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Division of Environmental Remediation
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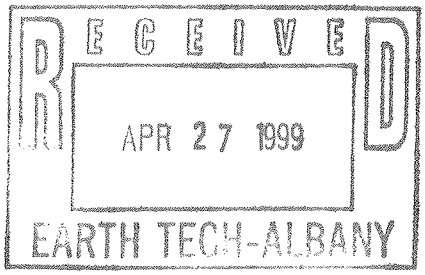
John P. Cahill
Commissioner

APR 23 1999



Mr. William S. Cooper
Project Manager
Earth Tech
12 Metro Park Road
Albany, New York 12205

Dear Mr. Cooper:

Re: Site ID #3-14-008
NOW Corporation Site
Final Remediation Report

The March 1999 Final Remediation Report for the NOW Corporation site has been reviewed by the New York State Department of Environmental Conservation. Comments from my March 12, 1999 letter were incorporated into the March 1999 Final Remediation Report. The report is hereby approved.

A total of three (3) additional bound copies of the report will be needed. Included in this total are a copy for the New York State Department of Health, one copy for the NYSDEC Regional Engineer, and copy for the document repository as required by the Citizen Participation Plan.

If you have any questions concerning this matter, please contact me at (518) 457-9285.

Sincerely,

Jeffrey E. Trad, P.E.
Project Manager
Eastern Field Services Section
Bureau of Construction Services
Division of Environmental Remediation

12 Metro Park Road, Albany, New York 12205

Telephone
518.458.1313

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March 24, 1999

Jeffrey E. Trad, P.E.
NYSDEC - Bureau of Construction Services
50 Wolf Road
Albany, New York 12233-7010

Subject: **NOW Corporation Site (#3-14-008)**
Final Remediation Report

Dear Mr. Trad:

Enclosed are two copies of the Final Remediation Report including Record Drawings for the NOW Corporation Site. The report incorporates the New York State Department of Environmental Conservation's (NYSDEC) review comments as specified in your letter, dated March 12, 1999.

Earth Tech appreciates the opportunity to provide engineering consulting services to the NYSDEC. Please contact me at 437-8381 if you have any questions or comments, or if you need additional copies of the report.

Very truly yours,

Earth Tech, Inc.

William S. Cooper
Project Manager

Encl. As Noted

cc: C. Bartlett (Earth Tech)

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Final Remediation Report
Now Corporation Site
Site 3-14-008

Volume I

Work Assignment No. D002520-34

Prepared for:

State Superfund Standby Program
New York State
Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7010

Submitted By:

Rust Environment & Infrastructure
12 Metro Park Road
Albany, New York 12205

March 1999

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APPENDICES

1.0 INTRODUCTION

This report has been prepared to summarize the construction activities associated with the groundwater and soil vapor extraction and treatment systems for the NOW Corporation Site, Registry #3-14-008, which is located in the Town of Clinton, Dutchess County, New York ("Site"). This report was prepared by Rust Environment and Infrastructure, Inc. (Rust) for the New York State Department of Environmental Conservation (NYSDEC) under the State Superfund Standby Program (Work Assignment D002520-34).

The report presents a brief description of the site and its background, the design investigation, the installation of the remedial component, and the project chronology. As-built drawings are provided as an attachment to the report. Modifications to the design set forth in the contract documents are included.

2.0 SITE DESCRIPTION AND BACKGROUND

The Site is located at an active manufacturing and warehouse facility, adjacent to NYS Highway 9G in the Village of Stattsburgh. The Site is listed as a Class 2 site in the NYSDEC Registry of Hazardous Waste Sites.

The Site was added to the Registry in December 1983, as a Class 2a site due to allegations of onsite disposal of "tank rinsing solution". In February 1989, a fire in the warehouse may have caused further contamination of the site. Runoff water samples collected after the fire contained low levels of benzene, toluene, ethyl benzene, trichloroethene (TCE), and 1,1,1-trichloroethane (TCA). Subsequent residential well water samples, collected in April 1989, contained several Volatile Organic Compounds (VOCs). In August 1990, the site was reclassified to Class 2. A Remedial Investigation and Feasibility Study (RI/FS) under the State Superfund Program was initiated in July 1992, and a Record of Decision (ROD) was issued in March 1995 for Operable Unit (OU) Number 1- Groundwater Contamination, and in November 1995 for OU Number 2- Soil Remediation.

The ROD remedy for groundwater contamination (OU 1) consists of five elements:

1. Groundwater extraction and treatment, and chemical vapor recovery from the impacted bedrock,
2. Infiltration of treated groundwater,
3. Institutional controls on groundwater use,
4. Maintenance of existing "point of entry" carbon adsorbers on impacted private wells, and
5. Long-term monitoring.

The ROD remedy for soil contamination (OU 2) consists of three elements:

1. Excavation of soil with over 700 ppb of TCE located near the northeast corner of the building (Area A), along the drainage ditch near the northern corner of the building (Area B), and the south corner of the concrete pad (Area C),
2. Excavation of weathered bedrock with over 700 ppb of TCE in Area A and Area B, and
3. Onsite treatment of excavated soils and weathered bedrock by low temperature thermal desorption (LTTD).

The remediation of both operable units was implemented concurrently under a single set of contract documents. The NYSDEC contracted Rust to design the groundwater remediation system and the soil remediation system in August, 1995. The contract documents were issued in April of 1997. NYSDEC issued a Notice to Proceed to Earth Remediation Services (ERS) on August 27, 1997. The contract was substantially completed in February 1998 and final punch list and restoration items were completed in June of 1998.

