Remedial Action Work Plan
JCI Jones Chemicals, Inc. Superfund Site
Caledonia, New York

June 13, 2003
004-03165-03-003

Prepared for
JCI Jones Chemicals, Inc.
100 Sunny Sol Boulevard
Caledonia, New York 14423

Prepared by
LFR Levine·Fricke Inc.
3382 Capital Circle, N.E.
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LETTER OF TRANSMITTAL

June 23, 2003

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Michael Cruden
Bureau of Western Remedial Action
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway, 11th Floor
Albany, New York 12233-7017

Subject: Remedial Action Work Plan, JCI Jones Chemicals, Inc. Superfund Site, Caledonia, New York

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Sincerely,

E. Cambeiro for:

Shekhar R. Melkote, P.G.
Senior Hydrogeologist

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CERTIFICATION

All engineering information, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by an LFR Levine·Fricke New York Professional Engineer.

A. Scott Starr, Senior Engineer
New York Professional Engineer (78821-1)

6-20-03
Date

1.0 INTRODUCTION

On behalf of the JCI Jones Chemicals, Inc. (JCI), LFR Levine·Fricke (LFR) prepared this Remedial Action Work Plan (RAWP) for the JCI Caledonia, New York Superfund site ("the Site") as required by the Consent Decree ("the Decree") under the Comprehensive Environmental Response, Compensation, and Liability2 Act (CERCLA). JCI and the U.S. Environmental Protection Agency (U.S. EPA) entered into the Decree to conduct Remedial Design/Remedial Action (RD/RA) at the Site on July 11, 2001. The remedial action includes treatment of affected soil by SVE and affected-groundwater by source area pump-and-treat, chemical oxidation and monitored natural attenuation (MNA).

This report describes site background, description of the selected remedies, remedial action objectives, implementation of the remedial actions, and the Operation, Maintenance, and Monitoring (OM&M) for the selected remedies. The report also includes Construction Quality Assurance Plan (CQAP) and Health and Safety Plan (HSP).

1.1 Objective

The objective of this RAWP is to present the approach for constructing the proposed remediation systems in accordance with the remediation plans and technical specifications (LFR 2002). In addition, this Report includes the procedures for starting the remediation systems and performing operation, maintenance, and monitoring (OM&M) during their operational life. The design approach and results of the engineering analyses to support the development of the remediation plans and technical specifications were presented in the Final Remedial Design Report and Addendum (LFR 2002 and 2003).

2.0 BACKGROUND

2.1 Site Location and Description

The Site is located east of State Route 5 and on the northern side of Iroquois Road in Caledonia, northwestern Livingston County, New York (Figure 1). The Site is centered on latitude 42°58'40.9"N and longitude 77°50'49.1"W and is situated in a relatively flat, sparsely populated, lightly industrialized suburban area of the Village of Caledonia. Iroquois Road borders the Site to the south, farmlands to the north, and homes with acreage to the east and west. A construction company (formerly a lumberyard) and a printing company are located immediately northwest of the Site. A golf course, baseball field, and tennis court are present immediately south of Iroquois Road (Figure 2). The site vicinity to the west and southwest is populated with light service industries such as hardware stores, gasoline stations, dry cleaners,

restaurants, and other commercial businesses. Potable water to the Site and its vicinity is supplied through Village of Caledonia production wells located to the south.

The Site has nine buildings that comprise office space, drum storage sheds, interconnected warehouse buildings, a bleach manufacturing building, and chlorine and sulfur dioxide repackaging building (Figure 2). A railway line enters from the west, extends to within the eastern boundary, and runs to the north of the buildings.

Much of the Site is flat, and areas around the buildings are paved with asphalt. A large area south of the buildings, facing Iroquois Road, is landscaped with a maintained lawn. The area north of the buildings is also known as the "north property." The east portion of the north property is covered by gravel, the west portion by grass. In 1994 the drum storage sheds, called the "pole barns," which were originally located west of the warehouse/office complex, were moved north of the lagoon system that originally included three unlined ponds (lagoons A, B and C; Figure 2).

The topography of the Village of Caledonia is rolling to flat, with elevations ranging from about 710 feet above mean sea level (amsl) at the highest point to about 640 feet amsl along Spring Creek to the west (Figure 1). Although the surrounding area has considerable relief, the Site itself is relatively flat, with surface elevations ranging between 640 and 660 feet amsl. The two swales along Sunny Sol Boulevard and the lagoon system on the north property are some of the prominent surface features on the Site.

The vegetated areas to the north are covered with pasture grass and to the south are landscaped with turf grass and ornamental evergreen trees. The adjacent properties are mostly residential and municipal recreational areas vegetated in turf grass, ornamental shrubs and some hardwoods along property lines. Agricultural lands and wooded areas surround much of the developed area within the Village of Caledonia.

The Site lies entirely within Zone C, an area of minimal flooding outside both the 100- and 500-year flood zones. The isolation of the Site from the flood-prone zones documents that floodplain management concerns are not applicable to the Site. No wetlands were identified on the Site or adjacent properties. The nearest wetland area, CA-1, is approximately 0.5 mile west of the Site, and is associated with Spring Creek, also located to the west of the Site. There are no records of significant wildlife species or cultural resources present at or in the vicinity of the Site.

The Site has been used for industrial purposes since August 1939. The conceptual future land use for the property is anticipated to be industrial. Groundwater from on Site is presently treated through an air stripper and used only as non-contact cooling water, with minimum exposure to on site workers. Potable water is obtained from the Village of Caledonia. There are no plans to install drinking water supply wells on site. A deed restriction will be implemented to restrict groundwater usage.

The future land use for the property located immediately north of the former solvent AST source area is anticipated to be industrial. The future land use for the properties

located to the northeast and east is reported to be agricultural. Future land use to the west and southwest of the Site is reported to be light service industries such as hardware stores, gasoline stations, dry cleaners, restaurants, and other commercial businesses.

The climate of the Village of Caledonia is characteristic of western New York State, with warm summers and cold winters with moderate to heavy snowfall. Average daily temperatures range from 24 degrees Fahrenheit (°F) in January to 71°F in July. The average annual precipitation is 30 inches. Drainage is through the highly permeable silty and sandy gravel type soil that underlies the Site.

2.2 Present Operations

Commercial activities at the Site presently include:

- manufacture of sodium hypochlorite (bleach) through the reaction of chlorine and dilute sodium hydroxide
- manufacture of sodium bisulfite through the reaction of dilute sodium hydroxide and sulfur dioxide
- repackaging and distribution of chlorine, sulfur dioxide, sodium hydroxide, and various minerals acids, such as muriatic acid and hydrofluosilicic acid, from bulk to small containers
- distribution of various inorganic water treatment chemicals such as soda ash and lime

The raw materials that are used in the production and distribution processes are stored in large aboveground storage tanks (ASTs) on site. These tanks range in size from 1,000 to 16,300 gallons and have typically been constructed of stainless steel, fiberglass-reinforced plastic, cross-linked polyolefin, or other suitable synthetic material.

The non-contact cooling water for the plant is supplied through the on-site supply well, North Well. The North Well was installed in March 1985 immediately south of the lagoons (Figure 2). The North Well is 4 feet in diameter and 24 feet below ground surface (bgs), and is completed in the overburden glacial outwash soils. Groundwater from the North Well is extracted at 300 to 400 gallons per minute (gpm). Prior to 1985, non-contact cooling water was supplied through three on-site production wells, the West Well, the Middle (South Well), and the East Well. Because of their poor yields, groundwater withdrawal from the Middle (South) and East Wells was discontinued 1995; West Well was discontinued in 1998. The North Well is reported to pump continuously with periodic shut downs for maintenance (JCI 1999).

The principal waste stream from the plant has been wastewater from tank washings, floor washings, and other waste liquids from handling and packaging. This waste stream is first treated by the on-site elementary neutralization system (ENS) through

the addition of sulfur dioxide or caustic soda. Until recently, the wastewater was mixed in an approximately 1-to-99 ratio with non-contact cooling water (one part wastewater to 99 parts non-contact cooling water) prior to discharging to the lagoon system, in accordance with the New York State Pollutant Discharge Elimination System (SPDES), Permit No. NY0072079. The lagoon system has been in operation at least since 1954. Currently, the neutralized waste is no longer discharged to the lagoon system but recycled back into the facility process.

2.3 Historical Operations

The operational history of the Site has been summarized from information present in the remedial investigation (RI; LFR 1999). JCI purchased the property on which the Site is located in August 1939. Prior to the JCI purchase, the Site included an orchard, agricultural fields, and pasturelands. Reportedly, the property had been used as a food packaging facility prior to purchase.

Soon after the purchase of the property, JCI began production of sodium hypochlorite (bleach). In 1942, JCI purchased adjacent properties to the north and east, and JCI began repackaging chlorine from bulk sources to cylinders and 1-ton containers. Titanium tetrachloride was briefly manufactured between 1942 and 1943 for the U.S. government during World War II for use in smoke-screen operations. Repackaging of anhydrous ammonia and acids began in 1947. The production of aqua ammonia and bulk storage of hydrochloric, sulfuric, nitric, and hydrofluosilicic acids was started in 1953.

Between 1960 and approximately 1977, solvents and petroleum products, such as tetrachloroethene (PCE), trichloroethene (TCE), toluene, 1,1,1-trichloroethane (1,1,1-TCA), methylene chloride, and Stoddard solvent, were repackaged from bulk to smaller containers for distribution. Aqua ammonia was produced by combining water and ammonia until 1995.

In 1971, JCI began to transport commercial hazardous waste not generated by JCI. The hazardous waste materials were temporarily stored on site prior to transport and disposal off site. The hazardous waste materials were stored on the former Agway Property, which was located on the eastern side of the Site, and in the two pole barns, formerly located in the central portion of the Site immediately west of the warehouse/office complex. JCI discontinued the transportation and on-site storage of hazardous waste in 1980.

Repackaging of chemicals from bulk to small containers has been one of the primary activities at the plant. These repackaged chemicals not only include the chemicals manufactured at the plant, but also those that were brought in bulk loads to the Site for redistribution.

Materials brought to the Site in bulk form were generally stored in shipping containers (i.e., railroad tank cars or tanker trucks), ASTs, and underground storage tanks

(USTs). The tanks were typically constructed of stainless steel, fiberglass-reinforced plastic, or other suitable synthetic material. A majority of these tanks were taken out of service and removed between 1981 and 1986. During the removal of ASTs and USTs, soil samples were collected and analyzed, as required by the New York State Department of Environmental Conservation (NYSDEC). The analytical results indicated that product releases from these storage tanks and associated effects on the subsurface have been minimal (CRA 1993).

2.4 Hydrogeology

The hydrogeology and groundwater quality was evaluated through a network of monitoring wells presented on Figure 3; the monitoring well construction details are provided in Table 1.

The Site is underlain by two distinct stratigraphic zones, an upper overburden zone, and an underlying bedrock zone (Figure 4). The overburden zone can be grouped into two separate lithologic units consisting of an upper gravel-sand-silt mixture and lower gravelly silt. The gravel-sand-silt mixture unit includes varying amounts of gravel, sand, and silt, and was encountered from 25 to 40 feet bgs. The gravel-sand-silt mixture unit grades below into the gravelly silt unit, which is characterized by sediments with decreasing amounts of gravel and increased silt content. The gravelly silt unit directly overlies the bedrock between the depths of 40 to 70 feet bgs.

A carbonate bedrock (dolomite) was encountered at depths ranging between 30 and 80 feet bgs. The surface of the bedrock was found to slope steeply to the east. The upper portions of the bedrock are highly weathered and fractured. The thickness of the weathered zone varies, but was found to be less than 10 feet thick. The dolomitic bedrock at the Site appears to be equivalent to the Onondaga Formation of Upper Devonian age.

The overburden zone was found to be highly transmissive, yielding significant quantities of water. Many of the production wells in the region are completed in the overburden zone. Hydraulic testing conducted at the Site indicates the transmissivity of the overburden zone to range between 25 and 41 square feet per minute (ft^2/min). Groundwater yield in the underlying bedrock, however, was found to be significantly lower.

At the present time, the North Well is the only on-site production well reportedly pumping at between 300 to 400 gpm for 24 hours a day, 7 days a week with periodic shutdowns for maintenance. Water level measurements taken in January 2002, indicate the groundwater flow in the overburden zone is to the east- northeast (Figures 5). Hydraulic gradient for overburden zone was calculated to be 1.3×10^{-3} feet/foot (ft/ft). In the vicinity of the pumping North Well, the hydraulic gradient was calculated to be 6.9×10^{-3} ft/ft.

Groundwater flow in the bedrock zone during non-pumping conditions is both to the west and northeast (Figures 6). A groundwater "mound," or divide, appears to occur at monitoring well BP-1, located in the central portion of the Site. East of BP-1, the groundwater flow is toward the northeast. The average hydraulic gradient is 5.3×10^{-3} ft/ft.

2.5 Interim Remedial Measure

Chlorinated solvents were first reported in July 1981 in all on-site production wells and in discharge water to the lagoons. Analytical results of water discharged to the lagoons had indicated the presence of VOCs, which primarily included chlorinated solvents such as PCE and its degradation products TCE and 1,2-dichloroethene (1,2-DCE). To address this issue, comply with the SPDES permit, and to collect data for the treatability study related to the RI/Feasibility Study (FS), JCI installed an air stripper to treat the affected groundwater prior to discharge to the lagoon. In November 1994, LFR conducted hydraulic testing of the North and West Wells to design an air stripping tower to treat affected groundwater. An air-stripping tower, with the capacity of treating up to 500 gpm, was installed in May 1996. Since 1996, affected groundwater primarily from the North Well (300 to 400 gpm) has been treated prior to its being used as non-contact cooling water in the plant and subsequent discharge to the lagoons. Monitoring of the discharge water indicates that VOCs are below method detection limits (MDLs).

The Identification of Candidate Remedial Technologies Memorandum (LFR 1996) identified air stripping as one of the remedial technologies in the potential extraction and treatment of affected groundwater at the Site. A Treatability Study Evaluation Report (TSER) for the air stripper, which was being used in the remediation of the affected groundwater from the North and West Wells, was prepared by LFR in January 1997 (LFR 1997). Results indicate that the air stripper is operating at a greater than 99.5 percent removal efficiency of chlorinated solvents (LFR 1997). The air-stripper effluent samples analyzed for VOCs continue to be below MDLs.

2.6 Description of the Remedial Measures

Based on the analysis presented in the FS (LFR 2000), U.S. EPA (2000) issued the ROD that listed the selected following remedial alternatives:

- Soil Alternative #2: SVE of PCE-Affected Soil; and
- Groundwater Alternative #4: Source Area Pump-and-Treat/Monitored Natural Attenuation/Institutional Controls/ Chemical Oxidation

The above remedies are grouped into Remedial Work Elements I and II for the soil and groundwater medium, respectively:

2.6.1 Remedial Work Element I

Remedial Work Element I involves the treatment of soils affected with chlorinated solvents exceeding the soil cleanup objectives in the former solvent tank area at the Site by in situ Soil Vapor Extraction (SVE).

2.6.2 Remedial Work Element II

Remedial Work Element II for the groundwater medium involves the following components:

- extracting affected groundwater in the former solvent tank source area using a network of recovery wells in the overburden and bedrock aquifers
- treatment of extracted groundwater with the existing air stripper, which allows for the utilization of the treated water as non-contact cooling water within the plant, and discharge of the non-contact cooling water to the on-site lagoons until groundwater remediation goals in the former solvent tank area have been achieved
- in situ treatment of the DNAPL beneath former solvent tank source using an oxidizing agent, such as potassium permanganate (KMnO4)
- continued extraction and treatment of affected groundwater from the North Well
- discontinued pumping from the West Well to eliminate the potential to draw contaminants to deeper water-bearing zones
- monitored natural attenuation (MNA) of the slightly affected groundwater located outside the former solvent tank source area (Figures 7 and 8) and beyond the influence of existing and proposed extraction wells
- implementation of institutional controls (i.e., deed restrictions) to limit future on-site groundwater use to non-potable purposes until groundwater remediation goals are achieved

2.7 Remedial Action Objective

The Remedial Action objectives for the Site are proposed as follows:

- Treat source area soils beneath the former above-ground storage tank area affected with chlorinated solvents including tetrachloroethene (PCE) and its by products via SVE to below the NYSDEC TAGM #HWR-94-4046: Soil Cleanup Objectives.
- Hydraulically contain and treat affected groundwater through a network of groundwater extraction wells installed in the source area until the U.S. EPA MCLs and New York State Groundwater Quality Standards 6 NYCRR Part 703.5 are achieved.
- Treat potential DNAPL, if present, through chemical oxidation

- Conduct MNA sampling of the affected groundwater downgradient from the source area to confirm that PCE and its by products are not migrating off-site above the U.S. EPA MCLs and New York State Groundwater Quality Standards 6 NYCRR Part 703.5.

A summary of soil and groundwater remediation goals is presented below. The soil remediation goals are the NYSDEC TAGM #HWR-94-4046: Soil Cleanup Objectives. The groundwater remediation goals are based on the New York State Groundwater Quality Standards 6 NYCRR Part 703.5.

Chemical of Concern	Soil Medium (milligrams per kilogram or mg/kg)	Groundwater Medium (micrograms per liter or µg/l)
Tetrachloroethene (PCE)	1.4	5
Trichloroethene (TCE)	0.7	5
Cis-1,2-Dichloroethene (cis-1,2-DCE)	0.3	5
Trans-1,2-Dichloroethene (trans-1,2-DCE)	0.3	5
1,1-Dichloroethene (1,1-DCE)	0.4	5
Vinyl chloride	0.2	2

Applicable or Relevant and Appropriate Requirements (ARARs) or TBCs with which the selected remedy must comply include the following:

2.7.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements

- 6 NYCRR Parts 700 – 705 Groundwater and Surface Water Quality Regulations
- Safe Drinking Water Act (SDWA) MCLs and non-zero MCLGs (40 CFR Part 141)
- 10 NYCRR Part 5 State Sanitary Code

2.7.2 Action-Specific Applicable or Relevant and Appropriate Requirements

- National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)
- 6 NYCRR Part 257, Air Quality Standards
- 6 NYCRR Part 200, New York State Regulations for Prevention and Control of Air Contamination and Air Pollution
- 6 NYCRR Part 376, Land Disposal Restrictions
- 40 CFR 50, Air Quality Standards

- New York State Pollutants Discharge Elimination System (6 NYCRR Parts 750 – 758)
- Resource Conservation and Recovery Act (42 U.S.C. & 6901 et seq.)

2.7.3 Location-Specific Applicable or Relevant and Appropriate Requirements

Fish and Wildlife Coordination Act, 16 U.S.C. 661

2.7.4 Advisories, "To Be Considered," or Other Criteria

- New York State Air Guide - 1 for the Control of Toxic Ambient Air Emissions
- New York Guidelines for Soil Erosion and Sediment Control
- New York State Air Cleanup Criteria, January 1990
- NYSDEC Technical and Operational Guidance Series 1.1.1 November 1991
- NYSDEC Technical and Administrative Guidance Memorandum No. 94--HWR--4046

2.8 Remedial Design

The design approach and results of the engineering analyses to support the development of the remediation plans and technical specifications were presented in the Final Remedial Design Report and Addendum (LFR 2002 and 2003). The final construction plans and technical specifications are presented in Appendices A and B, respectively.

- Element I: treatment of PCE and its degradation products-affected soil in the former solvent tank source area by soil-vapor extraction (SVE). SVE is a proven technology for vadose zone remediation, and has proven to be reliable in numerous applications throughout the United States. Favorable conditions for efficient remediation with SVE are present at this site and include a sufficiently deep groundwater table and porous vadose zone.
- Element II: hydraulic containment and treatment of PCE and its by products-affected groundwater in the source area through a groundwater pump-and-treat system. Extracted water from two proposed overburden and one bedrock extraction well and the existing North Well will be treated by the existing air stripper, routed to the plant for use as non-contact cooling water and discharged to on-site lagoons.

After achieving hydraulic containment, PCE-DNAPLs, if present in the source area based upon most-current groundwater sampling data, will be treated by an oxidizing agent such as potassium permanganate. Monitored natural attenuation will be used to address the PCE-affected groundwater outside the source area. Treatment of PCE and its by products -affected groundwater will continue until groundwater levels are below the U.S. EPA MCLs and NYSDEC's groundwater standards.

3.0 IMPLEMENTATION OF REMEDIAL ACTION

This section details the activities required to construct the remedial systems. The remedial systems will be installed in general accordance with the construction drawings presented in Appendix A and specifications presented in Appendix B. The soil-vapor treatment and in situ chemical oxidation equipment will be installed in a prefabricated building. By enclosing the equipment in a building it will protect the equipment from rain, freezing temperatures, and direct sunlight and provide a sound barrier to nearby residences. Hazardous waste warning signs will be mounted on the building. The groundwater extraction control equipment will be housed in the existing air-stripper building.

LFR will oversee construction activities including the installation of piping, equipment, and electricity. LFR will also monitor health and safety and conduct health safety meetings. A daily record of field activities will be kept in a field notebook. The selected remedial action contractor will be responsible for the labor, materials, equipment, and subcontractors necessary to install the remedial systems. The contractor will also be responsible for providing and installing the equipment. The contractor will obtain local building permits as necessary to complete specified work.

3.1 Site Preparation

Site preparation activities will be implemented prior to construction of the remedial systems. The site preparation activities will consist generally of initial tasks that must be completed by the remedial action contractor and owner's engineer before on-site construction can begin.

3.1.1 Permitting

The selected remedial action contractor will be required to obtain all building and electrical permits prior to construction. In addition, the remedial action contractor will be required to coordinate all building and electrical inspections and provide the inspectors access to the project as necessary.

No environmental permits are required since remediation activities are being performed under an approved CERCLA remedial action. However, JCI is required to comply with substantiate requirements of the current SPDES permit NY-0072079. A notification will be made to the NYSDEC notifying it of the intended increase in the allowable flow rate from the stripper to at least 720,000 gpd due to the CERCLA corrective action requirement.

In addition, JCI is required to comply with the substantiate requirements of 6NYCRR Part 212 for General Process Emission Sources and the New York State Division of Air Resources (DAR) Guidelines for the Control of Toxic Ambient Air Contaminants (Guidelines; November 12, 1997) although an air permit is not required.

The proposed ISCO injection wells are classified as Type V wells. The U.S. EPA Region 2 implements the Underground Injection Control (UIC) program in New York; therefore, it is assumed that a Class V UIC permit will not be required for the injection of the chemical oxidant and authorization will be granted as approval of their Remedial Action Work Plan.

3.1.2 Site Security

The remedial action contractor will be required to provide barricades and fencing to prevent unauthorized personnel from entering the construction areas to prevent potential exposure pathways. Access to the construction areas will be limited during construction activities to authorized personnel. The source area and proposed extraction well locations are remote to JCI Jones Chemical process operations; therefore, JCI Jones personnel are not expected to need access to the construction areas.

3.1.3 Traffic Controls

Since the locations of all proposed construction activities are located on JCI Jones Chemical property, only limited on-site traffic control will be required. The proposed construction areas are outside of high flow traffic areas; however, barricades and temporary fencing will be used to control access to the construction areas.

The remediation contractor will micro-tunnel under the JCI Jones owned rail spur. Therefore, JCI Jones will coordinate with its chemical suppliers and the railroad prior to starting tunneling activities to remove any rail cars from the area and prevent any shipments until tunneling is completed.

3.1.4 Staging Areas and Decontamination Areas

The remedial action contractor will establish material and equipment staging areas and decontamination areas. These areas will be used to prevent the spread of affected media.

3.1.5 Institutional Controls

A deed restriction prohibiting potable use of on-site groundwater will be implemented by JCI. This deed restriction will be required to remain in affect until the groundwater cleanup objectives are met.

3.2 Vapor/Groundwater/ISCO Well Installation

Prior to beginning construction of the remediation systems, Nothnagle Drilling will install the soil vapor extraction, groundwater extraction, and in-situ chemical oxidation injection wells under the direction of an LFR engineer or geologist. The proposed location of the source area wells are shown in Figure 9. The well installations will be

in accordance with the construction drawings and technical specifications. IDW soil from the installation wells will be spread on site in the source area and remediated by the SVE system. Groundwater generated from the installation of the groundwater extraction wells will be treated on site with the air stripper then discharged to the lagoons.

The groundwater extraction and ISCO wells be sampled following installation to further refine the concentrations in the source area and expected concentrations to be treated by the air stripper. The groundwater samples will be analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260. In addition, the groundwater samples will be analyzed for color, pH, manganese, chlorides, chemical oxygen demand (COD) and total dissolved solids to establish a baseline for these parameters for comparison with future data following ISCO.

An LFR engineer or geologist will oversee the installation of the wells. During coring of the bedrock for the installation of the deeper wells, the LFR personnel will inspect rock cores for fractures to determine the proper depth of the wells.

3.2.1 SVE Wells

The drilling contractor will install two 4-inch diameter vapor extraction wells to approximately 17 ft bgs. The vapor extraction wells will be constructed of 15 feet of 0.020 inch Schedule 40 PVC well screen and 2 feet of Schedule 40 PVC riser. The annular space between the borehole and the screen will be filled with 20/30-grade sand to one foot above the top of the screen (1 to 17 ft bgs). The annular space above the sand filter pack 18 inches below the surface shall be filled with Type I Portland cement. The extraction wells shall be finished above grade with a slip-on cap for modification by the remediation contractor at a later date.

3.2.2 Groundwater Extraction Wells

The drilling contractor will install two overburden and one bedrock groundwater extraction wells. The 2 overburden wells shall be installed to 40 feet below ground surface (bgs) and constructed of 25 feet of 10 inch diameter Schedule 40 PVC high flow well screen (minimum area of 30 in^2/ft) and 15 feet of 10 inch diameter Schedule 40 riser. The annular space between the borehole and the screen shall be a minimum of 4 inch es and filled with sand to one foot above the top of the screen (14 to 40 ft bgs). A 1-foot bentonite seal will be placed above the sand filter pack and the remaining annular space to the surface shall be filled with Type I Portland cement. The extraction wells will be finished above grade with a slip-on cap for modification by the remediation contractor at a later date.

The bedrock well shall be a double-cased well set approximately 18 inches into competent bedrock (expected at 40-ft bgs). The surface casing shall be 10-inch diameter Schedule 40 PVC or equivalent inert material. The outer casing shall be anchored into position with a Type I Portland cement and allowed to cure for 24 hours.

Following curing, the drilling contractor shall core into bedrock approximately 15 ft and set 15 ft of 8 inch diameter Schedule 40 PVC high flow well screen (minimum area of 24 in^2/ft) and 40 feet of 8 inch diameter Schedule 40 PVC riser. The extraction well will be finished above grade with a slip-on cap for modification by the remediation contractor at a later date.

Pumping will be used to develop the groundwater extraction wells until development water flows clear and free of drilling fluids, cuttings, or other materials. The development water will be containerized for on-site treatment through the existing air stripper by JCI.

Short-term (approximately 5 minutes) pump tests will be performed on the groundwater extraction wells to verify that the desired flow rates can be achieved from each well. This will require the temporary storage of over 2,000 gallons of water in frac tanks that will be treated by the existing on-site air stripper. A pump capable of delivering at least 170 gpm will be used to conduct the pump test. The drawdown in the extraction well will be measured during the pump test to verify a sufficient flow rate at an acceptable drawdown.

3.2.3 ISCO Wells

The drilling contractor will install five overburden and one double-cased bedrock injection wells. The 5 overburden wells shall be installed to 40 feet below ground surface (bgs) and constructed of 25 feet of 2 inch diameter 0.020 inch Schedule 40 PVC well screen and 15 feet of 2 inch diameter Schedule 40 PVC riser. The annular space between the borehole and the screen shall be filled with 20/30-grade sand to one foot above the top of the screen (14 to 40 ft bgs). A 1-foot bentonite seal shall be placed above the sand filter pack and the remaining annular space to the surface shall be filled with Type I Portland cement. The injection wells will be finished above grade with a slip-on cap for modification by the remediation contractor at a later date.

The bedrock injection well will be a double-cased well to approximately 18 inches into bedrock (expected at 40-ft bgs). The surface casing shall be 6 inches and the inner casing will be 4-inch diameter Schedule 40 PVC riser. The annular space between the inner and outer casing will be filled with a Type I Portland cement and allowed to cure for 24 hours. Following curing, the drilling contractor will core into bedrock approximately 15 ft. Screen may be required if the borehole will not remain open. The injection well shall be finished above grade with a slip-on cap for modification by the remediation contractor at a later date.

3.3 Trenching and Piping

Trenching and piping will be required to install the SVE and groundwater extraction systems' piping. The native material will be used as pipe bedding and backfill material since the trenches are not located in high vehicular traffic areas. The bottoms of the

trenches will be accurately graded to provide uniform bearing and support for each section of pipe.

The PCE concentrations in soil where trenching for piping and electrical conduit will be placed are expected to be below the Universal Treatment Standard (UTS) criteria; however, minimal soil above the UTS concentration may be encountered in the source area. If this occurs this soil will be used as backfill material for the trenching in the source area and remediated by the SVE system.

3.3.1 SVE

The vacuum supply line will be routed underground and manifolded to each of the SVE wells. The vacuum line will be constructed of 6-inch diameter Schedule 40 PVC pipe. This supply line will be buried only approximately 12 inches bgs since there is no traffic in this area. The vacuum lines will be sloped toward the SVE wells to drain potential condensate build-up. The SVE wells will be manifolded to the vacuum line with 4-inch diameter Schedule 40 PVC pipe. The SVE piping network will be pressure tested for one hour at a pressure of 30 psi.

3.3.2 Groundwater Extraction

The groundwater extraction water piping and electrical conduit will be routed underground to each extraction well. The water lines will be constructed of 6-inch diameter dimension ration (DR) 17 HDPE pipe. This water line will be buried a minimum of 36 inches bgs. The electrical conduit shall be 1-inch diameter Schedule 40 PVC pipe and will be buried above the water line. The water lines will be pressure tested for one hour at a pressure of 100 psi.

3.3.3 ISCO

No piping and trenching will be required for the ISCO system. The selected oxidant will be added directly into each injection well.

3.4 Geomembrane

The existing concrete rubble in the area of SVE system will be moved to a JCI designated area to allow placement of the geomembrane. A 100-foot by 30-foot 40-mil high density polyethylene liner will placed over the affected soil in the source area to minimize short circuiting of the vapor extraction system. Approximately 12 inches of soil cover will be placed over the liner and re-seeded in accordance with the technical specifications in Appendix B.

3.5 SVE Treatment Building

A 20-ft by 16-ft metal building will be constructed in the source area to house the SVE and ISCO equipment. The building will be equipped with lights, electrical receptacles, and louvered vent fan. The building will be anchored to a 6-inch reinforced concrete slab constructed of 3,500 psi concrete. The remedial contractor will be responsible for providing plans of the metal building that meets New York State Building Code requirements for snow and wind load and are certified by a New York professional engineer.

3.6 Equipment Installation

3.6.1 SVE System

A skid-mounted SVE system will be anchored to the concrete slab in the treatment building and connected to the vacuum manifold. The SVE system will consist of a 117-gallon insulated moisture separator tank to remove excess and a 20-hp regenerative SVE blower (Rotron™ model DR/P-13BM72D or equivalent blower) capable of delivering 750 cfm at 65 inches of water column. The blower will be equipped with a particulate filter, a timer, pressure and vacuum gages, an adjustable vacuum relief valve, a flow meter, and a thermometer. The blower will be equipped with sound suppression equipment on both the suction and discharge piping. A liquid level sensor will be installed in the moisture separator tank. The blower will contain internal controls to shut down if the motor's temperature reaches a factory-set high temperature limit. After the motor cools, the blower will restart automatically. The adjustable vacuum relief valve, mounted on the skid, will allow fresh air to enter the suction line if the vacuum reaches a preset point. This feature should minimize the likelihood of shutdown caused by high motor temperature. A visible flashing alarm mounted on the outside of the treatment building will be tripped if the system is automatically shut down due to a high level water or high temperature condition.

The SVE effluent will be routed into two parallel granular activated carbon (GAC) canisters (Carbtrol® Model G-3P) that are in series with an additional two GAC canisters for removal of VOCs. Treated soil vapors will be discharged to the atmosphere from a vent six feet above the roofline of the structure.

3.6.2 Groundwater Extraction Pumps and Controls

Based upon previous groundwater modeling, the proposed flow rates to maintain the desired 400-foot capture zone width are as follows:

- north well – 170 gpm
- two proposed overburden wells – 130 gpm/well
- bedrock well – 70 gpm

Extraction wells OEW-1 and BEW-1 will primarily be used as hydraulic containment wells for the source area preventing the continued migration of dissolved-phase chlorinated solvent compounds, while extraction wells OEW-2 and the North Well will primarily function to capture the dissolved compounds that have migrated downgradient from the source area.

Therefore, based on the design requirements, a Grundfos 150S50-2 with 5-horsepower, 4-inch motor or equivalent pump will be installed in the overburden wells. The bedrock well will include a Grundfos 80S30-3 with 3-horsepower, 4-inch motor or equivalent pump. The existing north well pump may be replaced if it cannot be efficiently operated at a reduced flow rate of 170 gpm.

The proposed pump motors wills operate on 230-VAC, three-phase, electrical power. The north well currently operates on 240-VAC, three-phase, electrical power. The power supply to each extraction well pump will be equipped with an amperage sensor. If a pump draws the groundwater surface to the level of the intake, the pump will begin to cavitate and the amperage will change significantly. This amperage increase will be detected by the sensor and the sensor will signal the control panel to shut down the extraction well pump. After a 5-minute time delay, the control panel will restart the extraction well pumps.

A new control cabinet, for the groundwater extraction wells, will be installed and will contain motor starters, pump savers, hand switches, alarm lights, etc. This equipment will be connected to and controlled by the existing air-stripper programmable logic controller. The existing system features the following operational characteristics:

- Shut down the groundwater extraction pumps if the water level in the effluent wet well reaches a preset level. The extraction pumps will restart when the water level in the wet well reaches a low-level set point.
- Shut down the entire system if the air stripper's blower pressure switches (high or low pressure) are tripped. This actuates a latching failure condition requiring manual restart at the Site.
- Shut down the air-stripper blower at loss of the groundwater extraction pumps. The control panel is equipped with a zero to 30-minute time delay for restart of the stripper blower to protect the motor.

A new control panel will be added to connect the existing pressure and liquid level switches to the proposed pumps to control their operation at fail-safe conditions.

The extraction wells will be completed in locking 2-square-foot steel vaults. Inside the 2-square-foot steel vaults will be a ball valve, sampling port, and pressure gage as shown in the construction drawings. A minimum 2 feet downstream from the ball valve will be a water meter housed in a meter box. Following the water meter, approximately 12 inches will be a check valve installed in a valve box as shown on the construction drawings.

3.6.3 ISCO System

The injection equipment will be housed in the SVE treatment building and used on an as needed basis. The system will include a 1,000-gallon solution mix tank, mixer, and connection to potable water source. The $KMnO_4$ solution will be manually batch-mixed as necessary for delivery to the injection points (section 3.3).

3.7 Survey

Following construction, the vertical and horizontal position of each groundwater and vapor extraction well and ISCO injection well will be surveyed by a registered land surveyor licensed in the State of New York. The survey will document the vertical elevations of the top of the casing pipe and the ground surface elevation adjacent to each well. The survey will also determine the horizontal location of each well.

3.8 Installation/Start-up Training

Upon completing construction, the systems will be started-up by the remediation contractor in accordance with manufacturers' instructions. The remediation contractor and manufacturer's representatives will demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.

3.9 O&M Manuals

At system start-up, the remediation contractor will provide JCI with three copies of operation and maintenance (O&M) manuals for each system. The manuals will include the following:

- Condensed operating instructions explaining preventative maintenance procedures, safe methods of checking the equipment for normal operation, and safe procedures for starting and stopping the equipment
- Complete list of equipment and materials with manufacturers' names and model numbers
- Flow diagrams and system layouts showing piping, valves, and controls
- Wiring and control diagrams
- Manufacturers' bulletins, cuts, and descriptive data
- Maintenance instructions for each piece of equipment including manufacturer's list of parts, recommended spare parts, routine maintenance procedures, possible breakdowns and repairs, and a troubleshooting guide to help the operator determine what steps must be taken to correct any equipment problems.

3.10 Monitored Natural Attenuation

The proposed remedy is designed to capture and treat groundwater contamination in the former AST area and in the vicinity of wells OP-16, OP-9, North, and West Wells. Contamination outside this area will be addressed through monitored natural attenuation (MNA). Groundwater concentrations in most wells outside of the source area are at or slightly above the MCL and will be addressed through MNA.

Natural attenuation is defined as the biodegradation, dispersion, advection, dilution, sorption, volatilization, and/or chemical and biochemical stabilization of contaminants to effectively reduce contaminant toxicity, mobility, or volume to levels that are protective of human health and the ecosystem. Biodegradation is generally considered to be the primary mechanism for attenuating biodegradable contaminants but is not the primary mechanism for the Site; abiotic processes appear to be the main mechanism of natural attenuation (LFR 2002).

Monitoring of the natural attenuation processes will be implemented approximately three months after the start-up of the remediation systems.

4.0 SYSTEM START-UP

After completion of construction, the SVE and pump-and-treat systems will be started to verify that each component has been installed properly and is performing satisfactorily. The in situ chemical oxidation treatment will not be implemented until hydraulic containment has been achieved. It is projected that system startup activities will take five days to complete.

4.1 Soil-Vapor Extraction

Air samples will be collected from the SVE influent and effluent at start-up, and after 24 and 72 hours of operation. The air samples will be analyzed by a fixed-base laboratory for PCE, TCE, and cis-1,2-DCE using EPA Method TO-14. The system flow rate will be monitored and vacuum readings will be measured each day for two days at OW-1, OW-2, OW-3, and OP-11. Air samples and flow measurements will be collected periodically during start-up from each vapor extraction well to assess contaminant removal rates across the source area.

4.2 Groundwater Extraction

The flow rate from each groundwater extraction well will be adjusted to maximize flow rate and drawdown without causing cavitation of pumps and therefore, cycling of the pumps. Groundwater elevations will be measured in selected on-site monitoring wells prior to start-up and at least twice per day for five days after start-up, for determining

capture zone of the remediation system. Based on the data collected, flow and pressure adjustments may be made to enhance the performance of the pump-and-treat system.

Monitoring wells OP-7, OP-8, OP-9, OP-11, OP-12, OP-15, L-1, and PZ-2 will be used to determine the capture zone of the overburden groundwater extraction system. BP-4 and the west well will be used to confirm the capture zone of the bedrock groundwater extraction well. In addition, the overburden and bedrock ISCO wells will be used to monitor the groundwater elevation to assess the drawdown in this area.

The groundwater remediation system will operate continuously for at least the first six months of operation. Treatment system water samples will be collected from the influent and effluent of the air stripper on a daily basis for at least the first three days then weekly for the first month then monthly for 6 months. The first three daily samples will be shipped overnight and analyzed using EPA Method 8260 on a 24-hour turnaround basis for PCE, TCE, cis-1,2-DCE, and trans-1,2-DCE. These data will be used to evaluate the mass recovery rate of the remediation system, to evaluate the performance of the air stripper, and to determine whether SPDES permit discharge standards are being met.

4.3 ISCO

If groundwater-sampling data indicate the presence of DNAPL-PCE in the source area after achieving hydraulic control, injection of potassium permanganate will be initiated. Based upon stoichiometric ratios as determined in the Remedial Design Report (LFR 2002), 105 kg of $KMnO_4$ will be applied for the overburden and 50 kg for the bedrock aquifer. It is assumed that the required volume of $KMnO_4$ will have to be added to a solution that is 30% of the volume of the affected area to ensure that the oxidant reaches the entire suspected 15-foot diameter DNAPL source area. Therefore, 3,470 gallons of a 0.81% $KMnO_4$ solution will be added to the overburden aquifer and 890 gallons of a 1.5-% $KMnO_4$ solution will be added to the bedrock aquifer.

The $KMnO_4$ solution will be batch mixed as needed in the 1,000-gallon mix tank. A Carus Helix Feeder (Model 25-07) will be rented and used to feed the dry $KMnO_4$ into the make-up water. A flow meter on the mix tank effluent will assist in determining ~~the~~ when the desired volume of solution has been delivered to the injection point.

The $KMnO_4$ solution will be injected at a maximum pressure of 15 psi to prevent potential soil fracturing. Since the transmissivity of the overburden aquifer is 233 gpm/ft and is 45 gpm/ft for the bedrock aquifer, the required volume of solution can be added in one day without exceeding darcian flow. The groundwater extraction wells will be turned-off in the source area during injection and for a minimum of 24-hours following injection. The SVE system will be operated during the ISCO injections to recover potential vapors generated from the reaction of the PCE with the $KMnO_4$.

After completing the first injection, subsequent groundwater monitoring data from the area will be evaluated to determine if additional injections are required. Groundwater

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samples will be collected from OP-11, OP-16, and each of the injection wells. The samples will be analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260. In addition, the groundwater samples will be analyzed for color, pH, manganese, chlorides, and total dissolved solids.

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After completing the first injection, subsequent groundwater monitoring data from the area will be evaluated to determine if additional injections are required. At a minimum, at least six months will be required between injections to allow for rebound.

5.0 OPERATION, MAINTENANCE & MONITORING

Operation, maintenance, and monitoring (OM&M) of the proposed remedial systems will be required to ensure that the equipment is operating efficiently and remediation is proceeding at an acceptable rate.

5.1 O&M SCHEDULE AND ACTIVITIES

5.1.1 SVE: O&M Schedule and Activities

Operation and maintenance events will be conducted monthly for the first quarter and then quarterly thereafter (routine O&M). During each routine O&M event, the equipment will be inspected and preventive maintenance conducted in accordance with manufacture specifications provided in the O&M Manuals to be supplied by the equipment manufacturers. Monitoring data will be collected during each routine O&M visit and equipment repairs will be made as necessary. Large fluctuations in the SVE system flow rates, vapor concentrations or temperatures are likely indicators that occlusions or short circuiting may be occurring in the formation, piping system, knockout tank, or GAC vapor treatment vessels. The following tasks should be conducted during the routine O&M events:

- The depth to groundwater and vacuum will be measured in on-site monitoring wells OW-1, OW-2, OW-3, and OP-11.
- The run-time hours, vacuum and temperature of influent vapor, pressure and temperature of effluent vapor will be recorded at SVE blower system.
- The vapor flow rate and vacuum at each extraction well will be measured.
- An organic vapor analyzer will be used to measure vapor concentrations from the extraction wells, the blower influent, and the system effluent.
- soil vapor influent and SVE blower effluent (post GAC vapor phase treatment) air samples will be collected and analyzed for PCE, TCE, and cis-1,2-DCE by EPA Method TO14.
- The volume of water collected in the knockout tank will be monitored and the water collected should be treated on site.

During routine O&M visits, fine tuning and adjustments of the soil-vapor extraction flow rates, pressures, operating time cycles, etc. will be made to the systems based on the data collected. These fine-tuning adjustments are intended to maximize the performance of the remediation systems. The field data collected during each event, modifications to the operational profile of the remedial systems, and repairs to the systems will be recorded on a site-specific O&M checklist. Semi-annual status reports will be provided to the U.S. EPA.

The SVE system is expected to operate approximately two years. The GAC vessels for vapor phase treatment are predicted to be removed within the first six months of operations (LFR 2002).

5.1.2 Groundwater Extraction: O&M Schedule and Activities

Operation and maintenance events will be conducted monthly for the first quarter and then quarterly thereafter (routine O&M) until shutdown of the SVE system. Following shutdown of the SVE system, semi-annual O&M visits will be made. During each routine O&M event, the equipment will be inspected and preventive maintenance conducted in accordance with manufacture specifications provided in the O&M Manuals to be supplied by the equipment manufacturers. Monitoring data will be collected during each routine O&M visit and equipment repairs will be made as necessary.

The following tasks will be conducted during the routine O&M events:

- The depth to groundwater will be measured in the groundwater extraction and on-site monitoring wells OP-7, OP-8, OP-9, OP-11, OP-12, OP-15, L-1, PZ-2, BP-4, and the West Well.
- The run-time hours, total volume, and pressure will be recorded for each extraction well and at air stripper.
- A groundwater sample will be collected from each extraction well and analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260.
- Air stripper influent and effluent groundwater samples will be collected and analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260.

During routine O&M visits, fine-tuning and adjustments of the groundwater extraction flow rates will be made to the system based on the data collected. These fine-tuning adjustments are intended to maximize the performance of the remediation systems. The field data collected during each event, modifications to the operational profile of the remedial systems, and repairs to the systems will be recorded on a site-specific O&M checklist. Semi-annual status reports will be provided to the U.S. EPA.

In addition to the routine O&M visits, JCI Jones personnel will monitor and record the total flow rate into the stripper on a daily basis as part of normal operations, and an effluent sample will be collected from the air stripper on a monthly basis by JCI personnel for laboratory analysis in accordance with the SPDES permit.

5.1.3 ISCO: O&M Schedule and Activities

No on-going O&M activities beyond post-injection monitoring will be required following an injection of the $KMnO_4$ solution. Understanding that the oxidation of DNAPL PCE is mass-transfer-limited, additional injections may be warranted based upon groundwater sampling data in the source area.

5.1.4 MNA: O&M Schedule and Activities

Samples from the 8 selected overburden (OP-3, OP-6 through OP-11, OP-14, and OP-16) and 4 bedrock (BP-4, BP-3, and BP-6) monitoring wells along the groundwater flow path will be collected and analyzed by a NYDOH certified laboratory on a quarterly basis for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260. Physical parameters such as temperature, pH, specific conductance, dissolved oxygen, turbidity and oxidation-reduction potential (Eh) will be measured at each monitoring well during each sampling event. In addition, water level readings will be collected at BP-1, BP-2, BP-5, OP-1, OP-2, OP-5, OP-12, OP-13, PZ-1, L-2, and L-3 to generate groundwater flow maps.

Data validation procedures, QA/QC objectives and sampling protocols are described in detail in the Field Sampling and Quality Assurance Plan presented in Appendix C.

Within 60 days of completion of MNA quarterly sampling, the sampling data will be submitted to the U.S. EPA including groundwater flow maps. At a minimum, the report will summarize the field conditions and sampling activities, groundwater flow conditions, MNA analytical results, QA/QC data validation, and summary and conclusions. Figures and tables will be included to present relevant data summaries.

5.2 Monitoring and Reporting Program

Monitoring to determine the effectiveness of the remediation systems will be conducted in accordance with the O&M schedules discussed in section 5.1. Soil vapor influent and SVE blower effluent (post GAC vapor phase treatment) air samples will be collected on a quarterly basis after the first quarter and analyzed for PCE, TCE, and cis-1,2-DCE by EPA Method TO14. During each air sampling event, the vacuum and flow rate in the SVE wells will also be measured.

To assess the groundwater extraction system, a groundwater sample will be collected on a quarterly basis after the first quarter from each extraction well and analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260. Air stripper influent and effluent groundwater samples will also be collected and

analyzed on a quarterly basis after the first quarter for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by EPA Method 8260.

For the first two years, LFR proposes to assess natural attenuation progression by collecting groundwater samples from the 8 selected overburden (OP-3, OP-6 through OP-11, OP-14, and OP-16) and 4 bedrock (BP-4, BP-3, BP-6, and the proposed bedrock ISCO well) monitoring wells on a quarterly basis. Also, water level readings will be collected at the groundwater extraction (North Well, OEW-1, OEW-2, and BEW-1) and on-site monitoring wells BP-1, BP-2, BP-5, OP-1, OP-2, OP-5, OP-12, OP-13, PZ-1, L-2, and L-3 to generate groundwater flow maps. LFR recommends reducing the monitoring to a semiannual basis after two years.

Groundwater samples will be collected from the monitoring wells in accordance with the Field Sampling and Quality Assurance Plan presented in Appendix C. These samples will be analyzed using EPA Methods 8260 by an NYDOH-approved laboratory. In addition, depth to water, pH, specific conductance, dissolved oxygen, turbidity and oxidation-reduction potential (Eh) will be measured at each monitoring well during each quarterly event. IDW groundwater will be treated containerized and treated on site by the existing air stripper.

The field monitoring and analytical data, along with any recommendations for modifications to the remediation system will be presented in semi-annual monitoring reports.

5.3 Completion Report

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A completion report will be submitted to the U.S. EPA within 90 days of startup. The report will include:

- As-built record drawings of system construction
- Copies of field notes and photographic logs
- Evaluation of SVE and groundwater extraction system performance for the first month of operation
- Recommendations for performing in-situ chemical oxidation

Following start-up and operation of the remediation systems, semi-annual status reports will be submitted to the U.S. EPA. The semi-annual reports will include data tables, figures, an evaluation of the data, and recommendations for further remediation including potential ISCO.

5.4 Post-Remediation Monitoring

When the concentrations of VOCs in the SVE wells decrease to non-detectable levels as measured by EPA Method TO-14, LFR will recommend beginning SVE system shut down procedures including post-remediation monitoring. Post-remediation monitoring

will include collecting six soil samples from the source area vadose zone using 3-inch split spoon samples and analyzing the samples using EPA Method 8260 to confirm that the cleanup objectives have been achieved. The soil samples will be collected from various depths in the source area vadose zone. If the soil concentrations are below the cleanup objectives, then the system will be shut down; however, if chlorinated VOC concentrations remain above the cleanup objectives, then the system will be restarted. Remediation of the VOC concentrations in the saturated zone in the source area will be confirmed by groundwater sampling data. The post-remediation groundwater monitoring will be conducted in accordance with the Post-Remediation Plan (PRM) to be submitted within 45 days after designated groundwater monitoring points have recorded readings less than or equal to remediation goals for the third consecutive year.

6.0 HEALTH AND SAFETY PLAN

Minimal inhalation and direct contact exposure to volatile organic compounds is expected by the construction workers during trenching in the source area. This exposure will be monitored using an organic vapor analyzer (OVA) and regulated in accordance with the Site Health and Safety Plan. A copy of HSP is included as Appendix D and will be maintained at the Site during remedial actions. Exposure by on-site JCI Jones Chemical employees is not expected since construction activities will not be performed in work areas and there will be minimal disturbance of affected media.

During ISCO, the nature of the chemical being injected requires that close attention be paid to health and safety concerns related to worker safety. $KMnO_4$ may irritate and damage the mucous membranes; therefore, respirators and eye protection will be worn during handling. Health and safety concerns have been addressed as follows to provide protection for site workers and adjacent residents. The treatment area will be barricaded off with caution tape and warning signs during injection events.

6.1 Material Safety Data Sheets

A material safety data sheet (MSDS) for $KMnO_4$ is included in Appendix E. This information will be reviewed with site workers during safety briefings prior to the commencement of any activities that involve contact with $KMnO_4$.

