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Transmitted Via Regular Mail

May 15, 1997

Ms. Mary Jane Peachey
New York State Department of Environmental Conservation
Region 8
Division of Hazardous Waste Remediation
6274 East Avon-Lima Road
Avon, NY 14414-9519

Re: Remedial Design/Remedial Action Work Plan
Crosman Corporation Site
East Bloomfield, NY
Project #: 0415-415.01 #2

Dear Ms. Peachey:

On behalf of Crosman Corporation and New Coleman Holdings, Inc. (Crosman), please find enclosed two (2) copies of the Remedial Design/Remedial Action (RD/RA) Work Plan for the Crosman Site located in East Bloomfield, New York.

Please feel free to contact me at (716) 292-6740 if you have any questions.

Very truly yours,

BLASLAND, BOUCK & LEE, INC.

William B. Popham
Vice President

WBP/car
Enclosure
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cc: Lorelei J. Borland, Esq., & Mr. Christopher W. McDermott, New Coleman Holdings, Inc.
Mr. Dave Stolz, Crosman Corporation
Thomas F. Walsh, Esq., Jaeckle, Fleischmann & Mugel
Mr. David Crosby, NYSDEC, Albany
Mr. Joe Ryan, NYSDEC, Buffalo
Ms. Dawn Hettrick, NYSDOH, Albany

TECHNICAL REPORT

Remedial Design/ Remedial Action Work Plan

Crosman Corporation Site
East Bloomfield, New York 14443

May 1997

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

30 Corporate Woods, Suite 160
Rochester, New York 14623
(716) 292-6740

Crosman Corporation Site
East Bloomfield, NY
Remedial Design/Remedial Action Work Plan

Certification

I hereby certify that Blasland, Bouck & Lee, Inc. has prepared this Remedial Design/Remedial Action (RD/RA) Work Plan in accordance with the approved remedial alternative as described in the approved Focused Feasibility Study (FS) dated February 1997 for the Crosman Corporation Site (Site I.D. #835012) in East Bloomfield, New York.

Edward R. Lynch, P.E. New York State P.E. No. 57526	5/12/97 Date

1.0 Introduction

1.1 General

Blasland, Bouck & Lee, Inc. (BBL) has prepared on behalf of Crosman Corporation and New Coleman Holdings, Inc. (collectively "Crosman") a Remedial Design/Remedial Action (RD/RA) Work Plan to remediate trichloroethylene (TCE) from the soil and groundwater at the Crosman Facility (Site) in East Bloomfield, New York. This Work Plan fully develops the remedial system design including implementation and remedial schedule outlined in the focused Feasibility Study (FS) prepared by BBL dated February 1997 and approved by DEC in a letter dated February 19, 1997.

1.2 Site Description

The Site is located on a 50-acre parcel along New York State Routes 5 and 20 in a rural area in the Town of East Bloomfield (Figure 1-1). The Site is located in an area characterized by rolling topography. The ground surface at the Site slopes moderately downward to the northwest from the Crosman plant to the facility entrance at Routes 5 and 20. The Site contains a 225,000-square-foot manufacturing facility and office building (the plant); a 5,000-square-foot wastewater pre-treatment building; parking areas; a 3/4-acre man-made lined retention pond; and undeveloped land (Figure 1-2). Although the Site is bordered primarily by agricultural and residential land, a Rhone-Poulenc Films Inc. facility is located to the east-southeast.

The discharge from the retention pond drains through a culvert under Routes 5 and 20. Drainage from this culvert flows northwest to an unnamed tributary to Fish creek, which drains into Mud Creek near Victor, New York. Surface waters within a 2-mile radius of the Site consist of small streams and ponds.

1.3 Site History

The Crosman facility was constructed and operations were initiated during 1966. Prior to this time, the property was used for agricultural purposes or was left fallow. The plant was subsequently expanded in 1969, 1983 and 1985. The lined retention pond was constructed in 1968 to hold non-contact cooling water and stormwater and for fire protection. A production well (PW-1) was installed in the north-central portion of the Site in 1970 to supply non-potable process and non-contact cooling water. The wastewater pre-treatment facility was completed in 1978.

Crosman has been involved in the manufacture of airguns, BB's, pellets, zinc-plated carbon dioxide gas cartridges, and rangefinders at the plant since 1966. During the plant's operation, steel, brass, aluminum, and plastic have been received in bar and round stock; machined by screw machines, lathes, grinders, and cutting devices; formed, punched, and slotted by punch presses; cleaned with degreasing agents; and finished by black oxidizing, painting, copper coating or zinc plating. Zinc die castings are received, milled, drilled, tapped, deburred, and painted. Molded plastic components are also received for use in the air gun manufacturing process. These manufacturing processes have generated in the past the following waste streams: spent TCE, oil, petroleum naphtha, paint solvents, freon, steel sludge, paper and cardboard, scrap steel, zinc, brass, aluminum, plastic, wood, paint, and non-hazardous iron hydroxide sludge. By July 1995, Crosman had completely phased out its use of TCE, and no longer utilizes TCE at its facility.