Several design modifications significantly impacted the contract, requiring preparation of a formal change order to the contract specifications. Other modifications were minor field design changes that did not require amending the contract.

3.0 DESIGN INVESTIGATION

As part of the final design study, Rust conducted an initial phase of design investigation to obtain technical data to design: a vapor extraction system, a groundwater recovery and treatment system and a treated groundwater re-injection system. The investigation included topographic surveying, installation and development of observation, injection, and recovery wells, well performance testing, and a 48 hour constant rate aquifer pumping test. The study report, including recommendations for the final design parameters, was submitted to the NYSDEC in March 1996. The recommendations, which included the final number and locations of recovery wells, pumping rates and soil vapor extraction points, were based on interpretation of technical data collected during this study and the 1995 RI/FS report by Engineering-Science (RI/FS).

The remedial design and construction for OU 1, groundwater contamination, was comprised of three major components: the groundwater recovery, treatment and injection system; the vapor extraction and treatment system; and the treatment building. Following is a summary of the general aspects, construction schedule and construction modifications to the design for each component.

4.0 GROUNDWATER RECOVERY, TREATMENT AND INJECTION SYSTEM

The remedial system for OU 1 fulfills the dual objectives of contaminated groundwater containment, and contaminant source reduction. The remedial system consists of three recovery wells (TW-1, TW-2A and TW-3) which pump contaminated groundwater to an air stripper for removal of VOCs. The air stripper exhaust is treated by vapor phase granular activated carbon (GAC) to remove VOCs. Treated effluent is pumped to a distribution pit from which water flows by gravity to two injection wells (IW-1 and IW-2). When effluent flow exceeds the infiltration capacity of the two wells, water rises in the distribution pit and overflows by gravity to an outfall on Crum Elbow Creek. Two of the groundwater recovery wells, TW-1 and TW-2A, which are located north of the Now Corporation building, are equipped with vapor recovery piping connected to the soil vapor extraction system (SVE) unit (Section 5.0). Drawing Sheet 1 of 14, Site Plan, presents the general layout of the groundwater remediation system.

4.1 CONSTRUCTION

Groundwater is recovered from the three on-site recovery wells using submersible pumps. Recovery wells TW-2 and TW-3 were installed originally as part of the initial phase design investigation discussed in Section 3.0. The investigation concluded that recovery well TW-2 provided little drawdown within the known contaminant plume area. Subsequently, replacement well TW-2A was installed in March of 1996. Sheet 6 of 14 shows the typical recovery well design (as-built). Water is pumped from the wells to the treatment system through 1 ½-inch I.D. x 4-inch I.D. double-walled high density polyethylene (HDPE) piping installed below grade. The influent pipe detail is shown on Sheet 6 of 14.

The groundwater process flow diagram is depicted on Sheet 4 of 14. Treatment of the recovered groundwater is achieved using an air stripper with vapor phase GAC for the exhaust. The groundwater is pumped to a forced draft, diffused plate type tray aerator. The unit is equipped with an over-sized blower to facilitate the use of the GAC adsorbers for air emissions control. Treated water collects in a three-chamber, precast concrete, settling tank located in the floor of the treatment building (Sheets 11 & 12 of 14). The treated water is pumped to a multi-media filter for solids separation. The pumping system uses a close-coupled centrifugal transfer pump driven by level indicators in the third chamber.

Water is pumped from the multi-media filter to precast concrete effluent distribution and meter pits via 3" HDPE force main as shown in detail on Sheets 6 & 7 of 14. Water then drains by gravity to two injection wells IW-1 and IW-2 which were also installed as part of the initial phase design investigation discussed above. Infiltration well construction details are shown on Sheet 6 of 14. The discharge lines are equipped with independent flow meters and control valves to allow tracking and control of the flows to the injection wells and to surface water discharge. Pipe outlets are placed at elevations to allow water to drain via gravity to the Crum Elbow Creek surface water outfall, rather than to over-fill the injection wells. Installation of the gravity effluent drainage pipe from the distribution and meter pit required directional boring and installation of 4" HDPE drainage pipe under Highway 9G to the Crum Elbow Creek Outfall structure as shown in plan and profile views on sheet 8 of 14.

Operational startup data for the pump and treatment system are presented in Table 1. Laboratory analyses of influent and effluent water samples collected at startup are included in Appendix A.

4.2 IMPLEMENTATION SCHEDULE

The groundwater recovery system was completed under the following schedule:

- October 13, 1997 Begin treatment building construction.
- October 14, 1997 Receive NYSDOT permit to bore under NYS Route 9G.
- October 14, 1997 Begin groundwater recovery system construction.
- December 4, 1997 Complete treatment building construction.
- January 2, 1998 Complete groundwater recovery and treatment system construction.
- January 9, 1998 Start-up groundwater recovery and treatment system.
- January 15, 1998 Achieve system design flow.

4.3 MODIFICATIONS

The following is a summary of modifications made to the groundwater treatment system.

- Installation method for Route 9G discharge line crossing (Sheet 7 of 14) - The original contract specifications for the Route 9G discharge line crossing were based on a jack and bore design. Instead of the specified jack and bore design, the Route 9G crossing was completed using directional boring. This modification eliminated the need for the manhole, jacking and receiving pits, pipe jacking and high level switching and wiring. The installation modifications and final construction elevations for the directional borehole are shown on sheet 7 of 14. This modification was administered as Change Order No. 1, Item 2, dated February 6, 1998.

