical Impracticability Waiver/Equivalency Determination, dated August 31, 2000, and subsequently approved by NYSDEC.

If you have any additional questions, please contact me at (865) 531-1922.

Sincerely,

HARDING ESE, Inc.

Ricky A. Ryan, P.E.
Principal Project Manager

[059]

Enclosure

Table 1

Confirmatory Sampling Results for BS27
Former Taylor Instruments Facility
Rochester, New York

		BS-27											
		Lift 1										Lift 2	Lift 3
Metals (mg/kg)	CG	N	N2	S	S2	S3	E	E2	W	W2	FLR	FLR	FLR
Cadmium	40	35 3	NA	57.2	4 42	NA	3 99	NA	289	BDL	2 38	NA	NA
Chromium	35	4 82	NA	3.81	NA	NA	4 42	NA	1050	36.2	53.2	232	51.8
Copper	25	26.2	49.8	152	278	1000	91.7	41.7	1140	80.1	361	114	9 26
Cyanide	5	1 50	NA	1.85	NA	NA	BDL	NA	23.4	BDL	4 94	NA	NA
Lead	270	2 91	NA	1 73	NA	NA	4 40	NA	439	2.6	18.2	NA	NA
Mercury	100	0.16	NA	0.0763	NA	NA	0 0831	NA	35 8	NA	0 122	NA	NA
Nickel	115	338	54 4	108	NA	NA	15	NA	1040	9 62	56 1	NA	NA
Silver	5	BDL	NA	BDL	NA	NA	BDL	NA	2 98	BDL	BDL	NA	NA
Zinc	400	60 2	NA	110	NA	NA	27 4	NA	680	29 1	91 6	NA	NA

N - North Grid Wall

S - South Grid Wall

East Grid Wall

W - West Grid Wall

FLR - Floor

N2 - Indicates second excavation beyond the initial northern grid boundary

BDL - Below Detection Limit

NA - Not Applicable (not analyzed)

CG - Cleanup Goal

Harding Lawson Associates
1400 Centerpoint Boulevard, Suite 158
Knoxville, TN 37932
Telephone: 865/531-1922
Fax: 865/531-8226

Engineering, Environmental, and Construction Services

September 8, 2000

David Pratt, P.E.
NYSDEC
Region 8
6274 East Avon-Lima Road
Avon, New York 14414

RE: Grid A1L18
Confirmatory Sampling Results and
Request For Technical Impracticality Waiver/Equivalency Determination
Former Taylor Instruments Site
Rochester, New York 14611
Voluntary Cleanup Agreement (VCA) Index #B8-0508-97-02

Dear Mr. Pratt:

As requested in your August 22, 2000 e-mail, this letter contains a formal request for a grid-specific variance in grid A1L18 from the site-specific cleanup goals at the subject site.

A1L18: Confirmatory sample results are below the TAGM with the exception of SVOCs and copper in the southeast wall after excavating beyond the original area proposed in the Remedial Work Plan (Table 1). HLA is requesting a variance for the few SVOCs and copper that are above the TAGM in this grid. The copper concentration in the southeast wall is 26.5 mg/kg and the cleanup goal for copper is 25 mg/kg. The SVOCs measured and their cleanup goals are as follows: chrysene 0.43 mg/kg and the TAGM is 0. 4 mg/kg; and benzo(a)anthracene 0.41 mg/kg and the TAGM is 0.224 mg/kg. HLA believes that the request should be approved for the same reasons given in our letter requesting a Technical Impracticability Waiver/Equivalency Determination, dated August 31, 2000, and subsequently approved by NYSDEC. If you have any additional questions, please contact me at (865) 531-1922.

Sincerely,

HARDING LAWSON ASSOCIATES

Ricky Ryan, P.E.
Principal Project Manager

[057]

Enclosure

TABLE 1

Confirmatory Sample Results
Former Taylor Instrument Site
Ames Street
Rochester, New York