6.2 Chemical Handling Procedures

Safe handling of chemicals includes the prevention of exposure of site workers to $KMnO_4$. $KMnO_4$ will be delivered to the site in 25-kg pails made of HDPE. The $KMnO_4$ will be stored on the concrete floor in the treatment building. A 25-foot exclusion zone marked by yellow caution tape will be established around the mixing and injection points.

7.0 CONSTRUCTION QUALITY ASSURANCE PLAN

The purpose of the Construction Quality Assurance Plan (CQAP) is to present the procedures that will be followed to verify that the remedial activities are executed in conformance with the construction drawings and technical specifications. A copy of the CQAP is included as Appendix F and will be maintained at the Site during construction.

The objectives of the CQAP include the following:

- Verify that materials are provided and installed in accordance with the overall intent of the design
- Maintain reports, photographic logs, sample and test results as documentation that the quality of construction satisfies the approved intent of the design
- Ensure that each party involved in the construction quality assurance program has a clear understanding of minimum acceptable requirements during construction for each design component

8.0 PROJECT TEAM AND SCHEDULE

8.1 Project Team

At the direction of the U.S. EPA's Remedial Project Manager and JCI Jones Chemical, LFR has overall responsibility for implementation of the remedial action. LFR will oversee the construction of the remedial systems to verify that they are constructed in accordance with the intent of the design. The various QA and management responsibilities of key project personnel are defined below.

8.1.1 Project Organization Chart

An organizational chart illustrating the relationships between the Settling Defendant U.S. EPA, and LFR and its prime subcontractors for this project is shown in Figure 10. The primary responsibilities of key personnel positions are described below. Subcontractors participating in this project are:

Contract Laboratories:

Columbia Analytical Services, Inc.
1 Mustard Street, Suite 250
Rochester, New York 14609-6925

Drilling Contractor:

Nothnagel Drilling
1821 Scottsville-Mumford Road
Scottsville, New York 14546

Remediation Contractor:

Marcor Remediation, Inc.
460 Buffalo Road, Suite 5
Rochester, New York 14611

8.1.2 Key Management Responsibilities

U.S. EPA Remedial Project Manager (George Jacob, CHMM)
The U.S. EPA Remedial Project Manager (RPM) will provide oversight of the remedial action and will work directly with the JCI's Project Manager and LFR while the project is being conducted.

JCI Project Manager (Timothy Gaffney, Executive Vice President, JCI Jones Chemicals, Inc., Caledonia, New York)
The JCI Jones Chemical Project Manager has overall responsibility for all phases of the remedial action. He has the authority to make the necessary decisions to implement and complete the project, although he will seek input from U.S. EPA and LFR.

LFR Project Director (Joseph Applegate)
The LFR Project Director will support the Project Manager and team in allocating adequate resources to meet the project objectives and schedule.

LFR Project Manager (Shekhar Melkote, P.G.)
The LFR Project Manager has overall responsibility for monitoring the project's adherence to U.S. EPA's objectives and LFR's quality standards. LFR's Project Manager along with the Project Engineer will be responsible for technical quality control and project oversight.

LFR Project Engineer (Scott Starr, P.E.)
The Project Engineer will be a registered professional engineer in the state of New York. LFR Project Engineer will be responsible for the remedial system installation. He will observe field construction activities, and manage system start-up and troubleshooting.

8.2 Schedule

The following table presents the draft schedule for implementation and startup of the proposed remedial action systems.

Task Description	Project Schedule Duration (Days)
EPA Approval of RAWP	*
Order Equipment and Initiate Remedial Construction	45
Install Extraction and Injection Wells	20
Install Trenching/Piping/Equipment	45
Start-up	5
Remedial Action Element I Completion	1,095[1]
Remedial Action Element II Completion	5,475[1]

Notes:

*U.S. EPA dependent; time frame begins upon U.S. EPA approval of Remedial Action Work Plan

[1]After start-up

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Table 1
Monitoring Well Construction Data
Jones Chemicals, Inc. Superfund Site
Caledonia, New York

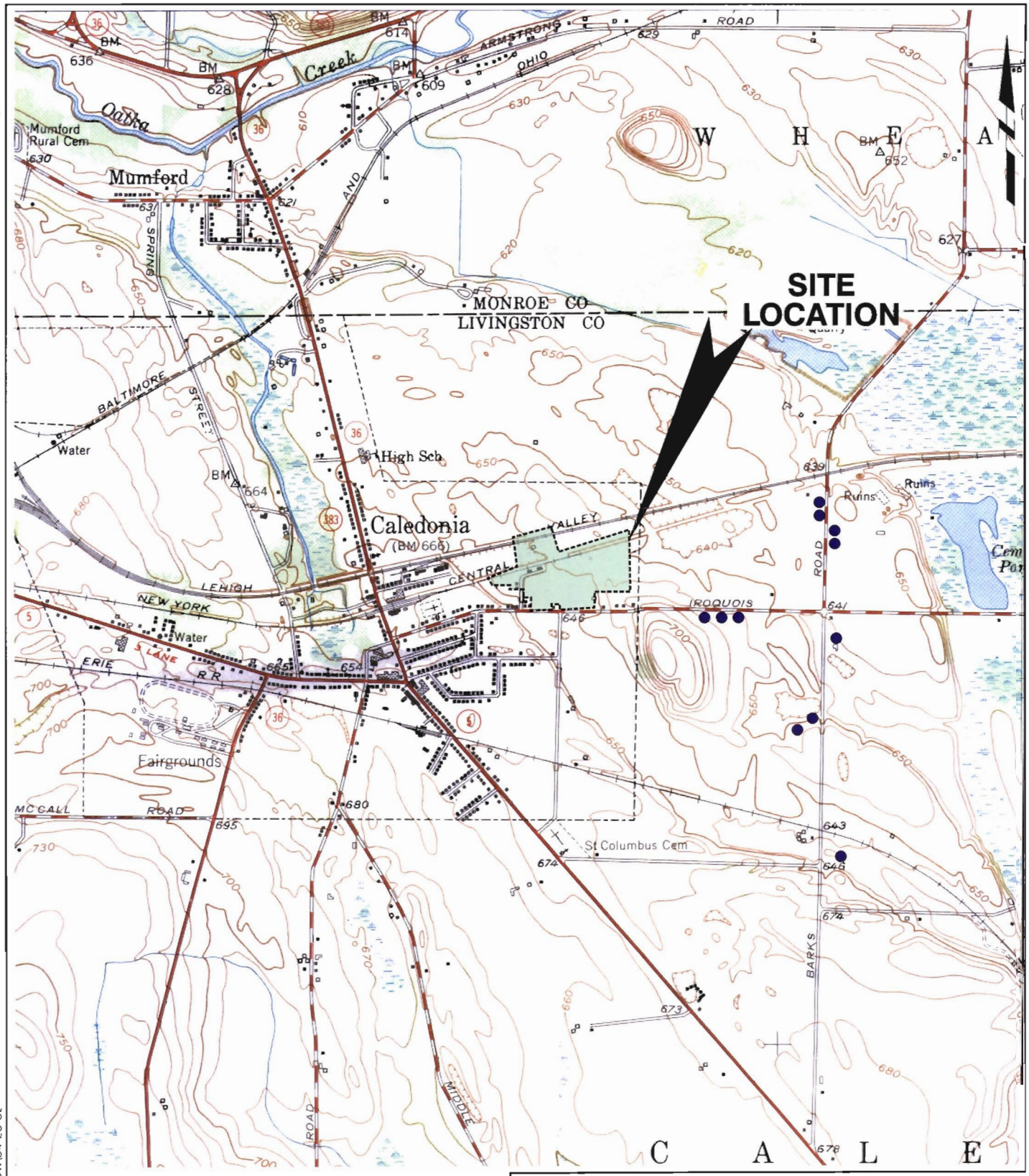
Well ID	TOC Elevation (feet NGVD)	Well Depth Depth (feet bgs)	Monitoring Zone	Screen Interval (feet bgs)	Well Diameter (inches)	Installation Date	Installed By
OP-1	648.465	30.0	Overburden	25-30	4	06/21/84	CRA
OP-2	650.555	25.3	Overburden	20.3-25.3	4	06/20/84	CRA
OP-3	649.800	31.0	Overburden	26-31	4	NA	CRA
OP-5	650.620	22.0	Overburden	17-22	2	04/24/96	LFR
OP-6	651.460	21.0	Overburden	16-21	2	08/23/94	LFR
OP-7	648.785	23.0	Overburden	18-23	2	04/23/96	LFR
OP-8	652.025	22.0	Overburden	17-22	2	04/23/96	LFR
OP-9	645.465	22.0	Overburden	17-22	2	04/26/96	LFR
OP-10	653.790	22.0	Overburden	17-22	2	04/25/96	LFR
OP-11	653.610	22.0	Overburden	17-22	2	04/25/96	LFR
OP-12	652.980	22.0	Overburden	17-22	2	04/29/96	LFR
OP-13	660.205	31.0	Overburden	26-31	2	11/18/97	LFR
OP-14	653.025	26.0	Overburden	21-26	2	11/19/97	LFR
OP-15	652.660	24.0	Overburden	19-24	2	11/19/97	LFR
OP-16	NS	44.0	Intermediate	39-44	2	08/19/98	LFR
BP-1	650.815	113.5	Bedrock	Open Hole (15 ft.)	6	06/26/84	CRA
BP-2	652.100	75.0	Bedrock	Open Hole (15 ft.)	4	06/18/84	CRA
BP-3	648.990	60.0	Bedrock	Open Hole (5 ft.)	2	02/06/87	CRA
BP-4	652.435	55.0	Bedrock	Open Hole (5 ft.)	2	02/11/87	CRA
BP-5	652.050	90.0	Bedrock	Open Hole (15 ft.)	2	05/02/96	LFR
BP-6	653.800	101.0	Bedrock	Open Hole (15 ft.)	4	05/02/96	LFR
L-1	650.420	21.0	Overburden	16-21	4	06/26/84	CRA
L-2	650.560	67.5	Bedrock	Open Hole (15 ft.)	4	05/30/84	CRA
L-3	649.755	20.0	Overburden	15-20	4	05/24/84	CRA
North Well	650.435	24.0	Overburden	NA	48	03/85	NA

Table 1
Monitoring Well Construction Data
Jones Chemicals, Inc. Superfund Site
Caledonia, New York

Well ID	TOC Elevation (feet NGVD)	Well Depth Depth (feet bgs)	Monitoring Zone	Screen Interval (feet bgs)	Well Diameter (inches)	Installation Date	Installed By
East Well	651.090	55.5	Bedrock	NA	6	NA	NA
West Well	652.340	45.3	Bedrock	NA	6	NA	NA
V-1	NS	NA	NA	NA	NA	NA	NA
V-2	NS	NA	NA	NA	NA	NA	NA
PZ-1	649.885	22.0	Overburden	12-22	2	11/29/94	LFR
PZ-2	649.510	23.0	Overburden	13-23	2	11/29/94	LFR
DEC-1	645.125	23.5	Overburden	21-23.5	NA	12/21/83	NYSDEC
DEC-2	642.930	25.5	Overburden	23-25.5	NA	12/22/83	NYSDEC
DEC-3	643.000	17.5	Overburden	15-17.5	NA	12/22/83	NYSDEC
DEC-4	645.445	34.0	Overburden	NA	NA	10/30/84	NYSDEC
DEC-5	657.095	37.0	Overburden	NA	NA	10/31/84	NYSDEC
DEC-6	643.985	26.0	Overburden	NA	NA	11/01/84	NYSDEC
DEC-7	655.445	27.5	Overburden	25-27.5	NA	11/01/84	NYSDEC
DEC-8	645.905	31.5	Overburden	NA	NA	09/10/85	NYSDEC
DEC-9	649.245	27.0	Overburden	24.5-27	NA	09/12/85	NYSDEC
DEC-10	649.535	19.0	Overburden	16.5-19	NA	09/12/85	NYSDEC

Notes:
TOC = top of casing
NGVD = National Geodetic Vertical Datum
bgs = below ground surface
NS = not surveyed
NA = not available
CRA = Connestoga-Rovers and Associates, Inc.
LFR = LFR Levine·Fricke
NYSDEC = New York State Department of Environmental Conservation

FIGURES



Source USGS Quadrangle Caledonia, New York, 1950.
Photorevised 1987.

LEGEND

● Residential wells sampled NYSDOH, 1996.

0 2000 FEET

JCI Jones Chemicals, Inc - Superfund Site

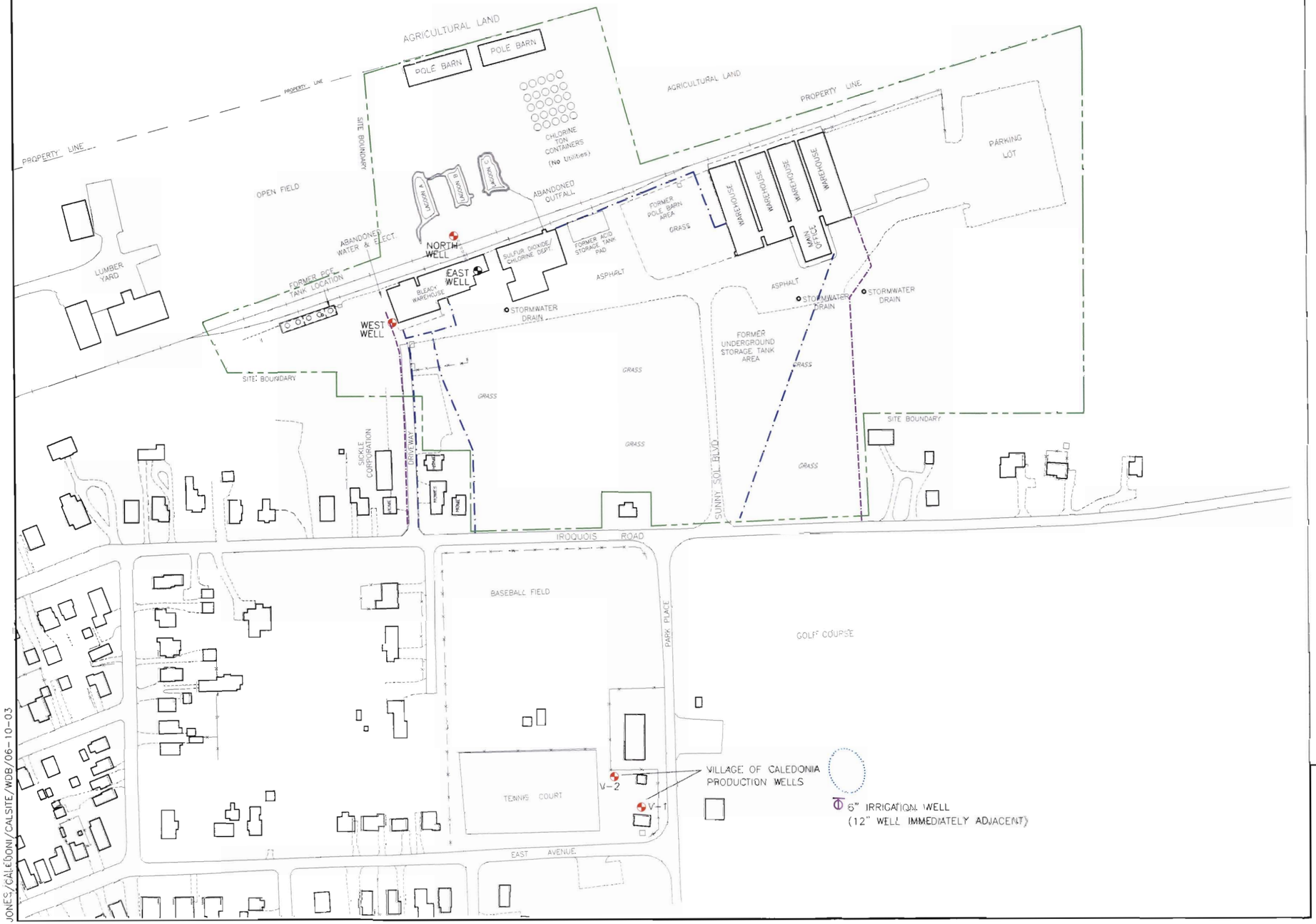
Site Location Map
Caledonia, New York

LFR LEVINE · FRICKE

Project No. 004-03165-03

Figure 1

ARCHGRAC\JONES\3165SITE\WDW04-23-02



JONES/CALEDONI/CALSITE/WDB/06-10-03

LEGEND

- Production wells
- Former production well
- Irrigation well
- Current water line
- Current gas line
- Site boundary
  JCI Jones Chemicals, Inc.

Note: White house and shed were razed in 1998.

N

0' 240' FEET
1" = 240'

JCI Jones Chemicals, Inc – Superfund Site

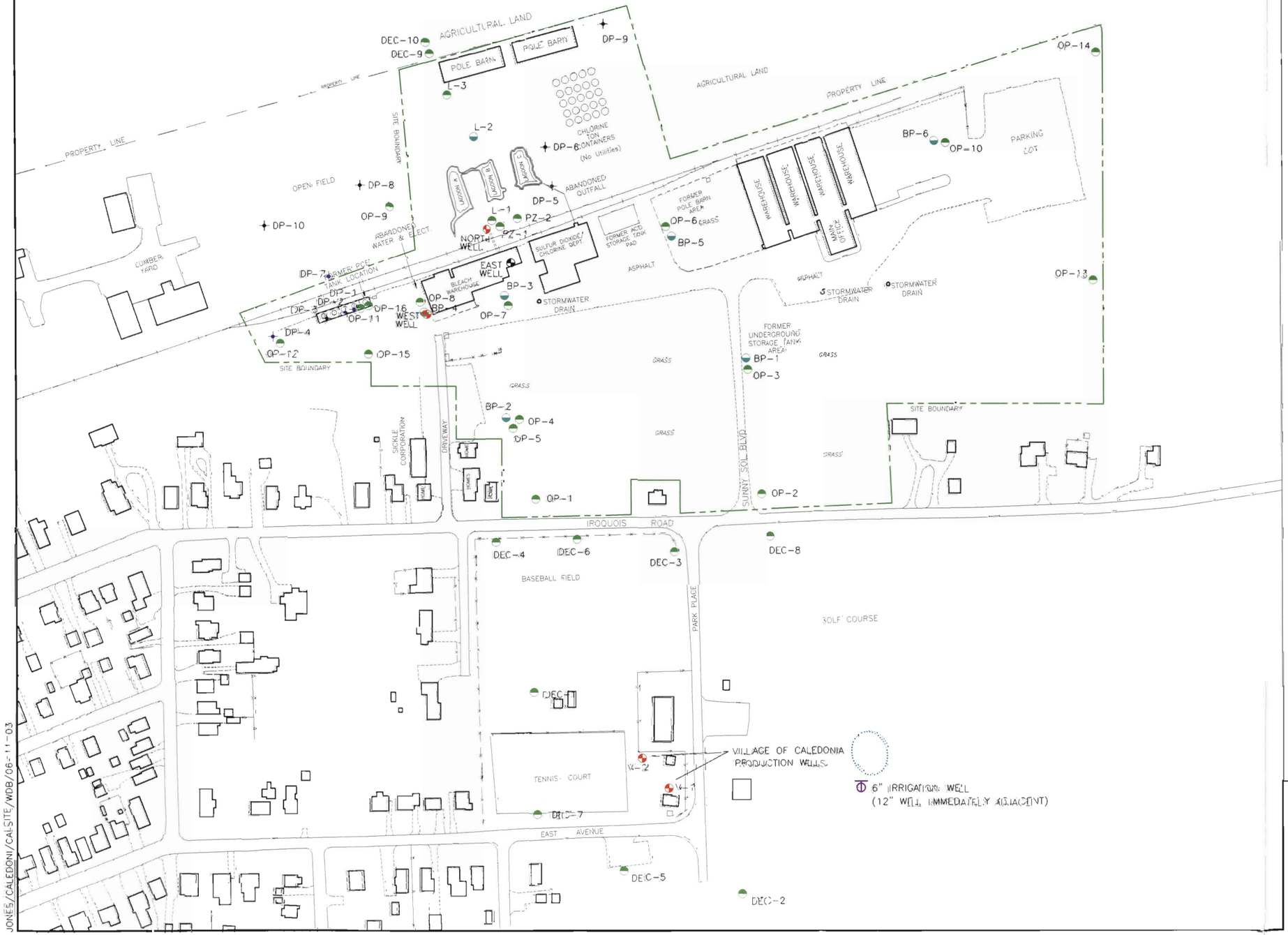
Site Map

Caledonia, New York

LFR LEVINE-FRICKE

Project No 004-03165.03

Figure 2



LEGEND

- Monitoring well–Bedrock
- Monitoring well–Overburden
- Production well
- Former production well
- Irrigation well
- Site boundary Jones Chemicals, Inc.
- Direct-Push sample locations

Note: Monitoring Wells and Direct-Push points were installed for the RI Phase (LFR 1999).

N

0' 240 FEET

1" = 240'

JCI Jones Chemicals, Inc – Superfund Site

Site Map With Monitoring Well Locations and Direct-Push Sample Locations Caledonia, New York

LFR LEVINE·FRICKE

Figure 3

Project No. 0034-03165-03

JONES/CALEDONI/CAL-SITE/WDB/06-11-03

WEST

EAST

WESTERN BOUNDARY | FORMER SOLVENT TANK LOCATION | WEST WELL | BLEACH WAREHOUSE | SULFUR DIOXIDE/ CHLORINE DEPT. | FORMER DRUM STORAGE AREA | WAREHOUSE/ OFFICE BUILDING | FORMER AGWAY PROPERTY

OP-12 DP-4 DP-3 DP-2 DP-1 OP-16 OP-11 B-10 B-2 OP-8 BP-4 WEST WELL NORTH WELL PZ-1 DP-5 OP-6 BP-5 OP-10 BP-6 OP-14

DEPTH BELOW GROUND SURFACE IN FEET

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

0 650
10 640
20 630
30 620
40 610
50 600
60 590
70 580
80 570
90 560
100 550
110 540
120 530

(3) (270) (260) (170) (110) (120) (180) (330,000) (7,100) (90,000) (39,000) (5,500) (79) (140) (16) (7.2) (22) (8) (5) (4.5) (20) (74) (1,600) (3,300) (23) (62,000) (<5) (5,800) (340) (2) (16) (2)

Gravel-Sand-Silt Mixture

Gravelly Silt

Weathered Bedrock

Gravel-Sand-Silt Mixture

Gravelly Silt

Gravelly Silt

Silty Sand With Gravel

Dolomite Bedrock

(<0.5)

Dolomite Bedrock

(<0.3)

LEGEND

- Gravel-Sand-Silt mixture
- Gravelly-Silt
- Silty Sand with Gravel
- Weathered Bedrock
- Bedrock (Dolomite)
- Screen interval and/or open hole
- Depth interval of soil sample

(7.2) Tetrachloroethene (PCE) (µg/l)

µg/l Micrograms per liter

<5 – Below detection limit; value shown is the detection limit.

N

0 200 FEET

APPROXIMATE HORIZONTAL SCALE

VERTICAL SCALE AS SHOWN

JCI Jones Chemicals, Inc.

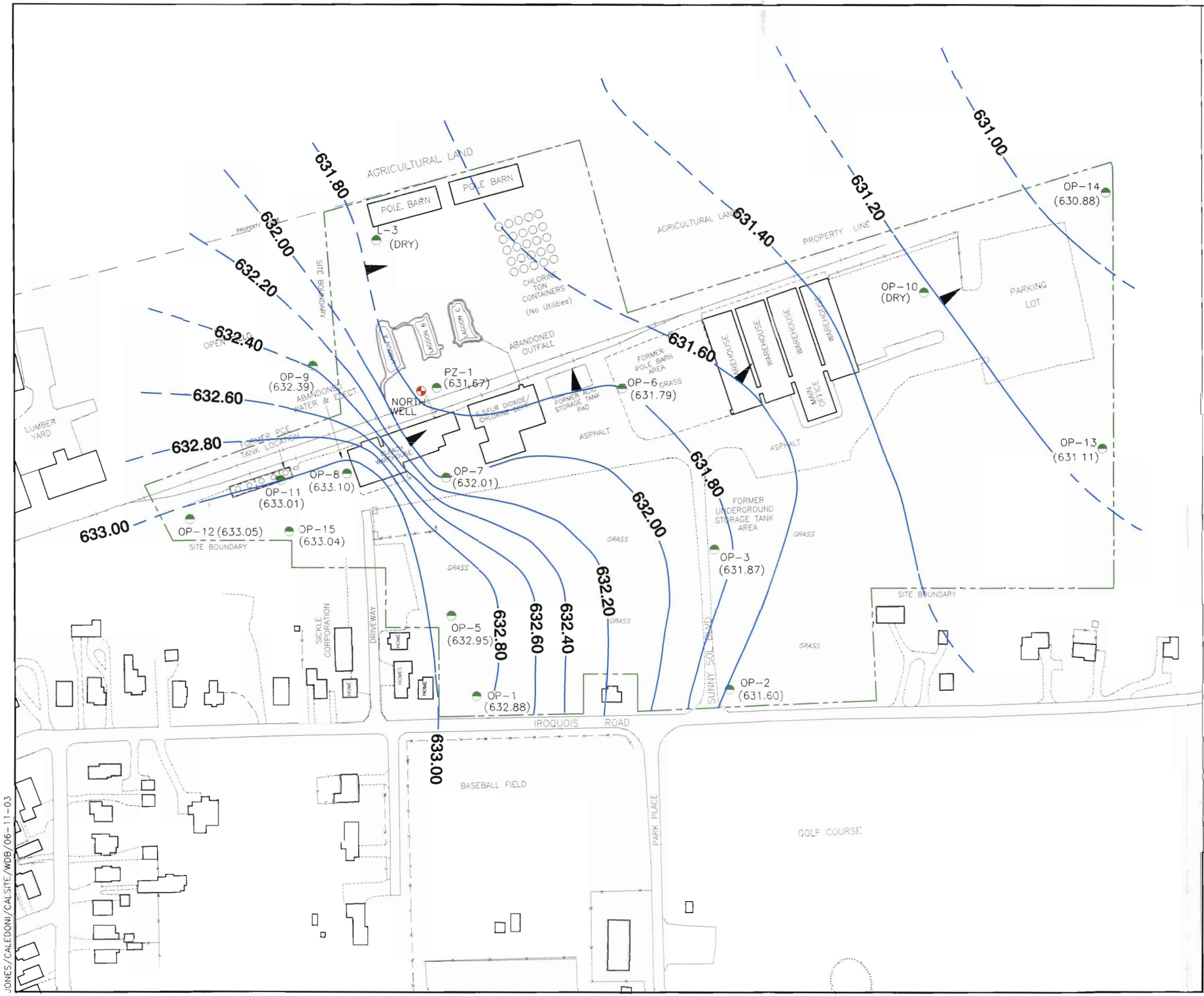
Generalized East-West Geologic Cross Section
Caledonia, New York

LFR LEVINE-FRICKE

Project No. 004-03165-03

Figure 4

JONES/CALEDONI/XSECTJ/WDB/06-11-03



JONES/CALEDONI/CALSITE/WDB/06-11-03

LEGEND

- Site boundary Jones Chemicals, Inc.
- Monitoring well–Overburden
- (633.04) Groundwater elevation (FT NGVD)
- 633.00 Groundwater elevation contour Contour interval = 0.20 Foot Dashed Denotes Inferred Contour (FT NGVD)
- NGVD National Geodetic Vertical Datum
- Groundwater flow direction

Notes: 1.) Pumping well (North Well) Groundwater Level Not Included.

2.) North Well pumping at approx. 300 gpm 24 hours/day, 7 days/week.

N

0 200 FEET

1" = 200'

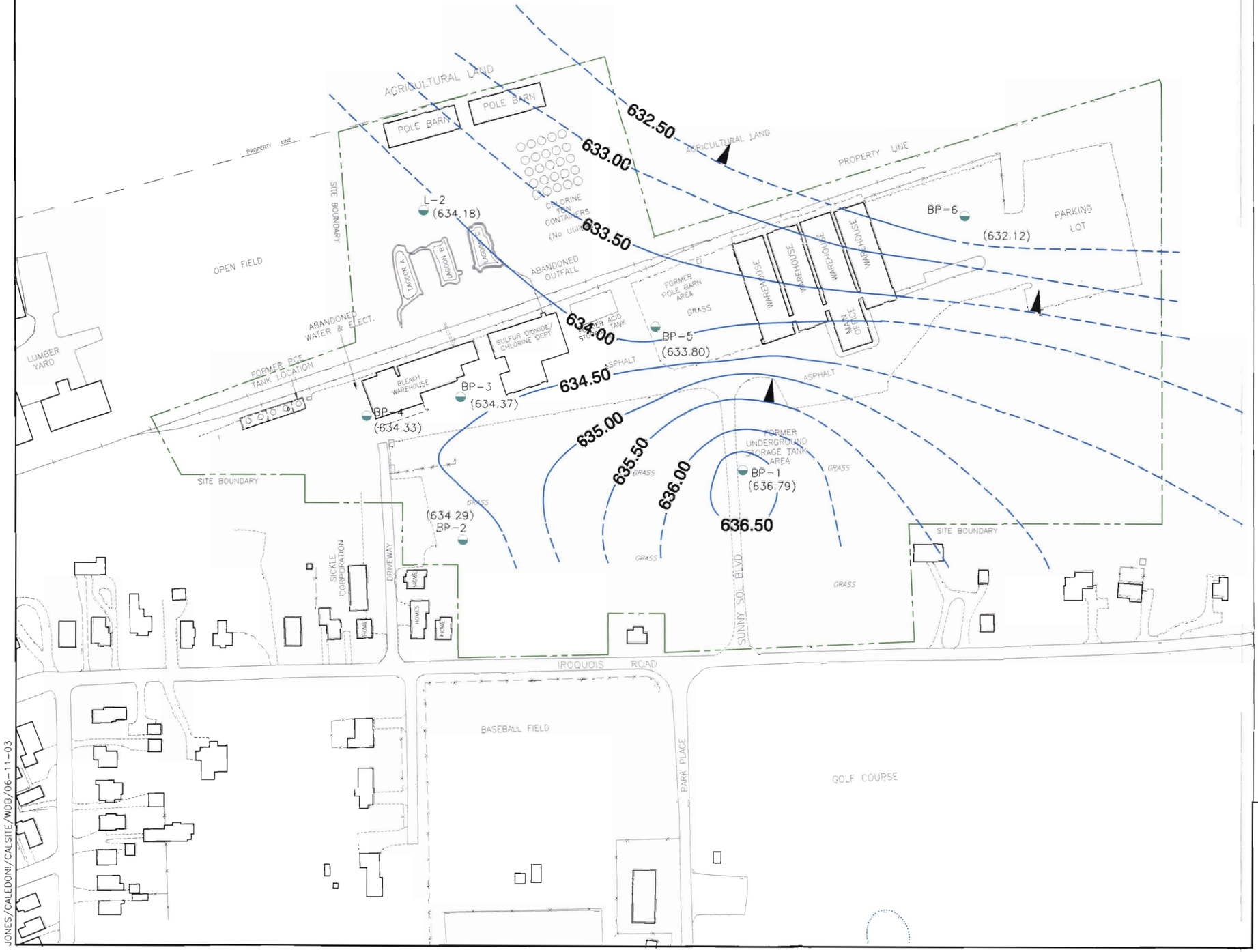
JCI Jones Chemicals, Inc – Superfund Site

Groundwater Elevation Contour Map, Overburden Monitoring Wells January 7, 2002 Caledonia, New York

LFR LEVINE·FRICKE

Figure 5

Project No 004-03165-03



JONES/CALEDONI/CALSITE/WDB/06-11-03

LEGEND

- Site boundary
- Jones Chemicals, Inc.
- Monitoring well–Bedrock
- (631.12) Groundwater elevation (FT NGVD)
- 632.50 Groundwater elevation contour Contour Interval = 0.50 Foot Dashed Denotes Inferred Contour (FT NGVD)
- NGVD National Geodetic Vertical Datum
- Groundwater flow direction

0 200 FEET
1" = 200'

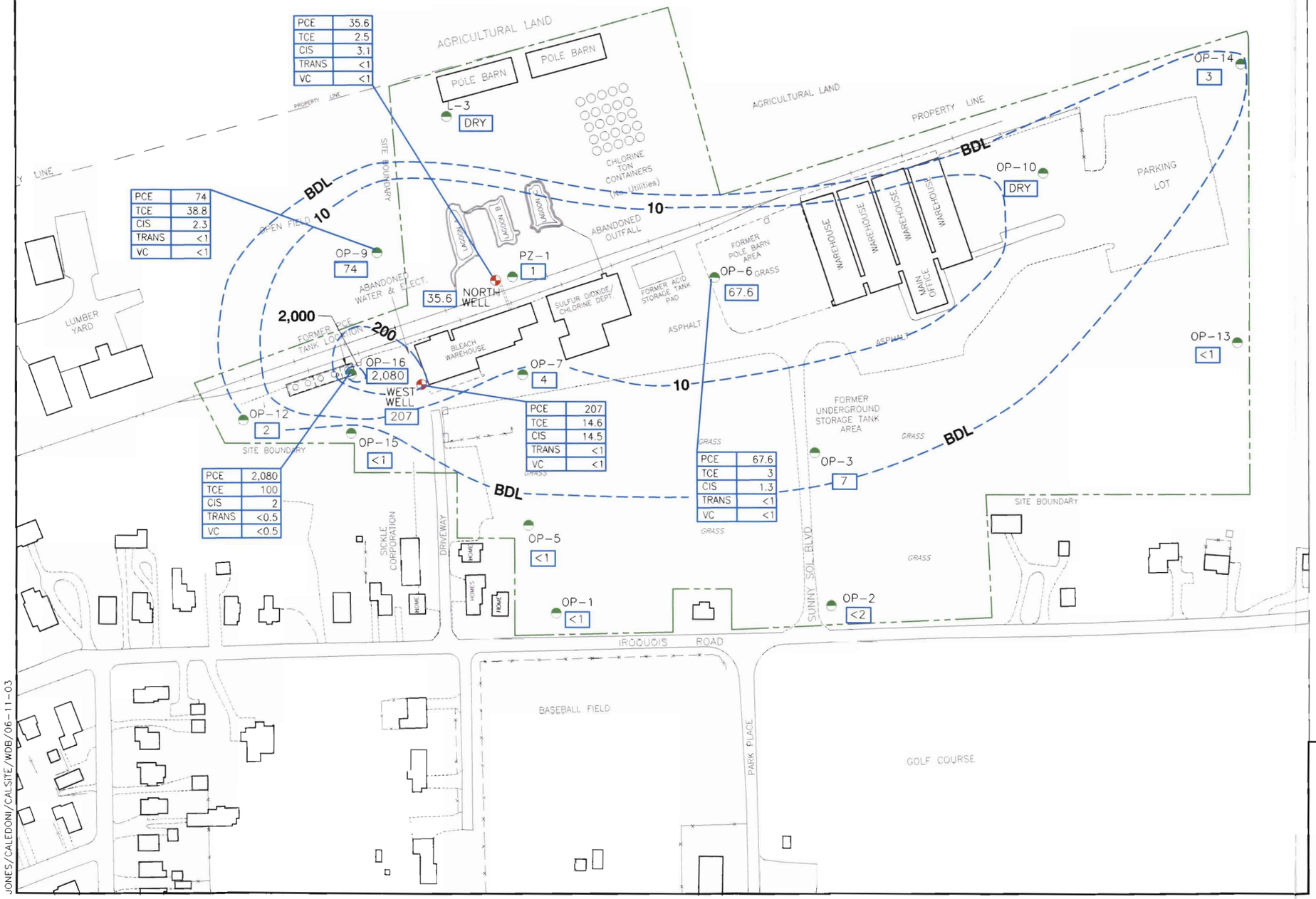
JCI Jones Chemicals, Inc – Superfund Site

Groundwater Elevation Contour Map, Bedrock Monitoring Wells January 7, 2002 Caledonia, New York

LFR LEVINE·FRICKE

Project No. 004-03165-03

Figure 6



JONES/CALEDONI/CALSITE/WDB/06-11-03

N

LEGEND

- Site boundary, Jones Chemicals, Inc.
- Production well
- Monitoring well-Overburden
- PCE — Tetrochloroethene
- 2 — PCE Concentration (µg/l)
- PCE — Tetrachloroethene (µg/l)
- TCE — Trichloroethene (µg/l)
- CIS — Cis-1,2-Dichloroethene (µg/l)
- TRANS — Trans-1,2-Dichloroethene (µg/l)
- VC — Vinyl Chloride (µg/l)
- 200 — PCE inferred isoconcentration contour (µg/l)
- µg/l — Micrograms per liter
- BDL — Below Detection Limits
- <1 — Value shown is the detection limit

Notes: 1.) OP-16 and West well are screened in the lower portion of the overburden/uppper bedrock zones.

2.) The concentration for OP-10 was 8 µg/l on August 19, 1999.

0 200 FEET
1" = 200'

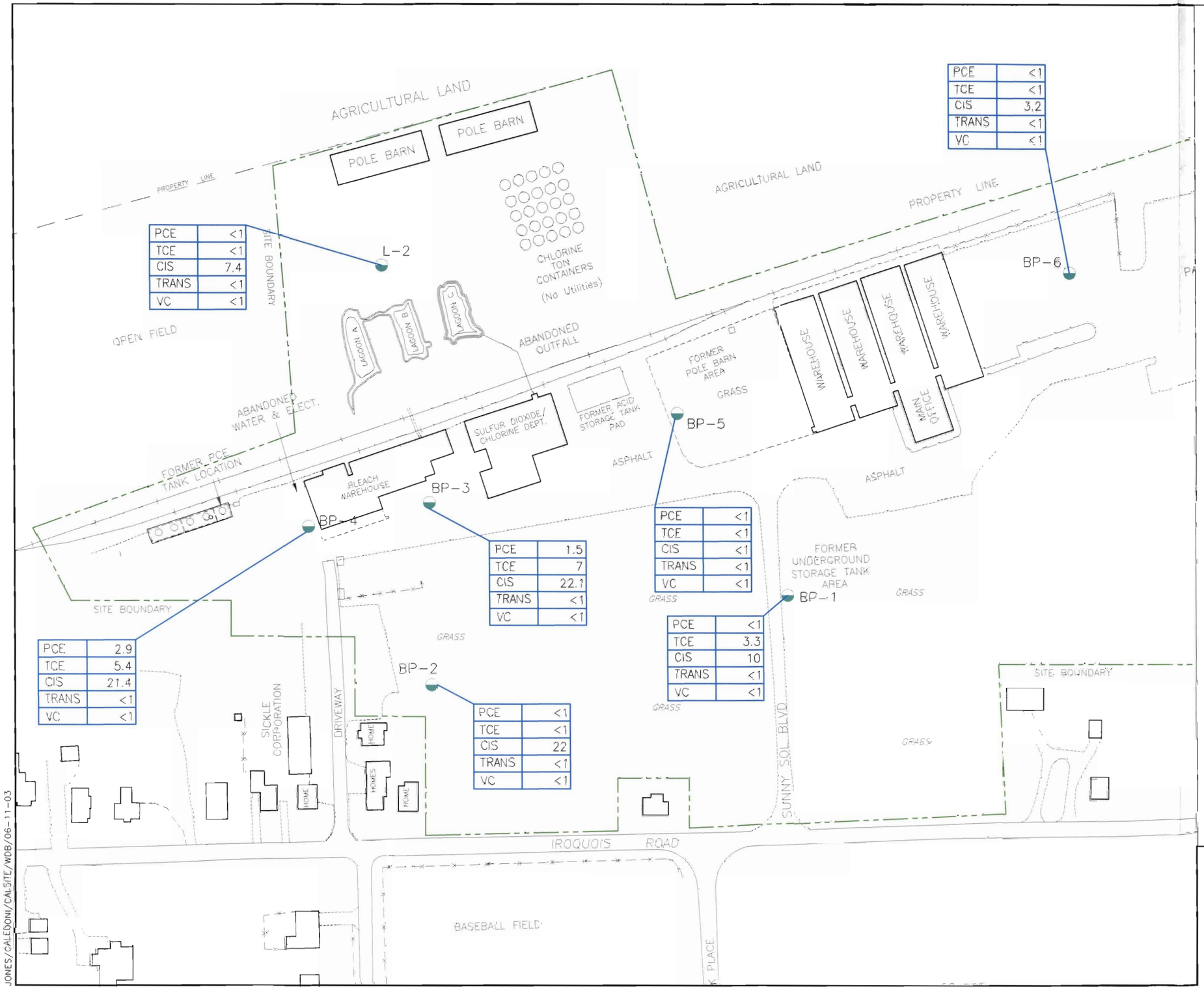
JCI Jones Chemicals, Inc - Superfund Site

Isoconcentration Map of PCE in Groundwater, Overburden Monitoring Wells
January 7, 2002
Caledonia, New York

LFR LEVINE-FRICKE

Figure 7

Project No. 004-03165-03



JONES/CALEDONI/CALSITE/WDB/06-11-03

LEGEND

Site boundary
Jones Chemicals, Inc.

Monitoring well-Bedrock

PCE	Tetrachloroethene (µg/l)
TCE	Trichloroethene (µg/l)
CIS	Cis-1,2-Dichloroethene (µg/l)
TRANS	Trans-1,2-Dichloroethene (µg/l)
VC	Vinyl Chloride (µg/l)

BDL Below Detection Limits

<1 Value shown is the detection limit

µg/l Micrograms per liter

N

0 150 FEET
1" = 150'

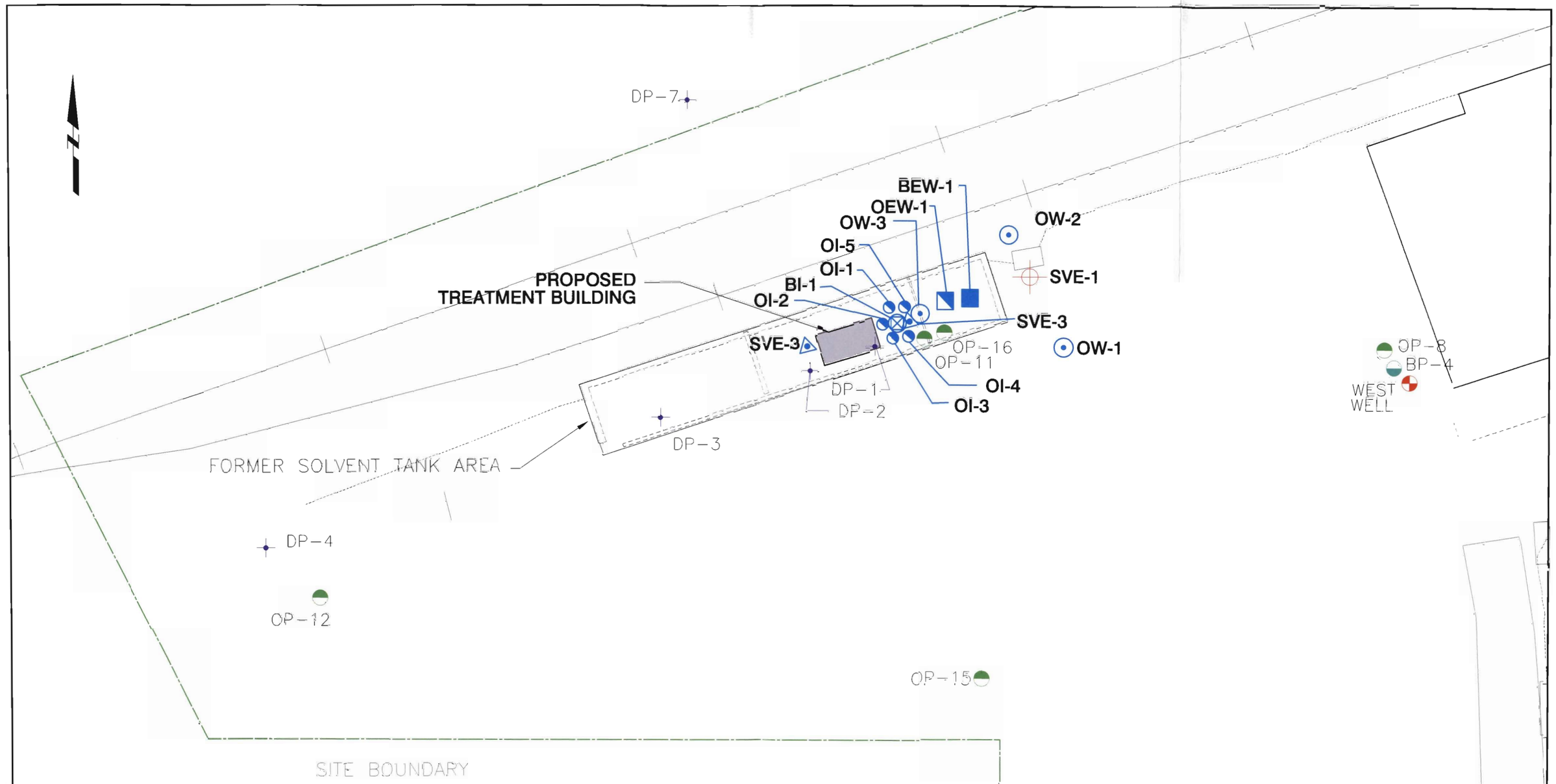
JCI Jones Chemicals, Inc - Superfund Site

Distribution of Chlorinated Solvents in Bedrock Monitoring Wells
February 7, 2002
Caledonia, New York

LFR LEVINE-FRICKE

Figure 8

Project No 004-03165-03



L E G E N D

- Monitoring well-Bedrock
- Shallow Monitoring well
- Production well
- Direct-Push sample locations
- Existing Extraction well
- OW-1 Existing Vapor Observation well
- Proposed Overburden Groundwater Extraction Well
- Proposed Bedrock Groundwater Extraction Well
- Proposed Bedrock Injection well
- Proposed SVE well
- Proposed Overburden Groundwater Injection Well

0 30 FEET
1" = 30'

JONES/CALEDONI/CALSITE/WDB/006-11-03

JCI Jones Chemicals, Inc – Superfund Site

Proposed Source Area Remedial Action Wells
Caledonia, New York

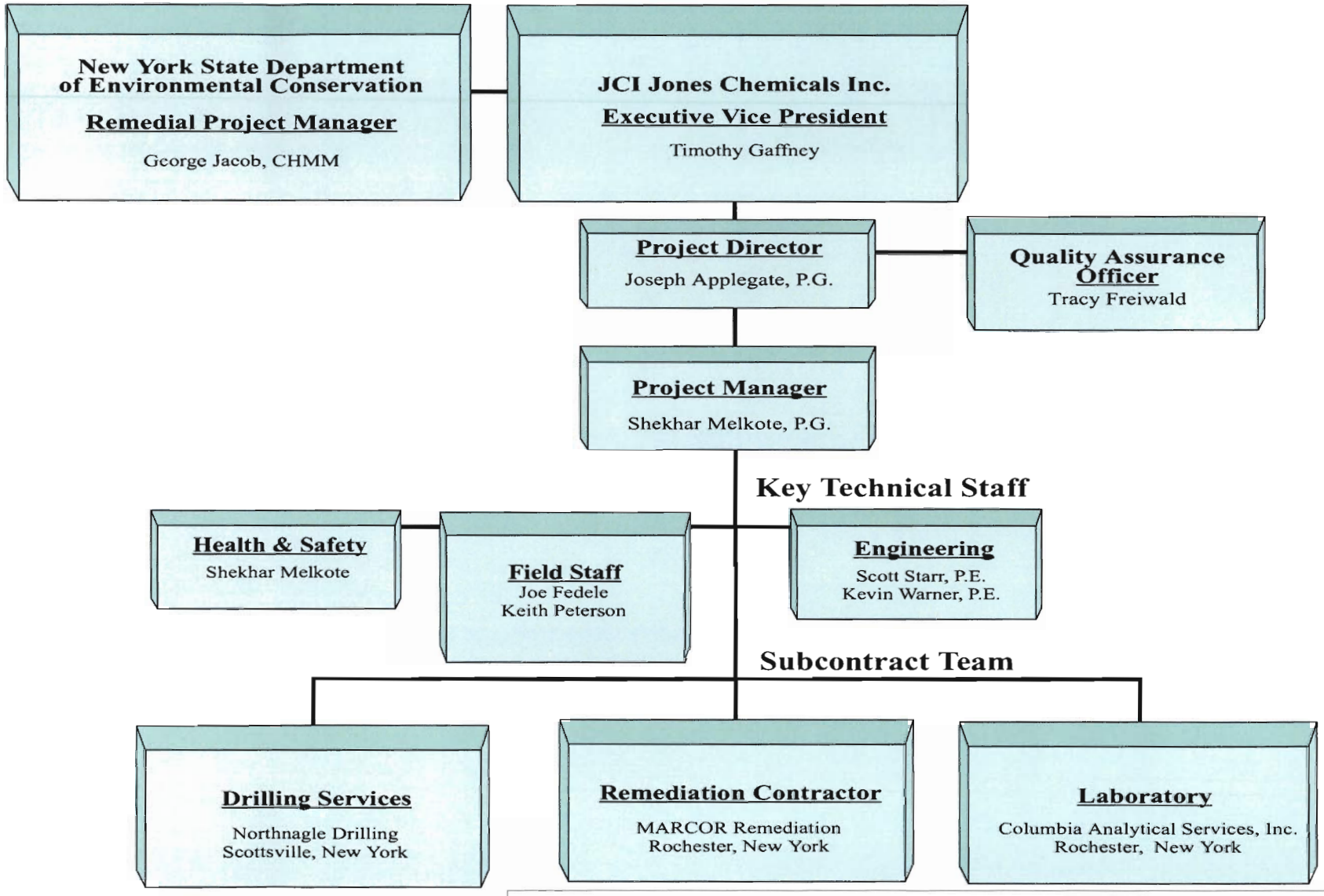
LFR LEVINE·FRICKE

Project No. 004-03165-03.