- Discharge Piping Diameter (Sheet 7 of 14)- The proposed 8-inch diameter ADS line was changed to 4-inch diameter HDPE SDR11 for the discharge pipe beneath and adjacent to Route 9G. The pipe connecting the distribution pit to the 4-inch diameter HDPE SDR11 discharge piping was changed from 8-inch diameter ADS Type N12 to 4-inch diameter HDPE SDR17. The as-built drainage line profile is shown on sheet 7 of 14. Effluent gravity discharge trenching and piping details are shown on sheet 8 of 14. Modifications were made to the distribution and meter pits to accommodate changes to the gravity drain to surface water discharge piping. The 8-inch diameter PVC sch 80 pipe inside the distribution pit was changed to 4-inch diameter PVC sch 80 pipe. Accordingly, an 8-inch to 4-inch eccentric reducer was substituted for the specified 12-inch to 8-inch reducer between the distribution pit and the meter pit.

- Pipe depth (Sheet 1 of 14) - The original contract specifications required a 42-inch minimum installation depth for subsurface piping. This depth could not be achieved in all areas because of shallow bedrock. A modification was approved allowing the use of 2-inch thick Styrofoam insulation and soil fill where shallow bedrock (<42 inches) was encountered.

This occurred along an approximately 100 foot run of piping between well TW-3 and the treatment building, and at the TW-2A well head.

- Well control box switches and electrical service (Sheet 6 of 14) - The run/stop switches originally specified in the well control boxes, at each wellhead, were replaced with lockable disconnect switches. Also, 24V DC transformers were not required in the well control boxes due to modifications (refer to section 5.5) in electrical service.

- Sample collection ports (Sheet 4 of 14) - The original contract design specifications for the groundwater treatment system did not include sample collection ports for influent and effluent water sampling. Five sample collection ports were added to the final design. This modification was administered as Change Order No.1, Item 4, dated February 6, 1998.

- Blower Voltage (Sheets 5 and 13 of 14) - The original contract specifications required a 480 volt air stripper blower for the groundwater treatment system. A 208 volt air stripper blower was used due to changes in the electrical design as discussed in Section 5.5.

- Pressure differential switch and mist eliminators (Sheet 4 of 14) - Modifications to the groundwater treatment system after system start-up included: 1) installation of a pressure differential switch at the top of the air stripper unit to shut the system down in the event operating pressures are exceeded, and 2) the installation of two mist eliminators to the air stripper exhaust system to prevent water from entering the booster blower. This modification was administered as Change Order No.1, Item 4, dated February 6, 1998.

- Flow distributor (Sheets 11 and 12 of 14) - The original contract specified a flow distributor where the air stripper effluent discharges into the first chamber of the settling tank. The distributor restricted air stripper effluent flow causing water to back-up into the air stripper. The flow distributor was disconnected.

- Settling tank chamber baffles (Sheet 12 of 14) - The original specifications proposed redwood baffles in each of the settling tank chamber. Cypress baffles were substituted due to availability.

5.0 VAPOR EXTRACTION SYSTEM

5.1 CONSTRUCTION

Pilot scale vapor extraction testing was performed during the March 1996 design investigation to identify vacuum/flow rate characteristics, areas of vacuum influence, and VOC concentrations. Based on Site conditions, a small pre-engineered SVE skid system was designed for the project. The SVE skid, delivered to the site on December 17, 1997, is equipped with a moisture separator, air filter, blower, instrumentation, and controls for the blower and air emissions. The unit was installed inside the treatment building. System exhaust is vented to the exterior for treatment by vapor phase GAC adsorption. The piping for the SVE system was installed in the groundwater recovery system piping trenches between wells TW-1 and TW-2A to the treatment building, and within a backfilled trench that extends from wells VE-2 and VE-1 to the treatment building. The SVE process diagram is shown on sheet 5 of 14. Operational startup data for the pump and treatment system are presented in Table 2. Air sample laboratory analytical reports during startup are included in Appendix B.

5.2 IMPLEMENTATION SCHEDULE

The vapor extraction system was completed under the following schedule:

- October 13, 1997 Begin treatment building construction.
- December 4, 1997 Complete treatment building construction.
- December 17,1997 Begin SVE system installation.
- January 12, 1997 Complete SVE system installation
- January 13, 1998 Start-up SVE system.
- January 19, 1998 Drill and install two shallow SVE wells (VE-1 and VE-2).
- January 22, 1998 Connect shallow wells to SVE system.

5.3 MODIFICATIONS

- Additional SVE wells (Sheet 1 of 14) - The original contract specified SVE using existing wells TW-1 and TW-2A. In January of 1998, two additional shallow SVE wells (VE-1 and VE-2) were added to the system. An air rotary drill (4-inch I.D.) was used to drill VE-1 to a depth of 18 feet and VE-2 to a depth of 23 feet. The lower 10 foot interval of each drill hole was screened with 2-inch I.D., 0.20 slot, Sch 40 PVC well screen connected to 2-inch I.D. Sch 40 PVC riser pipe. The vapor extraction wells were installed in bedrock beneath an area of known (former) soil contamination. This change was administered as Change Order No. 1, Item 5, dated February 6, 1998.

- GAC drum piping (Sheet 5 of 14) - The original design specified a 2-inch I.D. black iron pipe between the two granular activated carbon adsorber drums. The black iron pipe section was replaced with a 2-inch flexible hose. Relocation of system sample ports included installation of a short section of rigid pipe (approximately 6 inches long) between the carbon canisters to accommodate a sampling port.

- Transfer pump voltage (Sheet 5 of 14) - The transfer pump for the SVE system was changed from a 460V model to a 208V model. Accordingly, a 208 V blower (Model 3204-67L3 D) was used in place of the original specified 460 V blower (Model 3204-81L3).