		A1L18									
SVOCS (mg/kg)	CG	NW	SW	NE	NE2	NE3	NE4	NE5	SE	SE2	FLR
Benzo(a)anthracene	0.224	AGW	AGW	NA	2.8	BDL	7.4	BDL	9.4	0.41	BDL
Benzo(a)pyrene	0.061	AGW	AGW	NA	2.5	BDL	5.9	BDL	7.8	BDL	BDL
Benzo(b)fluoranthene	1.1	AGW	AGW	NA	2.0	BDL	4.7	BDL	6.8	BDL	BDL
Benzo(g,h,i)perylene	50	AGW	AGW	NA	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(k)fluoranthene	1.1	AGW	AGW	NA	2.000	BDL	6.5	BDL	7.8	BDL	BDL
Chrysene	0.4	AGW	AGW	NA	2.6	BDL	6.3	BDL	8.4	0.43	BDL
METALS											
Cadmium	40	AGW	AGW	NA	0.780	NA	NA	NA	1.22	NA	BDL
Chromium	35	AGW	AGW	NA	14	NA	NA	NA	22.4	NA	7.99
Copper	25	AGW	AGW	NA	93.9	315	159	4.97	171	26.5	14.8
Cyanide	5	AGW	AGW	NA	BDL	NA	NA	NA	BDL	NA	BDL
Lead	270	AGW	AGW	NA	109	NA	NA	NA	2180	47.1	5.50
Mercury	100	AGW	AGW	NA	135	130	44.6	BDL	24.8	NA	0.192
Nickel	115	AGW	AGW	NA	13.1	NA	NA	NA	21.4	NA	11.9
Silver	5	AGW	AGW	NA	1.20	NA	NA	NA	BDL	NA	BDL
Zinc	400	AGW	AGW	NA	233	NA	NA	NA	235	NA	27.5

NW - Northwest Grid Wall
SW - Southwest Grid Wall
NE - Northeast Grid Wall
SE - Southeast Grid Wall
FLR - Floor
NE2 - Indicates excavation beyond the initial grid boundaries
SVOCs - Semi-volatile Organic Compounds
BDL - Below Detection Limit
AGW - Adjacent Grid Wall
NA - Not Applicable (not analyzed)
CG - Cleanup Goal

New York State Department of Environmental Conservation
Division of Environmental Remediation
274 East Avon-Lima Road, Avon, New York 14414
Phone: (716) 226-5355 • **FAX:** (716) 226-8696
Website: www.dec.state.ny.us

Environmental Conservation 30 YEARS
John P. Cahill
Commissioner

September 14, 2000

Ricky A. Ryan, P.E.
Harding Lawson Associates
1400 Centerpoint Blvd.
Suite 158
Knoxville, TN 37932-1968

Re: Taylor Instruments #828028a
Rochester (C), Monroe (C)

Dear Mr. Ryan:

The New York State Department of Environmental Conservation (NYSDEC) has received your letters dated August 31, 2000 and September 8, 2000 regarding grid-specific approval for backfilling. The NYSDEC hereby approves backfilling of the grids outlined in these letters since the proposed soil cleanup work is consistent with the "feasible" and "practicable" language in the RWP.

If you have any questions, please do not hesitate to contact me.

Sincerely,

David G. Pratt, P.E.
Environmental Engineer 2

Enclosure

cc: M.J. Peachey
J. Charles
R. Schick
Edward Hynes - H&A
D. Napier
J. Albert
J. McCreary / L. Ford
Peter Reckmeyer - Sybron

Vew York State Department of Environmental Conservation
'ivision of Environmental Remediation
274 East Avon-Lima Road, Avon, New York 14414
ne: (716) 226-5355 • FAX: (716) 226-8696
osite: www.dec.state.ny.us

Environmental Conservation 30 YEARS

John P. Cahill
Commissioner

October 16, 2000

Ricky A. Ryan, P.E.
Harding Lawson Associates
1400 Centerpoint Blvd.
Suite 158
Knoxville, TN 37932-1968

Re: Taylor Instruments #828028a
Rochester (C), Monroe (C)

Dear Mr. Ryan:

The New York State Department of Environmental Conservation (NYSDEC) has received your letter dated September 28, 2000 regarding grid-specific approval for backfilling in grid BS27. The NYSDEC hereby approves backfilling of grid BS27 since the proposed soil cleanup work is consistent with the "feasible" and "practicable" language in the RWP.

If you have any questions, please do not hesitate to contact me.

Sincerely,

David G. Pratt, P.E.
Environmental Engineer 2

Enclosure

cc: M.J. Peachey
J. Charles
R. Schick
Edward Hynes - H&A
D. Napier
J. Albert
J. McCreary / L. Ford
Peter Reckmeyer - Sybron