Figure 9

ARCGRACH\JONES/3165ORG\WDB\06-11-03

Project Organizational Chart



LFR
LEVINE • FRICKE

Project No. 004-03165-03

Figure 10

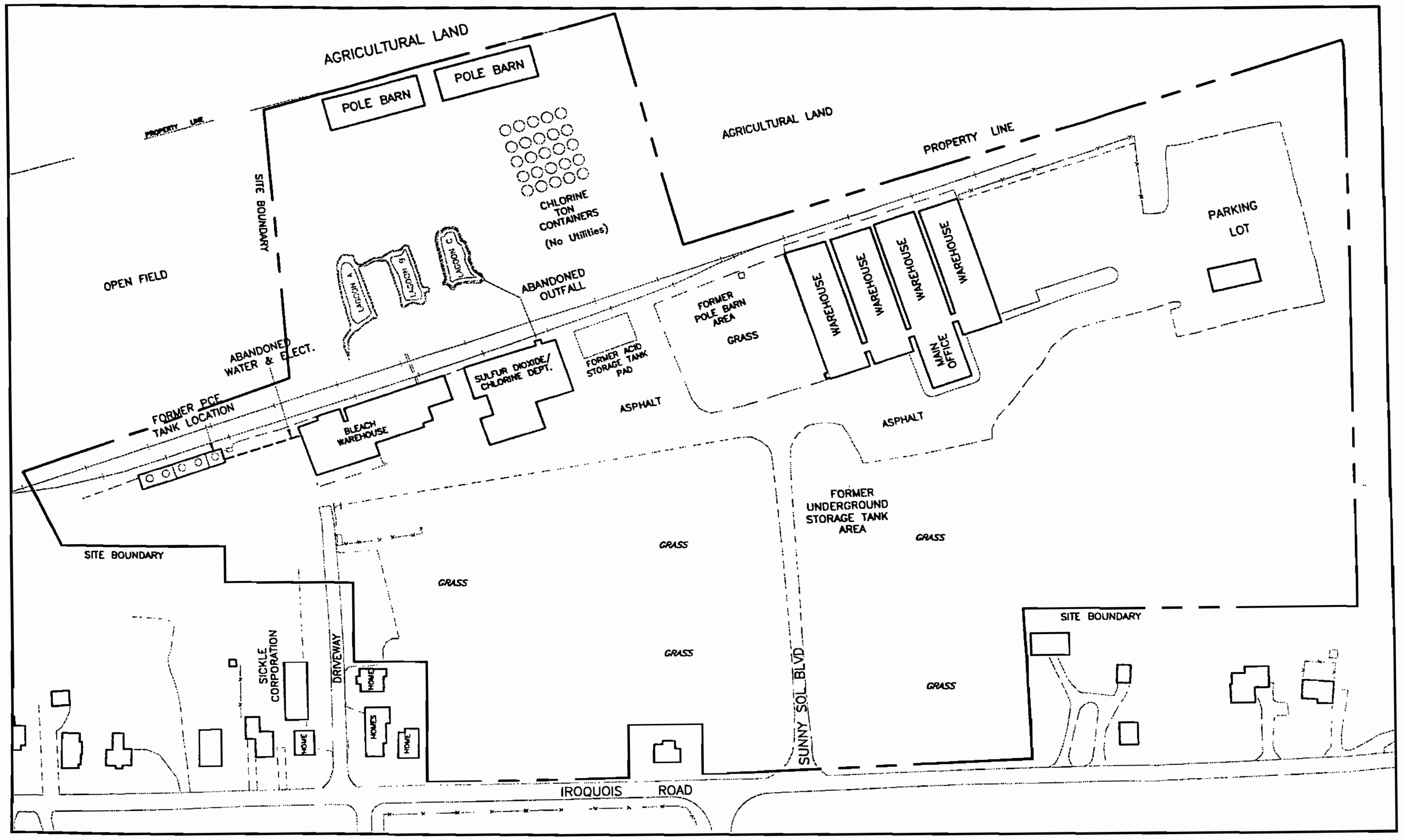
JCI Jones Chemicals, Inc.

Project Organizational Chart
Caledonia, New York

APPENDIX A

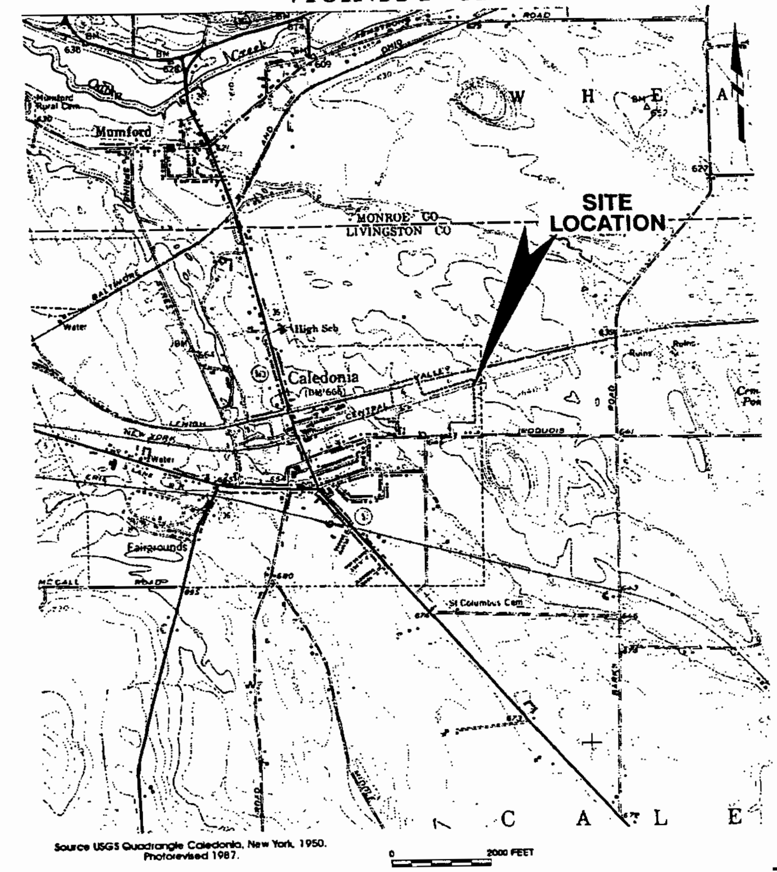
CONSTRUCTION DRAWINGS

CONSTRUCTION DRAWINGS FOR THE REMEDIAL WORK ELEMENT I (SOIL VAPOR EXTRACTION) AND REMEDIAL WORK ELEMENT II (PUMP AND TREAT, AND IN-SITU CHEMICAL OXIDATION)



JCI JONES CHEMICALS, INC.
SUPERFUND SITE
100 SUNNY SOL BOULEVARD
CALEDONIA, NEW YORK

VICINITY MAP



INDEX OF DRAWINGS

LFR LEVINE·FRICKE JCI JONES CHEMICALS, INC. SUPERFUND SITE CALEDONIA, NEW YORK	Title Sheet JCI Jones Chemicals, Inc. Superfund Site 100 Sunny Sol Boulevard Caledonia, New York	SCALE NTS DATE: REVISED 06-11-03 PROJECT NO. 3165.03	SHEET 1 OF 11

STATE OF NEW YORK · R. SCOTT S... · LICENSED PROFESSIONAL ENGINEER · 078821-1 · SEAL

6-20-03

ARC\JONES\CALEDONIA\3165COVER\WDB\04-30-02

GENERAL NOTES

1. CONTRACTOR RESPONSIBLE FOR OBTAINING AND COMPLYING WITH ALL REQUIRED PERMITS INCLUDING, BUT NOT LIMITED TO, CONSTRUCTION AND ELECTRICAL ACTIVITIES. CONTRACTOR EXPECTED TO COMPLY WITH APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
2. CONTRACTOR RESPONSIBLE FOR COMPLIANCE WITH THE LATEST NATIONAL ELECTRIC CODE (NEC) NFPA 70, NFPA 30 AND 30A AND APPROPRIATE CITY, COUNTY, STATE, AND FEDERAL ELECTRICAL CODES.
3. CONTRACTOR RESPONSIBLE FOR PROVIDING SAFE ACCESS TO SITE AT ALL TIMES.
4. CONTRACTOR RESPONSIBLE FOR PROVIDING LIGHTED BARRICADES AND OTHER SAFETY EQUIPMENT AS NECESSARY TO PROTECT THE PUBLIC 24 HOURS A DAY DURING CONSTRUCTION. BARRICADES TO BE IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD), FEDERAL HIGHWAY ADMINISTRATION (FHA).
5. CONTRACTOR ACCEPTS LIABILITY AND IS RESPONSIBLE FOR REPAIR AS NECESSARY TO ORIGINAL CONDITION OF ANY AND ALL DAMAGED UTILITIES, STRUCTURES, PAVEMENT, CURBS, AND VEGETATED AREAS; VEGETATED AREAS TO INCLUDE TREES, SHRUBS, AND GRASS.
6. CONTRACTOR TO CLEAN SITE TO ORIGINAL CONDITION, ACCEPTABLE TO THE ENGINEER.
7. CONTRACTOR'S WORKERS SHALL CONFORM WITH OSHA REGULATIONS CFR 29, PART 1910: 120, HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE.
8. THE FOLLOWING IS A LIST OF MATERIALS AND EQUIPMENT FOR WHICH MANUFACTURER'S OR SUPPLIER'S DATA SHEETS MUST BE SUBMITTED PRIOR TO COMMENCEMENT OF WORK:

   CONCRETE
   PIPING AND VALVES
   APPURTENANCES
   ANCHOR BOLTS AND GROUTING SYSTEMS FOR PIPING SUPPORTS
   PIPE SUPPORTS
   MODULAR BUILDING DESIGN LOADS

9. OUTSIDE WORK TO BE PERFORMED DURING NORMAL BUSINESS HOURS (7:00am - 5:00pm, MONDAY THROUGH FRIDAY) UNLESS SPECIFIC WRITTEN APPROVAL IS GIVEN BY THE ENGINEER. INSIDE WORK WILL BE CONDUCTED AFTER NORMAL BUSINESS HOURS. CONTRACTOR TO COORDINATE WITH OWNER AND ENGINEER TO CONDUCT INSIDE WORK.
10. ALL WORK UNDER THIS CONTRACT SHALL BE PERFORMED IN A MANNER WHICH DOES NOT DISRUPT THE OWNERS' NORMAL BUSINESS ACTIVITIES.
11. CONTRACTOR MUST PREPARE A SITE SPECIFIC HEALTH AND SAFETY PLAN.
12. CONTRACTOR TO PROVIDE RESTROOM FACILITY DURING CONSTRUCTION ACTIVITIES

ELECTRICAL

1. ALL ABOVEGROUND ELECTRICAL EQUIPMENT AND APPURTENANCES TO BE HOUSED IN GALVANIZED AND FLEX CONDUIT MEETING REQUIREMENTS IN NO. 2, GENERAL NOTES.
2. CONTRACTOR TO SUBMIT PROPOSED ELECTRICAL LAYOUT FOR EQUIPMENT AND APPURTENANCES TO ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO SUBCONTRACT WITH LOCAL POWER COMPANY OR ELECTRICIAN TO PROVIDE 460 VOLT THREE PHASE AND 110/220 VOLT SINGLE PHASE SERVICE. CONTRACTOR RESPONSIBLE FOR PROVIDING CORRECT AMPERAGE REQUIRED FOR EQUIPMENT SPECIFIED IN THE SVE TREATMENT BUILDING.
4. CONTRACTOR RESPONSIBLE FOR PROVIDING ALL ELECTRIC APPURTENANCES ASSOCIATED WITH POWER SERVICE, INCLUDING, BUT NOT LIMITED TO, POWER POLE, METER BOX, AND BREAKER BOX. CONTRACTOR TO PROVIDE LOCKABLE ON/OFF SWITCH ON POWER POLE.
5. CONTRACTOR TO INSTALL LOCKING LOCAL DISCONNECT ON/OFF SWITCHES TO ALL ELECTRICAL APPURTENANCES WITHIN COMPOUND AREA.
6. ALL ELECTRICAL EQUIPMENT SHALL BE UNDERWRITERS LABORATORY (UL) LISTED.

CIVIL

1. CONTRACTOR TO FIELD VERIFY ALL HORIZONTAL AND VERTICAL DIMENSIONS AND LOCATIONS; ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER PRIOR TO CONSTRUCTION.
2. ELEVATION POINTS AND CONTOURS ARE NOT SHOWN.
3. CONTRACTOR RESPONSIBLE FOR VERIFYING LOCATION OF ALL UNDERGROUND UTILITIES PRIOR TO EXCAVATION ACTIVITIES.
4. ALL CONCRETE TO BE 3,500 PSI, TYPE I, STANDARD DESIGN. USE A MINIMUM OF 3" COVER ON STEEL WHERE CONCRETE IS CONTACTING SOIL.
5. CONTRACTOR TO VERTICAL SAW CUT ASPHALT/CONCRETE PAVEMENT AT TRENCH/VAULT LOCATIONS PRIOR TO EXCAVATION.
6. CONTRACTOR RESPONSIBLE FOR OBTAINING ALL PERMITS NECESSARY FOR TRENCHING.
7. SLAB SUBGRADE AND PAVEMENT SUBGRADE, SHALL BE COMPACTED TO 98% ASTM D698 MAX. DENSITY.
8. SVE, GROUNDWATER EXTRACTION, AND IN-SITU CHEMICAL OXIDATION (ISCO) WELLS ARE TO BE INSTALLED BY ENGINEER. CONTRACTOR TO COMPLETE WELL HEADS AS SHOWN.

MECHANICAL

1. CONTRACTOR RESPONSIBLE FOR SUPPLY AND ASSEMBLY OF ALL PIPING AND APPURTENANCES FROM WELL HEADS TO TREATMENT SYSTEM BUILDINGS.
2. ALL LIQUIDS AND ISCO PIPING INCLUDING APPURTENANCES TO BE HYDROSTATICALLY PRESSURE TESTED FOR ONE HOUR @ 100 PSI. ALL SVE PIPING INCLUDING APPURTENANCES SHALL BE PRESSURE TESTED @ 30 PSI FOR ONE HOUR. ALL TESTING SHALL BE WITNESSED BY ENGINEER AND ENGINEER SHALL BE NOTIFIED 24 HOURS PRIOR TO TESTING.
3. ALL PIPING AND ELECTRICAL CONDUITS ON OR IN EXISTING FACILITY BUILDINGS TO BE SECURED TO SLAB OR WALL WITH UNISTRUT AND STRAPS OR EQUIVALENT. MAXIMUM UNSUPPORTED LENGTH OF PIPING SHALL BE LESS THAN 6 FEET.
4. EQUIPMENT/APPURTENANCES ON DETAILS ARE GENERIC ONLY. SIZE OF UNITS MAY BE DIFFERENT THAN SHOWN.
5. ALL APPURTENANCES, CONNECTIONS, GASKETS, SEALS ETC. TO BE PETROLEUM RESISTANT. LEVEL AND GROUT ALL SKIDS AS NECESSARY FOR PROPER SUPPORT.
6. CONTRACTOR TO PROVIDE ALL PIPE FITTINGS NOT SHOWN (REDUCERS, BUSHINGS, ETC.)
7. PIPE SUPPORTS TO BE PROVIDED WITHIN 6-INCHES OF ALL VALVES AND FITTINGS.
8. PIPE CONNECTIONS NOT SHOWN ON DRAWINGS. PROVIDE AND INSTALL UNION CONNECTIONS AS NECESSARY.

LFR LEVINE·FRICKE

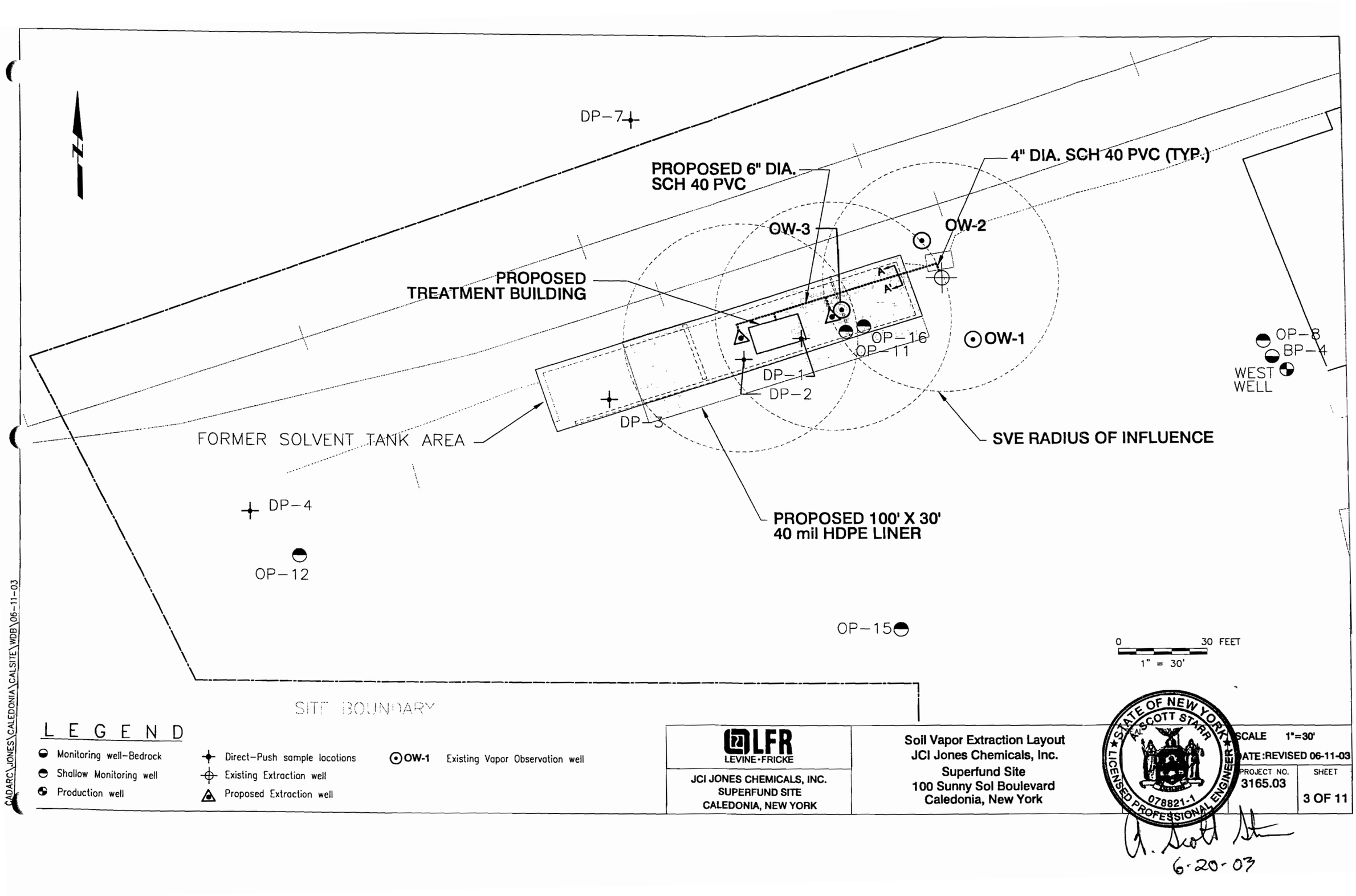
JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

General Notes
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New york

STATE OF NEW YORK · A. SCOTT STARR · LICENSED PROFESSIONAL ENGINEER · 078821-1

A. Scott Starr 6-20-03

SCALE NTS
DATE: REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 2 OF 11



LEGEND

- Monitoring well–Bedrock
- Shallow Monitoring well
- Production well
- Direct–Push sample locations
- Existing Extraction well
- Proposed Extraction well
- OW-1 Existing Vapor Observation well

LFR LEVINE-FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

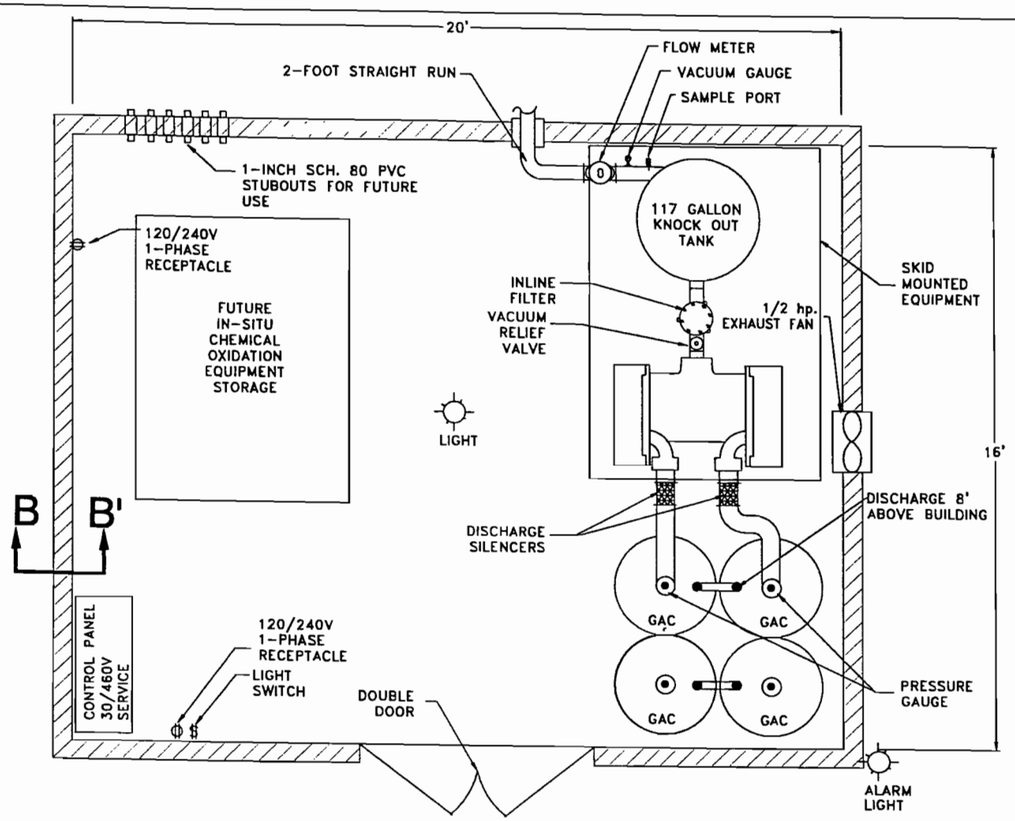
Soil Vapor Extraction Layout
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK
R. SCOTT STARR
078821-1
LICENSED PROFESSIONAL ENGINEER

6-20-03

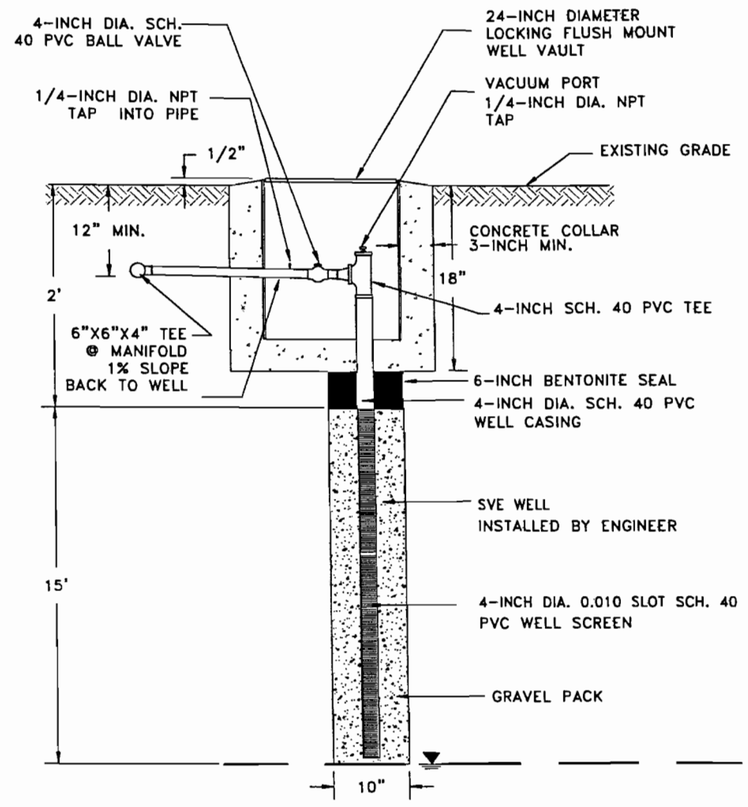
SCALE 1"=30'
DATE: REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 3 OF 11

CADARC\JONES\CALEDONIA\CALSITE\WDB\06-11-03



TREATMENT BUILDING SCHEMATIC

APPROXIMATE SCALE 1"=4'



TYPICAL SVE WELL AND VAULT DETAIL

NOT TO SCALE

NOTES:

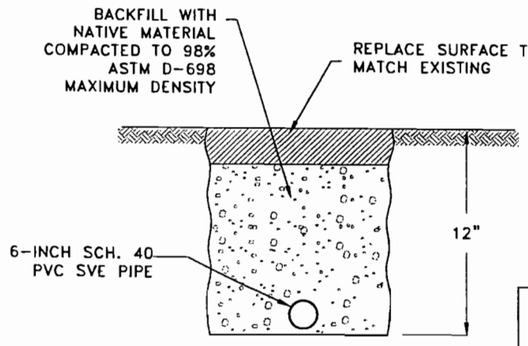
1.) ELECTRICAL LINES AND APPURTENANCES NOT SHOWN FOR CLARITY.

2.) CONTRACTOR SHALL INSTALL ALL ELECTRICAL DEVICES AND COMPONENTS IN COMPLIANCE WITH NEC.

3.) CONTRACTOR SHALL PROVIDE A MODULAR BUILDING THAT MEETS NEW YORK STATE BUILDING CODE REQUIREMENTS FOR SNOW AND WIND LOAD. DESIGN OF BUILDING SHALL BE CERTIFIED BY A REGISTERED NEW YORK P.E.

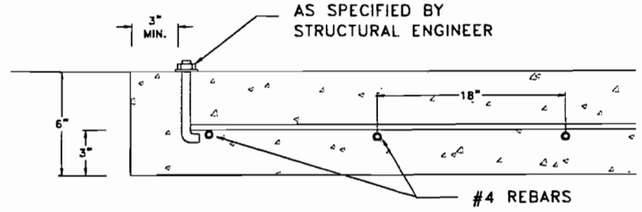
4.) PLANS SHALL BE SUBMITED TO THE ENGINEER FOR APPROVAL.

5.) CONTRACTOR SHALL CONSTRUCT A 6-INCH, 3,500 PSI CONCRETE SLAB WITH #4 REBAR AT 18-INCH O.C.E.W. THE TREATMENT BUILDING SHALL BE ANCHORED TO THE SLAB IN ACCORDANCE WITH STRUCTURAL ENGINEER SPECIFICATIONS.



A-A' TRENCH DETAIL

NOT TO SCALE



B-B' SLAB DETAIL

NOT TO SCALE

LFR LEVINE-FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

Treatment Building Layout, Trench Details, SVE Well Detail, and Slab Detail
JCI Jones Chemicals, Inc. - Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK · A. SCOTT STARR · LICENSED PROFESSIONAL ENGINEER · 078821-1

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SCALE NTS
DATE:REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 4 OF 11

G:\ARC\JONES\CALEDONIA\3165COM\WDB\06-11-03

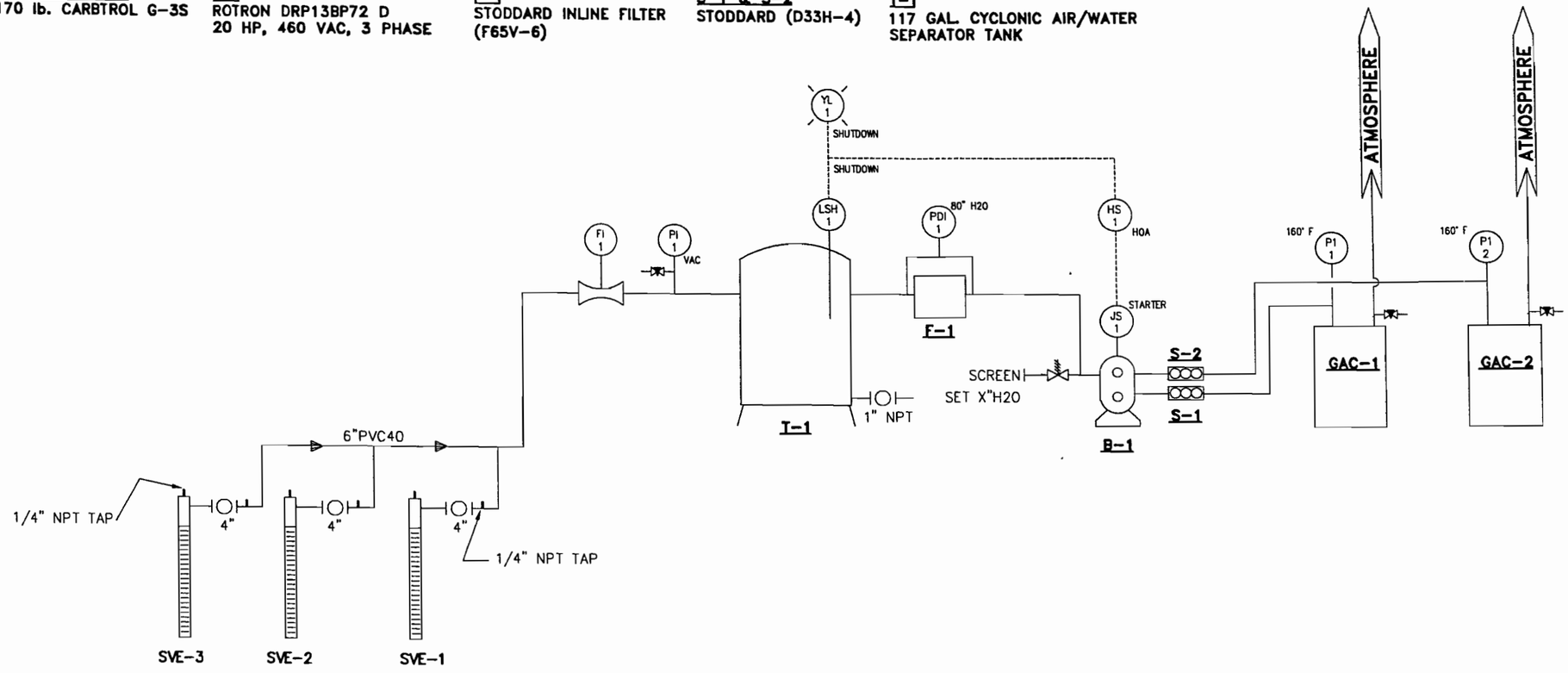
GAC-1 & GAC-2
170 lb. CARBTROL G-3S

B-1
ROTRON DRP13BP72 D
20 HP, 460 VAC, 3 PHASE

F-1
STODDARD INLINE FILTER
(F65V-6)

S-1 & S-2
STODDARD (D33H-4)

T-1
117 GAL. CYCLONIC AIR/WATER
SEPARATOR TANK



LFR LEVINE•FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

System Process Flow Diagram
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK
A. SCOTT STARR
078821-1
LICENSED PROFESSIONAL ENGINEER

6-20-03

SCALE NTS
DATE: REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 5 OF 11

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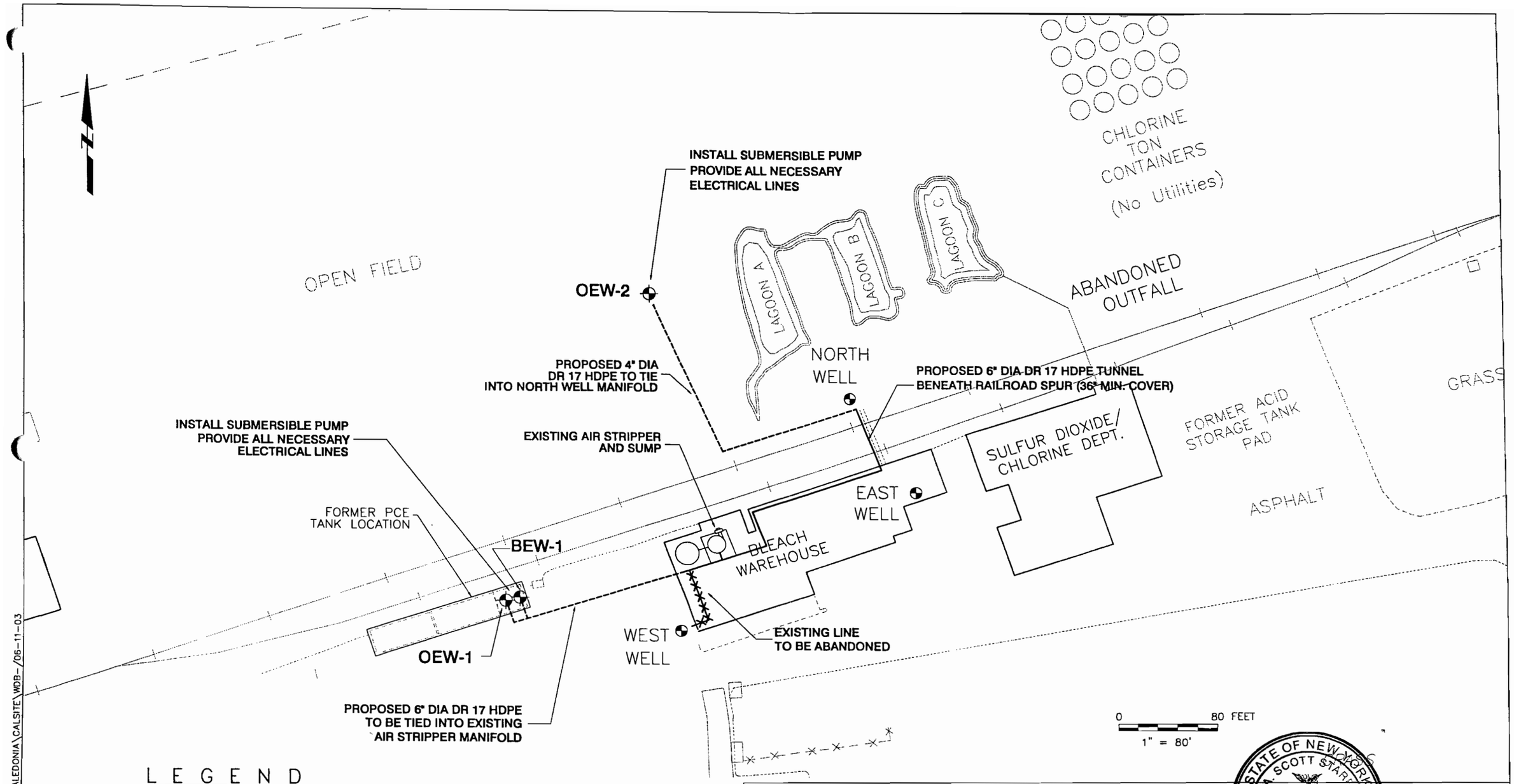

LEGEND

OEW-1 — Proposed Overburdon Extraction Well

BEW-1 — Proposed Bedrock Extraction Well

EAST WELL — Existing Production Well

HDPE High Density Polyethylene

LFR LEVINE·FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

Proposed Extraction Wells and Piping Layo
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK
SEAL
R. SCOTT STARR
078821-1
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SCALE 1"=80'
DATE:REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 6 OF 11

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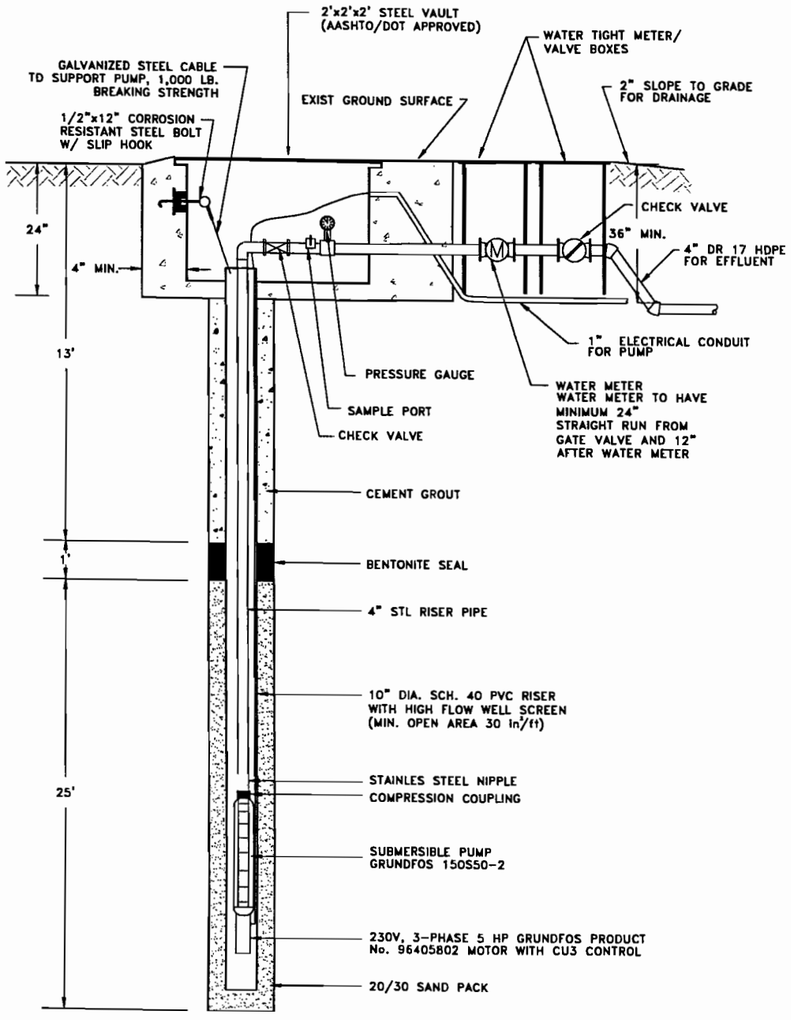
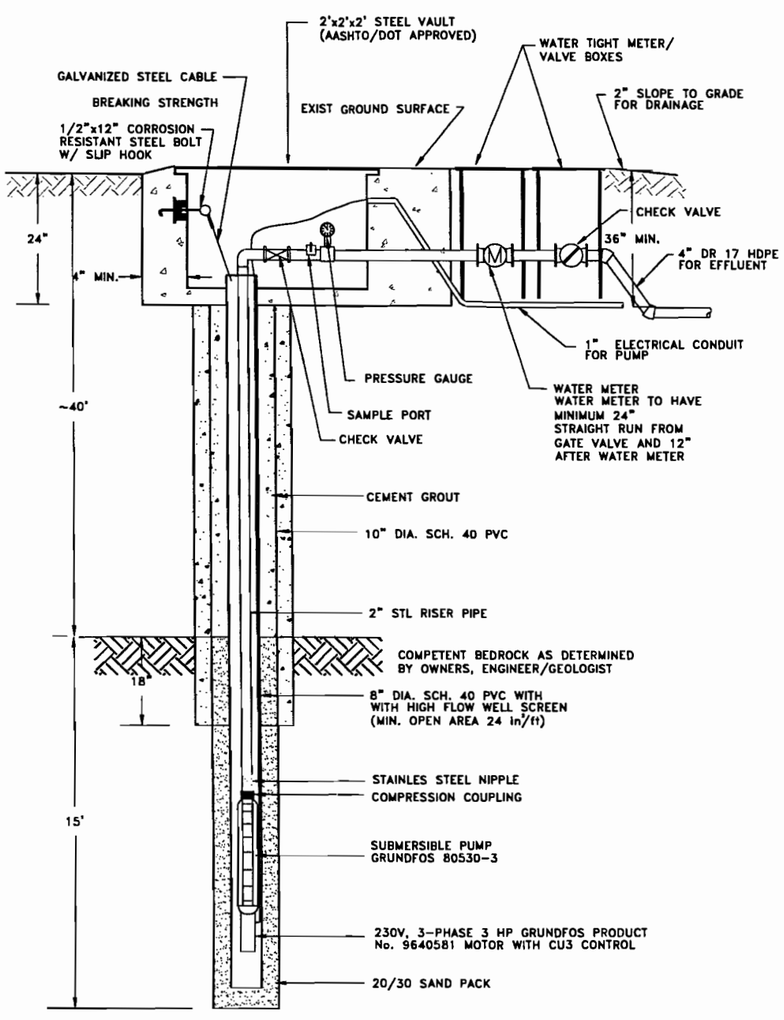
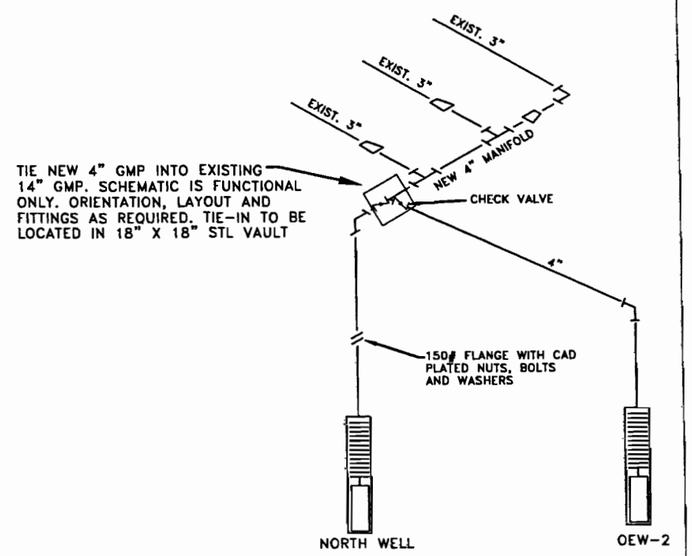


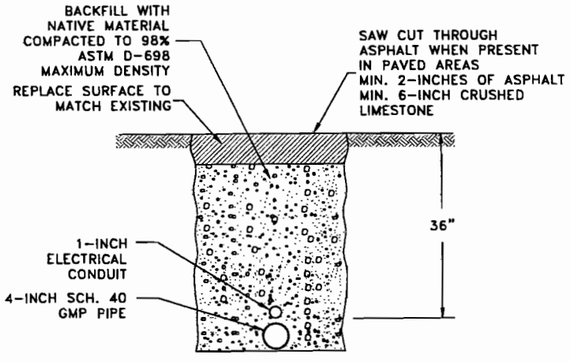
OVERBURDEN GROUNDWATER EXTRACTION WELL AND VAULT DETAIL
NOT TO SCALE



BEDROCK GROUNDWATER EXTRACTION WELL AND VAULT DETAIL
NOT TO SCALE



NORTH WELL TIE-IN DETAIL
NOT TO SCALE



TYPICAL GROUNDWATER EXTRACTION TRENCH DETAIL
NOT TO SCALE

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JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

Extraction Wells and Trench Detail
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

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SCALE NTS
DATE:REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 7 OF 11

C:...ARC\JONES\CALEDONIA\3165WELLS\EVR-WDB\06-11-03

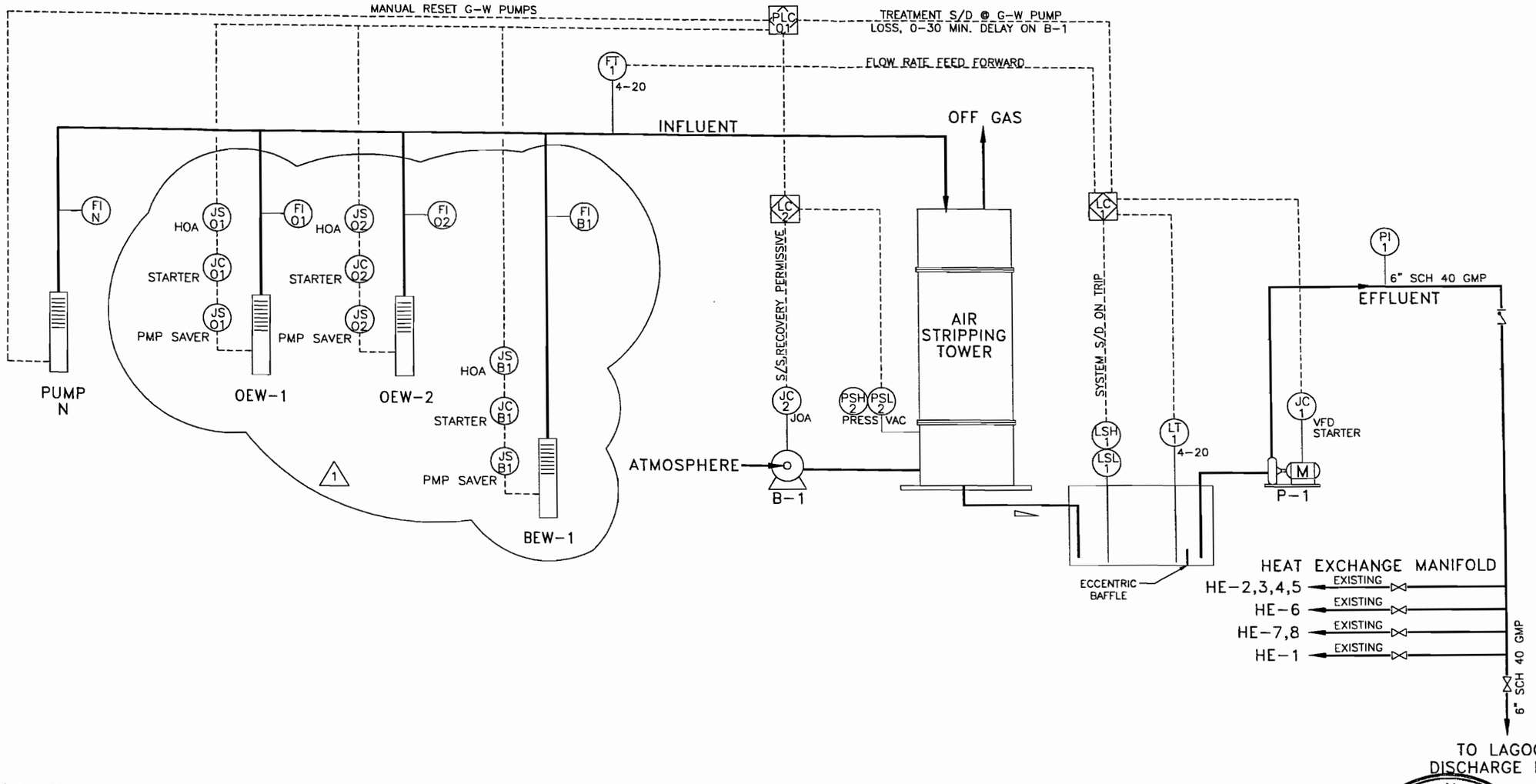
OEW-1
Grundfos 150S50-2
5 hp

OEW-2
Grundfos 150S50-2
5 hp

OEW-1
Grundfos 80530-3
2 hp

B-1 BLOWER
5500 scfm @ 6 in H_2O

P-1 PUMP
625 gpm @ 50 psid



1 SYSTEM ADDITIONS

LFR LEVINE-FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

Pump-and-Treat P&ID
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK · SCOTT STARR · SEAL · 078821-1 · LICENSED PROFESSIONAL ENGINEER

A. Scott Starr
6/20/03

SCALE NTS
DATE:REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 8 OF 11

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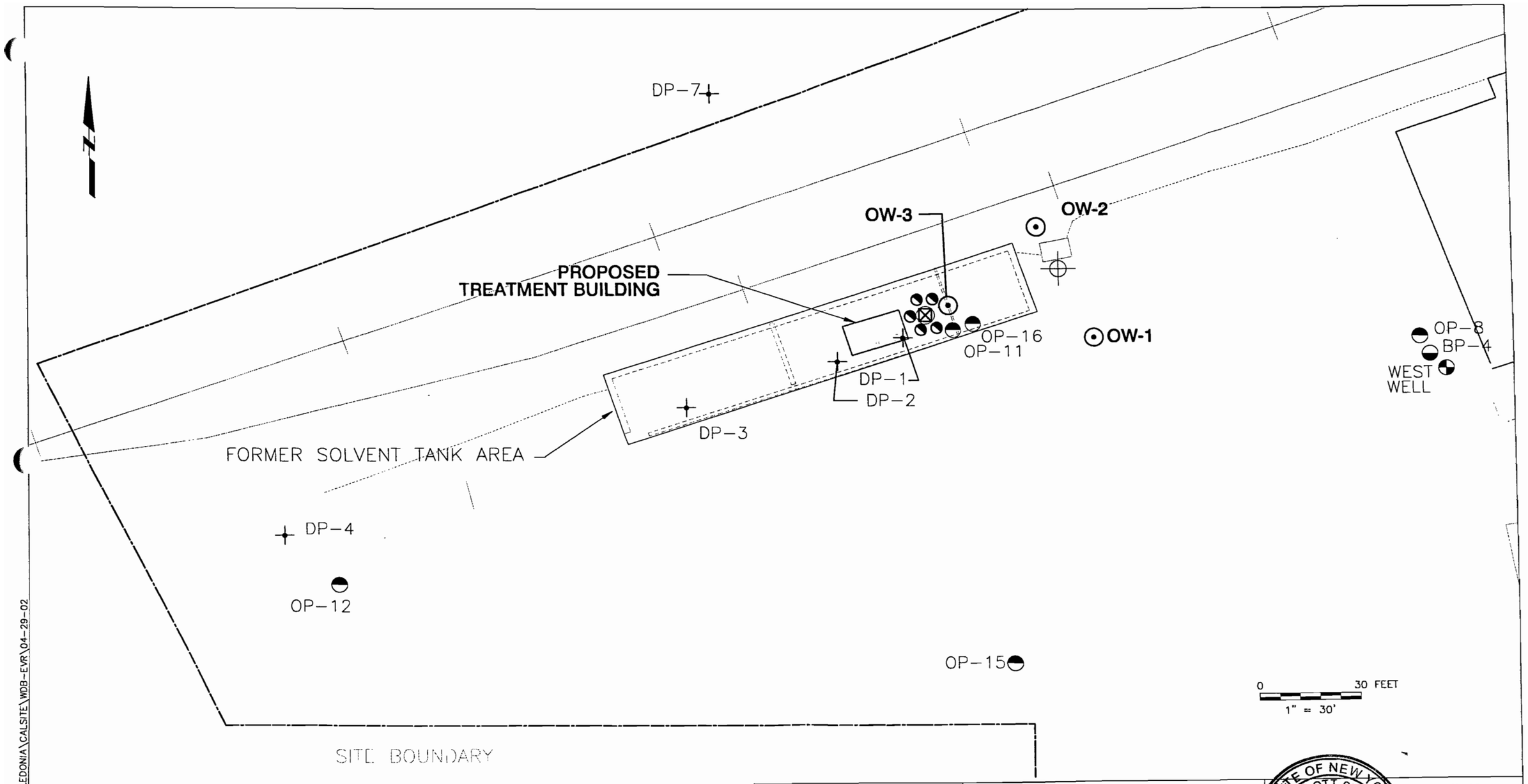

L E G E N D

- Monitoring well-Bedrock
- Shallow Monitoring well
- Production well
- Direct-Push sample locations
- Existing Extraction well
- Proposed Overburden Groundwater Injection Well
- OW-1 Existing Vapor Observation well
- Proposed Bedrock Injection well

LFR
LEVINE-FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

In-Situ Chemical Oxidation Layout
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK
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SCALE	1"=30'
DATE:	REVISED 06-11-03
PROJECT NO.	165.03
SHEET	9 OF 11