6.0 TREATMENT BUILDING, AND ASSOCIATED FACILITIES AND UTILITY SERVICE

6.1 CONSTRUCTION

Improvements were made to the NOW Corporation's existing perimeter road. A 6-inch layer of NYSDOT approved crushed stone was placed over the existing road surface. A culvert was installed beneath the access road in the area west of OW-6 (Sheet 1 of 14). Compacted crushed stone was used to level the area for a temporary weigh scale, and to construct an access ramp for the scale.

6.2 IMPLEMENTATION SCHEDULE

- September 4, 1997 Begin road improvements.
- September 26, 1997 Complete road improvements.
- October 13, 1997 Begin treatment building construction.
- October 28, 1997 Begin installation of primary electrical service.
- December 4, 1997 Complete treatment building construction.
- December 12, 1997 Complete installation of primary electrical service.

6.3 MODIFICATIONS

- Electrical service installation (Sheet 1 of 14) - The original contract specified underground electrical service. Central Hudson Gas and Electric, the local utility company, requested overhead primary electrical service to the treatment building instead of direct burial. The request was granted. A pole mounted transformer replaced the ground surface transformer.

- Concrete design mix (Sheet 10 of 14) - The concert design mix was modified for the treatment building footings and other cast-in-place structures. The approved modification mixture was: >4000 psi @ 28 days, water/cement ratio of 0.50 percent, 5.5 percent entrained air content and a 3.5 inch slump.

- Foundation depth (Sheet 10 of 14) - The contractor encountered bedrock during excavation for the treatment building footings. The foundation depth was reduced by 1 foot, from 44 inches to 32 inches, due to the shallow depth to bedrock along the northern wall. (An exemption of the 42 inch minimum foundation depth is granted for solid rock.)

- Roof Pitch (Sheet 10 of 14) - The roof pitch was changed from 12/4 to 12/3 to accommodate the changes in the overhead wiring for the treatment building.

- Propane tank location (Sheets 11 and 14 of 14) - The original contract specified the location of the propane tank at the northeast corner of the treatment building. The propane tank was installed on the south side of the treatment building. Two bollards, instead of four as originally specified, were required for this tank re-location.

- Sump (Sheets 11 and 14 of 14) - The original contract specifications for the treatment building proposed a 3 ft x 3 ft x 3 ft sump with a cast iron grate. The modified sump is 20 inches in diameter by 3 ft deep and is covered by a 2 ft x 2 ft fiberglass grate.

- Fresh air intake vent (Sheet 11 of 14) - The original contract specifications did not include a fresh air intake vent. A louvered vent was added to the east wall of the treatment building.

- Electrical control panel (Sheet 13 of 14) - In the treatment building, a single main electrical control panel was substituted for three control panels. Modifications include changes in the originally specified voltage and amperage requirements for the air stripper intake and exhaust blowers, the SVE blower pump, and the SVE exhaust gas heat exchanger.

- Electrical outlets (Sheet 13 of 14) - Four interior and two exterior 120 V outlets were installed inside/outside the treatment building as shown on Sheet 13 of 14.

7.0 SOIL REMEDIATION

The remedial design and construction for OU 2 , soil remediation, was comprised of six major components: soil excavation, construction of the LTTD pad, installation of weight scales, installation of the LTTD unit, air monitoring of stack emissions, and analysis of treated soil. Following is a summary of each of these components, including the implementation schedule. Modifications to the design plans are summarized.

7.1 EXCAVATION

The RI/FS conducted by Engineering-Science delineated three areas of contaminated soils (Areas A, B and C) (Sheet 2 of 14). On September 24, 1997, one truck load of material was excavated from Area C and moved to the paved LTTD test pad area in anticipation of using it for the first LTTD test burn. This soil did not yield any PID readings above background levels. Several test pits were dug in Area C to find contaminated soil for the test burn, but the material encountered did not yield any PID readings above background levels. Area C was backfilled with the excavated materials and abandoned. Excavation commenced in Area A locations where relatively high contaminant levels were identified in boreholes during the RI/FS. A test pit at Borehole 33 did not produce any PID readings above background levels. A trench, moving west from the Boring 33 location toward Borehole 39 was excavated. A maximum PID reading of 19 ppm was encountered at a depth of 1 to 1.5 feet in a zone of dense, gray, cohesive soil directly above the weathered rock. Two truck loads of this material were excavated for the first test burn.

Contaminated soil in Area A was excavated with a backhoe and transported by truck to the LTTD pad. Soil Remediation Technology (SRT) was subcontracted by ERS to perform the LTTD treatment. Soil piles were kept on the LTTD pad and were segregated by labeling and individual handling to prevent mixing of untreated and treated soil.

A subsurface soil sampling investigation was conducted to re-define the limits of soil contamination in the vicinity of Area A. The investigation consisted of continuous split spoon sampling of 29 soil borings. After the investigation was completed the area of soil contamination was re-delineated (Drawing NOW-01, dated October 27, 1997) which is attached as a Record Drawing. Soil excavation activity was centered in the area around borehole SB-111, which had indicated the highest degree of contamination.

SRT was unsuccessful in treating the soils after multiple test burn attempts, and on November 20, 1997, demobilized their LTTD unit from the Site. Piles of contaminated soil that would require further treatment remained on the LTTD pad.

On November 20, 1997, Innovative Remediation Technologies, Inc. (IRT) replaced SRT as the LTTD subcontractor. On November 23, 1997, approximately 15 cubic yards of contaminated soil was removed from Area A for IRT's first test burn. On December 6, 1997, full scale treatment of the contaminated soil was started. A lined, secondary staging pad was constructed to handle the overflow volume of stockpiled treated soil that had accumulated.