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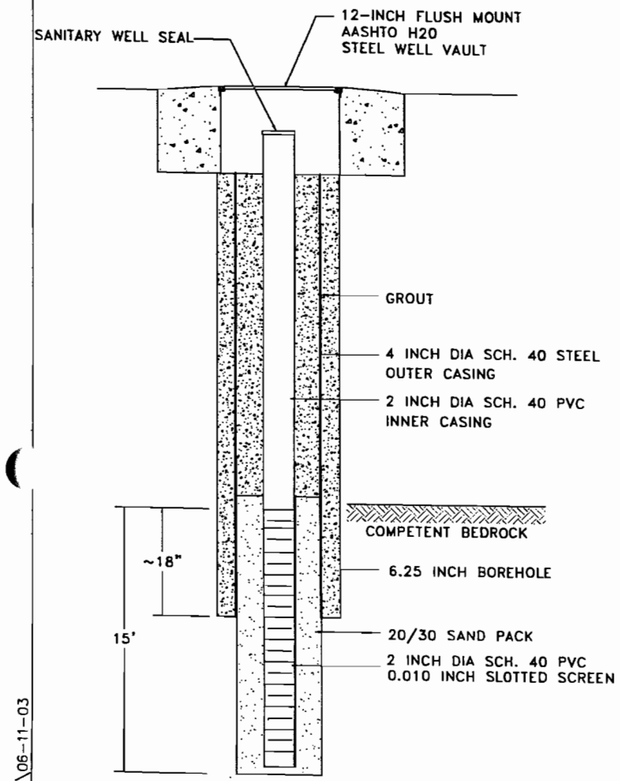
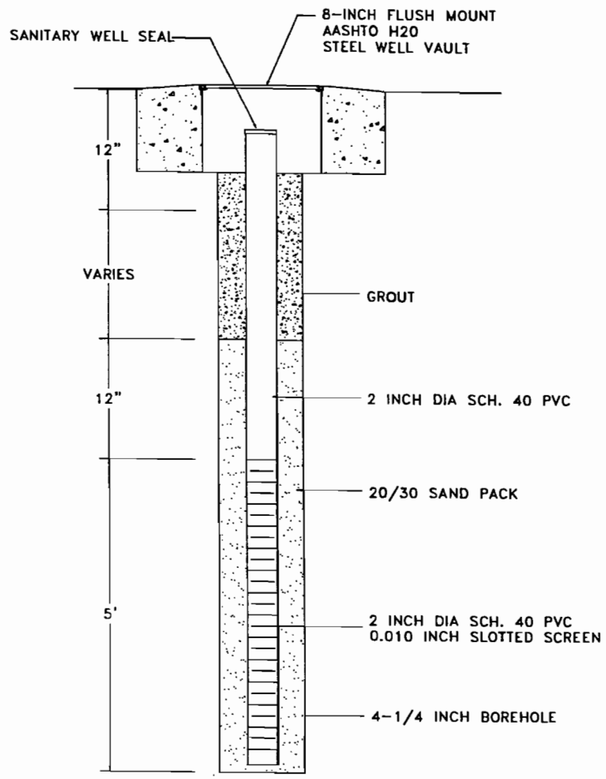
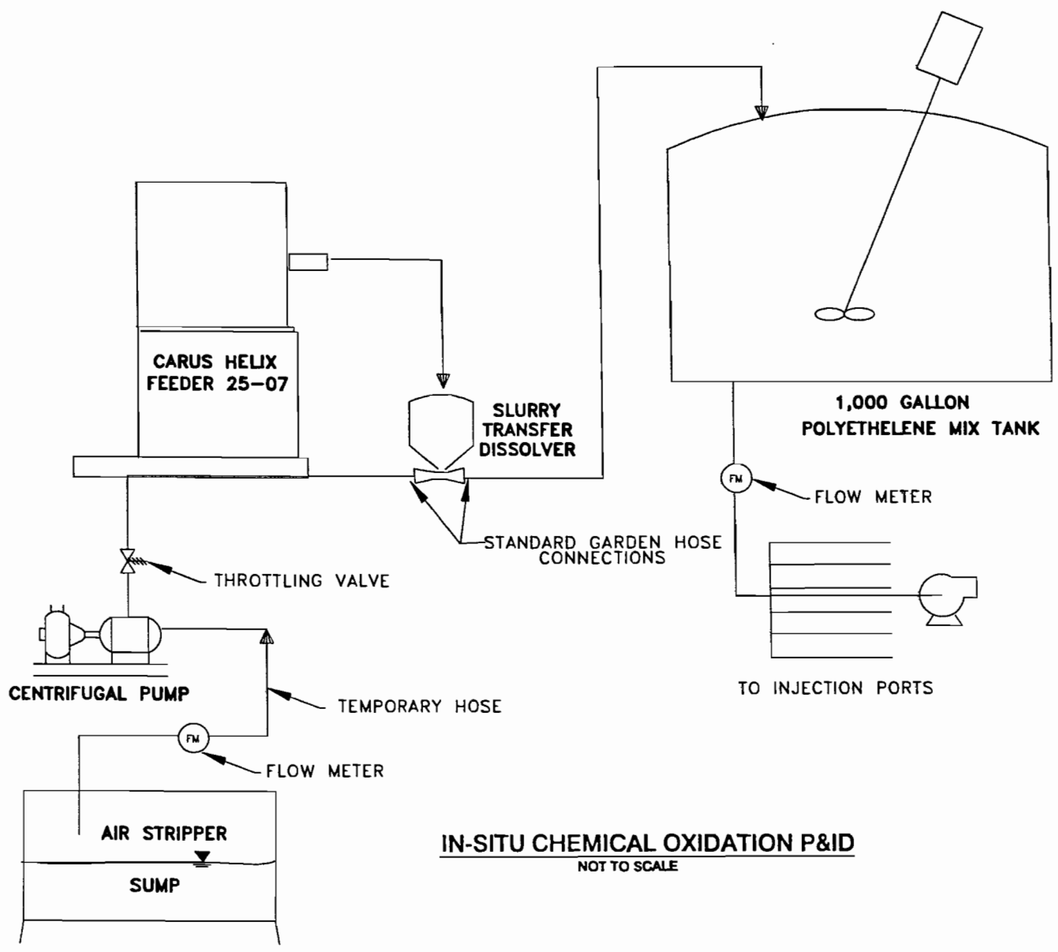


TYPICAL BEDROCK INJECTION WELL
NOT TO SCALE



TYPICAL OVERBURDEN INJECTION WELL
NOT TO SCALE



IN-SITU CHEMICAL OXIDATION P&ID
NOT TO SCALE

LFR LEVINE-FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

ISCO P&ID, Overburden Injection,
and Bedrock Injection Well Details
JCI Jones Chemicals, Inc. - Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

STATE OF NEW YORK
A. SCOTT STARR
078821-1
LICENSED PROFESSIONAL ENGINEER

6-20-03

SCALE NTS
DATE:REVISED 06-11-03
PROJECT NO. 3165.03
SHEET 10 OF 11

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FLOW DIAGRAM SYMBOLS

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

- LOCALLY MOUNTED INSTRUMENT (IN FIELD)
- FRONT PANEL MOUNTED INSTRUMENT (IN CONTROL ROOM)
- BACK PANEL MOUNTED INSTRUMENT (IN CONTROL ROOM)
- FRONT PANEL MOUNTED INSTRUMENT (AUXILIARY LOCATION)
- BACK PANEL MOUNTED INSTRUMENT (AUXILIARY LOCATION)
- SHARED DISPLAY, SHARED CONTROL: DCS OR PLC INPUT/OUTPUT
- COMPUTER FUNCTION DCS OR PLC INPUT/OUTPUT
- PROGRAMMABLE LOGIC CONTROL FUNCTION DCS OR PLC INPUT/OUTPUT
- FRONT PANEL MOUNTED INDICATING LIGHT (IN CONTROL ROOM)

FLOW ELEMENTS

- ORIFICE PLATE W/FLG TAPS
- VORTEX
- POSITIVE DISPLACEMENT
- TURBINE
- PADDLEWHEEL
- AVERAGING PITOT TUBE
- STRAIGHTENING VANE

PIPING AND OTHER IN-LINE INSTRUMENTS

- RUPTURE DISC (PRESSURE)
- RUPTURE DISC (VACUUM)
- REDUCER (1" x 2")
- FILTER
- STRAINER ("Y" TYPE)
- STRAINER (CONE OR FLAT TYPE)
- HOSE CONNECTION
- FLEXIBLE HOSE
- OPEN DRAIN
- SPECTACLE BLIND
- WELD CAP
- THREADED CAP
- THREADED PLUG

LINE SYMBOLS

- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- INSTRUMENT ELECTRICAL SIGNAL
- INSTRUMENT SIGNAL AIR LINE
- INSTRUMENT CAPILLARY LINE
- HYDRAULIC LINE
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
- ELECTRICAL HEAT TRACE
- STEAM HEAT TRACE
- INSULATION
- BATTERY LIMIT (BL)
- CONTINUATION ARROW (DWG. NO.)
- CONTINUATION OUTSIDE OF WORK PRODUCT (TOTAL DWG.)
- MATERIAL, INSULATION OR PIPING SPEC. CHANGE (HF2 | HF3)

VALVES AND ACTUATORS

- SLIDE GATE VALVE
- MANUAL GATE OR CONTROLLING GLOBE VALVE
- MANUAL GLOBE VALVE
- NEEDLE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- DIAPHRAGM VALVE
- 3-WAY VALVE
- 4-WAY VALVE
- PLUG VALVE
- ANGLE VALVE
- CHECK VALVE
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE & VACUUM RELIEF VALVE
- CONTROL VALVE WITH DIAPHRAGM ACTUATOR (FAIL CLOSE) (FC)
- CONTROL VALVE WITH DIAPHRAGM ACTUATOR (FAIL OPEN) (FO)
- PRESSURE REDUCING REGULATOR SELF-CONTAINED
- PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
- BACK PRESSURE REGULATOR SELF-CONTAINED
- MOTOR ACTUATED VALVE (M)
- PNEUMATICALLY ACTUATED VALVE
- SOLENOID ACTUATED 3-WAY VALVE (S)
- HANDWHEEL
- VANE ACTUATOR

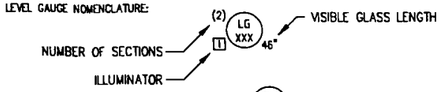
MISCELLANEOUS

- PURGE (P)
- LOGIC INTERLOCK (I)
- CHEMICAL SEAL
- SPECIALTY ITEM (SP)
- TIE IN TO EXISTING PIPING OR PIPING BY OTHERS (TIE IN)
- CORROSION COUPON (CC)

EXPLANATION OF IDENTIFICATION LETTERS

(1) ANY FIRST LETTER, IF USED IN COMBINATION WITH MODIFYING LETTERS D(DIFFERENTIAL), F(RATIO), M(MOMENTARY), K(TIME RATE OF CHANGE), Q(INTEGRATE OR TOTALIZE), OR ANY COMBINATION OF THESE IS INTENDED TO REPRESENT A NEW AND SEPARATE MEASURED VARIABLE, AND THE COMBINATION IS TREATED AS A FIRST LETTER ENTITY. THUS, INSTRUMENTS TDI AND TI INDICATE TWO DIFFERENT VARIABLES, NAMELY, DIFFERENTIAL TEMPERATURE AND TEMPERATURE. MODIFYING LETTERS ARE USED WHEN APPLICABLE.

(2) LEVEL GAUGE NOMENCLATURE:



(3) IDENTIFY RELAYS WITH FUNCTIONAL SUPERSCRIPT. (FY XXX)

(4) IDENTIFY ANALYZERS AND EQUIPMENT WITH SUPERSCRIPT OUTSIDE OF CIRCLE (AE XXX)^{2}
I.E. CO_2, PH, H_2S, ETC.

(5) FOR VACUUM OR DRAFT INSTRUMENTS ADD SUPERSCRIPT OUTSIDE OF CIRCLE (PI XXX) (PI XXX)

(6) EXCEPTIONS TO SCHEDULE OF IDENTIFICATION LETTERS:

FA – FLAME ARRESTOR	I/P – CURRENT TO PNEUMATIC CONVERTER
LD – LIQUID DRAINER	HSD – HAND SHUTDOWN
ST – STEAM TRAP	SS – SELECTOR SWITCH
SP – SET POINT	FC – FAIL CLOSED
BL – BATTERY LIMIT	FO – FAIL OPEN
TC – THERMOCOUPLE	NC – NORMALLY CLOSED
RTD – RESISTANCE TEMPERATURE DETECTOR	NO – NORMALLY OPEN
ESD – EMERGENCY SHUTDOWN	SC – SAMPLE CONNECTION
USD – UNIT SHUTDOWN	SO – STEAM OUT CONNECTION
SD – SHUTDOWN	TSO – TIGHT SHUT OFF
PB – PUSHBUTTON	TS – TEMPORARY STRAINER
HOA – HAND-OFF-AUTO SELECTOR SWITCH	VFD – VARIABLE FREQUENCY DRIVE
LOR – LOCAL-OFF-REMOTE SELECTOR SWITCH	
JOA – JOG-OFF-AUTO SELECTOR SWITCH	

(7) SUPPLY DESIGNATIONS:

AS – AIR SUPPLY	NS – NITROGEN SUPPLY
ES – ELECTRIC SUPPLY	SS – STEAM SUPPLY
GS – GAS SUPPLY	WS – WATER SUPPLY
HS – HYDRAULIC SUPPLY	PG – PROCESS GAS
IA – INSTRUMENT AIR	PW – PROCESS WATER

(8) ELECTRICAL RELAYS, SWITCHES AND MISC. ITEMS IDENTIFIED WITH AN INSTRUMENT TAG BALLOON AND AN (E) SHOWN IN PLACE OF THE INSTRUMENT TAG NUMBER ARE TO BE SPECIFIED AND FURNISHED BY ELECTRICAL.

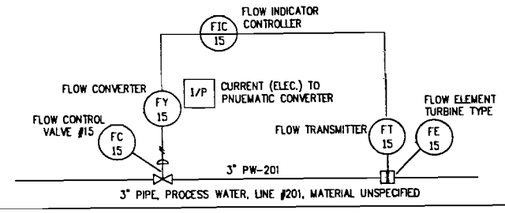
(HDA (E)) (HDA XXX)

(9) INSULATION DESIGNATIONS:

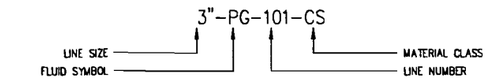
H – HIGH TEMP. MAINTENANCE	NP – NOISE PROTECTION
C – LOW TEMP. MAINTENANCE	
PP – PERSONAL PROTECTION	
FP – FREEZE PROTECTION	

	FIRST LETTER (1)		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, FLAME		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS VIEWING DEVICE		
H	HAND (MANUAL)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE RESTRICTION		
P	PRESSURE VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECH. ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

TYPICAL LOOP IDENTIFICATION



LINE NUMBER DESIGNATION EXAMPLE



LFR LEVINE·FRICKE

JCI JONES CHEMICALS, INC.
SUPERFUND SITE
CALEDONIA, NEW YORK

Process & Instrumentation Legend
JCI Jones Chemicals, Inc.
Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

SCALE:
DATE REVISED 06-11-03
SHEET
OF 11

STATE OF NEW YORK ★ A. SCOTT STARR ★ LICENSED PROFESSIONAL ENGINEER 078821-1

A. Scott Starr
6-20-03

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APPENDIX B

TECHNICAL SPECIFICATIONS

SECTION 00001

REMEDIAL SYSTEMS SPECIFICATIONS
JCI JONES CHEMICAL, INC. SUPERFUND SITE
CALEDONIA, NEW YORK

END OF PROJECT TITLE PAGE

SECTION 00010

TABLE OF CONTENTS

END OF TABLE OF CONTENTS

SECTION 01100

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: JCI Jones Chemicals, Inc.

B. Owner's Name: JCI Jones Chemicals, Inc. (JCI)

C. Engineer's Name: LFR Levine·Fricke (LFR)

D. The Project consists of the construction of remediation systems to clean up tetrachloroethene affected soil and groundwater.

1.02 DESCRIPTION OF WORK

A. Project Informational Drawings.
   1. Construction drawings are provided for information to indicate the proposed layout and the overall equipment for the remediation systems.
   2. Process flow diagrams are provided. Proposed systems shall comply with concept shown on these drawings.

B. Performance Requirements
   1. Provide and install all equipment and supporting structures as specified for the soil vapor extraction (SVE) system, groundwater extraction system, and in-situ chemical oxidation system.
   2. Design and coordinate the tie-in of the proposed groundwater extraction pumps to the existing PLC controller.
   3. Test, check-out and calibrate all components of the supplied systems.
   4. Provide installation assistance, start-up assistance, and training as required by individual specification sections. Also, provide a minimum of 2 days installation and startup assistance.
   5. At system start-up provide three copies of the Operation and Maintenance Manuals for each remediation system. The O&M Manual shall include:
      a. Operational description
      b. Equipment cut sheets including manufacturer's O&M requirements
      c. System startup and shut-down requirements/procedures
      d. Weekly and monthly maintenance requirements
      e. System troubleshooting procedures

1.03 WORK BY OWNER

A. JCI will award a contract for installation of the soil vapor extraction, groundwater extraction, and chemical oxidation injection wells which will commence on or about two weeks prior to initiation of construction of the remediation systems.

1.04 OWNER OCCUPANCY

A. JCI intends to continue to operate normal business operations during the entire construction period.

B. Cooperate with JCI to minimize conflict and to facilitate JCI 's operations.

C. Schedule the Work to accommodate JCI operations.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Work by JCI.

C. Provide access to and from site as required by law and by JCI:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions: work must be performed between 7:30 AM and 6:00 PM.

E. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to JCI and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 Project Schedule

A. Complete project per schedule presented in Request for Proposal.

END OF SECTION

SECTION 01155

ON-SITE HEALTH AND SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Construction/remediation activities may place Contractor's personnel, personnel of other Contractor's hired by Owner to perform work at site, and public in potentially hazardous situations due to exposure to groundwater containing tetrachloroethene, trichloroethene, dichloroethenes, and vinyl chloride.

B. Contractor is responsible for implementation and enforcement of safe work practices including but not limited to personnel exposure to hazardous materials; use of trenching, sheeting, and shoring; operation of equipment; and safety of public during progress of work.

1.02 SUBMITTALS

A. Provide two copies of Health and Safety Plan (HSP) to Owner and Engineer within 5 days notice to proceed. Work on-site shall not proceed until Health and Safety Plan has been submitted to the Engineer.
   1. Submittal of HSP is to inform Engineer and Owner so they can comply with HSP during performance of their on-site responsibilities.
   2. Submittal of Contractor's HSP shall neither impose on Engineer responsibility for adequacy of HSP nor relieve Contractor from full responsibility therefor.

1.03 QUALITY ASSURANCE

A. Contractor shall plan for and ensure personnel comply with basic provisions of OSHA Safety and Health Standards (29 CFR 1910.120), and General Construction Standards (29 CFR 1926) as appropriate[].
   1. Maintain one copy on project site.

B. Comply with applicable laws and regulations of any public body having jurisdiction for safety of persons or property.

1.04 OPERATIONS AND EQUIPMENT SAFETY

A. Contractor is responsible for initiating, maintaining, and supervising safety precautions and programs in connection with the work. Contractor shall take necessary precautions for safety of employees on Project site and other persons and organizations who may be affected by Project.

B. Contractor's duties and responsibilities for safety in connection with Work shall continue until such time as Work is complete and Engineer has issued notice to Contractor that work is complete.

1.05 HEALTH AND SAFETY

A. Contractor is responsible for implementation and enforcement of health and safety requirements and shall take necessary precautions and provide protection for the following:
   1. Personnel working on or visiting Project site, irrespective of employer.
   2. Work and materials or equipment to be incorporated in Work area on or off site.
   3. Other property at or adjacent to Project site.
   4. Public exposed to job related operations or potential release of pollutants, contaminants, or toxic hazardous materials.

B. Contractor shall prepare site specific health and safety plan/contingency plan (HSP). If Contractor does not have capability to prepare HSP, Contractor shall employ consultants with appropriate capability. Contractor is solely responsible for adequacy of HSP's preparation, monitoring, management, and enforcement. At minimum, Contractor's HSP shall address the site description and history; project activities and coordination with other contractors; hazard

evaluation; on-site safety responsibilities; work zones; personnel training; atmospheric monitoring, if appropriate; personal protection, clothing, and equipment; emergency procedures; and a contingency plan.

C. If Owner contracts with others for Work on-site, Contractor shall amend HSP to include provisions for Work of others. Contractor shall also manage, enforce, and monitor health and safety activities of other Contractors during duration of other Contractor's work.

1.06 ENGINEER'S RESPONSIBILITIES

A. When Engineer is required to be present on Project site to perform engineering services, Engineer will comply with Contractor's safety plans, programs, and procedures.

B. If Engineer determines Contractor's safety plans, programs, and procedures do not provide adequate protection for Engineer, Engineer may direct its employees to leave Project site or implement additional safeguards for Engineer's protection. If taken, these actions will be in furtherance of Engineer's responsibility to its employees only, and Engineer will not assume responsibility for protection of any other persons affected by Work.

C. If Engineer observes situations which appear to have potential for immediate and serious injury to persons, Engineer may warn persons who appear to be affected by such situations. Such warnings, if issued, shall be given based on general humanitarian concerns, and Engineer will not by issuance of any such warnings assume any responsibility to issue future warnings or any general responsibility for protection of persons affected by Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Construction progress schedule.

C. Submittals for review, information, and project closeout.

D. Submittal procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Engineer will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. JCI .
   2. Engineer.
   3. Contractor.

C. Agenda:
   1. Execution of JCI-Contractor Agreement.
   2. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   3. Designation of personnel representing the parties to Contract, Contractor and Engineer.
   4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   5. Scheduling.

3.02 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

3.03 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.04 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Other types as indicated.

B. Submit for JCI's benefit during and after project completion.

3.06 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies which the Contractor requires, plus two copies which will be retained by the Engineer.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.07 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

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

E. Deliver submittals to Engineer at business address.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from the Engineer.

H. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and Engineer review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, heat, water, potable water, and sanitary.

1.02 TEMPORARY ELECTRICITY

A. Equipment requiring electric power shall be powered by Contractor's generators or a temporary power drop by the electric utility.

1.03 TEMPORARY HEATING

A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

1.04 TEMPORARY WATER SERVICE

A. Connect to existing water source.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.05 POTABLE WATER

A. Contractor shall supply and provide potable water for their use.

1.06 SANITARY FACILITIES

A. Contractor shall supply and maintain temporary sanitary facilities for their use.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Materials and equipment incorporated into work:
   1. Conform to applicable specifications and standards.
   2. Comply with size, make, type, and quality specified or as specifically approved by Shop Drawing, Engineer, or other submittal.

B. Manufactured and Fabricated Materials and Equipment:
   1. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.
   2. Manufacture like parts of duplicate units to standard size and gauges, to be interchangeable.
   3. Material and equipment shall be suitable for service condition.
   4. Equipment capabilities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically approved in writing, in accordance with General Conditions.
   5. Equipment shall be adapted to best economy in power consumption and maintenance. Parts and components shall be proportioned for stresses occurring during continuous or intermittent operation, and components shall be proportioned for stresses occurring during fabrication and installation.
   6. Design so working parts readily accessible for inspection and repair, easily duplicated, and replaced.

C. Do not use material or equipment for purposes other than for which it is designed or specified.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project.

D. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment.

PART 2 PRODUCTS

2.01 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.02 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Engineer will consider requests for substitutions only within 15 days after date of Agreement.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Engineer will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify

products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of JCI personnel.

H. Closeout procedures, except payment procedures.

1.02 SUBMITTALS

A. Description of Major Equipment
   1. Manufacturers equipment data including operation, materials, dimensions, operating weights, etc,
   2. Pump curves and descriptions of wetted components.
   3. Electrical requirements
   4. Other equipment data required for submittal by other specification sections.

B. Drawings

C. Process and instrumentation diagrams indicating equipment size, utility requirements and control function.

D. As built drawings showing equipment and piping placement.

1.03 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where

necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Engineer four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Engineer of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

F. Utilize recognized engineering survey practices.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

3.05 CUTTING AND PATCHING

A. Execute cutting and patching to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new products in accordance with requirements of Contract Documents.

E. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

F. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

G. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

H. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.06 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

3.08 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

B. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.10 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

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

C. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Engineer when work is considered ready for Substantial Completion.

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

D. Notify Engineer when work is considered finally complete.

E. Complete items of work determined by Engineer's final inspection.

3.13 WARRANTY SERVICE

A. Furnish warranty of all components supplied for one year from date of Substantial Completion.

END OF SECTION

SECTION 02150

OFF GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The off-gas piping system shall consist of buried and above ground pipe, pipe supports, fittings, equipment and accessories..

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only...

B. AMERICAN GAS ASSOCIATION (AGA)..AGA Manual(1994; Addenda/Correction Jan 1996) A.G.A. Plastic Pipe Manual for Gas Service

C. AMERICAN PETROLEUM INSTITUTE (API)..API Spec 5L(2000) Line Pipe.

D. API Spec 6D(1994; Supple 1 Jun 1996; Supple 2 Dec 1997) Pipeline Valves (Gate, Plug, Ball, and Check Valves)

E. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTM A 153/A 153M(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

F. ASTM A 181/A 181M(2001) Carbon Steel Forgings, for General-Purpose Piping

G. ASTM A 307(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

H. ASTM A 53(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

I. ASTM C 920(1998) Elastomeric Joint Sealants

J. ASTM D 1248(2000) Polyethylene Plastics Molding and Extrusion Materials

K. ASTM D 1598(1986; R 1997) Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

L. ASTM D 1693(2000) Environmental Stress-Cracking of Ethylene Plastics

M. ASTM D 1784(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

N. ASTM D 2241(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

O. ASTM D 2447(1999) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

P. ASTM D 2466(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40

Q. ASTM D 2467(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

R. ASTM D 2513(2000) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

S. ASTM D 2517(2000) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

T. ASTM D 2564(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

U. ASTM D 2672(1996a) Joints for IPS PVC Pipe Using Solvent Cement

V. ASTM D 2683(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

W. ASTM D 2774(1994) Underground Installation of Thermoplastic Pressure Piping

X. ASTM D 2855(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and

Fittings

Y. ASTM D 2992(1996el) Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings

Z. ASTM D 3139(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

AA. ASTM D 3915(1999a)Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications

AB. ASTM E 515(1995) Leaks Using Bubble Emission Techniques

AC. ASTM F 1055(1998) Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

AD. ASTM F 402(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

AE. ASTM F 442/F 442M(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AF. ASTM F 656(1996a) Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

AG. AMERICAN WATER WORKS ASSOCIATION(AWWA)..AWWA C218Coating the Exterior of Aboveground Steel Water Pipelines and Fittings

AH. ASME INTERNATIONAL (ASME)..ASME B1.20.1(1983; R 1992) Pipe Threads, General Purpose (Inch)

AI. ASME B16.11(1996) Forged Fittings, Socket-Welding and Threaded

AJ. ASME B16.21(1992) Nonmetallic Flat Gaskets for Pipe Flanges

AK. ASME B16.5(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

AL. ASME B16.9(1993) Factory-Made Wrought Steel Buttwelding Fittings

AM. ASME B31.8(1995) Gas Transmission and Distribution Piping Systems

AN. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

AO. MSS SP-25(1998) Standard Marking System for Valves, Fittings, Flanges and Unions

AP. MSS SP-58(1993) Pipe Hangers and Supports - Materials, Design and Manufacture

AQ. MSS SP-69(1996) Pipe Hangers and Supports - Selection and Application

AR. MSS SP-72(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service

AS. MSS SP-89(1998) Pipe Hangers and Supports - Fabrication and Installation Practices

AT. NACE INTERNATIONAL (NACE)..NACE RP0185(1996) Extruded, Polyolefin Resin Coating Systems with Soft Adhesives for Underground or Submerged Pipe

AU. NACE RP0274(1998) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

AV. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)..NFPA 325-1(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

AW. NFPA 49(1994) Hazardous Chemicals Data

AX. NFPA 58(1998; Errata 58-98-1) Liquefied Petroleum Gas Code..NFPA 704(1996) Identification of the Fire Hazards of Materials for Emergency Response

AY. PLASTICS PIPE INSTITUTE (PPI)..PPI AW-32 TR21(2001) Thermal Expansion and Contraction of Plastic Pipe

AZ. THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)..SSPC SP 6(1994) Commercial Blast Cleaning

BA. UNDERWRITERS LABORATORIES (UL)..UL Gas&Oil Dir(1999) Gas and Oil Equipment Directory

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.
   1. Drawings containing graphical relationship of various components of the work, schematic diagrams of the systems, details of fabrication, layouts of particular elements, connections, clearance required for maintenance and operation, and other aspects of the work to demonstrate that the system has been coordinated and will properly function as a unit.
   2. Manufacturer's descriptive data and technical literature for each piping system, including design recommendations, pressure and temperature ratings, dimensions, type, grade and strength of pipe and fittings, thermal characteristics (coefficient of expansion and thermal conductivity) and chemical resistivity for each chemical constituent in the off-gas stream.
   3. Manufacturer's recommended installation procedures including materials preparation, and installations
   4. Pressure Testing
   5. Three copies, in indexed booklet form, of site specific operation and maintenance manual for the piping system including system operation, system maintenance, equipment operation, and equipment maintenance manuals described below.
   6. Warranty

1.04 QUALIFICATIONS

A. Contractor shall have a minimum of 3 years of experience in the construction of piping systems for sour gas, condensable gas, off-gas or vapor

B. Single Source Supplier
   1. The Contractor shall assign to a single supplier full responsibility for the furnishing of the off-gas piping system. The designated single supplier, however, need not manufacture the system but shall coordinate the selection, assembly, installation, and testing of the entire system as specified herein.

C. Manufacturer's Representative
   1. Services of a manufacturer's field service representative who is experienced in the installation of the materials and equipment furnished and who has complete knowledge of the proper operation and maintenance of the system shall be provided.

D. Jointing Plastic and Fiberglass Reinforced Pipe
   1. Manufacturer's prequalified joining procedures shall be used. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with AGA Manual. Joiners and inspectors shall be qualified at the job site by a person who has been trained and certified by the manufacturer of the pipe, to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training shall include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA Manual.

1.05 GENERAL REQUIREMENTS

A. Piping material and appurtenances shall be as specified and as shown on the drawings, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer.

B. Standard Products
   1. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have

been in satisfactory use for at least 2 years prior to bid opening. Pipe, valves, fittings and appurtenances shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site

C. Verification of Dimensions
   1. The Contractor shall become familiar with details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.

1.06 DELIVERY AND STORAGE

A. Packaging
   1. Plastic pipe shall be packed, packaged and marked in accordance with ASTM D 3892

B. Cleaners, Solvents and Glues
   1. A material safety data sheet in conformance with ANSI Z400.1 shall accompany each chemical delivered for use in pipe installation. Handling shall be in accordance with ASTM F 402.

C. Storage
   1. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Piping bundles shall be stored on a prepared surface and should not be stacked more than two bundles high.

1.07 SEQUENCING AND SCHEDULING

A. Blowers and control valves are specified in 11215 FANS/BLOWERS/PUMPS; OFF-GAS. Installation shall be as specified in Section 02315 and 02316 TRENCH EXCAVATION and FILL AND BACKFILL, except as modified herein or required by ASTM D 2774, ASTM D 2855, ASTM D 3839, or ASTM F 402, as appropriate for the pipe material.

PART 2 PRODUCTS

2.01 DESIGN STRENGTH

A. Design strength of piping shall be suitable for the operating pressure and temperature ranges indicated and/or shown.

B. STEEL PIPE
   1. For exposure potential to pressures less than 70 kPa (10 psig) and temperatures less than 100 degrees C (212 degrees F) and mild chemical exposure surface shall be blasted in accordance with SSPC SP 6. Steel pipe shall be Schedule 40 conforming to Grade A or B, Type E or S of ASTM A 53. Pipe threads shall conform to ASME B1.20.1. Fittings for pipe 1-1/2 inches and smaller shall conform to ASME B16.11. Buttweld fittings for pipe 1-1/2 inches or less shall conform to ASME B16.9. Joint sealing compound shall conform to UL Gas&Oil Dir, Class 20 or less. Polytetrafluoroethylene tape shall conform to ASTM D 3308. Weld neck flanges shall be used. Connections shall conform to ASTM A 181/A 181M, Class 60, carbon steel. Carbon steel components shall be coated with corrosion resistant materials. Coatings and finishes shall be 100 percent holiday free.
   2. Carbon Steel Located Above Grade
      a. Surfaces of aboveground carbon steel components shall be coated in accordance with AWWA C218.

C. POLYVINYL CHLORIDE (PVC) PIPING
   1. Design and fabrication of below grade components of the off-gas piping system shall be in accordance with ASTM D 2513 except as modified herein.
   2. PVC Pipe
      a. Pipe shall be in accordance with ASTM F 442/F 442M, ASTM D 2241, SDR 26. Materials shall conform to ASTM D 3915, ASTM D 1784, Type IV, Grade 1, rigid

(23447-B). The maximum eccentricity of the inside and outside circumferences of the pipe walls shall be 12 percent. Pipe shall be provided which does not fail, balloon, burst, or weep as defined in ASTM D 1598.

3. PVC Joints
   a. Joints shall be pressure rated solvent cemented bell joints in accordance with ASTM D 2672 except where flanged or threaded fittings are required at expansion joints, valves, flowmeter, equipment connections or otherwise shown. Flanges shall be joined to pipe by solvent cementing. Primer shall conform to ASTM F 656. Solvent cement shall conform to ASTM D 2564.
4. PVC Fittings
   a. Fittings shall be in accordance with ASTM D 2466.

D. FLANGED CONNECTIONS
1. Flanges
   a. Flanges shall be Class 150, socket weld, flat face in accordance with ASME B16.5. Drilling and dimensions of flanges, bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 150. Bolts and nuts shall conform to ASTM A 307.
2. Gaskets
   a. High temperature gaskets for above 160 degrees C (320 degrees F) should be aramid fibers bonded with nitrile butadiene rubber (NBR) or glass fibers bonded with polytetrafluoroethylene. EPDM is suitable for 100 degrees C (212 degrees F) or less. Chloroprene rubber is suitable for 80 degrees C (176 degrees F) or less. Florin rubber (i.e., Viton) and nitrile are suitable for 160 degrees C (320 degrees F) or less. Gaskets shall be full face, non-asbestos compressed material compatible with the expected condensates in accordance with ASME B16.21, 1/16 inch minimum thickness, full face or self-centering flat ring type. Gaskets shall be aramid fibers bonded with nitrile butadiene rubber (NBR) or glass fibers bonded with polytetrafluoroethylene suitable for 200 degrees F service and meeting applicable requirements of ASME B31.8 NFPA 58. High temperature gaskets shall be suitable for above 160 degrees C 320 degrees F.

E. Sealants
1. Sealants shall conform to ASTM C 920.

2.02 EQUIPMENT AND APPURTENANCES

A. Manually Operated Valves
1. Ball valves shall be in accordance with MSS SP-72. Gate, plug, ball, and check valves shall be in accordance with API Spec 6D. Thermoplastic gas shutoffs and valves shall be in accordance with ASME B16.40.

B. Relief Valves
1. Relief valve with manually adjustable pressure differential shall be provided for each blower or vacuum pump. Relief valve diameter shall be line sized or as otherwise indicated and shall be rated to relieve 750 cubic feet per minute at a set vacuum of 70 inches water. Materials shall be aluminum, bronze, or cast iron body, bronze or 316 stainless steel trim, and Buna-N, EPR, nitrile, Viton, or Teflon elastomers. Maximum operating temperature and pressure shall be 200 degrees F and 20 pound per square inch.

C. Supports for Aboveground Piping
1. Pipe hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and accessories. Design and construction shall be in accordance with MSS SP-58. Specific application shall be in accordance with MSS SP-69. Hanger and supports shall be capable of adjustment after placement of piping. Hangers and supports shall be the product of one manufacturer. Hangers, supports and accessories shall be hot dip galvanized in accordance with ASTM A 123/A 123 Munless copper or plastic coated. Restrained joints and thrust protection shall be provided. Concrete and metal cradles,

collars, floor stands, supports, kickers, and block shall be provided as recommended by manufacturer. Pipe cradle cushion material shall be elastomer sheet strapped to pipe to prevent chafing at pipe support. Elastomer sheet shall be utilized around top of pipe to prevent chafing of pipe strap.

PART 3 EXECUTION

3.01 CONDENSATE CONTROL

A. Off-gas piping shall be sloped uniformly between control elevations to enhance the removal of liquids. Provisions shall be made to collect and drain liquids from condensation in each pipe run by sloping the piping back to the extraction wells.

3.02 PRESSURE REGULATOR AND METER INSTALLATION

A. Vents
   1. Discharge stacks, vents, or outlet ports of devices shall be located where gas can be discharged into the atmosphere without undue hazard. Vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding. Stacks and vents shall be provided with fittings to preclude entry of water.

3.03 INSTALLING PIPE UNDERGROUND

A. Installation shall be as specified in Section 02315 and 02316 TRENCH EXCAVATION and FILL and BACKFILL, except as modified herein; and as required by ASTM F 402 and ASTM D 2855 for using solvents and cleaners, ASTM D 2774 for polyvinyl chloride and polyethylene pipe, and ASTM D 3839 for fiberglass pipe.

B. Valve Boxes
   1. Valve boxes shall be installed at each underground valve except where concrete or other type of housing is indicated. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Valve boxes shall be separately supported, not resting on the pipe, so that traffic loads cannot be transmitted to the pipe.

C. Magnetic Tape
   1. When non-metallic piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector.

3.04 INSTALLING PIPE ABOVEGROUND

A. With the exception of vacuum pipe segments as indicated and/or shown, thermoplastic pipe shall not be installed aboveground. Vertical pipe shall be installed plumb in all directions. Perpendicular piping shall be installed parallel to building walls. Piping at angles and 45 degree runs across corners will not be accepted unless specifically shown. Small diameter piping shall be installed generally as shown when specific locations and elevations are not indicated. Piping shall be located to avoid ducts, equipment, and beams. Piping shall be installed to avoid obstructing corridors, walkways, work areas, and like spaces. A minimum headroom clearance of 7 feet shall be provided under piping unless otherwise indicated. Temporary caps or plugs shall be provided at pipe openings at the end of each day's work. Piping shall be run in groups where practicable. Minimum clearance shall be 1 in between pipe and other work.

B. Hangers and Supports
   1. Pipe hangers and supports shall be installed in accordance with MSS SP-89 and MSS SP-69. Hangers or supports shall be installed at locations where pipe changes direction. Hanger rods shall be installed straight and vertical. Chain, wire, strap or perforated bar hangers will not be permitted. Hangers shall not be suspended from piping. Where proper hanger or support spacing does not correspond with joist or rib spacing, pipe shall be

suspended from structural steel channels attached to joists or ribs. Contact between dissimilar metals shall be prevented when supporting copper tubing, by use of copper plated, rubber or vinyl coated, or stainless steel hangers or supports. Thin walled stainless steel piping shall be isolated from carbon steel by use of plastic coated hangers or supports or by taping at points of contact with PVC or vinyl. Galvanized or stainless steel hangers and supports shall be used in basins or submerged locations. Maximum support spacing unless otherwise shown or approved for standard weight steel pipe shall be as follows:

a. Pipe Size Spacing
b. Up to size 1-1/2 in 6 feet.
c. 2 to 3 in 10 feet.
d. Greater than 3-1/2 in 12 feet

2. Maximum support spacing for pipe other than standard weight steel shall be two-thirds of the corresponding spacing for steel pipe unless otherwise shown or approved.

C. JOINTING PIPE
1. Non-metallic piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA Manual. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with AGA Manual.
2. O-Ring Joints
a. Jointing surfaces and adjacent areas shall be cleaned before making joint. Gaskets and "O"-rings shall be lubricated and adjusted in accordance with manufacturer's recommendations. Each gasket shall be checked for proper position around full circumference of the joint after "O"-rings are compressed and before pipe is brought fully home. Jointing pipe shall be done in accordance with ASTM D 3139 and manufacturer's recommendations.
3. Mechanical Joints
a. The plain end shall be centered and pushed into the bell. The gasket shall be firmly pressed evenly into the bell. The gland shall be slipped to the bell for bolting. The bolt threads shall be oiled. Bolts shall be tightened alternately 180 degrees opposite to each other to seat the gasket evenly. Bituminous coating shall be applied to ferrous bolts and nuts before assembly. The maximum torque on bolts shall be as follows:

	Bolt Size	Applied Torque
1)	5/8 in	50 ft-lb
2)	3/4 in	80 ft-lb
3)	1 in	90 ft-lb.
4)	1-1/4 in	110 ft-lb

D. Expansion Couplings
1. Expansion couplings in tension shall be provided to facilitate their removal. Stretcher bolts shall be set for maximum allowable elongation of expansion coupling as recommended by the manufacturer. Expansion couplings shall be provided as shown and as recommended by the manufacturer.

3.05 CONNECTIONS

A. Transitions Between Types of Pipe
1. Necessary adapters, specials and connector pieces shall be provided when connecting different types and sizes of pipe or pipe furnished by different manufacturers. Underground connecting joints shall be encased with, 6 inches minimum, Class B concrete unless otherwise shown, or recommended by manufacturer. Connections between piping and equipment, where required, shall be made using proper fittings to suit the actual conditions.

B. Connections to Off-Gas Source and Discharge Points
1. Contractor shall connect the off-gas pipelines to the source and discharge locations. The Contractor shall notify the Engineer, in writing, 10 days before final connections and

activation of the system.

C. Connection to Equipment
   1. The Contractor shall provide connections to the equipment in accordance with approved procedures. Isolation of equipment shall only be done at the valve location shown on the drawings.

D. Location of Existing Piping
   1. Locations of existing piping shown should be considered approximate. Contractor shall be responsible for determining exact location of existing piping which may be affected by his work during earth moving operations.

3.06 PRESSURE AND LEAKAGE TESTS

A. Tests shall be performed on sections that can be isolated. Joints shall be tested in sections prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. Labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection during the tests. The Contractor shall be responsible for the cost of repair, replacement, and retesting required because of failure to meet testing requirements. Prior to testing the system, the interior shall be blown out, cleaned and cleared of foreign materials. Meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of foreign materials. The Contractor shall maintain safety precautions for pressure testing during the tests. Contractor shall notify Engineer 24 hours in advance of pressure, leakage and/or vacuum testing. Tests shall be conducted in the presence of the Engineer unless otherwise directed. During the test, the entire system shall be completely isolated from compressors and other sources of pressure. Testing shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. Leakage test shall be conducted only after satisfactory completion of pressure test.
   1. Bubble Tests
      a. Each joint shall be tested in accordance with ASTM E 515 prior to backfilling or concealing any work.
   2. Pressure Testing
      a. Test pressure shall be not less than 1.5 times the design pressure, but shall not exceed 1.5 times the maximum rated pressure of the lowest-rated component in the system. Test pressures should recognize the weakest component of each segment tested for the design pressure and the maximum allowable operating pressure. Backfill shall be placed and compacted to at least the pipe centerline before testing. Concrete for blocking shall be allowed to reach design strength and shall be backfilled and compacted to assure restraint by harnessed joints before testing. Section to be tested shall be slowly filled with air. Corporation cocks shall be installed as necessary to remove air. Test pressure shall be applied for one hour and gauge pressure shall be observed. Leaks shall be continuously checked while test pressure is being maintained. The off-gas piping system shall be tested after construction and before being placed in service using air as the test medium. The pressure test shall continue for at least 1 hour from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of the test pressure, 100 psig, applied at the lowest elevation of the pipeline section, during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2)=T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. Lines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.
   3. Vacuum Testing

a. Test shall be performed on individual sections as approved by the Engineer. Openings shall be sealed in system or section to be tested. Vacuum 30 inches water shall be pulled for one hour (isolating system from vacuum by closing valves). System shall be allowed to normalize and then the initial vacuum readings shall be recorded. The vacuum shall be recorded at intervals of 1/4 hour for the duration of the 1 hour test. Measurable leakage (loss of vacuum) after corrections have been made for changes in atmospheric conditions in conformity with the relationship T(1)P(2)=T(2)P(1), in which T and P denote absolute temperature and total pressure, respectively, and the numbers denote initial and final readings, shall be repaired and retested.

4. Hanger Acceptance Testing
   a. Pipe systems shall be brought up to operating pressures and temperatures. Systems shall be recycled to duplicate operating conditions.

3.07 Demonstration

A. Upon completion of the work and at a time designated by the Engineer, the services of qualified personnel shall be provided by the contractor for a period of not less than 8 hours to instruct a representative of the Owner in the operation and maintenance of equipment furnished under this section.

END OF SECTION

SECTION 02200

SITE PREPARATION

PART 1 GENERAL - NOT USED

PART 2 PRODUCTS - NOT USED

2.01 MATERIALS

A. Fill Material: As specified in Section 02316 - Fill and Backfill

PART 3 EXECUTION

3.01 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to JCI.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to JCI.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.02 DEBRIS

A. Remove concrete rubble in area of soil vapor extraction system and move to JCI designated area on-site to allow for placement of geotextile as specified in Section 02372.

3.03 West Well Piping Abandonment

A. Contractor will cut the existing galvanized metal pipe on each ends leading from the West well to the air stripper. Any liquids in the piping shall be removed and containerized for treatment by Owner. The ends of the piping shall be capped and the pipe abandoned in-place.

END OF SECTION

SECTION 02315

TRENCH EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for slabs-on-grade, paving, site structures, and groundwater and vapor piping.

B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

A. Section 02316 - Fill and Backfill: Fill materials, filling, and compacting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

3.02 TRENCH EXCAVATING

A. Trench bottoms shall be over-excavated to accommodate the installation of granular bedding as detailed on the drawings. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1-inch or greater in any dimension or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing or unless otherwise indicated by Engineer.

B. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Where rocks and gravelly soils with stones greater than 4 inches in any dimension or as defined by the pipe manufacturer are encountered in the bottom of the trench, such material shall be removed 6 inches below the required grade and replaced with suitable materials as provided in Section 02316.

D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored. Furnish, place and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, damage the pipe, structures, or other work; diminish the width necessary for construction; otherwise damage or delay the work of the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavations. Remove loose matter.

G. Discontinue machine excavation in the vicinity of pipes, conduits and other underground structures and facilities and complete the excavation with hand tools as required by Industrial Code Rule 53. When determination of the exact location of a pipe or other underground structure is necessary for completing the work properly, excavate test holes to determine such locations.

H. Where unsuitable or unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in Section 02316. When removal of unsuitable or unstable material is required due to the fault or neglect of the Contractor in his performance of the Work, the

resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

I. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and remove all such water as fast as it may collect, in such a manner as shall not interfere with the progression of the work or the proper placing of pipes, or other work.

J. Minimize the creation and dispersion of dust.

K. Stockpile excavated material to be re-used in area designated on site.

3.03 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 02316

TRENCH FILL AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for slabs-on-grade, paving, and water and soil vapor piping.

B. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

A. Section 02315 - Excavation: Removal and handling of soil to be re-used.

B. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 1997.

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2000a.

C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.

D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2000.

E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994.

F. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2001.

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2001.

I. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

3.02 TRENCH BACKFILLING AND COMPACTION

A. Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified.

B. Each layer shall be compacted to not less than 98% of laboratory maximum density.

C. Trenches shall be backfilled to the grade shown on construction drawings. The trench shall not

be backfilled until all specified tests are performed.

D. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

E. Bedding shall conform to the details shown of the drawings. Material shall be deposited in 6 inch loose layers and compacted with approved methods to at least 98 percent maximum density. Bedding shall consist of select native material.

F. Other areas: Use native material, flush to required elevation, compacted to minimum 98 percent of maximum dry density.

3.03 SPECIAL REQUIREMENTS

A. Under paving, slabs-on-grade, and similar construction: 98 percent of maximum dry density.

B. Special requirements for both excavation and backfill relating to the specific utilities are as follows:
   1. Electrical Distribution Conduit: Direct burial cable and conduit shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

END OF SECTION

SECTION 02372

GEOMEMBRANE SURFACE LINER

PART 1 GENERAL

1.01 REFERENCES

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) (1999) Tensile Properties of Plastics

B. ASTM D 6497 (2000) Mechanical Attachment of Geomembrane to Penetrations or Structures

C. ASTM D 792 (1998) Density and Specific Gravity (Relative Density) of Plastics by Displacement

D. ASTM D 1204 (1994) Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

E. ASTM D 1505(1998) Density of Plastics by the Density-Gradient Technique

1.02 SYSTEM DESCRIPTION

1.03 SUBMITTALS

A. The following submittals must be forwarded to the Engineer 7 days prior to geomembrane placement upon request:
   1. Shop Drawings Layout and Detail Drawings
   2. Geomembrane penetration detail drawings
   3. Manufacturer's and fabricator's QC manuals
   4. Field Seaming procedures

1.04 QUALIFICATIONS

A. Manufacturer
   1. Manufacturer shall have produced the proposed geomembrane sheets for at least 5 completed projects having a total minimum area of 5 million square feet.

B. Fabricator
   1. The fabricator is responsible for seaming geomembrane sheets into panels. Fabricator shall have fabricated the proposed geomembrane panels for at least 5 completed projects having a total minimum area of 2 million square feet.

C. Installer
   1. The installer is responsible for field handling, deploying, seaming, anchoring, and field Quality Control (QC) testing of the geomembrane. The installer shall have installed the proposed geomembrane material for at least 5 completed projects having a total minimum area of 100,000 square feet. At least one seamer shall have experience seaming a minimum of 10,000 square feet of the proposed geomembrane using the same type of seaming equipment and geomembrane thickness specified for this project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Poly-Flex, Inc.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. HDPE Liner: 40 millimeter.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation:
   1. Surface preparation shall be performed in accordance with Section 02200. Rocks larger than 4 inch in diameter and any other material which could damage the geomembrane shall be removed from the surface to be covered with the geomembrane. Construction equipment tire or track deformations beneath the geomembrane shall not be greater than 1.0 inch in depth. Each day during placement of geomembrane, the Engineer and installer shall inspect the surface on which geomembrane is to be placed and certify that the surface is acceptable. Repairs to the subgrade shall be performed at no additional cost to the Owner.

B. Anchor Trenches
   1. Where an anchor trench is required, it shall be placed 24 inches back from the edge of the slope to be covered. The anchor trench shall be 24 inches deep and 18 inches wide. If the anchor trench is excavated in cohesive soil susceptible to desiccation, only the amount of anchor trench required for placement of geomembrane in a single day shall be excavated. Ponded water shall be removed from the anchor trench while the trench is open. Trench corners shall be slightly rounded to avoid sharp bends in the geomembrane. Loose soil, rocks larger than 1/2 inch in diameter, and any other material which could damage the geomembrane shall be removed from the surfaces of the trench. The geomembrane shall extend down the front wall and across the bottom of the anchor trench. Backfilling and compaction of the anchor trench shall be in accordance with Section 2316.

3.02 GEOMEMBRANE DEPLOYMENT

A. The procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be replaced or repaired. Only geomembrane panels that can be anchored and seamed together the same day shall be deployed. Adequate ballast (i.e., sand bags) shall be placed on the geomembrane, without damaging the geomembrane, to prevent uplift by wind. No equipment shall be operated on the top surface of the geomembrane without permission from the Engineer. Seams shall be oriented parallel to the line of maximum slope. Where seams can only be oriented across the slope, the upper panel shall be lapped over the lower panel.
   1. Wrinkles: The methods used to deploy and backfill over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6 inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired.

3.03 FIELD SEAMING

A. Trial Seams
   1. Trial seams shall be made under field conditions on strips of excess geomembrane. Trial seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and each piece of seaming equipment used that day. Trial seam samples shall be collected and tested in accordance with ASTM D 6392. One sample shall be obtained from each trial seam. This sample shall be at 36 inches long by 12 inches wide with the seam centered lengthwise.

B. Field Seams
   1. Panels shall be seamed in accordance with the geomembrane manufacturer's recommendations. In sumps, corners and odd-shaped geometric locations, the number of

field seams shall be minimized. Seaming shall extend to the outside edge of panels. Soft subgrades shall be compacted and approved prior to seaming. The seam area shall be free of moisture, dust, dirt, and foreign material at the time of seaming. Fish mouths in seams shall be repaired.

C. Polyethylene Seams
   1. Polyethylene geomembranes shall be seamed by thermal fusion methods. Extrusion welding shall only be used for patching and seaming in locations where thermal fusion methods are not feasible. Seam overlaps that are to be attached using extrusion welds shall be ground prior to welding. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend beyond the extrudate after placement. Extrusion welding shall begin within 10 minutes after grinding. Where extrusion welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. The total depth of the grinding marks shall be no greater than 10 percent of the sheet thickness.

D. Non-Polyethylene Seams
   1. Non-polyethylene geomembranes shall be seamed by methods as recommended by the geomembrane manufacturer. Seaming adhesives, solvents, or chemical cleaning agents shall be stored away from the geomembrane and only spill-resistant containers shall be used while working on the geomembrane. If low temperatures slow the curing process of chemically fused seams and delay seam testing, shall be used to accelerate sample curing.

3.04 DEFECTS AND REPAIRS

A. Destructive Seam Test Repairs: Seams that fail destructive seam testing may be overlaid with a strip of new material and seamed (cap stripped). Alternatively, the seaming path shall be retraced to an intermediate location a minimum of 10 feet on each side of the failed seam location.

B. Patches, Tears, holes, blisters and other defects shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming.

C. VISUAL INSPECTION AND EVALUATION
   1. Immediately prior to covering, the geomembrane, seams, and non-seam areas shall be visually inspected by the Engineer for defects, holes, or damage due to weather conditions or construction activities. At the Engineer's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material.

D. PENETRATIONS
   1. Geomembrane penetration details shall be in accordance with ASTM D 6497 or as recommended by the geomembrane manufacturer. Factory fabricated boots shall be used wherever possible. Field seams for penetrations shall be non-destructively tested in accordance with the installer's QC manual.

E. PROTECTION AND BACKFILLING
   1. The deployed and seamed geomembrane shall be covered with the specified material within 14 calendar days of acceptance. Wrinkles in the geomembrane shall be prevented from folding over during placement of cover materials. Cover soil shall not be dropped onto the geomembrane or overlying geosynthetics from a height greater than 3 feet. The soil shall be pushed out over the geomembrane or overlying geosynthetics in an upward tumbling motion. Soil shall be placed from the bottom of the slope upward. The initial loose soil lift thickness shall be 12 inches. Equipment with ground pressures less than 7 psi shall be used to place the first lift over the geomembrane. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

END OF SECTION

SECTION 02526

GROUNDWATER AND VAPOR EXTRACTION WELLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide extraction wells including drilling, casing, well screen, gravel packing, grouting, development, monitoring device, and incidental related work complete and ready for operation].

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)..ASTM A 53(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

C. ASTM A 312/A 312M(1995; Rev. A) Seamless and Welded Austenitic Stainless Steel Pipes..ASTM C 117(1995) Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing

D. ASTM C 136(1996; Rev. A) Sieve Analysis of Fine and Coarse Aggregates

E. ASTM C 150(1997) Portland Cement

F. ASTM D 1586(1984; R 1992) Penetration Test and Split-Barrel Sampling of Soils

G. ASTM D 1587(1994) Thin-Walled Tube Geotechnical Sampling of Soils..ASTM D 1785(1996; Rev. B) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

H. ASTM D 2487(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

I. ASTM D 2488(1993) Description and Identification of Soils (Visual-Manual Procedure)

J. ASTM D 4397(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

K. ASTM D 5088(1990) Decontamination of Field Equipment Used at Nonradioactive Waste Sites

L. ASTM D 5092(1990; R 1995) Design and Installation of Ground Water Monitoring Wells in Aquifers

M. ASTM F 480(1995) Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80

N. ASTM F 883(1997) Padlocks

O. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

P. 29 CFR 1910 Occupational Safety and Health Standards

Q. U.S. ARMY CORPS OF ENGINEERS (USACE)..EM 385-1-1(1996) Safety and Health Requirements Manual

R. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)..EPA 600-4-89-034(1989) Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells

S. EPA 600/4-79/020(1976) Contaminant Monitoring

1.03 SYSTEM DESCRIPTION

A. Each system, including equipment, materials, installation, and performance, shall be in accordance with local, State, and Federal regulations, ASTM D 5092, and EPA 600-4-89-034 except as modified herein.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data on:
   1. Well casing
   2. Well screen
   3. Filter pack
   4. Neat cement grout
   5. Bentonite seal
   6. Well Development Report
   7. Well Construction Permit

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in an undamaged condition. Unload and store with minimal handling. Store materials in on-site enclosures or under protective coverings. Store plastic piping and jointing materials, and rubber gaskets under cover, out of direct sunlight. Store materials off the ground. Keep insides of pipes and fittings free of dirt and debris. Replace defective or damaged materials with new materials.

PART 2 PRODUCTS

2.01 WELL CASING

A. Stainless Steel Piping
   1. ASTM A 312/A 312M, Type 304, Schedule 40S, with flush threaded joint end fittings. Threaded joints shall be wrapped with fluoropolymer tape, and provided with nitrile O-ring gaskets.

B. PVC Piping
   1. ASTM F 480, Type 1, Grade 1, PVC 12454, NSF wc or NSF pw, Schedule [40] [80], with flush threaded joint fittings. Threaded joints shall be wrapped with fluoropolymer tape, and provided with nitrile O-ring gaskets.

2.02 WELL SCREEN

A. Well screens shall be located as indicated. The length of the screen shall be as indicated. The open area of screens shall be as indicated on construction drawings. Slotted openings shall be distributed uniformly around the circumference of the screen. Open area shall approach the formation's natural porosity.

B. Stainless Steel Screens
   1. ASTM A 312/A 312M, Type 304, Schedule 40S, continuous slot construction, wire wound, with flush threaded joint ends.

C. PVC Screens
   1. ASTM D 1785, PVC 1120, NSF wc or NSF pw, Schedule [40] [80], screen, Schedule 80, machine-slotted construction, flush threaded joint ends. Slots shall be even in width, length, and separation.

2.03 FILTER PACK

A. Provide clean, durable, well-rounded, and washed quartz or granite, with less than 5 percent non-siliceous material. The filter pack shall not contain organic matter or friable materials. The

filter pack shall allow free flow of water in the well, and shall prevent the infiltration of aquifer materials. Filter pack shall have a uniformity coefficient less than 1.5, in accordance with and ASTM C 136.

2.04 ANNULAR SEALANTS

A. Bentonite Seal

B. Provide powdered, granular, pelletized, or chipped sodium or calcium montmorillonite in sealed containers from a commercial source, free of impurities. Diameter of pellets shall be less than one fifth the diameter of the borehole annular space to prevent bridging. Bentonite base grout shall be in accordance with ASTM D 5092.

C. Neat Cement Grout

D. Provide neat cement grout in accordance with ASTM D 5092. Cement shall be in accordance with ASTM C 150. Quick setting admixtures shall not be allowed. Drilling mud or cuttings shall not be used as a sealing material.

2.05 BOTTOM PLUGS

A. Provide flush threaded solid plug at the bottom of the well. Plug shall be the same material as the well screen to which it is attached. Joints shall be wrapped with fluoropolymer tape and provided with nitrile O-ring gaskets.

2.06 LOCKING WELL CAP

A. Provide flush threaded, and weatherproof well cap on the top of the well. Well cap shall be of the same material as the well casing to which it is attached. Well cap shall accommodate padlock.

2.07 WELL HEAD COMPLETIONS

A. Clearly mark and secure the well to avoid unauthorized access and tampering.

B. At-Grade Completions
   1. Provide cast iron vault box, 36 by 36 inches or 24 by 24 inches as specified with watertight frame and cover. Vault shall support H-20 loading. The frame shall be 12 inches deep, and shall be set in a concrete collar a minimum of 8 inches thick, and extending 4 inches beyond the edge of the frame in all directions. Frame and concrete collar shall be set flush with the level of the existing pavement. Locking well cap shall be provided on top of the well casing, which will terminate inside the vault as indicated.

PART 3 EXECUTION

3.01 GENERAL

A. Notify the Contracting Officer at least 15 days prior to commencement of work. Location[s] of well[s] shall be as indicated. Drilling, installation, and development of the extraction well[s] shall be supervised, directed, and monitored by the Engineer. Drilling, sampling, and well development equipment introduced to the well shall be decontaminated before and after each use in accordance with ASTM D 5088.

3.02 DRILLING

A. Borehole shall be advanced using conventional hollow-stem auger drilling methods. If it is the opinion of the Engineer that an alternate drilling method is required, justification for a boring method change shall be submitted to the Engineer, and approval for the change granted prior to drilling. Drill crew shall be experienced and trained in drilling and safety requirements for contaminated sites.

B. **Alignment**
   1. Verify that the well is straight by lowering a 10 foot section of 2 inch diameter steel pipe in

to the well.

3.03 WELL INSTALLATION

A. Well installation shall be in accordance with ASTM D 5092 and EPA 600-4-89-034, and as indicated on the well construction drawings. Borehole shall be stable and shall be verified straight before beginning installation.

B. Casings and Screens
   1. Well casings, screens, plugs, and caps shall be decontaminated prior to delivery by the manufacturer and shall be certified clean. Materials shall be delivered, stored, and handled in such manner as to ensure that grease, oil, or other contaminants do not contact any portion of the well screen and casing assembly prior to installation. If directed by the Engineer, the well screen and casing assembly shall be cleaned with high pressure water prior to installation. Personnel shall wear clean cotton or surgical gloves while handling the assembly. Centralizers shall be used to ensure that the well screen and casing assembly is installed concentrically in the borehole. When the assembly has been installed at the appropriate elevation, it shall be adequately secured to preclude movement during placement of the filter packs and annular seals. The top of the well casing shall be capped during filter pack placement.

C. Filter Packs
   1. Primary and secondary filter packs shall be placed as indicated on the approved well construction drawings to fill the entire annular space between the screen and casing assembly and the outside wall of the borehole. Place both the primary and secondary filters with a tremie pipe in accordance with EPA 600-4-89-034 and ASTM D 5092. Placement of the primary and secondary filters by gravity or free fall methods is not allowed. Control speed of filter placement to prevent bridging and to allow for settlement. Prior to commencement of work, equipment and methods required to place filters shall be approved by the Engineer

D. Bentonite Seal
   1. Bentonite shall be placed as a slurry through a tremie pipe. Control speed of bentonite placement to prevent bridging or segregation of slurry. Additional water shall be added to the annular space as directed by the Engineer to ensure complete hydration of the bentonite. Bentonite shall cure a minimum of 48 hours before the placement of cement grout to ensure complete hydration and expansion of the bentonite.

E. Neat Cement Grout
   1. Cement grout shall be placed in the annular space above the bentonite seal as indicated on the well construction drawings. Cement grout shall be placed as a slurry through a tremie pipe, and injected under pressure to reduce chance of voids. Grout shall be injected in one continuous operation until full strength grout flows out at the ground surface without evidence of drilling cuttings or fluid. Cement grout shall cure a minimum of 48 hours before beginning well development operations.

F. Well Head Completions
   1. Well head completions shall be as indicated and as specified herein.

3.04 WELL DEVELOPMENT

A. Well development shall be in accordance with EPA 600-4-89-034 and ASTM D 5092 except as modified herein. Bailing, surging, and pumping/overpumping/backwashing are acceptable development methods. Air surging and jetting are prohibited. Method of development shall be chosen by the Engineer. Well development shall not begin until the well installation is complete and accepted by the Engineer. Well development operations shall be conducted continuously until development water flows clear and free of drilling fluids, cuttings, or other materials.

3.05 WATER FROM WELL DEVELOPMENT OPERATIONS

A. Water from the well development operations shall be containerized for processing by the Owner.

3.06 INSTALLATION SURVEY

A. Upon completion of well installation and development and acceptance by the Engineer, the vertical and horizontal position of each well shall be determined by a registered land surveyor licensed in the State of New York. The survey shall document the vertical elevations of the top of the casing pipe and the ground surface elevation adjacent to each well. The survey shall also determine the horizontal location of each well. Survey shall be accurate to the nearest 0.01 foot.

3.07 CLEANUP

A. Upon completion of the well construction, remove debris and surplus materials from the job site.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete foundations and anchor bolts for pre-engineered building.

B. Concrete reinforcement.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280).

2.02 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

C. Water: Clean and not detrimental to concrete.

D. Fiber Reinforcement: Synthetic fiber shown to have long-term resistance to deterioration when exposed to moisture and alkalis; 1/2 inch length.

2.03 CONCRETE MIX DESIGN

A. Concrete Strength: Establish required average strength as specified on drawings for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

B. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

PART 3 EXECUTION

3.01 INSTALLING REINFORCEMENT

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.02 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

C. Place concrete continuously between predetermined expansion, control, and construction joints.

D. Do not interrupt successive placement; do not permit cold joints to occur.

3.03 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

END OF SECTION

SECTION 11181

GROUNDWATER EXTRACTION PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 1998.

C. Local and state regulations and codes

D. Electrical codes (NEC)

E. Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide equipment dimensions, piping and controls.

C. Manufacturer's Instructions

D. Maintenance Data.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in JCI's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 ELECTRIC GROUNDWATER PUMPING EQUIPMENT

A. Provide quantity and description as shown on drawings.

B. Manufacturers:
   1. Grundfos Model 80S30-3.
   2. Grundfos Model 150S50-2.
   3. Substitutions: See Section 01600 - Product Requirements.

2.02 ELECTRICAL AND CONTROLS

A. Design, provide and install electrical equipment and wiring as needed to operate the well pump motors. Equipment to be provided includes:
   1. Current sensor motor controls to automatically run motors until low current is sensed at low well water level.
   2. Current sensor control units to include adjustable delay after low level is sensed. Minimum adjustable range from 9 minutes to 6 hours.

2.03 ACCESSORIES

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and applicable code requirements.

3.02 WELL PUMP/MOTOR

A. Well pump/motor assembly will be installed per manufacturers specifications and as shown in the Drawings.

3.03 ELECTRICAL AND CONTROLS

A. Design and provide all electrical wiring to operate the well pumps, controls, current sensing unit, and install the same in accordance with manufacturer's specifications and as shown on the Drawings.

B. Connect proposed pump motors to existing PLC unit.

END OF SECTION

SECTION 11215

FANS, BLOWERS, AND PUMPS; OFF-GAS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Capacity and design of the air moving equipment and accessories shall be suitable for 24-hour full load service in an indoor location.

B. **Service Conditions**
   1. Service vapor collected from subsurface remediation unit.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)..AMCA 99(1986) Standards Handbook

C. AMCA 210(1985) Laboratory Methods of Testing Fans for Rating

D. AMCA 300(1996) Reverberant Room Method for Sound Testing of Fans

E. AMCA 301(1990) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

F. AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)ABMA 9(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

G. ABMA 11(1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

H. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)..ACGIH-2092(1998) Industrial Ventilation: A Manual of Recommended Practice (24th ed.)

I. AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA) AGMA 6011(1997; Rev H) Specifications for High Speed Helical Gear Units

J. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)B109.2(2000) Diaphragm Type Gas Displacement Meters (500 Cubic Feet per Hour Capacity and Over)

K. ANSI S2.19(1989; R 1997) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance

L. AMERICAN PETROLEUM INSTITUTE (API) Spec 6D(1994; Supple 1 June 1996; Supple 2 Dec 1997) Pipeline Valves (Gate, Plug, Ball, and Check Valves)

M. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ASTD 4167(1997) Fiber-Reinforced Plastic Fans and Blowers

N. ASTM F 1139(1988; R 1998) Standard Specification for Steam Traps and Drains..ASTM F 1508(1996) Specification for Angle Style, Pressure Relief Valves for Steam, Gas, and Liquid Services

O. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)..ASHRAE 52.1(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

P. ASME INTERNATIONAL (ASME)..ASME B16.1(1998) Cast Iron Pipe Flanges and Flanged Fittings

Q. ASME B16.5(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

R. ASME B16.40(1985; R 1994) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems

S. ASME B40.1(1991) Gauges - Pressure Indicating Dial Type - Elastic Element ASME PTC 19.3(1974; R 1998) Instruments and Apparatus: Part 3 Temperature Measurement

T. ASME BPVC SEC VIII D1(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

U. ASME PTC 25(1994) Pressure Relief Devices

V. INSTRUMENT SOCIETY OF AMERICA (ISA)..ISA MC96.1(1982) Temperature Measurement Thermocouples

W. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)..MSS SP-25(1998) Standard Marking System for Valves, Fittings, Flanges and Unions

X. MSS SP-72(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service

Y. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)..NEMA ICS 1(1993) Industrial Controls and Systems

Z. NEMA ICS 6(1993) Industrial Control and Systems, Enclosures

AA. NEMA MG 1(1998) Motors and Generators

AB. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)..NFPA 70(1999) National Electrical Code

AC. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)..NIST SP 250(1995) Calibration Service Users Guide

AD. WATER ENVIRONMENT FEDERATION (WEF)..WEF MOP OM-5(1984)Prime Movers: Engines, Motors, Turbines, Pumps, Blowers & Generators

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.
   1. Drawings showing dimensions of the equipment and layout of the off-gas system and subsystems, including location of components, layout and anchorage of equipment and appurtenances, equipment relationship to other parts of the work, clearances for maintenance and operation.
   2. Detailed Process Flow Diagram
   3. Piping and instrumentation diagram (P&ID) indicating: process equipment; instrumentation; piping and valves; stacks, vents and dampers; control equipment (including sensors, process controllers, control operators, valves, interlocks, and alarms); labels and other necessary information to correlate to the process flow diagram. The P&ID shall include blowers and pumps, valves and other in-line devices.
   4. Control System
      a. Wiring and ladder diagrams.
      b. Control sequences showing the control of the entire system
      c. Instrumentation; Detailed manufacturer's data on the overall controls, sensors, process controllers, control operators, valves, interlocks and alarms. Data describing in detail the equipment used
   5. Air Moving Equipment; Capacities and pressure differentials; performance charts and curves (including the complete selection of impeller sizes for a given casing for centrifugal blowers). Make and model, catalog cuts, manufacturer's descriptive and technical literature, including installation instructions.
   6. Diagrams and instructions, framed under glass or in approved laminated plastic, shall be posted where directed before acceptance testing of the systems.
   7. Condensed operating instructions in typed form explaining preventative maintenance

procedures, safe methods of checking the equipment for normal operation, and safe procedures for starting and stopping the equipment.

8. Complete list of equipment and materials. A listing covering component items forming a system or items that are interrelated and scheduled to be coordinated and submitted concurrently.
9. Three complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The operating instructions shall include the following for system components: manufacturer's name, model number, service manual, parts list, and brief description of each piece of equipment and its basic operating features; flow diagrams; system layout showing piping, valves, and controls; as-built wiring and control diagrams; control sequence describing startup, operation, and shutdown; manufacturer's bulletins, cuts, and descriptive data.
10. Three complete copies of maintenance instructions for each piece of equipment including the following: manufacturer's complete list of parts, recommended spare parts and supplies, with current unit prices and source of supply; routine maintenance procedures, including the requirements of WEF MOP OM-5, as a minimum; possible breakdowns and repairs; a troubleshooting guide to help the operator determine what steps must be taken to correct any equipment problems.
11. Warranty: Submit manufacturer warranty and ensure that forms have been completed in JCI's name and registered with manufacturer.

1.04 QUALIFICATIONS

A. Contractor
   1. Contractor shall have a minimum of 2 years of experience in the construction of systems for handling sour gas, condensable gas, off-gas or vapor.

B. Single Source Supplier
   1. The Contractor shall assign to a single supplier full responsibility for the furnishing of the off-gas moving system. The designated single supplier, however, need not manufacture the system but shall coordinate the selection, assembly, installation, and testing of the entire system as specified herein.

C. Manufacturer's Representative
   1. Services of a manufacturer's field service representative who is experienced in the installation of the equipment furnished and who has complete knowledge of the proper operation and maintenance of the system shall be provided.

1.05 GENERAL REQUIREMENTS

A. Standard Products
   1. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site. Pieces of equipment of the same types shall be products of the same manufacturer. Equipment shall be new and unused, except for test equipment. Materials may be reprocessed/recycled with equivalent durability and product warranty/guarantee.

B. Nameplates
   1. Each piece of equipment shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each air moving unit shall show the capacity in standard cubic feet per minute (SCFM) at rated speed in rpm and head in inches of water. Nameplate for each electrical motor shall show, at least, the minimum information required by paragraph 10.38 of NEMA MG 1. Any other information that the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

C. Verification of Dimensions
   1. After becoming familiar with details of the work, the Contractor shall verify all dimensions in the field and shall advise the Engineer of any discrepancy before performing the work.

1.06 DELIVERY AND STORAGE

A. Equipment delivered and placed in storage shall be stored in a clean, dry location and covered for protection against dust and moisture. Equipment stored longer than 60 days shall have silica bags suspended in the outlet and inlet of unit, bearings shall be filled full of grease, unit shall be filled with oil, machine surfaces shall be coated with grease, and entire unit shall be enclosed with plastic or tarps. Shaft of rotating equipment including motors shall be turned every two weeks to prevent flat spots on bearings.

1.07 SEQUENCING AND SCHEDULING

A. Details of and requirements for vapor extraction well construction and treatment equipment are included in other sections of this specification. The Contractor shall notify the Engineer of any deviations from head conditions specified for the source and discharge to ensure coordination with this Section. Pipe and valves not specified in this Section shall be in accordance with Section 02150 PIPING; OFF-GAS.

1.08 EXTRA MATERIALS

A. Auxiliary equipment, tools and spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall protect and safeguard the equipment, tools and parts until completion of the work, at which time they shall be delivered to the Engineer. Auxiliary equipment and spare parts shall be furnished as follows:
   1. Spare parts for each different item of material and equipment specified including the parts recommended by the manufacturer to be replaced after 1 year service.
   2. For each air mover: one extra of each part used that is made from glass, hard rubber, or clear plastic; one complete set of gaskets; 2 air intake filter replacement cartridges.
   3. One complete set of special tools, calibration devices, and instruments as required for operation, calibration, and maintenance of the equipment shall be provided. Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Contractor shall provide skid-mounted soil vapor extraction system enclosed in UL approved pre-engineered building in accordance with construction drawings. Acceptable manufacturers include:
   1. Maple Leaf
   2. BISCO Environmental
   3. Product Level Control Inc.

2.02 AIR MOVING EQUIPMENT

A. Air moving equipment shall be furnished and installed complete with drive units, filters, controls and appurtenances indicated or specified. Equipment shall be capable of operating at partial-load conditions without increased vibration over the normal vibration at full load operation and shall be capable of continuous operation down to the lowest step of unloading. Each unit shall be provided with unloading, vibration isolators, thermal overloads, high-and-low pressure safety cutoffs, low oil pressure cutout, internal motor-winding temperature sensing protection device, internal pressure relief valve, a complete oil charge, and protection against short cycling.

B. FANS
   1. Regenerative
      a. A EG&G Rotron regenerative blower shall be provided capable or delivering 750 scfm

at 67 inches of water vacuum.

2.03 INTAKE FILTER

A. Intake filter shall be installed on inlet to each unit.

B. Efficiency
   1. Intake filter shall be at least 90 percent efficient when tested in compliance with ASHRAE 52.1 dust spot method.

C. Surface Area
   1. Minimum filter surface area shall be 1 square foot per 25 cubic feet per minute to produce a filter flow through velocity of less than 0.127 meters per second. 25 feet per minute.

D. NOISE MINIMIZATION
   1. Silencer
      a. Each blower shall be provided with inlet and discharge silencers. Silencers shall be for standard grade silencing. Intake silencers shall be of the absorption, canister, or chamber type. Discharge silencers shall be of the absorption, canister, or chamber type. Canister type silencer shall be constructed of two concentric perforated cylinders lined with high temperature acoustical packing forming an annular flow path, with an internal plug creating a blocked line of sight. Silencer size shall be as recommended by the silencer manufacturer and shall be compatible with the blower requirements. Silencer connections shall match the adjacent piping. Mounting brackets shall be provided as required for silencer support. Silencer shall be constructed of heavy-duty rolled and welded steel plate with the inner liner welded to the outer shell to acoustically deaden the outer shell.

2.04 MONITORING

A. Each unit shall be equipped for monitoring the flow downstream of any bypass connections. Calibration of sensors shall be with standards traceable to NIST and in conformance with NIST SP 250.

B. Flow
   1. A turbine type flow meter shall be provided for measuring the process flow. Accuracy shall be within 0.5 percent of full scale.

C. Temperature
   1. Thermometers shall conform to ASME PTC 19.3 with wells and temperature range suitable for the use encountered. Thermometers shall be provided to indicate inlet air temperature, discharge air temperature. Thermometers shall be either red-reading mercury-in-glass type or dial type. Scale range shall include full range of expected operation and up to 125 percent, but not more than 150 percent of maximum. Accuracy shall be within 0.5 percent of full scale.

D. Pressure
   1. High and low pressure connections shall be 1/4 inch NPT female with a suitable shutoff cock at each connection. The high pressure connection to the gauge shall have a 10 micrometer (10 micron) 10 micron pleated paper filter and the low pressure connection shall have a fine mesh stainless steel strainer.

E. Draft Gauge
   1. Gauge shall conform to ASME B40.1 with a diaphragm or bellows actuating system, a circular scale and a zero adjustment screw. Inlet gauges shall have a range 0 to 100 inches water gauge vacuum. Gauges shall include the accessories for pipe mounting.

F. Pressure Gauge
   1. Gauges shall conform to ASME B40.1 with a single Bourdon tube style actuating system, a circular scale and a zero adjustment screw. Discharge gauges shall have a range of 0 to 11 psi. Gauges shall include the accessories for pipe mounting.

G. Differential Pressure Gauge
   1. The housing of each unit shall be equipped with a direct-reading gauge that measures the differential pressure range 0 to 14.5 psi with an accuracy of plus or minus 2 percent of full scale, calibrated linearly with 0.34 psi scale graduations. During operating conditions the pointer shall be within the mid-range of the gauge. Accuracy shall be within 0.5 percent of full scale.

H. Sampler
   1. Sampling port and equipment for collecting discrete and composite samples shall be provided with adequate access for personnel and equipment.

2.05 CONTROL SYSTEM

A. Unit shall have an automatic control system. Automatic controls shall be responsible for the balancing of the capacity with system requirements. These controls shall automatically balance the equipment capacity with the load. The system shall be provided with the necessary control devices required for normal operation. The automatic controls shall also include each of the following: a safe system operating mode when controls fail, indications for system failure, protective mechanisms and controls that are required for the safe operation of system equipment in an enclosure conforming to NEMA ICS 4.

B. Sequence of Control
   1. The sequence of control shall be as follows:
      a. Shut-down blower when moisture separator is full and trip visual alarm
      b. Timer to automatically turn-on and off the SVE blower.

C. Sequence of Equipment Operation
   1. Logic shall be included to allow for automatic or manual alternation of lead/lag/standby assignments of units installed in parallel. Instrumentation to modulate the pressure and volume output as well as start or stop units shall be included to meet pressure and/or volume demands. Controls shall include start and stop push button switches, hand-off-automatic (H-O-A) switches where the system controls operation.

2.06 Panel

2.07 Protective Devices

A. Blower protective devices, upon alarm condition, shall cause immediate de-energization of the motor, shall initiate the automatic shutdown sequence, and shall provide audible and visual alarm indication.

B. Surge and Overload Protection
   1. A set-point controller shall monitor current input to the motor. The controller shall initiate automatic shutdown sequence and give visual indication of reason for shutdown if surge conditions are indicated by the motor current. Manual control and override shall be provided to enable equipment startup and shutdown.

C. Oil Temperature and Pressure
   1. Temperature and pressure sensors with switches shall be installed on each oil pump. The control relay, selector switch, test push buttons, and running indicator, or light, on the panel shall indicate status. High oil temperature, high oil pressure or low oil pressure shall initiate protective shutdown and the indicator, or light, shall indicate the affected setting.

2.08 ELECTRICAL EQUIPMENT

A. Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with NFPA 70, with proper consideration given to environmental conditions such as moisture, dirt, corrosive agents, and hazardous area classification.

B. Electric Motors

1. Each electric motor-driven unit shall be driven by an ODP electric motor. Motor shall have a 1.15 service factor. Motors shall be squirrel-cage induction or synchronous having normal-starting-torque and low-starting-current characteristics, and shall be sized to avoid exceeding the nameplate power rating throughout the entire published characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearing shall be provided in the motor to carry the weight of the rotating parts plus the hydraulic thrust and shall be capable of withstanding upthrust imposed during starting conditions specified. Motors shall be rated 460 volts, 3 phase, 60 Hz and such rating shall be stamped on the nameplate. Motors shall conform to NEMA MG 1.

C. Control Equipment
1. Automatically controlled units shall have three-position MANUAL-OFF-AUTOMATIC selector switch in cover. Additional controls or protective devices shall be as indicated.

2.09 APPURTENANCES

A. Dielectric Fittings
1. Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

B. Isolation Joints
1. Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

C. Sleeve-type Couplings
1. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.

D. Split-sleeve Type Couplings
1. Split-sleeve type couplings shall be used in aboveground installations when approved in special situations, and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

E. Valves
1. Valve diameter shall be equal to the diameter of the pipe in which the valve is located unless otherwise indicated. Valves shall be screw, socket weld, buttweld, sweat, or flange connected. Valves shall be marked in accordance with MSS SP-25 to identify the manufacturer, valve sizes, pressure rating, body and seat material.

F. Relief Valve
1. Relief valve capable of maintaining a constant upstream pressure regardless of the downstream demand shall be provided for each air mover. Valve shall be ASTM F 1508 angle spring loaded, weighted, or pilot-operated diaphragm differential pressure relief valve. Valve shall be rated to relieve the full capacity of the air moving equipment 750 cubic feet per minute. Valve shall be factory-set to open at the vacuum of 80 inches of water and shall be field adjustable within a minimum range of plus or minus 20 percent. Valve shall be located within 5 feet upstream of vacuum equipment or downstream of pressure equipment.

G. Manual Valve
1. Ball valves shall be in accordance with MSS SP-72. Gate, plug and ball valves shall be in accordance with API Spec 6D. Thermoplastic gas shutoffs and valves shall be in accordance with ASME B16.40. Manual valve shall be wrench operated, rising stem, with

cap. Non-automatic valve shall be as required by Section 02150 PIPING; OFF-GAS.

H. **Inlet and Discharge Elbows**
   1. Inlet and discharge elbows shall be of the long sweep type with ASME B16.1, Class 125 flanges.

I. Expansion Coupling
   1. The inlet and the outlet of each unit shall be provided with flexible expansion couplings of extra heavy gauge rubber, wire reinforced type suitable for temperature range of minus 20 to plus 250 degrees F and pressure range from 15 inches of mercury vacuum to 15 psig.

J. Liquid Receiver
   1. Liquid receivers shall be designed, fitted, and rated 50 psi working pressure. Each receiver shall have a storage capacity not less than 85 gal. Each receiver shall be equipped with inlet and outlet drop pipe, drain with valve, relief valve and two bull's-eye liquid-level sight glasses. Sight glasses shall be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 3 inches horizontally from the drop pipe measured along the axis of the receiver. In lieu of bull's-eye sight glass, external gauge glass with metal glass guard and automatic closing stop valves shall be provided. The outside of liquid receivers shall be galvanized or supplied with commercial enamel finish.

2.10 BASE PLATE

A. Each unit shall be mounted on all-welded structural steel or cast iron base complete with vibration isolators with published load rating. The base plate shall have vertical jacking screws to facilitate leveling. The entire unit shall be isolated from the building structure.

2.11 WEATHERPROOF ENCLOSURE

A. A weatherproof enclosure shall be provided for the air moving equipment and motor assembly. The enclosure shall have lockable access doors and shall be louvered for ventilation. The enclosure shall be insulated and equipped with a thermostatically controlled ventilation.

2.12 ATTACHMENTS

A. Shafts, chains or gear driven equipment shall be provided with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel, or galvanized woven wire, or expanded metal set in galvanized steel frame. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment.

2.13 COATINGS OR FINISHES

A. Motors, casings and similar parts of equipment finished in the shop shall be cleaned, primed and given two finish coats with paint suitable for the environment in which the unit is to be placed at the factory. Ferrous surfaces not painted at the factory shall be given a shop coat of grease or other suitable rust resistant coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Vibration dampener shall be installed in sufficient quantity to isolate each unit from the structural base on which the unit is installed. Each air moving unit and motor shall be installed, aligned and leveled in accordance with the written instruction of the manufacturer. Deviation from horizontal shall be below limits of measurement. Flexible couplings shall not be used to compensate for misalignment between driver and driven unit. Blower venting shall not violate the provisions of either ACGIH-2092 or AMCA 99.

B. Concrete Foundations
   1. Concrete for equipment foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE have a minimum compressive strength of at least

3,500 psi. Concrete foundations shall be integral with and of the same class as that of the building floor. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

3.02 TESTING

A. Deficiencies
   1. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

B. Correct Installation
   1. Tests shall assure that the units and appurtenances have been installed correctly, there is no objectionable heating or vibration, noise from any part is not excessive, and manual and automatic controls function properly.

C. Field Equipment Test
   1. After installation of the air moving units and appurtenances is complete, operating tests shall be carried out to ensure that the installation operates properly. The Contractor shall provide an accurate and acceptable method of measuring the discharge flow and pressure.

D. Noise Suppression
   1. Sound level shall be less than 80 dB measured at 5 feet from the source

3.03 FIELD TRAINING

A. The Contractor shall conduct a field training course for designated operating, maintenance and supervisory staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover the items contained in the operating and maintenance instructions.

END OF SECTION

SECTION 11226

GRANULAR ACTIVATED CARBON

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The vapor phase activated carbon adsorption system shall be a complete once-through forced flow system. The system shall be capable of reducing the levels of the listed organic contaminants to the values shown in paragraph Performance Requirements. The unit shall be filled with granular activated carbon for removal of organic contaminants from soil vapor extraction air/gas. Equipment shall include, but shall not be limited to, vessels containing activated carbon, supporting equipment and accessories. Terminology is in conformance with ASTM D 2652. The system shall be complete with 2 parallel trains of 2 carbon vessels in series, blower, instruments, controls, valves, piping, and other specified appurtenances. The piping shall be arranged as shown on the drawings.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)..ASTM D 2652(1994) Activated Carbon
   2. ASTM D 2854(1996) Apparent Density of Activated Carbon

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.
   1. Warranty: Submit manufacturer warranty and ensure that forms have been completed in JCI's name and registered with manufacturer.

1.04 GENERAL REQUIREMENTS

A. Standard Products
   1. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

B. Nameplates
   1. Major equipment items such as adsorption vessels, blowers and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

C. Verification of Dimensions
   1. The Contractor shall, after becoming familiar with the details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work

D. Operation
   1. The system shall be designed to operate continuously, 24 hours per day, 7 days per week.

1.05 DELIVERY, STORAGE AND HANDLING

A. Parts shall be preassembled to the largest extent possible, compatible with transportation limitations and equipment protection considerations. Field assembly, if any, shall require merely bolting together of match-marked components. Equipment shall be crated and delivered to protect against damage during shipping. Flange faces shall be protected from damage. All openings shall be covered to prevent entrance of dirt, water and debris. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and until the units and equipment are ready for operation. Finished iron or steel surfaces shall be properly protected to prevent rust and

corrosion. All equipment delivered and placed in storage shall be stored with protection from the weather (humidity and temperature), dirt and dust, and other contaminants.

1.06 SPARE PARTS

A. Within 30 days of approval, the Contractor shall furnish a spare parts list for each different item of material and equipment specified with the shop drawings submitted. The list shall include parts, supplies, prices and sources schedule. The Contractor shall furnish those spare parts and special tools which are recommended by the manufacturer. The Contractor shall also provide 12 months supply of any expendable items and frequently replaced parts, except for carbon, as identified by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carbtrol

B. Substitutions: See Section 01600 - Product Requirements.

2.02 VAPOR PHASE ACTIVATED CARBON

A. Material shall conform to the following:
   1. The initial charge of carbon shall be virgin carbon.
   2. Activated carbon particle size shall be uniform for consistent pressure drop characteristics. Maximum particle size shall be 4.6 mm 0.2 inch diameter as determined by ASTM D 2862
   3. The granular activated carbon shall be of the type that can be accepted for offsite regeneration of the spent activated carbon by an approved carbon regeneration facility.
   4. Material shall be free from impurities that affect the serviceability and appearance of the finished product

2.03 VAPOR PHASE ACTIVATED CARBON ADSORPTION UNITS

A. Vessel
   1. Contractor shall provide Carbtrol G-3S activated carbon adsorption units that meet the following requirements:
      a. Minimum Number of Vessels: 4
      b. Minimum Adsorber Diameter: 2 ft
      c. Material of Construction: carbon steel
      d. Minimum Carbon Quantity per Vessel: 140 lbs
      e. Minimum Carbon Bed Depth: 34 inches
      f. Flow Direction: downflow
      g. Each unit shall be provided with an inlet air/gas distributor, if required. Sampling ports shall be provided on the inlet and outlet pipes of each vessel to allow independent sampling and measurement of breakthrough for each unit.

2.04 ACCESSORIES

A. Blowers
   1. The blowers shall conform to Section 11215 FANS/BLOWERS/PUMPS; OFF-GAS

B. Sampling Valves
   1. Sampling valves shall be provided at the inlet and outlet of each carbon unit.

C. Piping
   1. Piping shall be in accordance with Section 02150 PIPING; OFF-GAS.

D. Thermometers

E. Thermometers shall be dial type, 3-1/2 inch diameter, chromium plated case; remote or direct-type bulb as required; plus or minus 0.5 degree C 1 degree F accuracy; white face with black digits graduated in 1 degree C 2 degree F increments. Thermometer wells of the separable

socket type shall be provided for each thermometer with direct-type bulb. Range of thermometers shall be -20 to 100 degrees C.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Equipment shall be installed as shown and in accordance with written instructions of the manufacturer. Each vessel shall be mounted on a skid base. Reinforced concrete foundations for each carbon unit shall be designed to support the unit and shall be in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.02 PAINTING FOR CORROSION PREVENTION

A. Equipment which did not receive a factory finish shall be painted, unless specified otherwise. Surfaces that have not been factory primed shall be primed and top coated with the manufacturer's standard factory finish. Factory painting shall conform to manufacturer's standard factory finish. Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel is not required, unless otherwise specified.

3.03 FIELD QUALITY CONTROL

A. Equipment Tests
   1. After installation of the carbon adsorption system is complete, operating tests shall be carried out to ensure that the unit installed operates properly. All products shall be carefully inspected for defects in workmanship and material; debris and foreign matter shall be cleaned out of all equipment; all operating mechanisms shall be tested to check their proper functioning; and all nuts and bolts shall be checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced. Tests shall assure that there is no vibration, or noise from any parts. If deficiencies are revealed during tests, such deficiencies shall be corrected and the tests shall be reconducted at the Contractor's expense.

END OF SECTION

SECTION 13121

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. AISC S335 - Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design; American Institute of Steel Construction, Inc.; 1989.

B. AISC S342L - Load and Resistance Factor Design Specification for Structural Steel Buildings; American Institute of Steel Construction, Inc.; 1999.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2001.

D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2001a.

E. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2000.

F. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2002.

G. ASTM A 325M - Standard Specification for High-Strength Bolts for Structural Steel Joints (Metric); 2000.

H. ASTM A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2002.

I. ASTM A 490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2000

J. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2001a.

K. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001.

L. ASTM A 529/A 529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2001.

M. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2001.

N. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2001a.

O. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2001a.

P. ASTM A 992/A 992M - Standard Specification for Structural Steel Shapes; 2002.

Q. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2001.

R. ASTM C 991 - Standard Specification for Flexible Glass Fiber Insulation for Metal Buildings; 2000.

S. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 1999.

T. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2001.

U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 1998.

V. AWS D1.1 - Structural Welding Code - Steel; American Welding Society; 2002.

W. MBMA (LR) - Low Rise Building Systems Manual; Metal Building Manufacturers Association; 1996, with Rev 1 (4/97).

X. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 1982 (Ed. 2000).

Y. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Underwriters Laboratories Inc.; 1994.

1.02 DESCRIPTION OF BUILDING

A. Dimensions
   1. Building dimensions shall be as standard with manufacturer, not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of finished floor to intersection of insides of roof and sidewall sheets. The clear height between finished floor and bottom of roof steel shall be as indicated.

B. Framing
   1. Provide building with vertical walls and single-slope roof. Building shall be single-span or multiple-span structures with one of the following framing systems: self-framing, column with single-span or continuous trusses, continuous beam frames, column with rigid frame, or rigid frame type, similar to AISC S335, Type I construction. End walls shall be of beam and column design. Roof slope shall be a minimum of 1 to 24. Roof slope greater than that indicated may be furnished if the required materials are provided and appropriate drawings are submitted and approved. Design framed openings structurally.

C. Foundation Requirements
   1. Design foundations for allowable soil bearing pressure and a minimum bottom of footing depth as indicated. Use a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300N, "Cast-In-Place Concrete." The foundation loads are supplied by the building manufacturer.

1.03 DESIGN REQUIREMENTS

A. Design members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

B. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

C. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 120 degrees F.

D. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

E. **Deflection**
   1. Structural Members
      a. The maximum deflection of main framing members shall not exceed 1/240th of their respective spans. The maximum deflection due to live load in roof panels and purlins shall not exceed 1/180th of their respective spans.
   2. Roof Panels
      a. UL 580, Class 90. The design analysis shall establish that the roof when deflected under dead plus live or snow loads, will not result in a negative gradient. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. In addition, the roof decking shall be

designed for a 200-pound concentrated load at midspan on a 12 inch wide section of deck. Panels thinner than 0.03 inches are not permitted for diaphragms used to resist seismic loads in Seismic Zones 2 through 4.

3. Wall panels
   a. The maximum deflection due to wind on wall panels and girts shall be limited to 1/120th of their respective spans except that when interior finishes are used the maximum allowable deflection shall be limited to 1/180th of their respective spans.
4. Openings
   a. Limit deflections of steel framing above and along the side of rolling door openings to a maximum of 1/2 the allowable movement in the telescoping top roller of the doors to ensure proper operation. Frame all equipment openings over 12 by 12 inches.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Manufacturer's Instructions: Indicate preparation requirements and anchor bolt placement.

1.05 QUALITY ASSURANCE

A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of New York.
   1. Conform to applicable code for submission of design calculations as required for acquiring permits.
   2. Cooperate with regulatory agency or authority and provide data as requested.
   3. Submit complete design drawings for the preengineered building. Submit drawings for the foundations and anchorage.
   4. Submit design calculations for the entire preengineered building and foundations, prepared and stamped by a professional engineer. Also submit for components requested, and stamp with the seal of a professional engineer. Include sizes and location of anchor bolts.

B. Perform work in accordance with AISC "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design".

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for water leaks arising out of or caused by ordinary wear and tear by the elements. Such warranty shall start upon final acceptance of the work or the date the Owner takes possession, whichever is earlier.
   1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pre-Engineered Buildings:

1. Butler Manufacturing Co: www.butlermfg.com.
2. Ceco Building Systems: www.cecobuildings.com.
3. VP Buildings: www.vp.com/home2.html.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A 572/A 572M, Grade 50.

B. Structural Tubing: ASTM A 500, Grade B cold-formed.

C. Plate or Bar Stock: ASTM A 529/A 529M, Grade 50.

D. Anchor Bolts: ASTM A 307, galvanized to ASTM A 153/A 153M.

E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M, Class C.

F. Welding Materials: Type required for materials being welded.

G. Primer: SSPC-Paint 20, Red Oxide.

H. Grout: ASTM C 1107, Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2400 psi in two days and 7000 psi in 28 days.

2.03 MATERIALS - WALLS AND ROOF

A. Design roof and wall panels, accessories, and flashings to be completely weathertight and free of abrasions, loose fasteners, and deformations.

B. **Panels**
1. Fabricated of aluminum/zinc-coated steel or aluminum
2. Preformed
3. Factory-insulated to provide weathertight joint upon installation, with:
4. Outer sheet designed to overlap adjacent panel a minimum of one configuration.
5. If designed as diaphragm, roof decks shall be designed in accordance with SDI Diaphragm Mnl.
6. Insulation in the cores of the panels shall be asbestos-free composition and provide an overall "U" value of not more than 0.10 for wall panels and 0.05 for roof panels.
7. Insulation in factory-insulated panels shall have a flame spread rating of 75 or less and a smoke development factor of 150 or less

C. **Zinc-Coated Steel Sheet**
1. ASTM A 755/A 755M, Coating Class Z 350 G-90 or ASTM A 653/A 653M, SQ, Grade 33, Coating Class Z 350 G-90.

D. **Aluminum/Zinc-Coated Steel Sheet**
1. ASTM A 792/A 792M, AZ 55.

E. **Aluminum Sheet**
1. Alloy 3004 Alclad conforming to ASTM B 209M ASTM B 209.

F. **Liner Panels**
1. Formed of same type material as used for wall panels to closely approximate configuration of panels indicated.

2.04 COMPONENTS

A. Doors and Frames: Manufacturer's standard.

B. Windows: Manufacturer's standard.

C. CIRCULAR ROOF VENTILATORS

1. Provide circular roof ventilators fabricated of aluminum or zinc-coated steel with manufacturer's standard factory finish, color as indicated, furnished with removable bird screens and chain or cable operated dampers. Provide rigid weathertight ventilators free from vibration upon installation.

2.05 FINISHES

A. **Shop Painting**
   1. Ferrous metal work, except factory-finished work, zinc-coated work, aluminum-coated work, and work specified to be painted herein, shall be (1) cleaned of dirt, rust, scale, loose particles, grease, oil, and other deleterious substances; (2) phosphate treated; and (3) then be given one coat of an approved rust-inhibiting primer paint of the type standard with the metal building manufacturer.

B. **Factory Color Finish**
   1. Provide exterior and interior exposed surfaces of metal roof and wall panels, roof ventilators, louvers, and metal accessories with a thermal-cured factory finish. Color shall be selected from manufacturer's standard colors. Provide an exterior finish top coat of the building manufacturer's standard paint. Provide standard dry film thickness of 0.8 mil for exterior coating exclusive of primer. Provide exterior primer thickness standard with building manufacturer. Interior color finish shall consist of the same coating and dry film thickness as the exterior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Check concrete dimensions, anchor bolt size and placement, and slab elevation with the metal building manufacturer's templates and drawings before setting any steel.

3.02 ERECTION

A. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes in panels shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA Design Manual.

B. Framing Members and Anchor Bolts
   1. Onsite flame cutting of framing members, with the exception of small access holes in structural beam or column webs, will not be permitted. Concrete work is specified in Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE. Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses.

C. Roofing and Siding Installation
   1. Siding shall be applied with the longitudinal configurations in the vertical position. Roofing shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design.

D. Louvers and Ventilators
   1. Louvers and ventilators shall be rigidly attached to the supporting construction to assure a weather tight installation.

E. Doors and Windows
   1. Doors and windows, including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors and windows shall be sealed according to manufacturer's recommendations to provide weathertight construction.

F. Insulation Installation
   1. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.
      a. Board Insulation with Blanket Insulation
         1) Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer.
      b. Blanket Insulation
         1) Blanket insulation shall be installed over the purlins and held tight against the metal roofing. It shall be supported by an integral facing or other commercially available support system.

G. Vapor Retarder Installation
   1. Integral Facing on Blanket Insulation
   2. Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

H. Wall Liner
   1. Wall liner shall be securely fastened into place in accordance with the manufacturer's recommendation and in a manner to present a neat appearance

I. Do not field cut or alter structural members without approval.

J. Field Welding
   1. Steel, AWS D1.1. Aluminum, AA 30

K. Field Bolting
   1. AISC S329

3.03 FIELD PAINTING

A. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same color and material used for the shop coat.

END OF SECTION

APPENDIX C

FIELD SAMPLING AND QUALITY ASSURANCE PLAN

Field Sampling and Quality Assurance Plan
JCI Jones Chemicals, Inc. Superfund Site
100 Sunny Sol Boulevard
Caledonia, New York

June 13, 2003
004-03165-03-03

Prepared for
JCI Jones Chemical, Inc.
100 Sunny Sol Boulevard
Caledonia, New York

Prepared by
LFR Levine·Fricke
3382 Capital Circle, N.E.
Tallahassee, Florida 32308-1568

LFR
LEVINE • FRICKE

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ATTACHMENT

Field Sampling and Quality Assurance Plan
JCI Jones Chemicals, Inc. Superfund Site
Caledonia, New York
REVISION 0

June 13, 2003

Prepared by LFR Levine·Fricke

Isaac C Frenwald — 6/23/03
LFR Levine·Fricke Quality Assurance Manager — Date

E. Cambeiro for: Shekhar Melkote — 6/23/03
LFR Levine·Fricke Project Manager — Date

U.S. EPA Region 2 Remedial Project Reviewer — Date

U.S. EPA Region 2 Quality Assurance Reviewer — Date

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Field Sampling and Quality Assurance Plan (FSQAP) describes the field and analytical procedures to be followed during the remedial action activities that LFR Levine·Fricke (LFR) will conduct at the JCI Jones Chemicals, Inc., (JCI) Caledonia, New York Superfund site ("the Site"). Remedial action activities include installation of groundwater extraction wells, trenching and piping, installation of remediation equipment, and start-up and operation of the remedial systems. In addition, remedial activities may include the performance of in-situ chemical oxidation to remediate potential dense nonaqueous phase liquid (DNAPL)-PCE. To monitor the effectiveness of the remediation systems and the progress of natural attenuation outside the source area, routine air and groundwater sampling will be required.

1.2 Site Description

The Site description, including background, operational history and potential sources of chemicals, and hydrogeology, is discussed in the Remedial Action Work Plan. Analytical results of previous investigations indicate that chemicals of interest at the Site primarily include chlorinated solvent volatile organic compounds (VOCs) most significantly tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-DCE, and vinyl chloride. These chemicals were detected in on-site soil and groundwater, and appear to be related to the past storage and handling of chlorinated solvents at the Site.

1.3 Project Objectives

1. **Establish pre-start-up groundwater elevations and baseline concentrations of chlorinated VOCs in source area monitoring and extraction wells.** The general approach to meet this objective will include collecting water level readings from on-site monitoring wells. In addition, the approach will include collecting groundwater samples from the new groundwater extraction and ISCO wells and having the samples analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride, total dissolved solids, manganese, color, and pH at a fixed-base certified laboratory.