From December 6, 1997 to January 9, 1998, excavation and back filling was completed in the areas shown on the revised excavation plan (Drawing NOW-01). A total of 1013 tons of contaminated soil was excavated and treated on site (not including test burns).

Stack air emissions, and process water generated during the soil remediation process were treated using GAC units. Post excavation samples were collected from the excavation floor and walls and sent to a NYSDEC certified laboratory. Samples A-1, A-2 and A-3 were analyzed by American Environmental Network of Monroe, Connecticut. All other post-excavation samples were analyzed by Camo Laboratories, Inc., a New York State certified laboratory, of Poughkeepsie, New York. Post-excavation soil sample locations and a summary of TCE results are presented on Drawing NOW-1. Table 3 summarize the laboratory results for all targeted VOCs. Copies of the laboratory analytical reports are included in Appendix C. All of the soil processed on the site was used to backfill the excavations.

Modifications

The areas of excavation were modified as the result of an on-site investigation conducted during the construction period.

- Soil sampling (Drawing NOW-1) - During the week of October 13-17, 1997, Rust collected and analyzed soil samples from soil borings drilled on a nominal 20-foot grid pattern across the north side of the NOW Corp building. The investigation area included Excavation Areas A and B, and an area between Excavation Areas A and B. Based on the analytical results, the areas of excavation were revised as shown on Drawing NOW-01 (Soil Boring Location and Excavation Layout Map).

- Soil Analyses - Soil samples were analyzed using a field gas chromatograph (GC) for rapid field delineation of the extent of soil contamination. Additionally, duplicate soil samples were sent to Adirondack Environmental Services of Albany, NY to confirm the field GC results. PCE, 1,1,1-TCA and BTEX were not analyzed since they were not detected above the clean-up levels within the excavation areas. The field GC raw data is presented in Appendix D. Results of the field analyses are summarized in Table 4. The laboratory analytical results are provided in Appendix E. A comparison of the field GC and the Adirondack sample results are provided in Table 5. The comparison indicates the Field GC to be accurate in the determination of targeted compound contamination levels. Several soil sample results exceeded the linear range of the Field GC. Since the levels of contamination substantially exceeded the clean-up values, no effort was made to quantify these relatively high concentrations.

- Revised excavation layout (Drawing NOW-1) - The revised excavation layout was determined based on the field GC sample analysis data. The limits of the excavation were based on the concentrations at each soil boring relative to the adjacent soil boring samples. The quantity of soil to be excavated based on the revised layout was estimated to be 572 cubic yards or 966 tons. The calculations are provided on Table 6. The depth of the

excavation was determined by the depth that contamination was encountered in the soil borings.

- Uncontaminated soil set aside (Drawing NOW-1) - The top 6 inches of cover soils and vegetation were removed from the vicinity of boreholes SB-111, SB-117 and SB-119 and set aside since no contamination was found in the 0-1 ft interval. This modification was justified based on the analytical results of the 0-1 ft intervals for these borings (little to no contamination).

- Limit of excavation (Drawing NOW-1) - TCE was reported at a concentration of 12,000 ppb in composite soil sample B5 A-B. This sample was collected adjacent to the Now Corp building in Excavation Area B. The excavation could not be extended any farther in this direction without compromising the integrity of the building foundation. The south wall of the Area B excavation was terminated 5 feet from the building at a 2:1 slope.

7.2 LOW TEMPERATURE THERMAL DESORPTION PAD

The construction of a paved LTTD pad to contain soil piles and the treatment area was completed prior to commencing soil excavation and treatment. First, the sub-grade of the LTTD treatment and storage pad was established by balancing cut and fill using onsite materials. Six ounce geotextile material was then placed on the subgrade at the LTTD Pad. Six inches of Type I subbase material was placed on the geotextile followed by a 3-inch thick layer of Type 1 base course asphalt, a 1 ½-inch thick layer of Type 3 binder course, and a 1 ½-inch thick layer of Type 6 top course. The pavement was sloped so that all water drained to a drainage collection sump installed near the center of the pad. The pad berm was completed with a machine constructed asphalt berm.

Modifications

Modifications made to the LTTD pad included the following:

- Location of LTTD pad (Sheet 1 of 14) - The LTTD treatment pad was located approximately 25 feet south of the original plan submission.

- LTTD pad construction (Sheet 3 of 14) - The original contract specifications for the LTTD pad included the following: rough grading of existing soil, 7 oz geotextile, 8" Type I Subbase Course, Type 2 Base Course Asphalt Pavement and cast-in-place concrete pads for equipment support. A 6 oz geotextile was substituted for the 7 oz geotextile during construction. Geotextile was used beneath only the southern half of the LTTD pad in the area that was filled with graded material. This was a modification to the original design which specified geotextile liner beneath the entire LTTD pad. A 6-inch layer of Type 1 Subbase Course was substituted for the specified 8-inch layer, and Type 1 base course asphalt substituted for Type 2 base course asphalt. The cast-in-place concrete pads were not constructed. The surface of the LTTD pad was completed using only asphalt.

- Sump (Sheet 3 of 14) - A 24-inch diameter by 36-inch deep plastic drum was used to line the sump of the LTTD pad. The drum was substituted for the contract specified 24-inch diameter pipe section.

- Secondary staging pad (Sheet 1 of 14) - A secondary staging pad was built south of the LTTD pad to accommodate the growing volume of treated soil that accumulated while waiting for post-treatment laboratory analytical results. The secondary staging pad area was graded. Grading included placement of 6 to 8-inches of imported subbase material beneath the southern end of the pad. The secondary staging area was lined with a 40-mil geotextile. This modification was administered as Change Order No. 2, dated November 26, 1997.