2. **Monitor the effectiveness of the Soil Vapor Extraction System.** The general approach to meet this objective will include collecting influent and effluent air samples from the SVE system and having the samples analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride at a fixed-base certified laboratory.

3. **Monitor the capture zone of the groundwater extraction system.** The general approach to meet this objective will include collecting water level readings from on-

site monitoring wells and adjusting the groundwater extraction flow rates as necessary.

4. **Monitor the effectiveness of the air stripper.** The general approach to meet this objective will include collecting influent and effluent water samples at the air stripper and having the samples analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride at a fixed-base certified laboratory.

5. **Monitor the progression of natural attenuation outside the source area.** The general approach to meet this objective will include collecting groundwater samples at selected monitoring wells and having the samples analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride at a fixed-base certified laboratory.

6. **Monitor the effectiveness of ISCO.** The general approach to meet this objective will include collecting post injection groundwater samples in the source area and having the samples analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride, total dissolved solids, manganese, color, and pH at a fixed-base certified laboratory.

All samples will be analyzed at Columbia Analytical Services, Inc. (CAS) laboratories, Rochester, New York. The air samples will be analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. The groundwater samples will be analyzed for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. In addition, select groundwater samples will be analyzed for total dissolved solids, manganese, color, and pH.

Physical parameters of groundwater (temperature, pH, specific conductance, turbidity, dissolved oxygen [DO], oxidation reduction potential [ORP or Eh]) will be measured using field kits.

The specific method of analysis for each sampling medium, including associated quality assurance/quality control (QA/QC) blank samples, is included in Table C-1. A majority of field and laboratory sampling protocols, including equipment maintenance and calibration requirements, are incorporated in this FSQAP by reference to EISOPQAM (U.S. EPA 1996) and CAS laboratories' Quality Assurance Manual. A copy of CAS laboratories' Quality Assurance (QA) Manual is provided with this work plan; Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM) is available on the internet at http://www.epa.gov/region4/sesd/eisopqam. Specific SOPs for field instruments to be used for LFR personnel during soil and groundwater sampling are provided in Attachment C-1.

1.4 Data Quality Levels

The data quality levels with regard to analytical data are defined as follows:

- Level I: Field screening using portable instruments. Results are not intended to be either chemical specific or quantitative; however, the results are available on a real-time basis. Field instruments are calibrated against known standards.
- Level II: Field analyses performed using more sophisticated and portable analytical instruments. Results are semi-qualitative, qualitative, or quantitative, available on real-time basis.
- Level III. Off-site analyses performed at a fixed-base, certified laboratory. The analyses are performed using U.S. EPA analytical methods. Strict adherence to quality assurance/quality control (QA/QC) protocols is maintained. Instruments are calibrated as required by method. Additional calibrations may be conducted and/or blank and spike samples may be analyzed.
- Level IV: Contract Laboratory Procedures (CLPs) Routine Analytical Services. This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data. Some regions have obtained similar support from their own regional laboratories, university laboratories, or other commercial laboratories.
- Level V: Non-standard Methods. Analyses that may require method modification and/or development. CLP Special Analytical Services are considered Level V. Level V will not be utilized during the RD/RA for the Site.

Off-site analyses on subsurface air and groundwater samples will be performed by CAS laboratory, certified in the New York State CLP program.

The following data quality levels will be utilized during the remedial activities for the Site:

Level 1: Field Screening

- Screening air samples from the SVE system
- Ambient air monitoring for health and safety monitoring of on-site personnel.

Level II: Field Instruments

- Field physical parameters during groundwater sampling
- Vacuum and air flow rate readings from SVE system
- Pressure and water flow rate readings from the groundwater extraction wells and at the air stripper
- water levels
- Injection volumes and flow rates during ISCO

Level III: Off-Site Analysis

- Extracted vapor concentrations from SVE system

- Groundwater samples for chlorinated VOCs PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride
- Groundwater samples for total dissolved solids, manganese, color, and pH.

The list of target parameters for this project including analytical methods, QA/QC requirements, and Data Levels are listed in Table C-1. End use of data will be to monitor the effectiveness of the remediation systems.

1.5 Sample Network Design and Rationale

The sample locations are described in detail in the Remedial Action Work Plan.

1.6 Sample Network by Task and Matrix

Sample matrices, analytical parameters, and frequency of sample collection are listed in Table C-1.

1.7 Site Maps of Sampling Locations

Map showing proposed sample locations is shown on Figures 3 and 9 the Work Plan.

1.8 Project Schedule

The project schedule for the RA activities for the Site are depicted in Section 7.2 of the Work Plan. The remedial action activities will be initiated within 15 days of U.S. EPA approving this Work Plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the U.S. EPA's Remedial Project Manager and the Settling Defendant, LFR has overall responsibility for conduct of the remedial activities. LFR will oversee the performance of the remedial activities. LFR will also support the U.S. EPA in community relations. The various QA and management responsibilities of key project personnel are defined below.

2.1 Project Organization Chart

An organizational chart illustrating the relationships between the Settling Defendant U.S. EPA, and LFR and its prime subcontractors for this project is shown in Figure 10 in the Work Plan. This chart includes the individuals discussed below.

Project Director:	Joseph L. Applegate, P.G.
Project Manager:	Shekhar R. Melkote, P.G.
Project Engineer	Scott Starr, P.E.
QA Officer:	Tracy Freiwald
Health and Safety Officer:	Shekhar R. Melkote, P.G.

The primary responsibilities of key personnel positions are described below. Subcontractors participating in this project are:

Contract Laboratory:

Columbia Analytical Services, Inc.
1 Mustard Street, Suite 250
Rochester, New York 14609-6925

Drilling Contractor:

Nothnagel Drilling
1821 Scottsville-Mumford Road
Scottsville, New York 14546

Remediation Contractor:

Marcor Remediation, Inc.
460 Buffalo Road, Suite 5
Rochester, New York 14611

2.2 Key Management Responsibilities

U.S. EPA Remedial Project Manager (George Jacob, CHMM)

The U.S. EPA Remedial Project Manager (RPM) will provide oversight of the remedial action and will work directly with the JCI's Project Manager and LFR while the project is being conducted.

JCI Project Manager (Timothy Gaffney, Executive Vice President, JCI Jones Chemicals, Inc., Caledonia, New York)

The Settling Defendant's Project Manager has overall responsibility for all phases of the remedial action. He has the authority to make the necessary decisions to implement and complete the project, although he will seek input from the New York State Department of Environmental Conservation (NYSDEC) and LFR. He will review LFR's work products, including data packages and reports, technical memoranda, and letters.

LFR Project Director (Joseph Applegate)

The LFR Project Director will support the Project Manager and project team in allocating adequate resources to meet the project objectives, schedule, and deliverables.

LFR Project Manager (Shekhar Melkote, P.G.)

The LFR Project Manager has overall responsibility for monitoring the project's adherence to U.S. EPA's objectives and LFR's quality standards. He will provide assistance in terms of writing and distributing the FSQAP to those parties connected with the project (including the laboratories). LFR's Project Manager along with the Project Engineer will be responsible for technical quality control and project oversight.

LFR Project Engineer (Scott Starr, P.E.)

The Project Engineer is a registered professional engineer in the state of New York. LFR Project Engineer will be responsible for the remedial system installation and operation. He will observe field construction activities, and manage system start-up and troubleshooting.

2.3 Quality Assurance Responsibilities

U.S. EPA QA Manager

The U.S. EPA QA manager will remain independent of direct job involvement and day-to-day operations and has direct access to LFR personnel to resolve QA issues, when necessary. She will audit the project's QA program to evaluate if project specific requirements, LFR's policies, and U.S. EPA requirements are being met. Specific functions and duties include:

- providing QA audits on various phases of the field operations
- reviewing and approving QA plans and procedures
- providing QA technical assistance to project staff
- reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Respondents' Project Manager and LFR's Project Director

LFR QA Officer (Tracy Freiwald)

LFR's QA Officer will report directly to the Project Manager (Shekhar Melkote) and will be responsible for monitoring adherence to LFR's procedures for this project. The QA Officer will be responsible for the data validation of the analytical laboratory data.

Responsibilities of the project QA Officer include, at a minimum:

- monitoring adherence to the protocols described in the FSQAP
- providing guidance or assistance and resolving problems on QA/QC topics

- verifying that the specified data collection methods comply with QA/QC requirements and will obtain data of desired quality and integrity
- reviewing, evaluating, and approving quality-related changes to the SAP and FSQAP
- identifying nonconformances and verifying that appropriate corrective actions have been taken
- providing assistance to the Project Manager regarding corrective actions and, if necessary, soliciting involvement from the NYSDEC QA Manager and the Respondents' Project Manager
- communicating regularly with the Project Manager, QA Program Manager, NYSDEC QA Officer, and subcontract laboratories' QA Officers to monitor the progress of the QA tasks
- acting as the main contact for project QA matters, and providing guidance and appropriate procedures to the Project Manager and support personnel
- conducting laboratory evaluations and audits to check that analyses are performed in accordance with the FSQAP

2.4 Field Responsibilities

LFR Field Leader (Scott Starr)

The LFR Field Leader will support the LFR Project Manager and is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The LFR Field Leader is a highly experienced environmental professional and will report directly to the LFR Project Manager.

Specific field team leader responsibilities include:

- provision of day-to-day coordination with the Project Manager on technical issues in specific areas
- developing and implementing field-related work plans, maintaining schedule compliance, and monitoring adherence to management-developed study requirements
- coordinating and managing field staff, including sampling, drilling, and supervising field laboratory staff
- acting as field sample custodian
- implementing QC for technical data provided by the field staff including field measurement data
- authoring, writing, and approving text and graphics required for field team efforts
- coordinating and monitoring technical efforts of subcontractors assisting the field team

- identifying problems at the field team level, resolving difficulties in consultation with the Project Manager, implementing and documenting corrective action procedures, and providing communication between team and upper management
- participating in preparation of the final report

The duties and organizational charts of each laboratory's personnel are included in their respective QA plans.

3.0 FIELD SAMPLING PLAN

To accomplish the remedial action objectives identified in the Remedial Action Work Plan, the following field screening and sampling activities will be conducted at the Site:

- Air sampling for chlorinated VOCs
- Ambient Air monitoring for personnel health and safety
- Groundwater sampling for chlorinated VOCs and ISCO parameters

3.1 Air Sampling

Air monitoring and sampling will be performed in conjunction with the operation of the soil vapor extraction system. The VOCs recovered from the extraction wells will be periodically monitored and recorded using a PID meter. In addition, vapor samples will be collected as specified in the Work Plan using a Tedlar® bag and analyzed for chlorinated VOCs PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride by U.S. EPA Method T-014 at Columbia Analytical Services, Inc. (CAS laboratories).

3.2 Ambient Air and Soil Vapor Sampling

The ambient air will be monitored during field activities in accordance with the Site HSP using a PID.

3.3 Groundwater Sampling

Groundwater samples from monitoring wells and on-site extraction wells will be sampled in accordance with Section 7.0 of EISOPQAM (U.S. EPA 1996; http://www.epa.gov/region4/sesd/eisopqam/sect_07.pdf). The samples will be analyzed for chlorinated VOCs PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride; selected groundwater samples will be analyzed for ISCO indicator parameters (total dissolved solids, manganese, color, and pH). Groundwater samples will be hand-delivered within 24 hours of collection to CAS laboratories under chain-of-custody. Sampling information, such as sample identification number, point identification

number, well volume purges, and physical parameters, will be recorded on the Water Quality Sampling Information form in Attachment C-1. Sample custody and documentation procedures are discussed in Section 4.

3.4 Field Preparation and Mobilization

Upon U.S. EPA's approval of the remedial action Work Plan, LFR and subcontractors will mobilize to the Site. Field implements and other sampling equipment will be cleaned in the equipment decontamination area setup on the Site. Field sampling equipment, such as pumps, drilling rods, augers will be decontaminated in accordance with the procedures outlined in the Appendix B "Standard Field Cleaning Procedures" of the EISOPQAM (U.S. EPA 1996; http://www.epa.gov/region4/sesd/eisopqam/appb.pdf).

Field preparation and mobilization will include the following tasks:

- obtaining an underground utility clearance
- designating a field decontamination area
- mobilizing equipment to the Site

3.4.1 Obtaining Underground Utility Clearance

Underground utilities were marked during the Remedial Investigation field activities. Site utility maps will be reviewed for recent underground utilities or construction.

3.4.2 Designating a Field Decontamination Area

A field decontamination area will be designated and constructed in an appropriate area of the Site for the containerization of liquid investigation-derived waste (IDW), such as spent water used in cleaning sampling equipment. Sampling equipment, will be washed between each sampling location in the decontamination area.

Liquid IDW, such as spent decontamination and purge water will be containerized for treatment on-site with the existing air stripper. Solid IDW, which is expected to be minimal, will be returned to the source area.

3.4.3 Establishing a Waste Storage Area

A portion of the Site that is readily accessible to transport trucks and sampling rigs will be designated as a waste storage area. The waste storage area will be where IDW is temporarily stored before its disposal. The waste storage area will be secured to limit public access.

3.4.4 Mobilizing Equipment to the Site

Equipment such as drilling rigs, support trucks, drilling supplies, and backhoe will be mobilized to the Site after approval of the RA Work Plan. Equipment will be secured to limit access to authorized personnel only.

4.0 SAMPLE HANDLING AND DOCUMENTATION

Activities described in the following sections will be performed in accordance with the methodologies and protocols described generally herein. LFR personnel will follow the procedures described in the EISOPQAM, which is available on the internet: www.epa.gov/region4/sesd/eisopqam. The following chapters of EISOPQAM provide specific procedures:

- Sample Custody Procedure (Section 3.3)
- Sample Containers, Sample Preservation, and Maximum Holding Time (Appendix A)
- Sample Handling, Packaging, and Shipment (Appendix D)
- Decontamination Procedures (Appendix C)
- Sampling Equipment and Procedures (Section 15)
- Groundwater Sampling Procedures (Section 7)
- Storage and Disposal of Investigative Derived Waste (Section 5.15)

4.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for soil samples are presented in Table C-3. The certified, subcontracted laboratory will provide appropriate sample containers in sealed cartons, as well as sample labels and preservatives. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate).

4.2 Packing, Handling, and Shipping Requirements

The laboratory also will provide sample custody seals and packing materials for filled sample containers. The filled, labeled, and sealed containers will be placed in a cooler with bagged ice and carefully packed to reduce the possibility of container breakage. Samples will be packaged by field personnel and transported in accordance with applicable shipping regulations. The packaged samples will be hand-delivered to the laboratory within 24 hours of sample collection.

4.3 Documentation

Field personnel will provide documentation for field sampling, field analysis, and chain-of-custody activities. This documentation will facilitate reconstruction of field events and will aid in the data review and interpretation process. Documents, records, and information relating to fieldwork performance will be retained in a project file. The various forms of documentation that will be maintained throughout the RA are outlined below.

4.3.1 Daily Production Documentation

The Field Leader or his designee will record field activities performed at the Site on the Daily Field Report (Attachment C-1). The specific field testing and sampling measurements will be recorded on the Field Activities Record (Attachment C-1). At the end of each field day, each field activity form will be reviewed and initialed by the field staff.

4.3.2 Sampling Information

During soil sampling, detailed notes will be made regarding the location of sampling, physical observations, sample depths, and weather conditions on Field Activities Record form. Water-Quality Sampling Information and Water Level Measurements forms will be used during groundwater sampling (Attachment C-1).

4.3.3 Sample Chain-of-Custody

Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. The chain-of-custody forms provided by the laboratory will be used (an example of LFR's chain-of-custody form is included in Attachment C-1). The forms will be completed after each sampling site, after a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated responsible for sample custody. If the designated sampling person relinquishes samples to another sampling personnel or another field personnel, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer.

The original chain-of-custody form will accompany the samples to the laboratory, and copies will be forwarded to the designated Quality Assurance Officer for the RA. Field custody and documentation procedures will be performed in accordance with the methodologies and protocols generally described in detail in Section 3.3 EISOPQAM (U.S. EPA 1996).

Laboratory custody and documentation procedures are described in CAS laboratories' QA Manual in Section 8.

4.3.4 Field Equipment, Calibration, and Maintenance Logs

To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for appropriate field equipment. Calibration procedures are provided in Section 6.0.

4.3.5 Management of Investigation-Derived Materials and Wastes

Handling of IDW materials and wastes is discussed in Section 3.4.2. IDW will be tracked using the Drum and Bin Tracking Sheet (Attachment C-1).

4.4 Sample Designation System

LFR field personnel will assign a unique sample number to each sample collected during this investigation. The sample number will identify the project site, sample matrix, location code and sample number. For this investigation, LFR proposes retaining the existing well labels. The collected air sample will be designated by the number and time of collection (example: SVE -Inf-1 (1430).

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators that include method detection limit, precision, accuracy, completeness, representativeness, and data comparability.

The overall QA objective for this project is to develop and implement procedures for defensible sampling, chain-of-custody, laboratory analysis, and reporting that will provide results to meet the requirements of Work Plan. The analytical levels to support the objectives are discussed in Section 1.4 of this FSQAP.

QA objectives are generally defined in terms of the following six parameters:

- required quantification limits
- precision
- accuracy
- completeness
- representativeness
- data comparability

5.1 Required Quantification Limits

The required quantification limit is the quantitative analytical level for individual analytes necessary to characterize the risk associated with human health and environment. Quantitative limits may be expressed as the method detection limit (MDL) or practical quantitation limit (PQL).

MDL is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that its concentration is greater than zero.

PQL is the concentration in a sample analysis that corresponds to the lowest concentration standard of the calibration curve.

5.2 Precision

Precision is the measure of reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the RD objectives. To obtain a high level of precision, sampling, calibration and analytical procedures will be followed. Checks for analytical precision will include the analysis of field duplicates, laboratory standards, and matrix spike/matrix spike duplicate (MS/MSD) analyses. Checks for field measurements will include obtaining duplicate field measurements.

5.3 Accuracy

Accuracy is the deviation of a measurement from the true value of a known standard. Field and analytical accuracy will be monitored through initial and intermittent calibration of the appropriate instruments. In addition, internal standards, matrix spikes, blank spikes and surrogates will be used to assess the accuracy of laboratory analytical data.

5.4 Representativeness

Representativeness, the degree to which sampling data accurately and precisely represent Site conditions, is dependent on sampling and analytical variability. The Work Plan presents the rationale for the sampling, and the FSP and this FSQAP present sampling and analytical methodologies that are intended to provide representative data.

5.5 Data Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between the RD/RA and to the extent possible with the previously collected data will be maintained.

QA objectives for field measurement data are summarized in Table C-2. QA objectives for laboratory activities are provided in the CAS laboratories' QA Manual.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

LFR personnel will calibrate field instruments according to the LFR SOPs (Attachment C-1). The following field instruments will be used during this investigation:

- pH and ORP/Eh meter
- specific conductance meter
- photoionization detector (PID)
- flame ionization detector (FID)
- DO meter
- turbidity meter
- HACH kits for dissolved ferrous iron, sulfide and alkalinity measurements

Field and laboratory analytical equipment will be calibrated according to known standards to maintain QA/QC objectives. SOPs that are not in the EISOPQAM are provided in Attachment C-1; these SOPs discuss calibration procedures for field instruments such as the DO meter, the turbidity meter, and the HACH Kits used for measuring ferrous iron, sulfide, hydrogen sulfide, and alkalinity.

Calibration procedures and frequency for laboratory analytical instruments are provided in Section 11 of CAS laboratories' QA Manual.

7.0 ANALYTICAL PROCEDURES

Water, soil and vapor samples collected for analysis of VOCs will be hand-delivered to CAS laboratories, Rochester, New York (800-695-7222).

Analytical methods for the air and groundwater samples for VOCs being analyzed at the Site will be by EPA Methods TO-14 and 8260B, respectively.

7.1 Field Analytical Procedures

Field measurements include OVA – PID screening, temperature, pH, specific conductance, DO, ORP/Eh, and turbidity. Specific QA objectives for field parameters are listed in Table C-2.

7.2 Laboratory Analytical Procedures

CAS laboratories will conduct soil and groundwater analysis by analytical methods listed in Tables 5 and 6. In addition, detailed analytical procedures (including MDL and/or PQL and QA objectives) are provided in their QA Manual (submitted under separate cover).

8.0 INTERNAL QUALITY CONTROL CHECKS

Field and laboratory control checks will be used to maintain project DQOs. QC checks will include duplicates, spiked samples, blanks, laboratory control samples, internal standards, surrogate samples, calibration standards, and reagent checks. The proposed QA/QC blanks to be collected in the field are presented in Table C-1.

8.1 Internal Checks for Laboratory Activities

Internal QC checks for laboratory activities will be performed as specified in Section 10 of CAS laboratories' QA Manual.

8.2 Internal Checks for Field Activities

QA/QC procedures for field activities will include the collection of equipment blanks, field duplicates, trip blanks, and MS/MSD. Field QA/QC will be collected as specified in Table C-1.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data generated by field activities or laboratory operations shall be reduced and validated prior to reporting. Data reduction, validation and reporting information for the laboratories are provided in Section 12 of CAS laboratories' QA Manual.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the Field Sampling Plan and FSQAP. The audits of field and laboratory activities include two independent procedures: internal and external audits.

Field audits will assess sample collection protocols, determine the integrity of chain-of-custody procedures, and evaluate sample documentation and data-handling procedures. Field audits will be scheduled by the U.S. EPA RPM, LFR QA Officer or Project Manager. Written records of audits and recommendations for corrective action will be submitted to the Respondents' Project Manager and U.S. EPA RPM.

Requirements for audits of laboratory operations are outlined in Section 13 CAS laboratories' QA Manual.

11.0 PREVENTIVE MAINTENANCE

11.1 Field Instrument Preventive Maintenance

The field equipment for this project includes pH meters, specific conductivity meters, turbidity meters, DO meters, and FID/PIDs. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented on Field Meter/Calibration logs. A summary of preventive maintenance procedures is presented in Table C-4.

Laboratory routine preventive maintenance programs used to minimize the occurrence of instrument failure and other system malfunctions are described in Section 14 of the QA Manual.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

QA objectives are presented in Table C-2. Procedures used to assess data in laboratory-measured parameters are outlined in the Section 9 of CAS laboratories' QA Manual.

13.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out-of-quality-control performance which can affect data quality. Corrective action may occur during field activities, laboratory analyses, data validation and data assessment. LFR's QA Officer initiates corrective action procedures for field activities.

Corrective action procedures for laboratory activities are stated in Chapter 15 of the CAS laboratories' QA Manual.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

QA reports are designed to keep project members informed of the performance of QA/QC activities. The validity and documentation of data gathering activities should be addressed in the reports. Project-specific audits, significant problems, and solutions and corrective actions implemented concerning QA/QC activities are also summarized in the reports. Specific details of these reports are outlined Section 16 of the CAS laboratories' QA Manual.

REFERENCES

Columbia Analytical Services, Inc. 2001. Quality Assurance Manual. Rochester, New York. June 29.

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. 1996 (Includes 1997 Revisions). Enforcement and Investigations Branch. US-EPA, Region 4, SESD, Athens, Georgia. May.

Table C-1
Analytical Parameters and Quality Assurance/Quality Control Samples
JCI Jones Chemicals, Inc., Superfund Site
Caledonia, New York

Analyte	Matrix	Analytical Method[1]	Trip Blank	Equipment Blank(s)	Field Duplicate(s)	MS/MSD	Data Level(s)
Chlorinated VOCs	Air	TO-14	None	None	None	None	III
Chlorinated VOCs	MWs/Ews	SW-8260B	One per cooler	1	1/event	1	III
Total Dissolved Solids	MWs	160.1	None	None	1	None	III
Color	MWs	110.2	None	None	1	None	III
Manganese	MWs	200.8	None	None	1	None	III

Notes:

[1]Samples analyzed at CAS Laboratory, Rochester, New York

VOC = volatile organic compound (tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride)

MW = monitoring well

EW = extraction well

EPA = United States Environmental Protection Agency

Table C-2
Quality Assurance Objectives for Field Measurements
JCI Jones Chemicals, Inc., Superfund Site
Caledonia, New York

Parameter	Method Reference[1]	Precision[2]	Accuracy[3]	Completeness
WATER				
Standing Water Levels	Solinist Water Level Indicator	±0.01 feet	0.001 feet	95%
Temperature	E170., Mercury Thermometer or Electronic Temp. Probe	±0.5°C	1.0°C	95%
Conductivity	E120.1, Electrometric	±25	10 umho/cm^2	95%
pH	E150.1, Electometric	±0.1 pH units	0.05 pH units	95%
Turbidity	E180.1	10 NTU[4]	0.5 NTU[4]	95%
Redox Potential	ASTM 1498-93	±10mV	10 mV	95%
Dissolved Oxygen	SM-A4500	±0.05 mg/l	±0.1 mg/l	95%

Notes:

1. Methods: E - *Method for Chemical Analysis for Water and Wastes* (U.S. EPA 1983).
   SW - *Test for the Evaluation of Solid Waste*, SW-846 (U.S. EPA, September 1986).
   SM - *Standard Methods for Examination of the Water and Wastewater*, 18th ed. (APHA 1992).
   ASTM - *Annual Book of ASTM Standards* (American Society of Testing and Materials 1995).
2. Expressed as the acceptable deviation.
3. Expected based on equipment manufacturer's specifications.
4. Acceptable accuracy and precision based on the measured range.

NTU = nephelometric turbidity unit

NA = not applicable

Table C-3
Sample Container, Preservation, and Holding Time Requirements
JCI Jones Chemicals, Inc., Superfund Site
Caledonia, New York

Matrix	Analysis	Container	Preservation	Holding Time
Water	Volatile Organic Compounds	three 40-ml septum cap vials	Hcl to pH < 2, cool to 4°C	14 days
	Total Dissolved Solids	one 1-liter plastic bottle	Cool to 4°C, None	7 days
	Color	one 1-liter plastic bottle	Cool to 4°C, None	7 days
	Manganese	one 500-ml polyethylene bottle	HNO_3 to pH < 2Cool to 4°C	6 months
Air	Volatile Organic Compounds	Tedlar Bag	Cool to 4°C, None	48 hours

Notes:
ml = milliliter
°C = degrees Celcius
Hcl = hydrochloric acid
HNO_3 = nitric acid

Table C-4
Preventive Maintenance for Field Instruments
JCI Jones Chemicals, Inc., Superfund Site, Caledonia, New York

Instruments	Maintenance Procedures/Schedule	Spare Parts
Flame Ionization Detector *Photovac Model No. MicroFID, Foxboro OVA 128*	1. Calibrate daily, or more often as needed. 2. Maintain adequate hydrogen supply. 3. Check battery and recharge as needed. 4. Replace filter as needed.	1. Battery charger 2. Replacement filters
Photoionization Detector *Photovac Model No. 2020, Thermo-Environmental Model No. 580 B*	1. Calibrate daily, or more often as needed. 2. Check battery; recharge when low. 3. Clean lamp as needed. 4. Replace filter as needed. 5. Clean detector element (ultrasonically) as needed.	1. Battery charger 2. Replacement filters
Water Level Meter *Solinst Model No. 101*	1. Check tape for integrity and nicks, etc. at least once per year. 2. Replace battery as needed.	1. Batteries
Turbidity Meter *Orbeco-Hellige Model No. 966*	1. Check calibration daily, or more often as needed. 2. Replace battery as needed. 3. Check calibration with Formazin quarterly.	1. Batteries 2. NTU zero and NTU 40 buffers
Dissolved Oxygen Meter *YSI Model No. 95*	1. Calibrate daily, or more often as needed. 2. Check meter calibration via Winkler titration method at least once per year. 3. Replace membranes as needed. 4. Clean electrode every six months, or more often as needed. 5. Check temperature calibration with NIST traceable thermometer once per year.	1. Batteries 2. Extra membranes 3. Membrane solution
Ph/Eh Meter *Beckman Model Nos. 10, 11, and 210; Cole-Parmer Model No. 5938-10*	1. Calibrate daily, or more often as needed. 2. Clean electrodes once per year, or more often as needed. 3. Keep electrode in storage solution when not in use. 4. Check temperature calibration with NIST traceable thermometer once per year. 5. Replace batteries as needed.	1. pH buffers 2. Storage solution
Conductivity Meter *Cole-Parmer Model No. 19820 and 19815*	1. Calibrate daily, or more often as needed. 2. Replace batteries as needed. 3. Check temperature with a NIST traceable thermometer at least once a year. 4. Clean electrode at least every six months, or more often as needed.	1. Conductivity buffers 2. Batteries
Pressure Transducer *Instrumentation Northwest Model No. PSI 9000*	1. Calibrate yearly, or more often as needed.	None
Data Logger *Aquistar Model No. DL-4A*	1. Check batteries; recharge as needed. 2. Verify correct operation with pressure transducer and computer at least once per year.	1. Extra rechargeable batteries 2. Computer program disc
Colorimeter *HACH Model No. DR/700*	1. Replace batteries, as needed (good for approximately 500 tests). 2. Replace modules, as needed.	1. Batteries
Digital Titrator *HACH Model No. 16900*	1. Check performance of reagents and digital titrator at least annually. 2. Replace titration cartridges, as needed.	1. Batteries

Attachment C-1

Field Sampling Forms

LFR Inc.
Drum and Bin Tracking Sheet
Soil, Groundwater, and Carbon Storage

Project Number: _____ **Project Manager:** _____

Project Name: _____ **Project Location:** _____

No. of Containers	Type of Container (Drum/Bin)	Material (groundwater, soil, spent carbon)	Date Generated	LFR Staff	Sampling Date	LFR Staff	Hazardous (Y/N)	Chemicals of Concern	Destination Disposal Facility/ Manifest No.	Transportation Date	LFR Staff

CHAIN OF CUSTODY / ANALYSES REQUEST FORM

Project No.:	Field Logbook No.:	Date:	Serial No.:
Project Name:	Project Location:		
Sampler (Signature) :			

SAMPLES					ANALYSES									Samplers:
SAMPLE NO.	DATE	TIME	LAB SAMPLE NO.	NO. OF CON-TAINERS	SAMPLE TYPE								HOLD / RUSH	REMARKS

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
METHOD OF SHIPMENT:	DATE	TIME	LAB COMMENTS:		

Sample Collector:

LFR Levine-Fricke
3382 Capital Circle, North East
Tallahassee, Florida 32308-1568
(904) 422-2555

Analytical Laboratory:

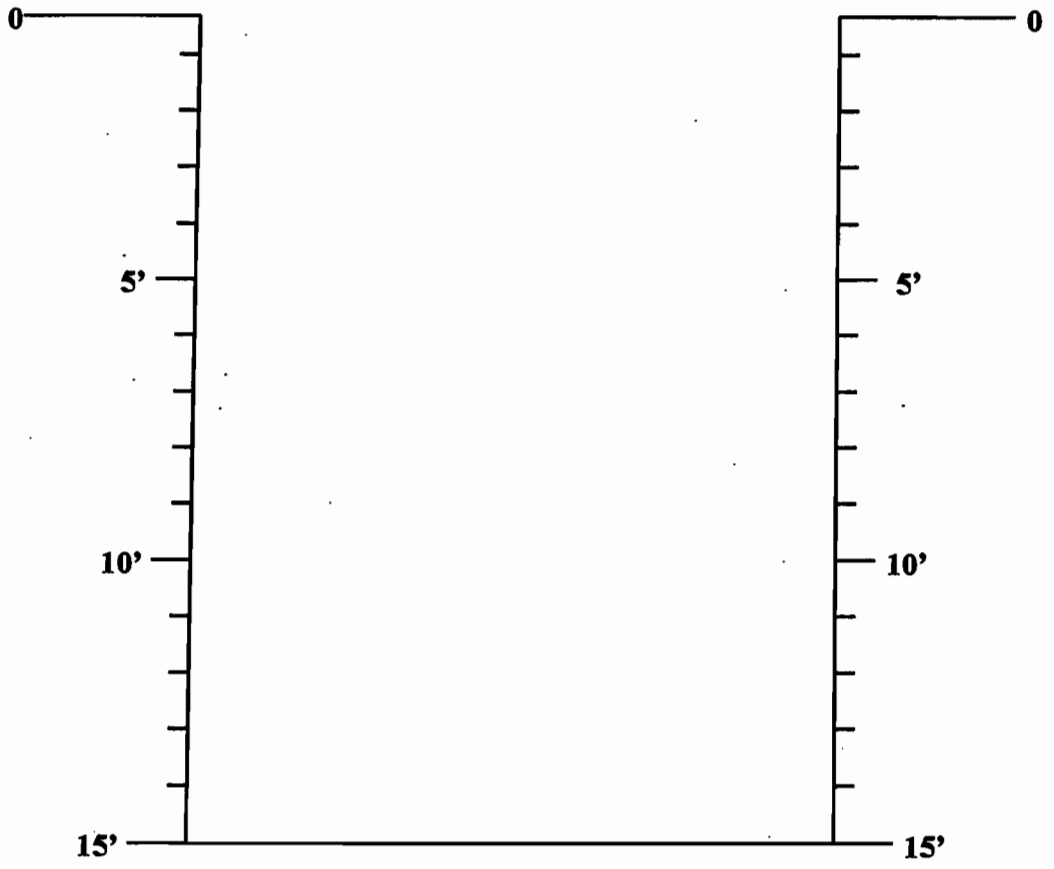
Shipping Copy (White) Lab Copy (Green) File Copy (Yellow) Field Copy (Pink)

FORM NO. 86/COC/ARF

LFR
LEVINE • FRICKE

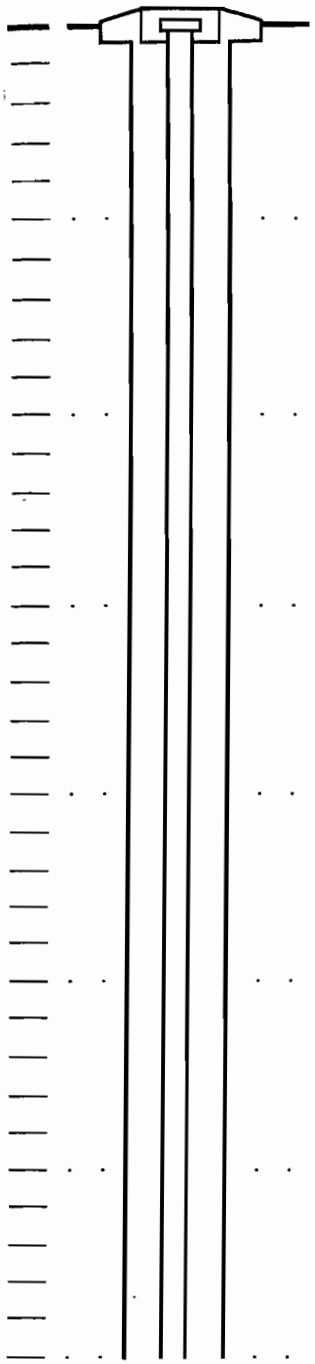
Project Name _____
Project Number _____
Location _____
Logged By _____ Date _____

TEST PIT LOG



NOTES: _____

WELL CONSTRUCTION	LITHOLOGY		SAMPLE DATA	
Depth, feet	Graphic Log	Description	Sample No. and Interval	Penetration Rate (Blows/ft.)



LF SOP No.: _____ SOP Followed (Y/N) _____ If No, complete and attach SOP Deviation Form and return to LF Principal Investigator

Well Permit No.: _____

Date well drilled: _____

Date water level measured: _____

Well elevation: _____

Drilling Company: _____

Driller: _____

Sampling method: _____

Hammer weight: _____

Sketch of Well Location:

LF Geologist/Engineer: _____ *Date:* _____

FIELD LOG OF WELL CONSTRUCTION AND LITHOLOGY FOR

Project No. Protocol No.

LFR LEVINE•FRICKE
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

LFR Inc.
WATER-QUALITY SAMPLING INFORMATION

Project No.: _____

Project Name: _____

Sample Location: _____

Sampler's Name: _____

Sampling Plan Prepared By: _____

Sampling Method: _____

Date: _____

Sample No.: _____

FB: _____

DUP: _____

- ☐ Centrifugal Pump
- ☐ Submersible Pump
- ☐ Hand Bail
- ☐ Disposable Bailer
- ☐ Teflon Bailer
- ☐ _____ (Other)

Analyses Requested	Number and Types of Bottle Used

Method of Shipment

_____ (Lab Name)

Courier: _____

Hand Deliver: _____

Well Number: _____

Depth of Water: _____

Well Depth: _____

Height of Water Column: _____

Volume in Well: _____

Well Diameter: _____

____ 2″ (0.16 gallon/feet)

____ 4″ (0.65 gallon/feet)

____ 5″ (1.02 gallon/feet)

____ 6″ (1.47 gallon/feet)

80% DTW _____

Time	Depth to Water	Volume Purged (gallons)	Totalizer Reading	Temperature (°C)	pH (SU)	Conductance (µmhos)	Turbidity (NTU)	DO (mg/l)	Remarks

Inlet Depth: _____

Comments: _____

(Recommended Method for Purging Well)

_____

LFR Inc.
Water Level Measurements

Project Name: _____ Date: _____

LFR Project No.: _____ Time: _____

General Observations: _____

Field Personnel: _____

A	B	C	D	E	F	G
Well ID	Well Elevation (feet)	Depth to Water Measurements (feet) 1st	2nd	Average	Water Level Elevation (B-E; feet)	Remarks

Equipment Used for Water Level Measurement: _____

Meter/Equipment I.D. Number: _____

Date:_____ LFR Job #_____

Daily Field Report

Name:_____ Job Name:_____

LFR Inc.

Employee Names	Time Onsite	Time Offsite	Hours Billed	Task #

Weather:_____
Temp. High:_____
Temp. Low:_____
Percipitation:_____

Work Completed By LFR:

Scheduled Future Work:

Scheduled Work Completion:

Equipment Rental By LFR:

Equipment Type	Useage

Samples Taken By LFR:

COC#_____
Laboratory:_____
Shipment Method:_____
Coolers:_____
Of Samples_____ Type:_____
Analytical Methods:_____
Shipment Date:_____

Purchases/Expenses By LFR:

Material	Cost	Payment	P.O.

Visitors

Name:_____
Time Onsite:_____ Offsite:_____
Affiliation:_____

Subcontractors

Name:
Time Onsite_____ Time Offsite_____
Of Employees_____ Type Of Equipment_____
Work Completed:

LFR Inc.
Field Activities Record Form

Project Number: _____ **Site Name:** _____

Field Personnel: _____ **Date:** _____

Date	Initials	Notes

Initials _____ Date _____

LFR Inc.
Employee Safety Information Form

This form is for use by employees who wish to provide a safety suggestion or report an unsafe workplace condition or practice

Description of Unsafe Condition or Practice

Causes or Other Contributing Factors

Employee's Suggestion for Improving Safety

Has this matter been reported to the Group Manager? ☐ **Yes** ☐ **No**

Employee Name (optional): _____

Date: _____

Employees are advised that use of this form or other reports of unsafe conditions or practices are protected by law. It would be illegal for LFR Inc. to take any action against an employee in reprisal for exercising rights to participate in communication involving safety.

LFR Inc. will investigate any report or question as required by the Injury and Illness Prevention Program Standard (8 CCR 3203) and will advise the employee who provided the information or the workers in the area of the response.

Attachment C-2

LFR Standard Operating Procedures

LFR STANDARD OPERATING PROCEDURE

OPERATION AND MAINTENANCE OF THE YSI MODEL 95 DISSOLVED OXYGEN METER

1.0 PURPOSE AND SCOPE

1.1 This LFR Levine·Fricke (LFR) standard operating procedure (SOP) describes how to measure dissolved oxygen (DO) using a YSI model 95 Dissolved Oxygen Meter. This meter has a range of 0 to 50 mg/l, a resolution of 0.01 mg/l, and an accuracy of ± 0.2 mg/l. Response time is 35 seconds for 95% change at 25 °C.

2.0 OPERATING INSTRUCTIONS FOR DISSOLVED OXYGEN MEASUREMENTS

2.1 Refer to the manufacturer's operating instructions for more detailed instructions than are presented here, if necessary.

2.2 Press the ON/OFF button. Allow approximately 15 minutes for the meter to warm up.

2.3 For best results, calibrate the meter each time it is turned on. Refer to Section 3.0 for calibration procedures.

2.4 Press MODE button until meter is in Dissolved Oxygen mg/l mode.

2.5 Collect sample, insert probe, and stir.

2.6 When the dissolved oxygen content is displayed on the screen, press the ENTER button and hold for approximately 2 seconds. The meter will flash SAVE on the display along with a site identity that it assigned (1 through 50).

3.0 CALIBRATION PROCEDURES

3.1 Ensure the sponge in the calibration chamber is wet. Insert the probe into the calibration chamber.

3.2 Turn the instrument on using the ON/OFF button. Allow the meter to warm up for approximately 15 minutes. Press the MODE button until dissolved oxygen is displayed in mg/l.

3.3 To enter the calibration menu, use two fingers to press and release both the UP ARROW and DOWN ARROW buttons at the same time (press DOWN ARROW slightly before UP ARROW).

3.4 Enter the local altitude using the arrow keys; 0 altitude for Florida.

3.5 Enter the salinity of the sample that is being measured (0 to 80 ppt) using the arrow keys; 0 for fresh water.

LFR STANDARD OPERATING PROCEDURE

OPERATION AND MAINTENANCE OF THE ORBECO-HELLIGE TURBIDITY METER

1.0 PURPOSE AND SCOPE

1.1 This LFR Levine·Fricke (LFR) standard operating procedure (SOP) describes the operation and maintenance of the Orbeco-Hellige Model 966 turbidimeter. This turbidity meter gives results in Nephelometric Turbidity Units (NTU) over three turbidity ranges: 0–20.00, 0–200.00, and 0–1000, with a test resolution of 0.01, 0.1, and 1, respectively. Readings for low and medium ranges have an accuracy of ±2%.

2.0 OPERATING INSTRUCTIONS FOR TURBIDITY MEASUREMENTS

2.1 Refer to the manufacturer's operating instructions for more detailed instructions than are presented here, if necessary.

2.2 Place the turbidity meter on a relatively flat and horizontal surface.

2.3 Allow approximately 15 minutes for the meter to come to equilibrium after major changes in temperature.

2.4 Perform a calibration check/adjustment before each day's use. Refer to section 3.0.

2.5 Select a test range: 0–20.00, 0–200.00, or 0–1000. Unless the sample is very turbid, you may want to start with the 0–20.00 range. If a reading of "1" occurs, switch to a higher range.

2.6 Collect a sample.

2.6.1 Use clean, dry, and relatively scratch-free sample containers (20 milliliter [ml], clear glass containers). Scratches, condensation, fingerprints, and dirt may provide inaccurate results, especially when measuring values below 10 NTU.

2.6.2 Fill the sample container to its neck. A lower meniscus may cause inaccurate results. Pour sample carefully and slowly to avoid bubbles from forming and clinging to the inside container. If bubbles appear, swirl tube, strike bottom gently to dislodge them or let container stand with cover removed until bubbles can be knocked free by gentle tapping.

2.6.3 Cap container tightly.

2.7 Remove the red dust cover from the TUBE well. Holding the sample container by the cap, insert it into the tube well and gently push down. Place the WELL CAP over the cap of the sample container. It should sit flush on the gray outer ring of the tube well.

STANDARD OPERATING PROCEDURE

Beckman Electronic pH/Temperature Meter (or Equivalent)

1.0 PURPOSE AND SCOPE

1.1 This LFR Inc. (LFR) standard operating procedure (SOP) describes the operation and maintenance of the Beckman electronic pH/temperature meters Models Φ-10 and Φ-11 currently used by LFR.

2.0 CALIBRATION

2.1 The meter should be calibrated prior to each day's use. The instrument should be calibrated if it is dropped, the batteries are replaced, or at the operator's discretion. Record the calibration on the appropriate form.

2.2 The Beckman meters automatically compensate for temperature affects on the **pH probe response**. However, these meters cannot compensate for temperature affects on the **actual pH** of the **buffer solutions** (because of differences in the chemistry of various solutions). Therefore, theoretical buffer solution values may need to be corrected for temperature affects at the time of calibration. Charts showing temperature affects for LFR's typical buffer solutions (provided by the manufacturer) should also be attached to the buffer solution bottles. These affects are usually negligible, but may be significant at temperature extremes. If the correction is negligible, this step may be omitted.

At the start of calibration, measure and record the buffer temperature (one may assume that each buffer is the same temperature, if storage conditions are equivalent). Based on the buffer temperature, read the corrected buffer pH value from the chart (those shown on the buffer bottle). Record these corrected values for each buffer solution to be used on the calibration log as the Theoretical pH Value (Temperature Corrected). After correcting the Theoretical pH buffer solution values for temperature (if necessary), proceed with calibration.

2.3 Turn on the meter and clear the display. Immerse pH and temperature probe in buffer 7 solution. Stir briefly and wait approximately 1 minute.

2.4 Press "pH," then press "STD." When auto "eye" stops flashing, display will show "locked" pH value. (Note: The "locked" value is not recorded in calibration paperwork.)

2.5 Rinse the probes in clean or de-ionized water. Immerse the pH probe in a second buffer standard solution of pH 4 or 10, whichever is closer to the anticipated sample pH. Stir briefly with the probe and wait approximately 1 minute before continuing. Press "STD" only (not "pH," as this will clear the initial standard calibration), and wait until the auto "eye" stops flashing. Display will show

"locked" pH value. (Note: The Theoretical value calculated by the operator is entered in the calibration log.) Rinse the electrode in clean or de-ionized water.

2.6 Check the calibration in the two buffers by following the operating instructions and record measured values in the actual column of the calibration log. The temperature is also recorded in the temperature column. Measured (actual) readings within ±0.20 of the theoretical value are acceptable. If the actual readings vary by more than ±0.20, the meter should not be used and should be labeled for repair.

3.0 OPERATING INSTRUCTIONS FOR pH MEASUREMENTS

3.1 Follow the meter manufacturer's model-specific operating instructions, as needed.

3.2 The meter must be calibrated prior to each day's use.

3.3 Rinse pH electrode and automatic temperature compensator probes with clean or de-ionized water, and gently shake or blot to remove excess water. Immerse probes in sample and stir briefly.

3.4 Measurements may be made with the auto mode either on or off. Measurements taken with the auto mode off may be more accurate than those taken with it on because the auto function may "lock on" to a reading before it has stabilized. Use the auto "eye" to toggle back and forth.

3.5 To take the measurement with the auto mode off, press "pH" and wait until the reading stabilizes. Record the pH and temperature.

3.6 To take the measurement with the auto mode on, press "pH" and wait until the auto "eye" symbol stops flashing. Record the pH and temperature.

3.7 Rinse the probes with clean or de-ionized water before beginning the next sample measurement or before storage.

3.8 For storage, soak the pH probe in a "storage solution" that has been designed specifically for the purpose of pH probe storage. It is normal for white crystals to form on the outside of the probe when it is in contact with a storage solution. If a storage solution is not available, the pH buffer of 7.00 standard units may be used temporarily (distilled or de-ionized water should not be used).

3.9 If solutions to be metered are likely to damage the probe or interfere with the reliability of readings, it is preferable to prearrange an alternative to field pH readings with the Principal Investigator.

4.0 ROUTINE MAINTENANCE

4.1 Change the batteries, as needed. This pH meter takes two 3.6-volt AA lithium batteries. Refer to the manual for specific instructions.

4.2 Clean the pH probe when performance indicates excessive slowness of response time and/or increase in drift during the calibration procedure. The probe may be cleaned more often as this may improve response time and prolong probe life. To clean the probe, soak in pH probe-cleaning solution (or 10% HCL/water) and rinse with de-ionized water.

4.3 Check the accuracy of the temperature reading using a NIST-traceable thermometer periodically, or at least once a year. Readings within 1.0°C are acceptable. Readings outside this range indicate that the temperature probe may need to be replaced.

5.0 INSTRUMENT MALFUNCTION

5.1 If the meter will not operate satisfactorily, it should not be used.

STANDARD OPERATING PROCEDURE

VWR Conductivity Meter

1.0 PURPOSE AND SCOPE

1.1 This LFR Inc. standard operating procedure (SOP) describes the operation, calibration, and maintenance of the VWR Model 23226-523 conductivity meter, or equivalent.

2.0 CALIBRATION

2.1 Calibrate meter prior to each day's use or more often. The instrument may need additional calibration if it is dropped, the batteries are replaced, or at the operator's discretion. Record calibration results in the appropriate calibration log.

2.2 To calibrate, use a conductivity standard calibration solution that has a value close to the expected value of the test solution. Calibration should be done on the same range to be used for making measurements

2.3 Immerse electrode in the conductivity standard and let the reading stabilize.

2.4 Adjust the trimmer screw on the back of the meter casing until the display indicates the nominal value of the standard.

2.5 Record results in calibration log. Rinse the electrode in de-ionized or distilled water.

3.0 OPERATING INSTRUCTIONS

3.1 Calibrate the conductivity meter prior to use or more often (see Section 2.0).

3.2 Set Function switch to Micromho, and Range switch to desired range. Using the lowest range possible for any given measurement yields greater accuracy.

3.3 Immerse the electrode into the test solution. Stir gently and wait a few seconds for readings to stabilize. If the temperature of the test solution differs from the ambient temperature, readings may take one to two minutes to stabilize, while the electrode and solution temperatures equalize.

3.4 Record readings. When using the 20,000µS and 200,000µS ranges, the displayed number must be multiplied by 1,000 to yield a value in microsiemens.

3.5 Rinse the electrodes in deionized or distilled water after each use.

3.6 Turn the meter OFF and store in protective carrying case.

LFR STANDARD OPERATING PROCEDURE

OPERATION AND MAINTENANCE OF THE PLATINUM REDOX ELECTRODE

1.0 PURPOSE AND SCOPE

This LFR Levine·Fricke (LFR) standard operating procedure (SOP) describes how to measure redox potential (ORP) to determine the oxidizing or reducing capability of a solution using an Orion Model 96-78 combination platinum redox and silver/silver chloride reference electrode probe. This probe has an epoxy body with sleeve reference junction and is resistant to acids, bases, and inorganic solvents, but should not be used in polar organic solvents.

2.0 OPERATING INSTRUCTIONS FOR PLATINUM REDOX ELECTRODE

2.1 Refer to the manufacturer's operating instructions for more detailed instructions than are presented here, if necessary.

2.2 Fill the chamber of the probe with 4 M KCl saturated with Ag/AgCl. Afterward, push the cap and body together to leak some filling solution past the conical reference junction.

2.3 Insert the platinum redox connector (large diameter) into the pH electrode input jack on the meter and the reference electrode connector (small diameter) into the reference electrode input jack.

2.4 Turn the meter on, set the function switch to the millivolt mode, and place the electrode in the sample solution (the filling solution level should be at least one inch above the sample solution). No calibration is necessary.

2.5 Record the ORP measurement.

3.0 ELECTRODE MAINTENANCE

3.1 The electrode can be routinely cleaned without disassembling. To remove precipitate that forms on the outside, rinse with distilled water.

3.2 Clean the inside by flushing with filling solution.

3.3 When not in use the electrode may be stored in water or air. If stored in air, the outside should be rinsed with distilled water, the filling solution should be drained from the inside chamber, flushed out with distilled water, and stored dry.

4.0 INSTRUMENT MALFUNCTION

If the meter/probe will not operate satisfactorily, it should not be used.

APPENDIX D

HEALTH AND SAFETY PLAN

Health and Safety Plan
JCI Jones Chemicals, Inc. Superfund Site
Caledonia, New York

June 13, 2003
004-03165-03-03

Prepared for
JCI Jones Chemical, Inc.
100 Sunny Sol Boulevard
Caledonia, New York

Prepared by
LFR Levine·Fricke
3382 Capital Circle, N.E.
Tallahassee, Florida 32308-1568

LFR
LEVINE • FRICKE

CONTENTS

1.0 GENERAL

LFR Levine·Fricke (LFR) has prepared this Health and Safety Plan (HSP) to use during the Remedial Design/Remedial Action (RD/RA) activities to be conducted at JCI Jones Chemicals, Inc. facility, located at 100 Sunny Sol Boulevard in Caledonia, New York ("the Site"). Activities conducted under LFR's direction at the Site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in 29 Code of Federal Regulations (CFR), and other applicable federal, state, and local laws, regulations, and statutes. A copy of this HSP will be kept on site during scheduled field activities.

This HSP addresses the potential hazards associated with planned field activities at the Site. It presents the minimum health and safety requirements for establishing and maintaining a safe work environment during the course of work. In case of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If work plan specifications change or if site conditions encountered during the course of the work are found to differ substantially from those anticipated, the Southeast Director of Health and Safety will be informed immediately upon discovery, and appropriate changes will be made to this HSP.

It is the Project Manager's responsibility to ensure that health and safety procedures are enforced at the Site. Project personnel, including subcontractors, shall receive a copy of this HSP for review and sign the form to indicate acceptance before on-site project activities begin.

LFR's health and safety programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in the LFR Corporate Health and Safety Manual. These health and safety procedures are incorporated herein by reference, and LFR employees will adhere to the procedures specified in the manual.

When specified in contract documents, this HSP may cover the activities of LFR subcontractors. However, this HSP may not address hazards associated with tasks and equipment that are specialties of the subcontractor (e.g., operation of a drill rig). Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, and procedures.

LFR is responsible for the safety of its employees and subcontractors under its control, but assumes no responsibility for the activities of other contractors or their subcontractors who may be working concurrently at the general project location. LFR will use a reasonable degree of care when marking potentially hazardous areas within its project work site and restricting access as appropriate. LFR will not be responsible for others outside its control who disregard such marked hazards or restricted access. This HSP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to LFR's work. All references, therefore, to

the site, the work, activities, site personnel, workers, persons, or subcontractors in this HSP are with respect to LFR work only.

2.0 CHEMICALS OF CONCERN

The chemicals of concern include the chlorinated solvents tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-DCE, and vinyl chloride. Concentration ranges of these compounds from previous site investigations are presented in Table 2 of the Work Plan.

3.0 PLANNED SITE ACTIVITIES

Scheduled work will consist of the following activities:

- Soil and groundwater sampling
- Drilling /installation of monitoring and extraction wells
- Collecting water level measurements from monitoring wells
- Conducting air sampling and vapor flow measurements

Work is anticipated to begin approximately August 2003 and may last approximately 15 years.

4.0 KEY PROJECT PERSONNEL AND RESPONSIBILITIES

Project Manager:	Shekhar Melkote, P.G.
Site Safety Officer:	Tracy Freiwald
Director of Health and Safety:	James Bucha, CIH, CSP

The responsibilities of key project personnel are outlined below.

4.1 Project Manager

The Project Manager has the ultimate responsibility for the health and safety of LFR personnel at the Site. The Project Manager is responsible for:

- ensuring that project personnel review and understand the requirements of this HSP
- keeping the Director of Health and Safety informed of project developments
- keeping on-site personnel, including subcontractors, informed of the expected hazards and appropriate protective measures at the Site

- providing resources necessary for maintaining a safe and healthy work environment for LFR personnel

4.2 Site Safety Officer

The Site Safety Officer (SSO) is responsible for enforcing the requirements of this HSP once site work begins. The SSO has the authority to immediately correct situations where noncompliance with this HSP is noted and to immediately stop work in cases where an immediate danger to site workers or the environment is perceived. Responsibilities of the SSO also include:

- obtaining and distributing personal protective equipment (PPE) and air monitoring equipment necessary for this project
- limiting access at the Site to authorized personnel
- communicating unusual or unforeseen conditions at the Site to the Project Manager
- supervising and monitoring the safety performance of site personnel to evaluate the effectiveness of health and safety procedures and correct deficiencies
- conducting daily tailgate safety meetings before each day's activities begin
- conducting a site safety inspection prior to the commencement of each day's field activities

4.3 Director of Health and Safety

The Director of Health and Safety is responsible for the review, interpretation, and modification of this HSP. Modifications to this HSP that may result in less stringent precautions cannot be undertaken by the Project Manager or SSO without the approval of the Director of Health and Safety. In addition, he has the following responsibilities:

- advising the Project Manager and SSO on matters relating to health and safety on this project
- recommending appropriate safeguards and procedures
- modifying this HSP, when necessary
- approving changes in health and safety procedures employed at the Site

4.4 Subcontractor Personnel

Subcontractor personnel are expected to comply with the minimum requirements specified in this HSP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site. Subcontractors may employ health and safety procedures that afford them a greater measure of personal protection than those specified in this plan so long as they are do not pose additional hazards to themselves, the environment, or others working in the area.

Remediation Contractor:

Marcor Remediation, Inc.
460 Buffalo Road, Suite 5
Rochester, New York 14611

A copy of Marcor's Health and Safety Plan is included as an attachmet to LFR's Health and Safety Plan (Appendix D; Attachment D-4).

5.0 HAZARDS OF KNOWN OR EXPECTED CHEMICALS OF CONCERN

A tetrachloroethene (PCE) source exists in the former solvent tank area. In unsaturated soils, PCE concentrations range from the method detection limit (MDL) to 330 mg/kg. In soil samples taken outside the former solvent tank source area, PCE levels ranged from 0.002 mg/kg to 0.310 mg/kg. In groundwater, the highest level of PCE (62,000 μg/l) was detected in the overburden monitoring well in the former solvent tank area. In groundwater samples collected outside the source area, PCE concentrations ranged from the MDL to 22 μg/l.

Known Compounds	Source (soil/water)	Known Concentration Range	
		Lowest	Highest
Tetrachloroethene	Soil[1]	MDL[3]	330
Tetrachloroethene	Groundwater[2]	MDL	62,000
Trichloroethene	Soil	MDL	0.32
Trichloroethene	Groundwater	MDL	100
1,2-Dichloroethene	Soil	MDL	0.010
1,2-Dichlorothene	Groundwater	MDL	37
1,1-Dichloroethene	Soil	<0.005	<0.005
1,1-Dichloroethene	Groundwater	MDL	2
Vinyl Chloride	Soil	<0.005	<0.005
Vinyl Chloride	Groundwater	<1	<1

[1]Soil concentrations are in milligrams per kilogram (mg/kg)

[2]Groundwater concentrations are in micrograms per liter (μg/l)

[3]MDL = Method Detection Limit, typically less than 1 mg/kg or μg/l.

Exposure pathways of concern for chemical compounds that may be present at the Site are inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of contaminated material. Wearing protective

equipment and following decontamination procedures listed in Section 9 can minimize dermal contact. To minimize inhalation hazards, dust control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels are presented in Section 10. Chemical descriptions of chemicals of concern, including health effects and exposure limits, are located in Attachment D-1.

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities. A calibrated photoionization detector (PID) or flame ionization detector (FID) will be used to monitor changes in exposure to volatile organic compounds (VOCs). Personnel will perform routine monitoring during site operations to evaluate concentrations of VOCs in employee breathing zones. If VOCs are detected above predetermined action levels specified in Section 10, the procedures found in Section 7 of this HSP will be followed.

In accordance with the Hazard Communication standard, material safety data sheets (MSDSs) will be maintained on site for chemical products used by LFR personnel at the Site. In addition, containers will be clearly labeled in English to indicate their contents and appropriate hazard warnings.

6.0 PHYSICAL HAZARDS

The following potential health and safety hazards may be encountered during scheduled activities at the Site:

- slips, trips, and falls
- heavy equipment
- heat stress
- cold stress
- noise
- electrical sources
- excavations
- underground and overhead utilities
- material and equipment handling
- traffic

6.1 General Safe Work Practices

- Workers will thoroughly clean their hands, faces, and other potentially contaminated areas before smoking, eating, or leaving the Site.

- Respiratory devices may not be worn with beards or long sideburns, or under other conditions that prevent a proper seal.
- Accidents and/or injuries associated with work at the Site will be immediately reported to the SSO. If necessary, an incident report will be initiated by the SSO.
- Periodic safety briefings will be held to discuss current site conditions, field tasks being performed, planned modifications, and work concerns.
- Site conditions may include uneven, unstable, or slippery work surfaces. Substantial care and personal observation is required on the part of each employee to prevent injuries from slips, trips, and falls.
- Workers will maintain good housekeeping practices during field activities to maintain a safe working environment. The work site will be kept free of debris, waste, and trash.
- The "buddy system" will be used whenever appropriate.
- To prevent head injury, ANSI-approved hard hats will be worn at all times while the worker is in an area in which overhead obstructions or falling objects may be encountered.
- To prevent eye injuries, workers must wear ANSI-approved safety glasses during field activities.

6.2 Heavy Equipment

Equipment, including earth-moving equipment, drill rigs, or other heavy machinery, will be operated in compliance with the manufacturer's instructions, specifications, and limitations, as well as any applicable regulations. The operator is responsible for inspecting the equipment daily to verify that it is functioning properly and safely.

Operation of equipment at the Site for the activities outlined in Section 3 poses potential physical hazards. The following precautions should be observed whenever heavy equipment is in use:

- PPE, including steel-toed boots, safety glasses, and hard hats, must be worn.
- Personnel must be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of its operation. Workers must never assume that the equipment operator sees them; eye contact and hand signals should be used to inform the operator of intent.
- Traffic safety vests are required for personnel working near mobile heavy equipment or near high traffic areas.
- Personnel should not walk directly behind, or to the side of, heavy equipment without the operator's knowledge.
- Nonessential personnel will be kept out of the work area.

6.3 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of accidents. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the possibility of heat-related illness, workers should drink plenty of fluids and establish a work schedule that will provide sufficient rest periods for cooling down. Personnel shall maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration. Workers should be aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.

Condition	Signs	Symptoms	Response
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing 911. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

6.4 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and foot wear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to warm area, such as truck cab; give warm fluids; warm body core as rapidly as possible; remove outer clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.

6.5 Noise

Noise may result primarily from the operation of drill rigs and mechanical equipment. The use of heavy equipment may generate noise above the OSHA permissible exposure limit for noise of 90 adjusted decibels for an 8-hour time-weighted average. Workers will wear appropriate hearing protection when operating or working near heavy equipment. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of earplugs, or equivalent, will be required.

6.6 Electric Shock

Electrical equipment to be used during field activities will be suitably grounded and insulated. Ground fault circuit interrupters (GFCI), or equivalent, will be used with electrical equipment to reduce the potential for electrical shock.

Lockout/tagout procedures in accordance with 29 CFR 1910.147 will be conducted before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees will be thoroughly trained before initiating this procedure.

6.7 Excavations

A competent person who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, will be present during excavation activities.

The atmosphere will be tested in excavations greater than 4 feet in depth where oxygen deficiency or toxic or flammable gases are likely to be present before employees are permitted to enter and begin work. The atmosphere should be ventilated and re-tested until flammable gas concentrations less than 20 percent of the lower explosive limit (LEL) are obtained. Worker entry will not be allowed if the oxygen concentration is less than 19.5 percent.

Workers will not enter excavations greater than 4 feet in depth without appropriate protective systems such as benching, sloping, or shoring. Side slopes will not be steeper than 1:1 without a written report from a qualified civil or geotechnical engineer. Excavations will be constructed in accordance with the OSHA Excavation Safety Standard, 29 CFR 1926, Subpart P.

A competent person will inspect excavations daily. If there is evidence that a cave-in or slide is possible, work will cease until the necessary safeguards have been taken. Excavated material will be placed far enough from the edge of the excavation (a minimum of 2 feet) so that it does not fall back into the opening. At the end of each

day's activities, open excavations will be clearly marked and secured to prevent nearby workers or unauthorized personnel from entering them. Remote sampling techniques will be the preferred method of sample collection in excavations.

6.8 Underground and Overhead Utilities

The locations of underground pipes, electrical conductors, fuel lines, and water and sewer lines must be determined before soil intrusive work is performed. Lines must be de-energized, blocked out, or blinded where feasible. Equipment with articulated upright booms or masts shall not be permitted to pass within 20 feet of an overhead utility line while the boom is in the upright position.

6.9 Materials and Equipment Handling Procedures

The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies or hydraulic lift gates.

6.10 Traffic

Vehicular traffic presents opportunities for serious injury to persons or property. Traffic may consist of street traffic or motor vehicles operated by facility employees or visitors to the Site. Workers and other pedestrians are clearly at risk during periods of heavy traffic. Risk from motor vehicle operations may be minimized by good operating practices and alertness, and care on the part of workers and pedestrians.

Site personnel will wear high-visibility safety vests whenever activities are conducted in areas of heavy traffic. Work vehicles will be arranged as a barrier between site workers and nearby traffic.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The purpose of PPE is to protect employees from hazards and potential hazards they are likely to encounter during site activities. The amount and type of PPE used will be based on the nature of the hazard encountered or anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the Director of Health and Safety or SSO.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater, sludge) is anticipated, without regard to the level of respiratory protection required.

LFR personnel will be provided with appropriate personal safety equipment and protective clothing. The SSO is to inform each worker about necessary protection and must provide proper training in the use of the safety equipment. The required PPE to be worn is described below.

7.1 Conditions Requiring Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSO determines on site that a higher level of PPE is required. Air monitoring will be routinely conducted using real-time air monitoring devices to determine if upgrading to Level C PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicate that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 10.

It is important to note that dermal protection is required whenever contact with chemically affected soils or groundwater is anticipated. The following equipment is specified as the minimum PPE required to conduct activities at the Site:

- work shirt and long pants
- ANSI-approved steel-toed boots or safety shoes
- ANSI-approved safety glasses
- ANSI-approved hard hat

Other personal protection readily available for use, if necessary, includes the following:

- outer nitrile or latex gloves and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event)
- chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated
- safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated
- hearing protection
- sturdy work gloves

7.2 Conditions Requiring Level C Protection

If air monitoring indicates that the site-specific action levels defined in Section 10 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the protective equipment specified for Level D, Level C also includes the following:

- NIOSH/MSHA-approved half-face air-purifying respirator (APR) equipped with filter cartridges as specified in Section 10.0.
- chemical-resistant clothing (e.g., Tyvek, polycoated Tyvek, or Saranex coveralls) when contact with chemically affected soils or groundwater is anticipated
- outer nitrile or latex gloves and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event)
- safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated

If air monitoring indicates that the site-specific action levels defined in Section 10 are exceeded, workers in the affected area(s) will upgrade to NIOSH/MSHA-approved full-face APRs instead of half-face APRs and safety glasses.

If air monitoring indicates that the site-specific action levels defined in Section 10 are exceeded, activities must cease, and personnel must evacuate the Exclusion Zone (see Section 9). The Project Manager and Director of Health and Safety will be contacted immediately.

8.0 SAFETY PROCEDURES

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Pertinent equipment or machinery will be secured and stored safely.

Access inside the specified work area will be limited to authorized personnel. Only LFR employees, designated LFR subcontracted personnel, and designated employees of the client will be admitted to the work site. Only those workers possessing evidence of the required current 40-hour OSHA health and safety training (or current 8-hour refresher) and physician's authorization to conduct hazardous waste activities will be permitted in the work area designated as the Exclusion Zone. The SSO will be responsible for requiring that workers wear proper personal protective clothing. Personnel entering the work area will sign the signature page of this HSP, indicating they have read and accepted the health and safety practices outlined in this plan.

The SSO will conduct a safety inspection of the work site before each day's activities begin to verify compliance with the requirements of the HSP. The results of this daily inspection will be documented on an LFR Site Safety Checklist. A copy of the checklist is included in Attachment D-2.

A daily morning briefing to cover safety procedures and contingency plans in case of an emergency will be included with a discussion of the day's activities. These daily meetings will be recorded on LFR Daily Tailgate Safety Meeting Forms. A debriefing to cover the activities is to be held upon completion of the work. A copy of the Daily Tailgate Safety Meeting Form is included in Attachment D-2.

Real-time air monitoring devices will be used to analyze for airborne contaminant concentrations every 30 minutes in the workers' breathing zones while workers are in the Exclusion Zone. If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. The equipment will be calibrated daily, and the results will be recorded on LFR's Air Monitoring form or project logbook. The results of air monitoring will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Attachment D-2.

Minimum emergency equipment maintained on site will include a fully charged 20-pound ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergencies. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the Site will include the decontamination procedures described below.

9.0 WORK ZONES AND DECONTAMINATION PROCEDURES

In some instances, it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will occur using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to determine a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Despite protective procedures, personnel may be exposed to potentially hazardous compounds while performing work tasks. If so, decontamination needs to take place using an Alconox wash, followed by a rinse with clean water. Standard decontamination procedures for levels C and D are as follows:

- equipment drop
- boot cover and outer glove wash and rinse
- boot cover and outer glove removal
- suit wash and rinse
- suit removal
- safety boot wash and rinse
- inner glove wash and rinse
- respirator removal
- inner glove removal
- field wash of hands and face

Workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. The SSO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area. Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Nondisposable items may need to be sanitized before reuse. Each Site worker is responsible for the maintenance, decontamination, and sanitizing of their own PPE.

Used equipment may be decontaminated as follows:

- An Alconox and water solution will be used to wash the equipment.
- The equipment will then be rinsed with clean water.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off site.

10.0 ACTION LEVELS

The following action levels were developed for exposure monitoring with real-time air monitoring instruments. The air monitoring data will determine required PPE levels at the Site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 30-minute intervals. If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained

measurements are observed, the following actions will be instituted, and the Project Manager and Director of Health and Safety will be notified. For purposes of this HSP, sustained readings are defined as the average airborne concentration maintained for a period of 1 minute.

Activity	Action Level	Level of Respiratory Protection
Soil/Groundwater Intrusive Activities	<5 ppm above background	Level D: No respiratory protection required.
	5 to 25 ppm	Level C: Half- or full-face air-purifying respirator fitted with organic vapor filter cartridges.
	> 25 ppm	Cease operations and evacuate work area. Contact Southeast Director of Health and Safety and Project Manager immediately.

11.0 CONTINGENCY PROCEDURES

In case of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient). Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is the SSO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. Section 12 of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on site during work activities.

Personnel should dial 911 in case of an emergency.

11.1 Injury/Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made of whether it is safe to continue work. The SSO, in consultation with the Project Manager and Director of Health and Safety, will make the decision regarding the safety of continuing work. The SSO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In case of an injury, the extent and nature of the victim's injuries will be assessed and first aid will be rendered as appropriate. If necessary, the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented in Attachment D-3. In case of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing 911. The individual rendering first aid will follow directions given

by emergency medical personnel via telephone. A person certified in first aid/CPR techniques will be present during field activities.

11.2 Fire

In case of fire, personnel should contact the local fire department immediately by dialing 911. When representatives of the fire department arrive, the SSO, or designated representative, will advise the commanding officer of the location, nature, and identification of hazardous materials on site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so.

11.3 Underground Utilities

In the event that an underground conduit is damaged during excavation or drilling, mechanized equipment will immediately be shut off until the nature of the piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted.

11.4 Evacuation

The SSO will designate evacuation routes and refuge areas to be used in case of an emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination areas whenever possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove contaminated clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSO, or designated representative, will count and identify Site personnel to verify that all have been evacuated safely.

11.5 Hazardous Material Spill

If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempt to stop or reduce the flow if it can be done without risk to personnel. Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Upright or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, shall be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

12.0 EMERGENCY CONTACTS

Ambulance:	911
Police:	911
Fire Department:	911
Hospital:	911
National Response Center:	(800) 424-8802
Poison Control Center:	(800) 876-4766
TOXLINE:	(301) 496-1131
CHEMTREC:	(800) 424-9300
LFR Director of Health and Safety:	(916) 786-0320
LFR Tallahassee, Florida Office	(850) 422-2555
Nearby Hospital:	(716) 473-2200

Highland Hospital
1000 South Avenue
Rochester, New York 14620

DIRECTIONS TO HOSPITAL:

1: Start out going East from site on NY-36 towards NY-5 by turning right. 0.0 miles (0.0 km)
2: Turn RIGHT onto NY-5. 7.0 miles (11.3 km)
3: Turn SLIGHT RIGHT onto NY-5/US-20. Pass through 1 roundabout. 2.8 miles (4.4 km)
4: Take the I-390 N ramp. 0.3 miles (0.4 km)
5: Merge onto I-390 N. 16.4 miles (26.4 km)
6: Take the RT-15/E HENRIETTA RD exit, exit number 16, toward W. HENRIETTA RD. 0.2 miles (0.3 km)
7: Turn RIGHT onto NY-15A/E HENRIETTA RD. 0.6 miles (0.9 km)
8: Turn SLIGHT RIGHT onto SOUTH AVE. 1.4 miles (2.3 km)

A hospital route map is presented in Attachment D-3. A copy of remediation contractor Marcor Remediation, Inc.'s health and safety plan is included as Attachment D-4.

13.0 LFR APPROVALS

This HSP has been prepared for the following project:

JCI Jones Chemicals, Inc.
100 Sunny Sol Boulevard
Caledonia, New York

LFR Project Number: 3165.02-001

This HSP has been reviewed and approved by the following LFR personnel:

Tracy Freiwald — Date: 6/23/03
Site Safety Officer

E. Cambers for: — Date: 6/23/03
Shekhar Melkote, P.G.
Project Manager

Joe Applegate for: — Date: 6/23/03
Jim Bucha, CIH.
Director of Health and Safety

SIGNATURE PAGE

The following signatures indicate that this Health and Safety Plan has been read and accepted by on-site LFR personnel, as well as subcontractors and their personnel.

NAME	COMPANY	SIGNATURE	DATE

Important notice to subcontractor(s):

This Health and Safety Plan has been prepared solely for the use of LFR personnel. It is supplied to you for informational purposes only and may not be relied upon for protection of your employees. The Subcontractor is responsible for providing, at its cost, all personal protective clothing and equipment required for its employees to perform their work in a safe manner and in compliance with all applicable state and federal OSHA regulations. Subcontractor is responsible for ensuring that such equipment is in good condition and is properly inspected and maintained. Subcontractor must, at a minimum, use the equipment and follow the procedures described in this HSP. Failure to do so may result in immediate termination of Subcontractor's services. This does not relieve the Subcontractor of the responsibility to provide equipment and institute procedures affording a greater degree of protection than those specified in this HSP should Subcontractor determine such measures are necessary to protect the health and welfare of its employees, second-tier subcontractors or others under its control or direction.

Attachment D-1

Chemical Descriptions

CHEMICAL DESCRIPTIONS

The following chemical descriptions are presented for chemicals that may be present at the Site. Each chemical description includes physical and odor recognition characteristics, health effects associated with exposure, and exposure limits expressed as an eight-hour time weighted average (TWA). Provided are federal OSHA ("OSHA") permissible exposure limits (PELs; located in 29 CFR 1910.1000); California OSHA ("Cal/OSHA") PELs (located in 8 CCR 5155); and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).

For sites outside California, Cal/OSHA PELs are included as an additional reference.

1,2-Dichloroethene (1,2-DCE)

1,2-DCE, a mixture of the cis and trans isomers, is a liquid with a slightly acrid odor. Available data conflict on whether there is significant difference in the toxicity from short-term exposure to trans-1,2-DCE versus cis-1,2-DCE. Narcosis has been identified as the important effect of inhalation.

- The OSHA PEL is listed as 200 ppm.
- The Cal/OSHA PEL is listed as 200 ppm.
- The TLV is listed as 200 ppm.

1,1-Dichloroethene (1,1-DCE)

1,1-DCE (also known as vinylidene chloride) is a volatile, colorless liquid that polymerizes easily and has a mild, sweet odor. Short-term exposure to 1,1-DCE can cause irritation to the skin and mucous membranes. 1,1-DCE is narcotic in high concentrations and can cause liver and kidney damage. 1,1-DCE has been identified by the National Institute for Occupational Safety and Health as a carcinogen.

- An OSHA PEL is not listed.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 5 ppm.

Tetrachloroethene (PCE)

PCE (also known as perchloroethene) is a colorless liquid with an ether-like odor. Short-term exposure to PCE may cause headaches, nausea, drowsiness, dizziness, incoordination, unconsciousness, irritation of the eyes, nose, and throat, and flushing of the face and neck. In addition, it may cause liver damage with such findings as

yellow jaundice and dark urine. Liver damage may become evident several weeks after exposure. Skin contact may create a dry, scaly, itchy dermatitis. PCE is Classified by the U.S. Environmental Protection Agency as a Group B2 probable human carcinogen.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 25 ppm.

Trichloroethene (TCE)

TCE is a clear, colorless liquid with a characteristic chloroform odor. It is a mildly toxic VOC that is also an experimental carcinogen, tumorigen, and teratogen. It can cause eye effects, hallucinations and distorted perceptions when inhaled. TCE is an eye and severe skin irritant. Exposure to vapors may cause eye, nose, and throat irritation. Prolonged inhalation of moderate concentrations of vapor may cause headaches and drowsiness. Inhalation of high concentrations may cause narcosis and anesthesia. Severe, acute exposure can result in cardiac failure. Significant chronic exposure may damage the liver and other organs. Prolonged repeated skin contact with the liquid may cause irritation and dermatitis.

- The OSHA PEL is listed as 100 parts per million (ppm).
- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 50 ppm.

Vinyl Chloride

Vinyl chloride is a colorless gas with a sweet odor. It is a known human carcinogen that causes liver and blood tumors. It is a poison by inhalation. It is also a severe skin and eye irritant and can cause skin burns by rapid evaporation and consequent freezing. Chronic exposure has also shown liver injury. Short-term exposure to vinyl chloride can cause dizziness, light-headedness, nausea, dullness of visual and auditory responses, drowsiness, and unconsciousness. Irritation of the skin and eyes can also occur. Skin contact with the liquid can cause frostbite. Vinyl chloride is classified by the U.S. Environmental Protection Agency as a Group A human carcinogen.

- The OSHA PEL is listed as 1 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 1 ppm.

Note: Published exposure limits designate a skin notation that indicates dermal contact can contribute to the overall exposure.

Attachment D-2

LFR Levine·Fricke Forms

LFR
LEVINE • FRICKE

SITE SAFETY CHECKLIST

Project Name _____ *LFR Project No.* _____

Project Activities _____

	YES	NO	N/A
Written Health and Safety Plan (HSP) is on site	☐	☐	☐
Addenda to the HSP are documented on site	☐	☐	☐
Information in the HSP matches conditions and activities at the site	☐	☐	☐
HSP has been read and signed by all site personnel, including visitors	☐	☐	☐
Daily tailgate safety meetings have been held and documented	☐	☐	☐
Site personnel have appropriate training and medical clearance	☐	☐	☐
Air monitoring is performed and documented as described in the HSP	☐	☐	☐
Air monitoring equipment has been calibrated daily	☐	☐	☐
Site zones are set up and observed where appropriate	☐	☐	☐
Access to the work area limited to authorized personnel	☐	☐	☐
Decontamination procedures are followed and match the requirements of the HSP	☐	☐	☐
Decontamination stations (including hand/face wash) are set up and used	☐	☐	☐
Personal protective equipment used matches HSP requirements	☐	☐	☐
Hearing protection used where appropriate	☐	☐	☐
Respirators are properly cleaned and stored	☐	☐	☐
Trenches and excavations are in compliance with federal, state, and local safety requirements before worker entry	☐	☐	☐
Spoils are placed no closer than 2 feet from the edge of an excavation	☐	☐	☐
Emergency and first aid equipment is on site as described in the HSP	☐	☐	☐
Drinking water is readily available	☐	☐	☐
Accessible phone is readily available for emergency use	☐	☐	☐
Proper drum and material handling techniques are used	☐	☐	☐
Drums and waste containers are labeled appropriately	☐	☐	☐
Extension cords are grounded and protected from water and vehicle traffic	☐	☐	☐
Ground-fault circuit interrupters (GFCI) are used with electrical equipment	☐	☐	☐
Tools and equipment are in good working order	☐	☐	☐
Lighting is adequate	☐	☐	☐
Compressed gas cylinders are upright and secured	☐	☐	☐

Notes (All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here): _____

_____

_____

_____

_____

_____

_____

Conducted By: _____ *Signature:* _____ *Date:* _____

LFR
LEVINE • FRICKE

DAILY TAILGATE SAFETY MEETING FORM

Date _____ *Time* _____ *LFR Project No.* _____

Project Name _____ *Specific Location* _____

Type of Work _____

Chemicals Present _____

SAFETY TOPICS DISCUSSED

Protective Clothing/Equipment _____

_____

Hazards of Chemicals Present _____

_____

Physical Hazards _____

_____

Special Hazards _____

_____

Other Topics _____

_____

ATTENDEES

Name (please print) ***Signature***

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

LFR
LEVINE • FRICKE

AIR MONITORING FORM

Date _____ *LFR Project No.* _____

Project Name _____ *Type of Activities* _____

Type of PID/FID _____ *Serial No.* _____

Initial Calibration Reading _____ *End-of-Use Calibration Check* _____

Calibration Standard/Concentration _____

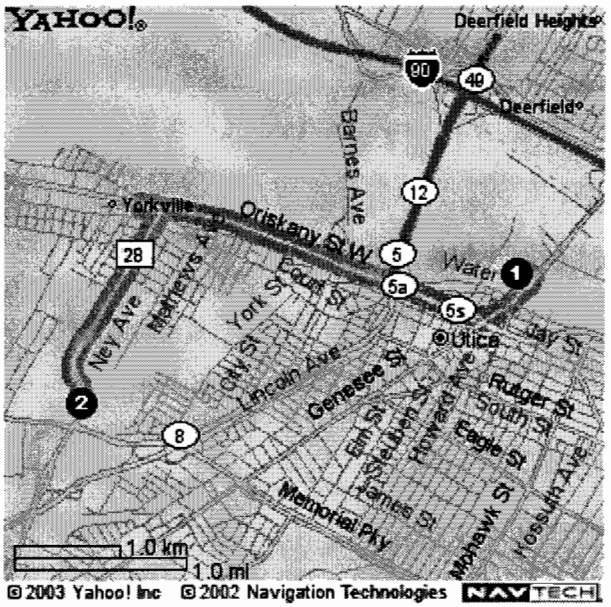
Mini-RAM Serial No. _____ *Zeroed in Z-Bag?* ☐ Yes ☐ No

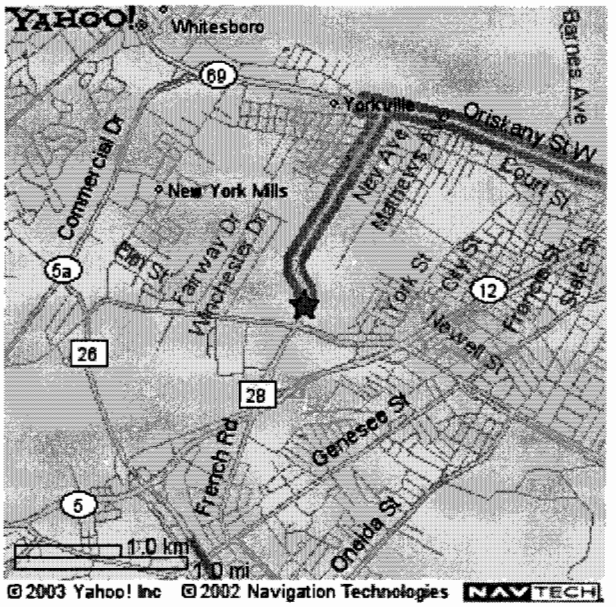
Time	Activity/Location	PID/FID (ppm)	Mini-RAM (mg/m^3)

Name (print) _____ *Signature* _____

Attachment D-3

Hospital Route Map





Directions Miles

1. **Start on MEADOW ST 0.0**
2. **Turn Right on LEE ST 0.1**
3. **Turn Right on N GENESEE ST 0.4**
4. **Turn Right on ORISKANY ST W 2.1**
5. **Turn Left on HUNTINGTON PL 0.0**
6. **Turn Left on W WHITESBORO ST 0.1**
7. **Turn Right on CHAMPLIN AVE 1.3**

Distance: 4.0 miles Approximate Travel Time: 8 mins

Attachment D-4

Marcor Health and Safety Plan

This Manual Contains
The
Health and Safety Plan
And
Standard Operating Procedures
For

MARCOR Remediation, Inc.
460 Buffalo Road Suite #5
Rochester, NY 14611

Job Number: **TBD**

Customer Name: **JCI Jones Chemicals, Inc.**
100 Sunny Sol Boulevard
Caledonia, New York 14423

Table of Contents

SECTION 1.0 INTRODUCTION

MARCOR Remediation, Inc. (MARCOR) has developed this Health and Safety Plan (HASP) for the work being performed at the JCI Jones Chemicals, Inc. facility, located at 100 Sunny Sol Boulevard in Caledonia. New York ("the Site").

Section 1.1 Site Description

JCI Jones Chemicals, Inc. is an active chemical manufacturing facility in a rural community, Caledonia, located in the northwest portion of Livingston County in upstate New York. The project area consists of a former bulk chemical storage area located at the west side of the site and the lagoon area located on the north side of the site.

Section 1.2 Intent

The intent of this plan is to provide the minimum safety requirements and general procedures to be met by MARCOR and MARCOR subcontractor personnel. All MARCOR personnel will follow the applicable Federal/State rules and regulations and MARCOR Procedure No. 05-547-01 Hazardous Waste Operations and Emergency Response (1910.120). In the event of conflicting procedures, personnel will follow those that afford the highest protection.

Section 1.3 Scope of Work

The project involves the installation of aboveground and subsurface remedial equipment.

Specific work activities covered by this HASP include:

- Mobilization;
- Excavation and loading of contaminated soil;
- Transportation of contaminated soil to a staging area;
- Installation of subsurface piping and liner;
- Installation of aboveground equipment and enclosure;
- Installation of submersible well pumps;
- Work area monitoring;
- Modification of existing remedial equipment;
- Personal and Equipment Decontamination;
- System startup and site personnel operation training;
- Demobilization.

Section 1.4 Hazards Overview

The possible hazards associated with the work activities outlined above are:

- Slips, trips and falls
- Heavy equipment
- Excavations
- Underground and overhead utilities

- Noise
- Electrical sources
- Vehicular traffic
- Material and equipment handling
- Heat stress
- Cold stress
- Chemical exposure
- Environmental hazards
- Biological hazards
- Fire

SECTION 2.0 PROJECT PERSONNEL AND ON-SITE ORGANIZATION

The key project personnel are as follows:

Title	Name	Company Telephone	Mobile
Project Manager	Mark N. Ramsdell	(585) 247-6955	(585) 303-4063

The Project Manager has overall responsibility for ensuring that the project is properly carried out. He/she coordinates between office and field personnel and manages administrative requirements for the HASP.

Project Supervisor	TBD	(585) 247-6955	TBD

The Project Supervisor monitors the project's progress, regularly reviews the project schedule, and reviews all major work elements prior to submittal. He/she oversees scheduling and serves as the primary contact between MARCOR and the client for health and safety issues.

Site Safety & Health Coordinator	Douglas A. Stamp	(585) 247-6955	(585) 303-4068

The Site Safety and Health Officer (SSHO) is responsible for the health and safety of MARCOR employees on the work site, unless otherwise specified in the HASP. The SSHO will establish operating standards in conjunction with the Project Manager and Project Supervisor and coordinate safety and health activities for the work site. He/she will review project plans and revisions to plans to assure that safety and health procedures are incorporated through all of the work phases. Specifically he/she is responsible for:

- Assuring that a complete copy of the HASP is at the site prior to the start of work activities and that all workers are familiar with it.
- Conducting on-site health and safety training and briefing sessions.
- Ensuring the availability, use, prior maintenance and decontamination of personal protective equipment and other safety or health equipment.
- Maintaining a high level of safety awareness among workers and communicating pertinent safety and health matters to them promptly.
- Assuring that all activities are performed in a manner consistent with the MARCOR standard operating procedures and the HASP.
- Monitoring for dangerous conditions during field activities.
- Initiating immediate corrective actions in the event of an emergency or unsafe condition.
- Promptly notifying the project manager of any emergency, unsafe condition, problem encountered or needed exception to this HASP.
- Recommending improvements in safety and health measurements to the project manager.
- Conducting safety and health performance and system audits.

The SSHO has the authority to:

- Suspend activities or otherwise limit exposures if the health or safety of any person appears to be endangered.
- Notify personnel to alter work practices that he/she deems do not properly protect them or the environment surrounding them.
- Suspend an individual from work for violation of the requirements of this HASP or MARCOR Procedures.

SECTION 3.0 WORK AREAS AND SITE CONTROL

Access to the work site will be limited to the trained authorized personnel governed by this plan. The site may be divided into three well-delineated zones, as follows:

1. **Contaminated or Exclusion Zone** - This zone includes the actual areas of contamination. This zone has the highest inhalation exposure potential and/or presents a high probability of skin contact with cutaneous or percutaneous effecting chemicals.

2. **Contamination Reduction Zone** - This zone includes the area immediately surrounding the Contamination Zone. This zone has the next highest inhalation hazard but does not have a probability of skin contact with cutaneous or percutaneous effecting chemicals.

3. **Support Zone** - This zone covers areas outside of the contamination reduction zone and contains support functions, i.e. command post. Adverse exposure to chemicals is unlikely.

Access to the established contamination or exclusion zone is limited to authorized personnel wearing the appropriate personal protective equipment (PPE).

The contamination or exclusion zone will be cordoned off with flagging tape. The zone will be monitored by the SSHO to ensure personnel do not enter without proper PPE. The entry/exit corridor, decontamination zone, and support zone will be located upwind of the active work zone. A sign-in log will be employed to ensure that only authorized employees are on-site and in the exclusion zone. The amount of time each employee is in the exclusion zone will be entered on the log as well.

The Project Supervisor and/or his designee, and the SSHO and/or designee shall maintain site security and control. Their duties include limiting access to the site to authorized personnel, oversight of the projec equipment and materials and general oversight of site activities, as appropriate.

SECTION 4.0 CHEMICAL HAZARD EVALUATION

The chemical hazards associated with the remedial activities involve inhalation of airborne contaminants, direct skin contact with contaminated materials and incidental ingestion of the chemical constituents present in the soils and groundwater at the site. Constituents present in soils and groundwater include chlorinated solvents tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-DCE and vinyl chloride.

Symptoms of exposure are: headaches; nausea; drowsiness; dizziness; loss of coordination; unconsciousness; irritation of the eyes, nose and throat; flushing of the face and neck; dermatitis; reduced sensory responses; and cardiac failure. Long-term exposures may result in kidney and/or liver damage, tumors or cancer.

Copies of the Material Data Safety Sheets (MSDS) of the known site constituents are included in Appendix A.

SECTION 5.0 ON-SITE WORK PLAN AND PERSONAL PROTECTIVE EQUIPMENT

Section 5.1 Levels of Protection

Personal protective equipment (PPE) will be utilized to protect personnel from site hazards. Varying levels of protection will be required depending upon the levels of contaminants and degree of physical hazard. A summary of the levels is presented in this section.

Level D Protection

Due to the relatively low concentration of contaminants at the site, it is anticipated that Level D personal protection will be utilized for the majority of the remedial activities. As MARCOR Company policy, the minimum level of personal protection required at the site will be Level D. Level D personal equipment consists of the following:

- Work clothing as dictated by weather with a minimum of a work shirt and long pants;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles meeting ANSI Z87;
- Hard hat, meeting ANSI Z89;

Additional equipment, when deemed necessary, can include the following:

- Work gloves;
- Hearing protection;
- Chemical resistant gloves;
- Chemical resistant clothing;
- Steel toe work boots with protective overboots

Level C Protection

Level C protection will be required when the airborne concentration of suspected constituents exceed site action levels (see Section 6.2). Level C protection will be used for operations when air-monitoring instruments indicate an upgrade is necessary. The following equipment will be utilized for Level C personal protection:

- Half face, full face or powered air purifying respirator;
- Tyvek suit or coveralls;
- Steel toe work boots;
- Latex booties over steel toe work boots;
- Safety glasses or goggles meeting ANSI Z87;
- Hard hat meeting ANSI Z89;
- Face shield in addition to safety glasses or goggles;
- Nitrile, neoprene, or PVC gloves;
- Hearing protection as necessary.

Section 5.2 Work to be performed – Mobilization

Site mobilization includes establishing the exclusion, contamination reduction, and support zones. Additional hazards associated with this phase include equipment delivery and movement, materials handling, and site preparation.

Potential hazards during this work are:

- Fatigue;
- Skeletal injuries;
- Eye, contusion and laceration hazards;
- Slip, trip and fall hazards associated with irregular and/or slick working surfaces;

Environmental hazards that may be encountered during this phase are the following:

- Aggressive flora such as poison ivy or poison oak;
- Aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders and snakes;
- Environmental hazards such as sunburn, lightning, heavy rain, heat and cold stress related illnesses;
- Biological hazards include blood-borne pathogens, rabies, and Lyme disease.

Workers must wear Level D protection as indicated above.

Section 5.3 Work to be performed – Excavation and Loading of Contaminated Materials

This phase of the project involves the excavation and removal of contaminated soils. Excavation depths are estimated to be to a maximum of three (3) feet below ground surface. The hazards involved in the excavation of impacted soils are the following:

- Heavy equipment operation;
- Excessive noise from equipment operation.
- Chemical hazards: inhalation of airborne dust particles and contaminated soil constituents.

Controls: Prior to excavation MARCOR will notify the Underground Facilities Protective Organization (UFPO) to properly identify and mark all underground utilities. All available drawings detailing the location and nature of privately owned utilities would be reviewed prior to excavation. MARCOR will utilize the proper benching and sloping techniques required to perform the excavation in a safe manner if soil conditions warrant. Good housekeeping practices will be utilized to maintain the safety of the site. All equipment, waste debris and unused materials will be neatly stored at the end of each working day. If necessary, all workers will utilize personnel protective equipment during excavation activities.

Workers must wear Level D protection as indicated above.

Section 5.4 Work to be performed – Soil Transportation

This phase of the project involves the loading and transportation of potentially contaminated soils to an on-site temporary staging pad. Soils will be loaded into trucks or the front bucket of a backhoe and transported to the designated staging area. The hazards involved with this phase of the project include:

- Heavy equipment operation;
- Falling objects during loading of trucks;
- Vehicular traffic;
- Handling of potentially contaminated materials;
- Chemical hazards: inhalation of airborne dust particles and contaminated soil constituents.

Controls: No unnecessary personnel will be allowed to be near the heavy equipment or trucks during loading operations.

Workers must wear Level D protection as indicated above.

Section 5.5 Work to be performed – Equipment/Material Installations

This phase of the project involves the installation of subsurface piping, submersible pumps into wells, a system enclosure, aboveground remedial equipment and modifying the existing remedial system. All excavated areas will be backfilled with native materials where possible after installation and testing of equipment/materials. The hazards involved with this phase of the project include:

- Heavy equipment operation;
- Falling objects during unloading of trucks;
- Vehicular traffic;
- Handling of or contact with potentially contaminated materials;
- Chemical hazards: inhalation of airborne dust particles and contaminated soil/water constituents.

Controls: Personal Protective Equipment including the use of chemical resistant gloves will be utilized when handling potentially contaminated soil/water. Protective overboots will be worn while walking on potentially contaminated soil. Personnel must not kneel on potentially contaminated soil without wearing chemical resistant clothing. Personnel must be aware of the heavy equipment operations and communicate with heavy equipment operators to insure safety.

Workers must wear Level D protection as indicated above.

Section 5.6 Work to be performed – Work Area Monitoring

This phase of the project involves the monitoring of work areas. Monitoring of work areas will be performed through air monitoring of breathing zones with real-time air monitoring equipment. Monitoring equipment shall be calibrated at a minimum of once per day at the beginning of the work shift and as needed. Results of calibrations and air monitoring shall be recorded in the daily log. The hazards involved with this phase of the project include:

- Chemical hazards: dermal and inhalation exposure to potentially contaminated soil/water.
- Heavy equipment operation;
- Slip, trip and fall hazards;

Controls: Personal Protective Equipment including the use of chemical resistant gloves will be utilized when handling potentially contaminated soil/water. Protective overboots will be worn while walking on potentially contaminated soil. Personnel must not kneel on potentially contaminated soil without wearing chemical resistant clothing. Personnel must be aware of the heavy equipment operations and communicate with heavy equipment operators to insure safety.

Workers must wear Level D protection as indicated above.

Section 5.7 Work to be performed – Personal and Equipment Decontamination

All personnel and equipment located within the exclusion zone will be decontaminated as necessary before leaving the site. MARCOR personnel involved in decontamination activities may come into contact with soils containing chemical constituents present at the site. MARCOR personnel will employ the use of necessary personal protective equipment (PPE) while performing decontamination activities.

Standard decontamination procedures are listed in Section 7.0 below.

Workers must wear Level D protection as indicated above.

Section 5.8 Work to be performed – System Startup and Site Personnel Training

This phase of the project involves the testing and starting of the installed remedial equipment and training of on-site personnel in the operation of the equipment. The hazards involved with this phase of the project include:

- Electrical sources;
- Pinch points;
- Rotating equipment;
- Noise;
- Heat;
- Chemical hazards: dermal and inhalation exposure to potentially contaminated vapor/water.

Controls: Qualified personnel shall complete this work only. No equipment guards or protective devices shall be removed unless the equipment is properly locked out/tagged out. MARCOR will train on-site personnel in the safe operation of installed remedial equipment.

Workers must wear Level D protection as indicated above.

Section 5.9 Work to be performed – Demobilization

At the completion of the project all equipment and excess materials will be removed from the site. Demobilization will consist of removal of all equipment, supplies and vehicles at the site. Hazards associated with equipment operation and materials handling include vehicular traffic, slip, trip and fall hazards.

Workers must wear Level D protection as indicated above.

No changes are to be made to the level of protection without approval of the SSHO or Project Manager.

SECTION 6.0 SITE MONITORING AND ACTION LEVELS

Section 6.1 Organic Vapor Monitoring

If sustained organic vapor readings in the worker-breathing zone exceeds 5 PPM above background, then organic vapor levels will be monitored downwind of the work zone in 15-minute intervals. If the total organic vapors exceed 15 PPM above background, then work activities will discontinue and additional downwind monitoring performed. Efforts will be taken to mitigate the source of organic vapors.

Section 6.2 Action Levels

An increase in the level of personal protection will be implemented if sustained readings of greater than the listed action levels are detected in the worker-breathing zone for a duration of greater than 5 minutes.

Action Level	Level of Respiratory Protection
0-5 ppm	Level D – No respiratory protection required
6-50 ppm	Level C – Half-face APR w/ organic vapor cartridges
51-100 ppm	Level C – Full-face APR w/ organic vapor cartridges
> 100 ppm	Cease work and evacuate area. Notify SSHO

Personnel on-site shall use the "buddy" system (pairs). Buddies should practice hand signals for communication. Communication or visual contact shall be maintained between crewmembers at all times.

Personnel must observe each other for signs of toxic exposure. Indicators of adverse effects include, but are not limited to:

1. Changes in complexion and skin discoloration.
2. Changes in coordination.
3. Changes in demeanor.
4. Excessive salivation and pupillary response.
5. Changes in speech pattern.

Personnel shall be cautioned to inform each other of non-visual effects of toxic exposure such as:

1. Headaches
2. Dizziness
3. Nausea
4. Blurred Vision
5. Cramps
6. Irritation of eyes, skin or respiratory tract

SECTION 7.0 DECONTAMINATION PROCEDURES

Personnel and equipment leaving the exclusion zone shall be thoroughly decontaminated. Decontamination of personnel will be by scrubbing with a soap/water mixture followed by clean water rinses.

All respirators, protective clothing and decontamination waste will be disposed of in accordance with MARCOR Procedure No. 05-570-01, 05-572-01, 05-574-01, 05-575-01 and 05-576-01.

A decontamination unit shall be positioned at the entrance to the contamination reduction zone with a step-off area just inside the contamination reduction zone. All personnel entering or leaving the contamination reduction zone shall pass through these areas to don or doff their protective equipment.

Contaminated protective equipment, materials and equipment/instruments shall not be removed from the work areas until they have been properly cleaned or properly packaged and labeled.

Employees shall not be permitted to exit the regulated area until contaminated clothing and equipment have been removed and decontaminated and employees have washed their hands and faces with soap and water.

Removal of materials from protective clothing or equipment by blowing, shaking or any other means, which may disperse materials into the air, is prohibited.

Equipment will be washed with Alconox and water and rinsed with clean water for decontamination.

SECTION 8.0 MEDICAL MONITORING

Medical monitoring will be required for those employees required to wear respirators. Employees who wear or may wear respiratory protection must be provided respirators in accordance with the guidelines of 29 CFR 1910.134.

The regulation requires that an individual's ability to wear respiratory protection be medically certified before he/she performs designated duties.

Employees who wear or may wear hearing protection devices must be provided them in accordance with the guidelines of 29 CFR 1910.95. This regulation requires that an individual's hearing level be medically evaluated.

Medical documents are on file for all MARCOR personnel and may be provided as needed.

SECTION 9.0 PERSONNEL TRAINING

Site Workers: All employees performing activities must have satisfactorily completed one of the following prior to their start of work on the site.

1. An off-site training course of at least 40 hours meeting the requirements of 29 CFR 1910.20 (e) on safety and health at hazardous waste operations within the last 12 months.

2. An off-site refresher course of at least 8 hours meeting the requirements of 29 CFR 1910.120 (e) on safety and health at hazardous waste operations within the last 12 months.

3. They must also have satisfactorily completed hazardous communication training meeting the requirements of 29 CFR 1910.120 and completed site-specific training as outlined below.

Managers and supervisors must have completed an off-site training course of at least 8 hours meeting the requirements of 29 CFR 1910.120 (e) on supervisor responsibilities for safety and health at hazardous waste operations.

A written certificate of training is on file for each employee and supervisor requiring training.

Site Specific Training: Site specific training shall be provided to each employee before beginning work on the site. Personnel will be briefed by the SSHO as to the potential hazards to be encountered.