7.3 WEIGHT SCALES

A temporary weight scale was placed adjacent to the LTTD pad to weigh soils before and after LTTD treatment during the project. The scale was placed on September 23, 1997 following grading of the adjacent road surface. On October 1, 1997, the scale was calibrated and certified by the Bureau of Weights and Measures. The scale was removed following completion of OU 2 remediation.

7.4 LTTD UNIT

A portable, batch type, Low Thermal Desorption (LTTD) Unit was used to remove target VOCs from the excavated soil. Prior to the start of full scale treatment, a test burn was conducted to confirm that the LTTD system was operating in compliance with all applicable regulations and was achieving the treatment goals. During the test burn, soil temperature and contaminant concentrations were monitored to establish the required residence time necessary to adequately volatilize the contaminants from the soil.

Modifications

Modifications made to the LTTD unit prior to and during full scale treatment include the following:

- LTTD Subcontractor - Soil Remediation Technology (SRT) was originally subcontracted by ERS to conduct the on site soil remediation. SRT conducted their preliminary test burn on September 25, 1997. During this test burn, TCE was detected in the post-carbon treatment air effluent, suggesting carbon break-through. The 200 pound carbon canisters were replaced with 400 pound carbon canisters to remedy the problem. SRT conducted three subsequent tests burns to demonstrate that their system was meeting the soil cleanup criteria. Test Burn #1 conducted November 11, 1997, failed to achieve soil cleanup standards as determined by the on-site field gas chromatograph. Test Burn # 2 and Test Burn #3 also failed to achieve the soil cleanup standards as confirmed by the post-treatment soil samples submitted to the state approved laboratory. SRT was unable to successfully remediate the soils. ERS replaced SRT with Innovative Remedial Technologies, Inc. (IRT) on November 18, 1997.

On November 25, 1997, IRT conducted their first test burn. Prior to treatment the soil was broken up as much as possible with a skid steer. Laboratory analytical results were: pretreatment TCE levels of 3.7 ppm, post treatment TCE levels of 2.7 ppm. Due to this unsuccessful attempt, IRT made some minor modifications to the LTTD unit prior to conducting the next test. These changes included increasing the heater temperatures, using a larger propane regulator, and loading their batch boxes to one-half of their maximum capacity. The second test burn was conducted on December 2, 1997. This test proved to be successful and full scale treatment was started December 6, 1997.

Individual soil piles were typically sub-divided into three or four batches for LTTD treatment. Following treatment, batches were combined to re-establish the initial soil piles. Table 7 summarizes record keeping information regarding soil piles, batch numbers, and processing dates.

7.5 MONITORING OF STACK EMISSIONS AND NOISE LEVELS

Continuous monitoring of the LTTD unit stack emissions used a multi-gas monitor manufactured by Breul & Kjaer Model 1302. The equipment displayed LTTD process air conditions continuously during processing, and recorded the air condition every 2 minutes. Results of the monitoring are documented in Appendix F with graphs illustrating the daily maximum, minimum and standard deviations for propane, VOCs, TCE and moisture content.

During the test burns, influent, effluent, and 1 hour "peak period" effluent samples from the LTTD carbon treatment unit were collected using charcoal adsorbent sample tubes. The sample tubes were analyzed by Performance Analytical, Inc., of Canoga Park, California, using NYSDEC-approved protocol for substantiating conformance with all required permitting and operating requirements. Sampling results are presented in Appendix G.

Ambient air monitoring for dust was performed using a real time aerosol monitor (mini RAM). Treated piles of soil were hydrated prior to use as backfill material to meet particulate air quality compliance standards.

Noise levels at the site's perimeter were checked during night-time operations for exceedances of the pre-established background noise level of 10 decibels (dba). No exceedances were noted.

Modifications

Modifications in LTTD air monitoring included the following:

- Sample collection and analysis method - The original contract specifications required the use of EPA Method 0030 for LTTD stack gas sample collection. Rust evaluated the LTTD soil remediation system and determined that EPA Method 0030 "Volatile Organic Sampling Train", which is applicable to hazardous waste incinerator systems, was not appropriate. The LTTD system operated at temperatures significantly below incinerator temperatures, utilized condensing units to cool stack gases to below 120° F, and generated negligible operating

pressures. Rust/NYSDEC approved substitute methods TO-14 for sample collection and EPA Method 8240 for target compound list analysis. After the first LTTD test burn, Rust/NYSDEC determined that NIOSH Method 1022 would be a more suitable method for stack emissions monitoring. Two jumbo charcoal tubes were used to collect the samples. The samples were analyzed by Performance Analytical Inc. for a selected list of VOCs. Copies of the laboratory analytical reports are included in Appendix G.

- Sampling frequency - The original contract specifications required biweekly air sampling assuming a total of 120 hours of operation (10 days/2 weeks and 12 hours/day). Due to time constraints with completing the project, the operating schedule was increased to 24 hours per day. To accommodate the schedule change, an approval was given for weekly sampling assuming 120 hours of operation (5 days/week and 24 hours/day).

- Continuous monitoring of LTTD emissions - Continuous monitoring of the LTTD stack emissions was performed. Daily review of stack data indicated the maximum readings consistently exceeded the air emission standards for TCE and VOC's. These data were considered unreliable due to instrument detection limit capabilities. It was apparent that the propane that was used to heat the LTTD unit interfered with the baseline of the other detectors. High spikes of propane resulted in minimum VOC readings and elevated TCE readings. Low propane spikes resulted in maximum VOC readings and near minimum TCE readings. The mean average for the compounds of concern were below discharge limits. To verify compliance, pre-carbon treatment, post-carbon treatment and 1 hour "peak period" effluent air samples were collected and analyzed (Appendix G).

7.6 ANALYSIS OF TREATED SOIL

Treated soil stockpiles were sampled and submitted to Camo Laboratories, Inc. for analysis of Target Compound List (TCL) volatiles. Each soil sample consisted of 2 brown soil clods and 3 gray soil clods to be composited at the laboratory (brown representing shallow soil and gray representing deeper soil/weathered bedrock). Confirmatory soil samples were collected on a daily basis when the LTTD unit operated the entire day. Otherwise, confirmatory soil samples were collected at the rate of one sample per 24 hours of unit operation. Analytical results are summarized in Table 8. Copies of the laboratory analytical reports are included in Appendix H.

Modifications

- Soil sample consistency - The original sampling protocol used to verify that treated soils met the clean up criteria included sampling soil "clods". Due to physical changes in the soil consistency, resulting from re-treatment, the sampling protocol was changed to a ratio of clods/fines to reflect the actual pile consistency at the time of sampling.

7.7 IMPLEMENTATION SCHEDULE

Soil remediation at the NOW Corporation site was completed under the following schedule:

- September 19, 1997 Completed construction of the LTTD treatment pad.
- September 22, 1997 SRT delivered and set up the LTTD Unit.
- September 25, 1997 SRT conducted LTTD Test Burn #1 of soil from excavation Area A.
- October 13, 1997 Commenced exploratory boring program to determine the extent of contaminated soil along the north side of the Now Corporation building.
- October 17, 1997 Completed exploratory soil boring and soil sampling program.
- October 27, 1997 SRT conducted LTTD Test Burn #2.
- November 18, 1997 Rust/NYSDEC granted approval to ERS to subcontract IRT for LTTD soil remediation.
- November 20, 1997 SRT began demobilization.
- November 21, 1997 SRT completed demobilization. IRT arrived on site and set up its own LTTD unit.
- November 25, 1997 Conducted IRT Test Burn #1.
- December 2, 1997 Conducted IRT Test Burn #2.
- December 5, 1997 Completed construction of secondary soil staging area.
- December 6, 1997 Commenced full scale treatment of contaminated soil.
- December 30, 1997 Completed excavation of contaminated soils.
- January 7, 1998 Completed treatment of contaminated soils.
- January 9, 1997 Completed backfilling excavation areas with treated soils.
- January 30, 1998 Removed secondary LTTD staging pad and liner.

8.0 RESTORATION

Final grading of all excavation areas was completed to approximate original topographic conditions. A ditch was excavated in Area B and the ditch between well TW-3 and the road was extended to promote and maintain drainage. Fabric and rip-rap were placed in the drainage swale behind the Treatment Building in accordance with contract specifications. Brush and soil piles were removed. Seeding and mulching was completed.

The surface of the LTTD pad was decontaminated. The LTTD sump was backfilled with crushed stone. The temporary secondary soil staging area was decontaminated and decommissioned. A soil sample was collected to verify the competency of the liner after the pad was removed. Results are presented in Table 8. The ramps and weight scale were removed. Soil samples were collected from these areas to confirm compliance with soil cleanup standards (Table 8). All paving and road improvements were left in place.

The Treatment Building, vapor extraction wells, groundwater wells, drainage culverts and utilities installed for this project will remain in place to maintain continued site remediation.

As of August, 1998, final inspection and documentation indicated that all of the restoration work was completed satisfactorily to the terms and conditions of the original contract specifications.

9.0 PROJECT CHRONOLOGY

Work in progress or completed at the NOW Corporation Site during each month of field activity was as follows:

AUGUST 1997

Summary: On August 26, 1997, a pre-construction meeting was held involving the principal parties. On August 27, 1997, NYSDEC issued a Notice to Proceed.

SEPTEMBER 1997

Summary: ERS mobilized to the Site, constructed the LTTD treatment pad, began constructing the groundwater recovery and treatment building and began improvements to the Site perimeter road.

OU 1

- Cleared and grubbed construction areas (treatment building, Crum Creek outfall, trench excavation areas).
- Electrical contractor installed utility poles.

OU 2

- Cleared and grubbed construction areas (LTTD pad, perimeter road, weight scale area)
- Installed silt fence and erosion control trenches in LTTD pad construction area and soil excavation Area B.
- Completed installation of temporary office trailer and utilities.
- Staked and graded footprint of LTTD treatment pad.
- Excavated and installed LTTD treatment pad sump.
- Installed geotextile beneath southern portion of LTTD treatment pad.
- Placed and compacted subbase for LTTD treatment pad.
- Placed and graded base course, binder course and top course asphalt pavement for LTTD treatment pad.
- Constructed access ramp for LTTD treatment pad.
- Constructed and installed berms for LTTD treatment pad.
- 9/19/97 - Completed installation of LTTD treatment pad.
- 9/22/97 - SRT delivered and setup LTTD unit.
- Began road improvements.
- Received 21,000 gallon fractionation tank for temporary storage of contaminated water (encountered during excavation and generated by the LTTD process).
- Installed culvert beneath road west of OW-6.
- 9/23/97 - Received and installed weight scales.
- 9/24/97 - Excavated soils in Area C for use in SRT Test Burn #1 (no contaminated soil found in Area C).

- Excavated contaminated soil in Area A for use in LTTD test burn.
- 9/25/97 - Completed LTTD Test Burn #1.
- 9/26/97 - Completed road improvements.

OCTOBER 1997

Summary: Continue construction of groundwater recovery system and treatment building. Conduct drilling program to re-delineate areas of soil contamination.