Topics will include:

- Availability of this HASP.
- General site hazards and specific hazards in the work areas including those attributable to the chemicals present.
- Selection, use, testing and care of the body, eye, ear, hand, foot and respiratory protective equipment to be worn, with the limitations of each.
- Decontamination procedures for personnel, their personal protective equipment and other equipment used on the site.
- Emergency response procedures and requirements.
- Emergency alarm systems and other forms of notification and evacuation routes to be followed.
- Methods to obtain emergency assistance and medical attention.

SECTION 10.0 EMERGENCY RESPONSE

Section 10.1 Notification of Site Emergencies

In the event of an emergency, site personnel will signal distress with three blasts from an appropriate horn (vehicle horn, air horn, etc.). This sound signal will be loud enough to be clearly heard above other noise present. Appropriate authorities will then be immediately notified of the nature and extent of the emergency.

The following standard hand signals will be used whenever necessary:

Hand gripping throat ..... Out of air, can't breath
Grip partner's wrist or
both hands around waist..... Leave area immediately
Hands on top of head ..... Need assistance
Thumbs up ..... Ok, I am all right, I Understand
Thumbs down..... No, negative

Telephone communication to command post should be established as soon as practical. The telephone number is TBD. The following table shows Emergency Response Telephone Numbers. This table will be maintained at the work site by the SSHO. The location of the nearest telephone is TBD.

EMERGENCY RESPONSE TELEPHONE NUMBERS

Fire Department (Caledonia)	911
Police Department (Livingston Co.)	911
Ambulance (Caledonia)	911
Hospital (Strong Memorial)	(585) 275-2100
Poison Control Center	(800) 876-4766
Chemical Emergency Advice	(800) 424-9300
Client Safety and Environmental Control	(585) 538-2314
Client Emergency Response	(585) 538-2314

Should someone be transported to a hospital or doctor, a copy of this Health and Safety Plan must accompany them. Directions and a map indicating the route to the nearest hospital are included in Appendix B.

Section 10.2 Responsibilities

The SSHO (or designee) will be responsible for responding to all emergencies. The SSHO will: (1) Notify appropriate individuals, authorities and/or health car facilities of the potentially hazardous activities and potential wastes that may develop as a result of the investigation; (2) Have working knowledge of safety equipment available at the site; and (3) Ensure that a map which details the most direct route to the nearest hospital is prominently posted with the emergency telephone numbers.

Employees who will respond to emergency situations involving hazardous materials shall be trained in how to respond to such emergencies. The Project Supervisor will ensure that the following safety equipment is available at the site: eyewash station, first aid supplies and fire extinguisher. The emergency response plan will be reviewed daily to ensure its applicability for the planned day's operations.

Section 10.3 Accidents and Injuries

In the event of a safety or health emergency at the site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. Personnel trained in first aid procedures should be present during site activities to provide appropriate treatment of injuries or illnesses occurring during site activities.

In the event of a safety or health emergency at the site, the SSHO will be immediately notified. Upon notifications of an exposure incident, the SSHO will contact the appropriate emergency response personnel, who will, according to the seriousness of the accident, provide recommended medical diagnosis and, if necessary, treatment.

The Project Manager and Project Supervisor will be immediately informed of any injuries or incidents. The Project Supervisor and/or the SSHO will investigate facility/site conditions to determine whether, and at what levels, exposure actually occurred, the cause of such exposure and the means to be taken to prevent the incident from recurring.

The SSHO, the Project Supervisor and the exposed individual will complete an exposure incident reporting form. The form will be filed with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

Section 10.4 Site Communications

Hand signals will be utilized where phones are impractical. If possible, mobile telephones will be present during site activities for emergency response and office communications. The locations of public telephones will be identified prior to the start of activities. These will provide back up for the mobile telephones and serve as the primary off-site communication network. Daily tailgate safety meetings will be used to communicate any new hazards to all site personnel and to reinforce adherence to safe work practices and this Health and Safety Plan.

Section 10.5 Emergency Response

In case of emergency, site personnel should evacuate to the identified decontamination or designated safe refuge location, both for their own personal safety and to prevent hampering response/rescue efforts. Unless changed by the Project Manager, the command center will be used as the safe refuge. In the case of an evacuation, the SSHO will account for all personnel. A log of all individuals entering and leaving the site will be kept so that everyone can be accounted for in an emergency.

In the event of an emergency, the SSHO will direct all notification, response and follow up actions. Contact with any outside response personnel (ambulance, fire department, etc.) will be done at the direction of the SSHO, again with the individuals trained in first aid procedures. If an individual is transported to a hospital or a doctor, a copy of this HASP must accompany the individual.

Follow up activities must be completed before on site work is resumed following an emergency. All used emergency equipment must be recharged, refilled or replaced. Government agencies must be notified as appropriate. An investigation of the incident must be conducted as soon as possible. The resulting report must be accurate, objective, complete and authenticated (signed and dated).

Section 10.6 Medical/First Aid Response

On-site medical and/or first aid response to an injury or illness will only by provided by trained personnel competent in such matters. The SSHO is responsible for directing these actions and contacting the appropriate off-site response personnel (paramedics, etc.).

Section 10.7 Fire Fighting Procedures

A fire extinguisher, intended for small fires, will be available on each operating piece of heavy equipment and in the Project Supervisor's (or his designee's) vehicle during all site activities. When the fire cannot be controlled with the extinguisher, the area should be evacuated immediately. The SSHO (or designee) will determine the time to contact fire department and response personnel.

Section 10.8 Emergency Decontamination Procedure

The extent of emergency decontamination depends on the severity of the injury or illness and the nature of the contamination. Minimum decontamination will consist of detergent washing and rinsing and removal of contaminated outer clothing and equipment. If the emergency is such that there is insufficient time to complete all of those actions, it is acceptable to remove the contaminated clothing without washing it.

If the situation is such that the contaminated clothing cannot be removed, the person should be given required first aid treatment, and then wrapped in plastic or a blanket prior to transportation to medical care. If heat stress is a factor in the victim's illness/injury, the outer protective garment must be removed from the victim immediately.

Section 10.9 Emergency Equipment

On-site equipment for safety and emergency response shall be maintained, as follows:

- Fire Extinguisher
- First Aid Kit
- Eye Wash Station (wash bottles at a minimum)
- Extra copy of the Health and Safety Plan

These will be located on site in the command post or with the project Supervisor and/or the SSHO.

SECTION 11.0 SPECIAL PRECAUTIONS

Section 11.1 Heat Stress/Cold Injury Protection Program

Formal training in prevention of heat and/or cold injuries will be provided as part of the site-specific training. Informal review of these techniques will be made as part of daily pre work briefings. Any person who experiences signs of heat related distress would be instructed to stop work immediately. Medical attention will be sought if there is any doubt that prompt and full recovery will result without it. Symptoms of heat related distress include muscle cramps, pale and clammy or hot, dry and flushed skin, confusion, disorientation and incoherent speech, nausea and/or convulsions.

Section 11.2 Heavy Machinery/Equipment

Site employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory protection, hearing protection and protective eyewear significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

Section 11.3 Construction Materials and Site Refuse

All construction materials and site refuse will be contained in the specified appropriate areas. Site personnel should make certain that soil spoils, cuttings, etc., are not scattered throughout the area of activity and that trash and scrap materials are immediately and properly packaged and labeled.

Section 11.4 Additional Safety Practices

The following are important safety precautions that will be enforced during this work:

1. There will be no eating, drinking or smoking in the exclusion or contamination reduction zone.

2. All personnel must pass through the contamination reduction zone to enter or exit the exclusion zone.

3. As a minimum, emergency eye washers will be on the hot side of the contamination reduction zone and/or at the workstation.

4. An emergency deluge shower/spray cans are to be located on the clean side of the contaminated reduction area.

5. At the end of the workday, all personnel working in the exclusion area shall take a hygienic shower.

6. All supplied breathing air shall be certified as Grade D or better.

7. Where practical, all tools/equipment will be spark proof, explosion resistant, and/or bonded and grounded.

8. Medicine and alcohol can mask the effect from exposure to certain compounds. Personnel involved in the project must not consume controlled substances and alcoholic beverages. Consumption of prescribed drugs must be at the direction of a physician familiar with the person's work.

9. An adequately stocked first aid kit will be on-scene at all times during operational hours. It is suggested that an oxygen inhalator respirator be available and a qualified operator present. The location of these items and the operator shall be posted.

10. Hands and face must be thoroughly washed upon leaving the contamination reduced zone and before eating, drinking or any other activity.

11. Contact with potentially contaminated surfaces should be avoided whenever possible. One should not walk through puddles, mud or other discolored surfaces, kneel on the ground, lean, sit or place equipment on drums, containers, vehicles or on the ground.

12. Air purifying respirators will be inspected daily by the SSHO.

13. Cartridges for air purifying respirators in use will be changed daily at a minimum.

14. No excessive facial hair, which interferes with the effectiveness of a respirator, will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing will be performed prior to respirator use to ensure the wearer obtains a proper seal.

15. Unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

16. Legible and understandable precautionary labels shall be prominently affixed to containers of raw materials, intermediates, products, by-products, mixtures, scrap, waste, debris and contaminated clothing.

Section 11.5 Daily Log Contents

The Project Manager and the SSHO will establish a log in/out system appropriate to the site, that will record, at a minimum, the following information: Personnel on the site, their arrival and departure times and their destination on the site; Incidents and unusual activities that occur on site such as, but not limited to, accidents, spills, breaches of security, injuries, equipment failures and weather related problems; Conversations that may affect the work such as: (1) Media Visits, (2) Safety and Health Inspections by the SSHO and external agencies, (3) Owner/Agent Meetings, and (4) Employee/Union Meetings; Changes to the Work Plan and the Health and Safety Plan; Daily Information generated such as (1) Changes to the Work and Health and Safety Plans, (2) Work accomplished and the current site status, and (3) Air monitoring results; Personnel in PPE and times of PPE in contamination zone.

Section 11.6 Plan Acknowledgement

All site personnel have read the above plan and are familiar with its provisions.

	PRINTED NAME	SIGNATURE
Site Safety and Health Officer	Douglas A. Stamp	
Project Manager	Mark N. Ramsdell	
Project Supervisor		
Other Site Personnel		

Appendix A

Material Safety Data Sheets for Known Site Constituents

Note: See Appendix E, Potassium Permanganate Material Safety Data Sheets.

Appendix B

Hospital Route Directions & Map

Note: See LFR Appendix D, Health and Safety Plan; Attachment D-3, Hospital Route Map.

APPENDIX E

POTASSIUM PERMANGANATE MATERIAL SAFETY DATA SHEETS

CAIROX®

Potassium Permanganate

CAS Registry No. 7722-64-7

Technical Grade

Technical Grade is recommended where potassium permanganate is fed as a solution and where particle size is not critical.

Technical Grade

Assay
Guaranteed 98% $KMnO_4$

Particle Size
20% maximum retained on #425 U.S. Standard Sieve (formerly #40)
7% maximum through #75 U.S. Standard Sieve (formerly #200)

Standards and Specifications
CAIROX® Potassium Permanganate is certified by the National Sanitation Foundation (NSF) to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals - Health Effects.

Technical Grade meets:
AWWA Standard B603
Military Specifications MIL-P-11970-C dated 14 October 1983
Water Chemical Codex RMIC values

Chemical/Physical Data

Formula	$KMnO_4$
Formula Weight	158.0 g/mol
Form	Granular Crystalline
Specific Gravity	
Solid	2.703 g/cm^3
3% Solution	1.020 g/mL by weight, 20°C / 4°C
Bulk Density	Approximately 100 lb/ft^3

Decomposition may start at 150 °C / 302 °F

Solubility in Distilled Water

Temperature		Solubility	
°C	°F	g/L	oz/gal
0	32	27.8	3.7
20	68	65.0	8.6
40	104	125.2	16.7
60	140	230.0	30.7
70	158	286.4	38.3
75	167	323.5	43.2

For more information, refer to the *Solubility Fact Sheet.*

Shipping Containers

25 kg pail (55.125 lb) net, with handle, made of HDPE, weighs 3.1 lb. It is tapered to allow nested storage of empty drums, stands approximately 15½ inches high and has a maximum diameter of 12 inches.

150 kg drum (330.750 lb) net, made of 22-gauge steel, weighs 22.4 lbs. It stands approximately 29½ inches high and is approximately 19¾ inches in diameter.

Special Packages will be considered on request.

Packaging meets UN performance oriented packaging requirements

Description

Crystals or granules are dark purple with a metallic sheen, sometimes with a dark bronze-like appearance. Potassium permanganate has a sweetish, astringent taste and is odorless.

Handling, Storage, and Incompatibility

Protect containers against physical damage. When handling potassium permanganate, respirators should be worn to avoid irritation of or damage to mucous membranes. Eye protection should also be worn when handling potassium permanganate as a solid or in solution.

Potassium permanganate is stable and will keep indefinitely if stored in a cool, dry area in closed containers. Concrete floors are preferred to wooden decks. To clean up spills and leaks, follow the steps recommended in our MSDS. Be sure to use goggles, rubber gloves, and respirator when cleaning up a spill or leak.

Avoid contact with acids, peroxides, and all combustible organic or readily oxidizable materials including inorganic oxidizable materials and metal powders. With hydrochloric acid, chlorine gas is liberated. Potassium permanganate is not combustible, but will support combustion. It may decompose if exposed to intense heat. Fires may be controlled and extinguished by using large quantities of water. Refer to the *MSDS* for more information.

Corrosive Properties

Potassium permanganate is compatible with many metals and synthetic materials. Natural rubbers and fibers are often incompatible. Solution pH and temperature are also important factors. The material must be compatible with either the acid or alkali also being used.

In neutral and alkaline solutions, potassium permanganate is not corrosive to iron, mild steel, or stainless steel; however, chloride corrosion of metals may be accelerated when an oxidant such as permanganate is present in solution. Plastics such as polypropylene, polyvinyl chloride Type I (PVC I), epoxy resins, fiberglass reinforced plastic (FRP), Penton, Lucite, Viton A, and Hypalon are suitable. Teflon FEP and TFE, and Tefzel ETFE are best. *Refer to Material Compatibility Chart*.

Aluminum, zinc, copper, lead, and alloys containing these metals may be (slightly) affected by potassium permanganate solutions. Actual studies should be made under the conditions in which permanganate will be used.

Shipping

Potassium permanganate is classified by the Hazardous Materials Transportation Board (HMTB) as an oxidizer. It is shipped under Interstate Commerce Comission's (ICC) Tariff 19.

Proper Shipping Name:	Potassium Permanganate (RQ-100/45.4)
Hazard Class:	Oxidizer
Identification Number:	UN 1490
Label Requirements:	Oxidizer
Packaging Requirements:	49 CFR Parts 100 to 199, Sections: 173.152, 173.153, 173.194

Shipping Limitations:

Minimum quantities:

Rail car: See Tariff for destination
Truck: No minimum

Postal regulations:

Information applicable to packaging of oxidizers for shipment by the U.S. Postal Service to domestic and foreign destinations is readily available from the local postmaster.

United Parcel Service accepts 25 lbs as largest unit quantity properly packaged; consult United Parcel Service.

Regulations concerning shipping and packing should be consulted regularly due to frequent changes.

Repacking

When potassium permanganate is repacked, the packing, markings, labels, and shipping conditions must meet applicable Federal regulations. See Code of Federal Regulations-49, Transportation (parts 100-199) and Federal Hazardous Materials Substances Act, 15 U.S.C. 1261.

Applications

Listed below are some of the many applications of potassium permanganate. Permanganate is a powerful oxidizing agent. The optimum condition under which it is to be used can be easily established through technical service evaluations or laboratory testing.

Oxidation and Synthesis - Organic chemicals and intermediates manufacture. Oxidizes impurities in organic and inorganic chemicals.

Water Treatment - Oxidizes iron, manganese, and hydrogen sulfide; controls taste and odor; and is an alternate pre-oxidant for Disinfection By-Product (THMs and HAAs) control.

Municipal Wastewater Treatment - Destroys hydrogen sulfide in wastewater and sludge. Improves sludge dewatering.

Industrial Wastewater Treatment - Oxidizes hydrogen sulfide, phenols, iron, manganese, and many other organic and inorganic contaminants; resultant manganese dioxide aids in removing heavy metals.

Metal Surface Treatment - Conditions mill scale and smut to facilitate subsequent removal by acid pickling in wrought metal manufacturing and jet engine cleaning.

Equipment Cleaning - Assists in cleaning organic and inorganic residues from refining and cooling towers and other processing equipment. Decontaminates hydrogen sulfides, pyrophoric iron sulfides, phenols, and others.

Purification of Gases - Removes trace impurities of sulfur, arsine, phosphine, silane, borane, and sulfides from carbon dioxide and other industrial gases.

Mining and Metallurgical - Aids in separation of molybdenum from copper; removes impurities from zinc and cadmium; oxidizes flotation compounds. Removes iron and manganese from acid mine drainage.

Hazardous Waste Treatment or Remediation - Treats phenols, chlorinated solvents (TCE, PCE), tetraethyl lead, chelated metals, cyanides, and sulfides.

Slag Quenching - Controls hydrogen sulfide and acetylene emissions during quenching of hot slag.

Food Processing - Controls sulfides, soluble animal oil, grease, organic acids, ketones, nitrogen compounds, mercaptans, and BOD.

Carus Chemical Company
315 Fifth Street
P. O. Box 599
Peru, IL 61354
Tel. (815) 223-1500
Fax (815) 224-6697
Web: www.caruschem.cor
E-Mail: salesmkt@caruschem.com

CARUS

Responsible Care®
Good Chemistry at Work

MATERIAL SAFETY DATA SHEET

CAIROX® Potassium Permanganate

Section 1 Chemical Product and Company Identification

PRODUCT NAME: CAIROX® potassium permanganate, $KMnO_4$
SYNONYMS: Permanganic acid potassium salt
Chameleon mineral
Condy's crystals
Permanganate of potash

MANUFACTURER'S NAME: CARUS CHEMICAL COMPANY

MANUFACTURER'S ADDRESS:
Carus Chemical Company
1500 Eighth Street
P. O. Box 1500
LaSalle, IL 61301

TRADE NAME: CAIROX® potassium permanganate

TELEPHONE NUMBER FOR INFORMATION: 815/223-1500

EMERGENCY TELEPHONE NO: 800/435-6856

AFTER HOURS NO. 815/223-1565
5:00 PM-8:00 AM Central Standard Time
Monday-Friday, Weekends and Holidays

CHEMTREC TELEPHONE NO.: 800/424-9300

Section 2 Composition/Information on Ingredients

Material or component	CAS No.	%	Hazard Data	
Potassium permanganate	7722-64-7	97% min. $KMnO_4$	PEL-C	5 mg Mn per cubic meter of air
			TLV-TWA	0.2 mg Mn per cubic meter of air

Section 3 Hazards Identification

1. Eye Contact
   Potassium permanganate is damaging to eye tissue on contact. It may cause severe burns that result in damage to the eye.

2. Skin Contact
   Contact of solutions at room temperature may be irritating to the skin, leaving brown stains. Concentrated solutions at elevated temperature and crystals are damaging to the skin.

3. Inhalation
   Acute inhalation toxicity data are not available. However, airborne concentrations of potassium permanganate in the form of dust or mist may cause damage to the respiratory tract.

4. Ingestion
   Potassium permanganate, if swallowed, may cause severe burns to mucous membranes of the mouth, throat, esophagus, and stomach.

Section 4 First Aid Measures

1. Eyes
   Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Do not attempt to neutralize chemically. Seek medical attention immediately. Note to physician: Soluble decomposition products are alkaline. Insoluble decomposition product is brown manganese dioxide.

2. Skin
   Immediately wash contaminated areas with large amounts of water. Remove contaminated clothing and footwear. Wash clothing and decontaminate footwear before reuse. Seek medical attention immediately if irritation is severe or persistent.

3. Inhalation
   Remove person from contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. Seek medical attention immediately.

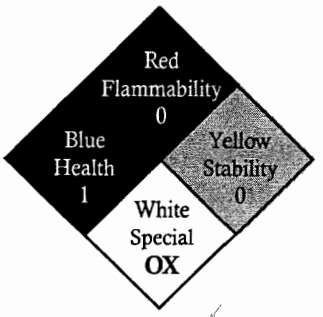
4. Ingestion
   Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water. Seek medical attention immediately.

Section 5 Fire Fighting Measures

NFPA* HAZARD SIGNAL

Health Hazard (less than 1 hour exposure)	1	=	Materials which under fire conditions would give off irritating combustion products. Materials which on the skin could cause irritation.
Flammability Hazard	0	=	Materials that will not burn.
Reactivity Hazard	0	=	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.
Special Hazard	OX	=	Oxidizer

***National Fire Protection Association 704**



FIRST RESPONDERS:

Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach site of incident with caution. Use Emergency Response Guide NAERG 96 (RSPA P5800.7). Guide No. 140.

FLASHPOINT None

FLAMMABLE OR EXPLOSIVE LIMITS Lower: Nonflammable Upper: Nonflammable

EXTINGUISHING MEDIA Use large quantities of water. Water will turn pink to purple if in contact with potassium permanganate. Dike to contain. Do not use dry chemicals, CO_2, Halon® or foams.

SPECIAL FIREFIGHTING PROCEDURES If material is involved in fire, flood with water. Cool all affected containers with large quantities of water. Apply water from as far a distance as possible. Wear self-contained breathing apparatus and full protective clothing.

Section 6 Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Clean up spills immediately by sweeping or shoveling up the material. Do not return spilled material to the original container. Transfer to a clean metal drum. EPA banned the land disposal of D001 ignitable waste oxidizers. These wastes must be deactivated by reduction. To clean floors, flush with abundant quantities of water into sewer, if permitted by Federal, State, and Local regulations. If not permitted, collect water and treat chemically (Section 13).

PERSONAL PRECAUTIONS
Personnel should wear protective clothing suitable for the task. Remove all ignition sources and incompatible materials before attempting clean-up.

Section 7 Handling and Storage

WORK/HYGENIC PRACTICES
Wash hands thoroughly with soap and water after handling potassium permanganate, and before eating or smoking. Wear proper protective equipment. Remove contaminated clothing.

VENTILATION REQUIREMENTS
Provide sufficient area or local exhaust to maintain exposure below the TLV-TWA.

CONDITIONS FOR SAFE STORAGE
Store in accordance with NFPA 430 requirements for Class II oxidizers. Protect containers from physical damage. Store in a cool, dry area in closed containers. Segregate from acids, peroxides, formaldehyde, and all combustible, organic or easily oxidizable materials including anti-freeze and hydraulic fluid.

Section 8 Exposure Controls/Personal Protection

RESPIRATORY PROTECTION
In the case where overexposure may exist, the use of an approved NIOSH-MSHA dust respirator or an air supplied respirator is advised. Engineering or administrative controls should be implemented to control dust.

EYE
Faceshield, goggles, or safety glasses with side shields should be worn. Provide eye wash in working area.

GLOVES
Rubber or plastic gloves should be worn.

OTHER PROTECTIVE EQUIPMENT
Normal work clothing covering arms and legs, and rubber or plastic apron should be worn.

Section 9 Physical and Chemical Properties

APPEARANCE AND ODOR	Dark purple solid with a metallic luster, odorless
BOILING POINT, 760 mm Hg	Not applicable
VAPOR PRESSURE (mm Hg)	Not applicable
SOLUBILITY IN WATER % BY SOLUTION	6% at 20°C (68°F), and 20% at 65°C (149°F)
PERCENT VOLATILE BY VOLUME	Not volatile
EVAPORATION RATE (BUTYL ACETATE=1)	Not applicable
MELTING POINT	Starts to decompose with evolution of oxygen (O_2) at temperatures above 150°C (302°F). Once initiated, the decomposition is exothermic and self-sustaining.
OXIDIZING PROPERTIES	Strong oxidizer
SPECIFIC GRAVITY	2.7 @ 20°C (68°F)
VAPOR DENSITY (AIR=1)	Not applicable

Section 10 Stability and Reactivity

STABILITY Under normal conditions, the material is stable.

CONDITIONS TO AVOID Contact with incompatible materials or heat (>150°C/302°F).

INCOMPATIBLE MATERIALS Acids, peroxides, formaldehyde, anti-freeze, hydraulic fluids, and all combustible organic or readily oxidizable inorganic materials including metal powders. With hydrochloric acid, toxic chlorine gas is liberated.

HAZARDOUS DECOMPOSITION PRODUCTS When involved in a fire, potassium permanganate may liberate corrosive fumes.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION Material is not known to polymerize.

Section 11 Toxicological Information

Potassium permanganate: Acute oral LD_{50}(rat) = 780 mg/kg Male (14 days); 525 mg/kg Female (14 days)
The fatal adult human dose by ingestion is estimated to be 10 grams. (Ref. Handbook of Poisoning: Prevention, Diagnosis & Treatment, Twelfth Edition)

EFFECTS OF OVEREXPOSURE

1. Acute Overexposure
   Irritating to body tissue with which it comes into contact.

2. Chronic Overexposure
   No known cases of chronic poisoning due to potassium permanganate have been reported. Prolonged exposure, usually over many years, to heavy concentrations of manganese oxides in the form of dust and fumes, may lead to chronic manganese poisoning, chiefly involving the central nervous system.

3. Carcinogenicity
   Potassium permanganate has not been classified as a carcinogen by OSHA, NTP, IARC.

4. Medical Conditions Generally Aggravated by Exposure
   Potassium permanganate will cause further irritation of tissue, open wounds, burns or mucous membranes.

Registry of Toxic Effects of Chemical Substances
RTECS #SD6476000

Section 12 Ecological Information

Entry to the Environment

Potassium Permanganate has a low estimated lifetime in the environment, being readily converted by oxidizable materials to insoluble manganese dioxide (MnO_2).

Bioconcentration Potential

In non-reducing and non-acidic environments manganese dioxide (MnO_2) is insoluble and has a very low bioaccumulative potential.

Aquatic Toxicity

Rainbow trout, 96 hour LC_{50}: 1.8 mg/L
Bluegill sunfish, 96 hour LC_{50}: 2.3 mg/L

Section 13 Disposal Consideration

DEACTIVATION OF D001 IGNITABLE WASTE OXIDIZERS BY CHEMICAL REDUCTION

Reduce potassium permanganate in aqueous solutions with sodium thiosulfate (Hypo), or sodium bisulfite or ferrous salt solution. The thiosulfite or ferrous salt may require some dilute sulfuric acid to promote rapid reduction. If acid was used, neutralize with sodium bicarbonate to neutral pH. Decant or filter, and mix the sludge with sodium carbonate and deposit in an approved landfill. Where permitted, the sludge can be drained into sewer with large quantities of water. Use caution when reacting chemicals. Contact Carus Chemical Company for additional recommendations.

Section 14 Transport Information

U. S. DEPARTMENT OF TRANSPORTATION INFORMATION:

Proper Shipping Name:	49 CFR 172.101	Potassium Permanganate
ID Number:	49 CFR 172.101	UN 1490
Hazard Class:	49 CFR 172.101	Oxidizer
Division:	49 CFR 172.101	5.1
Packing Group:	49 CFR 172.101	II

Section 15 Regulatory Information

TSCA Listed in the TSCA Chemical Substance Inventory

CERCLA **Hazardous Substance**

Reportable Quantity: RQ - 100 lb 40 CFR 116.4; 40 CFR 302.4

RCRA Oxidizers such as potassium permanganate meet the criteria of ignitable waste. 40 CFR 261.21

SARA TITLE III Information

Section 302 Extremely hazardous substance: Not listed
Section 311/312 Hazard categories: Fire, acute and chronic toxicity
Section 313 CAIROX® potassium permanganate contains 97% Manganese Compound as part of the chemical structure (manganese compounds CAS Reg. No. N/A) and is subject to the reporting requirements of Section 313 of Title III, Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

Section 15 Regulatory Information (cont.)

STATE LISTS	Michigan Critical Materials Register:	Not listed
	California Proposition 65:	Not listed
	Massachusetts Substance List:	5 F8
	Pennsylvania Hazard Substance List:	E
FOREIGN LISTS	Canadian Domestic Substances List (DSL)	Listed
	Canadian Ingredient Disclosure List	Listed
	European Inventory of Existing Chemical Substances (EINECS)	2317603

Section 16 Other Information

NIOSH	National Institute for Occupational Safety and Health
MSHA	Mine Safety and Health Administration
OSHA	Occupational Safety and Health Administration
NTP	National Toxicology Program
IARC	International Agency for Research on Cancer
TSCA	Toxic Substances Control Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act of 1986
PEL-C	OSHA Permissible Exposure Limit-OSHA Ceiling Exposure Limit
TLV-TWA	Threshold Limit Value - Time Weighted Average (American Conference of Governmental Industrial Hygienists)

Kenneth Krogulski
May 2000

CARUS

Responsible Care®
A Public Commitment

APPENDIX F

CONSTRUCTION QUALITY ASSURANCE PLAN

Construction Quality Assurance Project Plan
JCI Jones Chemicals, Inc. Superfund Site
Caledonia, New York

June 13, 2003
004-03165-03-003

Prepared for
JCI Jones Chemicals, Inc.
100 Sunny Sol Boulevard
Caledonia, New York 14423

Prepared by
LFR Levine·Fricke Inc.
3382 Capital Circle, N.E.
Tallahassee, Florida 32308-8702

LFR
LEVINE • FRICKE

CONTENTS

FIGURE

1.0 INTRODUCTION

This Construction Quality Assurance Project Plan (CQAPP) is an integral component of the remedial measures being undertaken at the Site. The purpose of this document is to provide a written construction quality assurance (CQA) plan that identifies steps that will be used to monitor and document the quality of materials and the condition and manner of their installation. The CQA plan helps to ensure proper structural stability and integrity of all unit components, and proper construction of all units. The CQAPP procedures will be followed to ensure that the remedial construction activities at the Site comply with the approved design.

The CQAPP presents quality assurance procedures for the remedial construction of the following:

- an SVE system to treat the affected soils in unsaturated zone beneath the former solvent tank area
- a groundwater extraction system in the source area beneath the former solvent tanks area
- a chemical oxidation system to treat potential DNAPLs, if present, in the source area

A construction quality assurance (CQA) report will be prepared and submitted along with the Remedial Action Reports for Elements I and II. The report will describe the construction quality procedures and provide documentation of relevant testing and construction observations.

1.1 Construction Quality Assurance Objectives

The CQA objectives for the Site include the following:

- assurance that the Remedial Subcontractor and other parties involved have a clear understanding of the design objectives
- verification that materials required are provided in accordance with the approved design
- verification that the various components of remedial system are installed in accordance with approved design
- maintenance of photographic logs, daily logs, audit reports, and CQA reports as documentation that the quality of the remedial construction satisfies the requirements of the approved design

1.2 Definitions

Quality Assurance refers to a planned and systematic pattern of all means and actions designed to provide adequate confidence that material meet design and regulatory requirements and will perform satisfactorily.

Quality Control refers to those actions that provide a means to evaluate and measure the characteristics (quality) of materials and services as per the design requirements.

1.3 Design Documents

This section describes the procedures for controlling the receipt, processing and distribution of design documents, including revisions to these documents in the form of field changes. These procedures ensure that project personnel and subcontractors use the correct design document revision.

1.3.1 General Requirements

The General Contractor (GC) is defined as the general contractor awarded the remediation contract by JCI or its consultant LFR. The GC will identify the current revision of drawings, specifications, and other design documents prepared for the Site. It is the responsibility of the GC to receive, control, and distribute to his subcontractors the design documents and design document changes.

Through this CQAPP, a system for the receipt, control, and distribution of design documents, including contract drawings and specifications, as-built drawings, subcontractor submittals, and requests for information, is established.

The GC is responsible for design documents control in the field. As appropriate, three files will be maintained on site showing:

- master set (original contract drawings)
- current construction drawings
- drawings annotated to reflect as-built conditions

The GC is responsible for maintaining, on a day-to-day basis, complete set of contract drawings representing as-built conditions. The GC reviews all as-built drawings. All as-built data are stamped or marked as built and initialed by the GC and cosigned by the Project Engineer (PE).

Revisions will be generally as follows:

- Revisions to design will be made in red ink.
- Deletion to/or non-completed work will be made in pencil.

- All survey measurements will be provided along the survey of items including final locations and/or elevations.

Any proposed design changes by the GC (such as pumps, blowers, tanks, piping, meters, electrical components, control boxes, etc.) shall be made in writing to the PE no later than 15 days after award of the contract.

During the construction of remedial activities, the PRP's Representative field staff may make changes, provided such changes do not affect the overall integrity of the design or violate regulatory requirements. Prior to making any changes, the field staff must contact and obtain PE's approval. The PE will evaluate any potential impacts of the proposed changes with JCI and U.S. EPA (and/or its representatives) and approve/disapprove such changes.

During the construction of the system and/or based on other field conditions, the GC can propose changes that can improve the overall efficiency of the system. Such Field Change Requests will be made in writing to the PE. The GC and/or its subcontractors can propose Field Change Requests as long as they do not result in unacceptable delays. The PE will consult with JCI and U.S. EPA (and/or representatives) and may approve/disapprove the Field Change Requests.

The GC will review all submittals including that of its subcontractor's for completeness and accuracy prior to forwarding to the PE. Such drawings may include shop drawing, samples, certifications, manuals, material lists, test reports, boring logs, etc. The PE or his/her representative will review, stamp and sign-off on the submittal in a timely manner.

1.3.2 Material Control

Materials required for the constructions will be reviewed and accepted as per the specified requirements. Receipt inspection ensures that material and equipment are in conformance to the specification and purchase order requirements. The receipt inspection process generally includes (1) visual inspection, (2) marking and tagging where appropriate, (3) documentation, and (4) preparation for proper storage. All items and material are stored, handled, and maintained in accordance with manufacturer/supplier requirements.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

This section describes the project organization and identifies the major parties involved. A brief description of the roles of each party is also presented. Major groups involved in the remedial action are the U.S. EPA, the PRP and its representative LFR, and the GC (including its subcontractors). These groups must interact in a timely and efficient manner to achieve the remedial objectives. Effective management is critical in

ensuring efficient, timely and credible execution of the project. The project organizational chart is presented on Figure A-1.

2.1 U.S. EPA

The U.S. EPA is the federal agency overseeing the implementation of the remedial measures. U.S. EPA and/or its representative will be on site during remedial construction to ensure regulatory compliance.

2.2 Potentially Responsible Party (PRP)

The PRP is responsible for negotiating the Consent Decree and Statement of Work with the U.S. EPA, overseeing the performance of their remedial contractor and funding the remedial construction and subsequent monitoring. The PRP is also responsible for coordinating Site activities with existing site operations and address local community concerns.

JCI Jones Chemicals, Inc., Caledonia, New York (JCI) is the PRP for the Site. JCI is also the owner of the Site. The management and funding of the remedial construction and post-construction monitoring will be the ultimate responsibility of PRP. Implementation of the remedial construction at the Site will be performed through its hired environmental consultant LFR Levine·Fricke (LFR).

2.3 PRP's Engineer

The PRP's consultant, LFR, will be the Engineer for the Site. The PRP has entered into an agreement with LFR to oversee the remedial construction at the Site. LFR is responsible for preparing the design for project construction and for furnishing record drawings and complete documentation to the agencies overseeing the project. LFR will schedule and coordinate the required work with the GC, manufacturers, and installers to ensure timely completion of the project. LFR's representative will be on site during key construction activities.

LFR is an environmental consulting firm qualified to perform all aspects of the remedial construction work. LFR's Project Manager and Project Engineer for the Site are listed below. The Project Engineer is a registered professional engineer in the State of New York.

Shekhar Melkote, P.G.
Project Manager
LFR Levine·Fricke (LFR)
413 Porter Road
East Longmeadow, MA 01028
(413) 525-2839

Scott Starr, P.E.
Project Engineer
LFR Levine·Fricke (LFR)
3014 U.S. Highway 301, North
Suite 500
Tampa, Florida 33619
(813) 661-1810

2.3.1 Project Manager

LFR's Project Manager (PM) Mr. Shekhar Melkote, P.G., will be the PRP's representative for the project and will have the general responsibility of assuring that the remedial construction activities are conducted in accordance with the U.S. EPA approved design. The PM in coordination with the PRP selected the GC and awarded the construction work. The PM or his designee will interface with the selected GC regarding daily operations and compliance with the approved design plans. The PM responsibilities typically include the following:

- Ensure that the remedial construction activities are conducted in accordance with the U.S. EPA approved design and plans.
- Coordinate remedial construction activities and document submittals with the Project Engineer.
- Ensure that the project scope and objectives are defines and that procedures, schedules, budgets, and resources are established.
- Establish project procedures and protocols, instructions, lines of communication, controls, and reporting requirements.
- Manage project scope, safety requirements, schedule, cost and quality, and taking corrective actions where necessary.
- Propose alternate methods, if necessary, to the Project Engineer.
- Review and discuss design changes with U.S. EPA, PRP, and other affected parties. Subsequently accept or reject design changes with appropriate documentation.
- Review all project-related data, documents, and submittals to regulatory agencies.

2.3.2 Project Engineer

The Project Engineer Mr. Scott Starr, P.E. will be responsible for the design content of the remedial construction. The Project Engineer or his representative will assist the PM in coordinating field activities related to the construction and will be present on site to observe the construction and startup of the remedial system.

The Project Engineer is responsible for reviewing all drawings including the daily as-built drawings and reporting any deviations from the approved design. The Project Engineer is a licensed New York State professional engineer.

2.3.3 CQA Officer

LFR's Project Engineer Mr. Scott Starr, P.E. will act as the CQA Officer for the remedial construction. Mr. Starr has sufficient practical, technical, communication and managerial skills to successfully oversee and implement CQA activities.

The following list some of the specific responsibilities of the CQA officer:

- Review or request peer review of the design documents and specifications for completeness and accuracy.
- Verify that remedial construction materials meet design requirements.
- Schedule and coordinate CQA inspection activities.
- Conduct on-site inspection of construction work to ensure compliance with design documents, plans, and other regulatory requirements.
- Maintain CQA inspection logs.
- Coordinate selection of the GC and review all submittals made by the GC.
- Provide the PM with periodic CQA reports.

2.4 General Contractor

The selected GC, Marcor, will be the remedial contractor for the Site. The PRP has entered into an agreement with Marcor to initiate all activities related to the remedial construction at the Site. Marcor is responsible for constructing the remedial systems in accordance with the intent of the design. Marcor will also be responsible for all submittals by the subcontractors, manufacturers, and installers.

Marcor is an environmental contracting firm that is an approved contractor for the New York State Department of Environmental Conservation and is qualified to perform all aspects of the remedial construction work. Marcor's Project Manager for the Site is listed below and is a registered professional engineer in the State of New York.

Mark Ramsdell, P.E.
Project Manager
Marcor Remediation, Inc.
460 Buffalo Road, Suite 5
Rochester, New York 14611
(585) 247-6955

2.5 Communication

Project meetings will be held regularly to achieve a high degree of quality during construction and to ensure the end product meets the overall design requirements. Periodic meetings will help all parties understand their roles and responsibilities and resolve any problems that may arise.

2.5.1 Pre-construction Meeting

Prior to the start of any construction activity, a pre-conference meeting between PRP, LFR and GC will be held. At a minimum the PM, Project Engineer and the GC's

representative will participate in the meeting. The general purpose of the pre-conference meeting is to discuss the responsibilities of each party such that their role is clearly understood. General topics may include review of project documents, any revisions or modifications to the approved design, proposed construction startup date, and safety issues. The U.S. EPA will be notified of the pre-construction conference to provide them with the opportunity to attend. The following is a list of potential subjects for discussion during pre-conference meeting:

- design and other pertinent project-related documents
- methods for distributing and storing of documents and reports
- health and safety requirements of on-site personnel
- CQAPP procedures and each party's role and responsibilities
- lines of authority and communication
- protocols for inspection and audits
- discussion of material control and storage

2.5.2 Progress Meeting

Progress meetings between LFR, PRP, GC and other concerned parties will held weekly or as deemed necessary to review current project status, planned activities for next two weeks, problems requiring resolution, any new developments and/or potential changes to the design. Recorded summary progress meeting notes (Section 4) become part of the construction record.

3.0 INSPECTION AND TESTING

This section describes the procedures for conducting and documenting quality verification inspections. It includes pre-construction inspections, construction inspections, and post-construction inspections. Pre-construction inspections involve certification of materials and receipt of materials prior to installation. Construction inspections involve in-process verification of installations as per the requirements. The CQA Officer will conduct a post-construction inspection as final check to ensure that the remedial systems are meeting the required specifications. Appropriate documentation of the various inspections will be required as described in Section 4.

3.1 Pre-construction activities

The CQA Officer and GC shall review the design drawings and specifications prior to starting construction. During this review process, the GC shall return the design to the PM for clarification or modification if any part of the design is deemed unclear. A pre-construction conference shall be conducted where additional questions and comments may be addressed. During this pre-construction conference, field inspection personnel

will be trained by the Project Engineer to provide staff with an understanding of expected conditions, methods of construction, and the scope of plans and specifications.

3.2 Inspection Schedule

General pre-construction, construction, and post construction quality assurance requirements are discussed in the following sections. Specific quality assurance testing requirements are included on the design drawings and specifications.

3.3 Inspection/Testing Requirements

3.3.1 Drilling and Well Installation

CQA activities will include visual inspection and oversight by the CQA Officer or assigned staff during drilling and installation of the wells. The inspection will include verifying that the wells are set at the designed depths and constructed with appropriate materials in accordance with the design drawings. This will include documenting appropriate screen length, screen opening size, material specification, and well-head specifications. The CQA Officer will record these activities in daily construction notes (Section 4.2) that will become part of the construction record.

3.3.2 Trenching and Piping

The CQA activities during trenching and piping will include visual inspection to verify that the piping and backfill material is in conformance with design specifications. The CQA Officer will inspect all trenching activities to ensure trenching is conducted according to the design specifications including correct depth, width, height as well as appropriate backfill and bedding materials. After installation, the piping will be pressure tested to design specifications prior to back filling. The CQA Officer will ensure proper backfill materials are used and that compaction of trench backfill is completed in accordance with design specifications. The CQA officer will record these activities in daily construction notes (Section 4.2) that will become part of the construction record.

3.3.3 Remediation System Equipment

Visual inspection during installation and a post-construction inspection will be conducted to verify that above-grade piping, equipment, structures, and supports have not been damaged by construction activities and remain in conformance with design specifications. The GC or subcontractor will perform tests in the presence of the CQA Officer to check components of the remedial systems. The tests will be performed in accordance with manufacturer recommendations to check equipment operational performance.

The CQA Officer will inspect all components of the remediation system equipment including, but not limited to:

- Groundwater extraction pumps, valves, pressure gauges, and flow meters
- SVE equipment including blower, knock out vessel, piping, valves, electrical, and appurtenances
- Modifications of the existing air stripper tower to treat the additional extracted groundwater, including additional piping, valves, flow gauges, and appurtenances
- Chemical oxidation system including chemical supply tanks, injection pumps, flow meters, pressure gauges, and appurtenances

Subsequent to construction completion, the CQA officer will complete start-up testing of the SVE, groundwater extraction system, the groundwater treatment and discharge system, and the chemical oxidation system. System components will be adjusted to obtain optimum and continuous operating condition. The CQA Officer will record these activities in daily construction notes (Section 4.2) that will become part of the construction record.

3.4 Waste Handling

As previously approved by the U.S. EPA for the Site, wastes such as drill cuttings or drilling mud generated during the installation of SVE and recovery wells will be returned to the source area. Drill cuttings containing DNAPL or visible contamination will be containerized in 55-gallon drums. These drums will be staged in fenced area, labeled as hazardous waste, profiled, and disposed off-site through a licensed hazardous waste disposal subcontractor.

Liquid waste such as well development water and decontamination or rinsate water will be containerized in 55-gallon drums. The liquid waste will be treated on-site prior to discharge to the lagoon system.

4.0 DOCUMENTATION

This section describes the documentation and record keeping that will be used during the remedial construction. Appropriate documentation and record keeping is required during the construction of each critical component of the remedial system. The records and checklist provide a means for the CQA Officer in meeting the quality assurance objectives.

4.1 CQAPP Review and Approval

The Pre-Final Remedial Design report including the CQAPP is under the control of LFR and no revisions, additions or deletions may be made to the contents, except as

requested by the PRP or its representative. The PM is responsible for the distribution and control of copies of this document.

This document shall be reviewed and approved by the PM and PRP, and submitted to U.S. EPA for its review and approval. Requests for revisions shall be forwarded to the PRP and/or LFR. The PM will determine the impact of a revision on the document. If the requested revisions are extensive, the document will be completely revised and will include the appropriate revision number and date. Minor revisions will be addressed in a letter and forwarded to U.S. EPA and all other affected parties.

4.2 Daily Record keeping

The CQA Officer shall maintain a Daily Quality Assurance Summary log. These reports shall various construction activities and quality assurance evaluation. Where necessary the CQA Officer may initiate corrective action in coordination with the PM: Problem identification and appropriate corrective action measures should also be documented as discussed below.

4.2.1 Daily Quality Assurance Summary Log

The Daily Quality Assurance Summary Log include the following key items:

- date, project name, location and identification code
- weather conditions
- minutes of any meetings held
- description and location of construction underway during the time frame of the Daily Summary Log
- equipment and personnel (including GC and its subcontractors) at each location
- description of areas or components being observed or inspected
- description of off-site materials received, including quality verification (vendor certification) documentation
- record of calibrations/re-calibrations of field equipment
- decisions made regarding approval of material or construction work, and/or any corrective actions initiated as a result of quality issues
- cataloging of inspection data sheets and/or other construction related reports
- results of any field measurements
- signature of CQA Officer

4.2.2 Inspection Data Sheets

The CQA Officer maintain Inspection Data Sheets which shall include the following general information:

- description of inspection activity
- location of inspection activity
- type of inspection activity including procedure and references
- field observations including supporting calculations
- results of inspection activity including any variance from specification requirements
- personnel involved in inspection activity
- signature of CQA Officer

4.3 Corrective Action Measures

CQA Officer initiates corrective action measures when construction material or construction activities deviate from specification requirements. A brief report of corrective action measures shall be forwarded to the PM, PRP, the U.S. EPA and other affected parties. The corrective action report shall typically include the following information:

- problem identification, location and description
- probable causes of the problem
- how, when and by whom the problem was identified
- length of time that the problem existed
- recommended corrective action measures with references (if appropriate)
- outcome of corrective action measures
- signature of the CQA Officers

4.4 Photographic Documentation

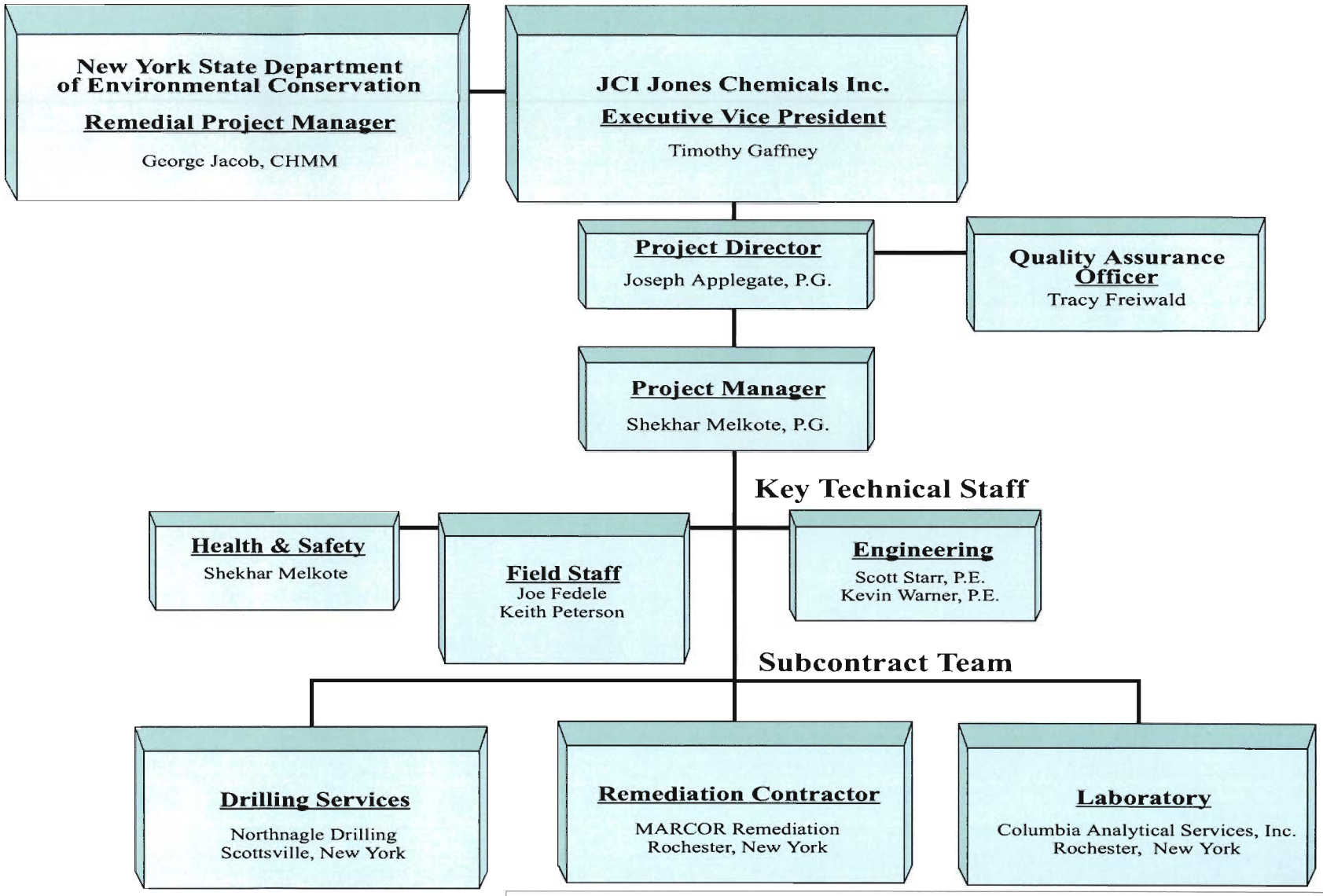
The CQA Officer shall take photographs during the various phases of the remedial construction. Each photograph shall be appropriately indexed, labeled, and captioned providing the viewing location, direction, object, and date and time. The photographs will be become part of the construction record and will made available to all interested parties upon request.

4.5 Final Documentation

Upon completion of the remedial construction, the CQA Officer will prepare a CQA Certification Report. The report shall include the Daily Quality Assurance Summary Logs, Inspection Data Sheets, field observations and results, corrective action measures (if any), and photographic documentation. The report shall be included with the Remedial Action Report for each work Element I and II.

ARCGRACH\JONES\3165ORG\WDB\06-11-03

Project Organizational Chart



JCI Jones Chemicals, Inc

Project Organizational Chart
Caledonia, New York

LFR LEVINE · FRICKE

Project No. 004-03165-03

Figure F-1