OU 1

- Install crushed stone sub-base for the treatment building settling tanks and the distribution and meter pits.
- 10/14/97 - Received NYSDOT permit to bore beneath Route 9G.
- 10/14/97 - Began direction boring beneath Route 9G.
- 10/14/97 - Installed pre-cast concrete meter pit, distribution pit and settling tanks.
- 10/16/97 - Completed direction boring and pipe installation beneath Route 9G.
- 10/23/97 - Completed treatment building footings and concrete block installation.
- Electrical contractor installed utility poles for overhead primary electrical service.
- Completed installation of effluent pipe from directional boring to Crum Elbow Creek outfall.
- Pour monolith concrete slab for treatment building.

OU 2

- 10/1/97 - The Bureau of Weights and Measures calibrated and certified the weight scales.
- Rust set up field laboratory gas chromatograph (GC).
- Rust conducted a drilling program to re-delineate the horizontal and vertical extent of soil contamination between proposed excavation Areas A and B .
- Analyzed drilling program soil samples with the field GC. Sent duplicate samples to a NYSDEC certified laboratory to confirm the GC results.
- 10/27/97 - SRT completed LTTD Test Burn #2.

NOVEMBER 1997

Summary: Continued constructing treatment building and trenching for groundwater recovery, vapor extraction and groundwater infiltration systems. Performance problems were encountered with the LTTD treatment unit.

OU 1

- Completed treatment building foundation, framing, roofing, siding and exterior concrete slabs.
- Installed conduit beneath the treatment building floor slab for the VES and groundwater treatment system.
- Installed piping in the meter and distribution pits.

- Installed piping from the meter pit to each injection well and from the meter pit to the pipe installed beneath Route 9G.
- Excavated a trench from the treatment building to well TW-3 and installed pipe and electrical conduit in trench.

OU 2

- 11/6/97 - Rust submitted map illustrating re-delineated areas of soil contamination along the north side of NOW Corp building.
- SRT conducted a third unsuccessful LTTD test burn.
- SRT was unsuccessful in treating contaminated soil. ERS replaced SRT with IRT.
- 11/21/97 - IRT mobilized to the site and set up their LTTD treatment unit.
- 11/25/97 - IRT conducted their first LTTD test burn.

DECEMBER 1997

Summary: Begin full scale treatment of contaminated soil. Substantial completion of groundwater and vapor extraction systems.

OU 1

- Installed propane heater, propane storage tank and associated piping.
- Completed construction of the treatment building.
- Installed weir plates between settling tanks.
- Completed trenching and installation of underground piping and pitless adapters to recovery wells TW-1, TW-2A and TW-3.
- Installed air stripper tanks.
- Central Hudson Electric Company and ERS's electrical contractor installed overhead electric power lines from the pole mounted transformers to the treatment building.
- Installed pumps, pressure transducers and multi-media filter in the treatment building.
- Installed intake and exhaust air vents in the treatment building.
- Completed installation of groundwater treatment system equipment and piping.
- Installed the vapor extraction system.

OU 2

- 12/2/97 - IRT conducted two LTTD test burns.
- Graded area near LTTD pad and installed geotextile lining for secondary soil staging pad.
- 12/6/97 - Begin full scale treatment of contaminated soil.
- 12/15/97 - Began soil excavation in Area B
- 12/16/97 - Began backfilling Area A-A' with treated soil.
- 12/18/97 - Completed soil excavation in Area B.
- 12/19/97 - Began soil excavation in Area A".
- 12/19/97 - Completed backfilling Area A-A'.
- 12/30/97 - Backfilled Area B with treated soil.

JANUARY 1998

Summary: ERS started the groundwater recovery and vapor extraction treatment systems. Soil excavation, treatment and backfilling was completed.

OU 1

- 1/9/98 - Started the groundwater treatment system. Initial startup problems with water being drawn into the booster blower, and with water leaking from the air stripper trays.
- ERS applied epoxy to the corners of the air stripper trays to minimize leaking.
- ERS installed a pressure differential switch at the top of the air stripper trays to shut down system if recommended operating pressures were exceeded.
- Collected operation and monitoring data for the groundwater treatment system on a regular basis.
- Installed mist eliminators between the air stripper and the booster blower to curtail water infiltration into the blower.
- 1/13/98 - Started the vacuum extraction system.
- Collected operating data from the vacuum extraction system.
- 1/19/98 - Installed two vapor extraction wells on the north side of the NOW Corp building.
- Relocated the influent sample ports on the groundwater treatment system.
- Installed piping for the two vapor extraction wells.
- Installed bollards around the groundwater injection wells.
- Installed locking caps on recovery wells.

OU 2

- 1/2/98 - Completed soil excavation in Area A".
- 1/7/98 - Completed LTTD treatment of contaminated soils. (A total of 1,013 tons of soil were treated from 12/2/97 to 1/7/98.)
- 1/8/98 - Completed backfilling Area A" with treated soil.
- Decontaminated the weight scales, backhoe and LTTD unit.
- Decommissioned the secondary soil staging pad.
- Removed weight scales.
- ERS and IRT demobilized equipment from Site.

10.0 CONSTRUCTION CERTIFICATION

Construction was substantially completed in accordance with the Contract Documents, prepared by Rust E&I, and entitled "Groundwater and Soil Remediation, Now Corporation Site, Site No. 3-14-008." (Contract No. D003682), and incorporating the modifications presented herein.

PE Stamp

Signature: _____

Rust Environment & infrastructure

Date: 3/22/99

Final Remediation Report
Now Corporation Site
Site 3-14-008

Volume II

Work Assignment No. D002520-34

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