Groundwater is pumped from production well PW-1 to two pressurized storage tanks. The production well, which was installed in 1970, pumps at an average of approximately 55 gallons per minute (gpm), yielding approximately 80,000 gallons per day. Eighty to ninety percent of the water pumped from production well PW-1 is used as non-contact cooling water via pumping through a series of manifolds to manufacturing equipment located throughout the plant. Spent non-contact cooling water is discharged to the storm water drain system and conveyed to the retention pond for cooling. The pond also receives the collected stormwater runoff from the plant and grounds. The pond ultimately discharges at outfall #001 into a swale that flows into a tributary of Fish Creek. This discharge is authorized by a State Pollutant Discharge Elimination System (SPDES) permit (#0103039) and is monitored on a monthly basis for TCE, pH, temperature, and flow rate.

The remaining 10 to 20 percent of the water pumped from production well PW-1 is used in industrial processes such as BB coating and black oxidizing. The rest of the process water required for plant operations is obtained from the Town of East Bloomfield public water supply system. Spent process water is piped to rubber-lined, steel flow through process storage tanks located in several subsurface sealed concrete vaults. Process water is then directed to the pre-treatment building, where metals removal is accomplished through hydroxide precipitation. After pre-treatment, the process water is discharged to the sanitary sewer system, in accordance with the USEPA's requirements for industrial users of publicly owned treatment works.

TCE, while in use as a degreasing agent at the plant from 1966 to 1995, was first stored in two aboveground storage tanks until the mid-1980's, when the tanks were removed. From the mid 1980's until 1995, all virgin TCE entering the facility for use in the degreasers, and all spent TCE, was strictly handled in 55-gallon U.S. Department of Transportation-approved drums and stored inside the facility in conjunction with Crosman's hazardous materials handling protocols. The tanks, which reportedly had capacities of approximately 175 and 250 gallons, were located outside the plant, adjacent to the walls on the east and west sides of the facility. Use of both tanks was discontinued in 1986.

The parking area around the tank on the east side of the plant was originally covered with gravel, until it was paved in the late 1970's. While BBL found no record or employee knowledge of any TCE release or improper disposal activities over the life of the facility, an inadvertent release or releases from the former TCE storage tank located on the east side of the plant (herein referred to as the source area) appeared to have occurred. The presence of TCE in soil and groundwater on the east side of the Site became the focus of the RI and the interim remedial measure (IRM) performed at the Site.

Based upon the elevated concentrations of TCE detected in the source area along the eastern edge of the main building, an IRM system was designed to meet the following objectives:

- Capture and treat groundwater with the highest levels of TCE proximal to the source area; and

- Reduce the concentration of TCE in the groundwater near the source area.

The IRM, which was designed concurrently with the RI, consists of a source area hydraulic control groundwater pump-and-treat system, with groundwater treatment accomplished through air stripping. The hydraulic control of the source area groundwater is achieved by pumping groundwater at recovery well IRM-1. See Figure 1-2. The IRM system was installed and in operation in October 1995, and is currently operating on a continuous basis.

The IRM performance evaluation included measurement of surrounding groundwater elevations, collection of groundwater quality samples from surrounding monitoring wells, collection of influent/effluent samples for the air stripping system, and collection of post-carbon air samples. The IRM Performance Evaluation Report was approved by the NYSDEC in December 1996.

Although the soil samples collected during the RI could not corroborate the presence of a residual mass of TCE in subsurface soils, its presence within the vadose zone remained a possibility due to the complex behavior of TCE. Based upon this potential, a Soil Vapor Extraction (SVE) pilot test was performed at the Site in October 1996 along the eastern side of the main building. One of the primary objectives of the SVE pilot test was to identify whether a mass of TCE still remained in the unsaturated zone that could serve as a continuing source of groundwater impact. Based upon TCE removal rates and vapor concentrations measured during the pilot test, it was concluded that a moderate amount of residual TCE still remained in the unsaturated zone which could potentially serve as a continuing source of groundwater degradation.

A Focused Feasibility Study (FS) for the Site was submitted to the NYSDEC in January 1997. The FS, which included the SVE Pilot Test Report, was subsequently approved by NYSDEC in February 1997. The recommended remedial alternative presented in the FS is discussed in Section 1.4, below.

1.4 Overview of Selected Remedial Alternative

The FS identified the preferred remedial alternative that has been incorporated into the Record of Decision (ROD)for the Crosman facility. The selected remedy for the Crosman facility as described in the FS includes the following:

- Continued long-term operation and monitoring of PW-1 to maintain Site-wide hydraulic control;

- Aggressive operation of a full-scale soil vapor extraction (SVE) system to remove the moderate mass of TCE remaining in the vadose zone soils of the source area. The SVE system will be operated for a maximum duration of two years;

- Continued operation and maintenance of the IRM groundwater recovery and treatment system while the groundwater in the source area has significantly higher TCE concentrations than the downgradient portion of the plume; and

- Long-term monitoring of Site groundwater.

Figure 1-3 illustrates the relative location of the areas to be addressed as part of the remedial action, including the locations of PW-1, IRM, and SVE systems.

1.5 Purpose/Description of Remedial Action Objectives

The remediation goals selected for the site in the Record of Decision are:

- Mitigate the threat to surface waters by regulating TCE discharges from the lined cooling pond through the existing SPDES permit;

- Eliminate the potential for direct human ingestion of contaminated groundwater;

- Mitigate the impacts of contaminated groundwater to the environment; and

- Provide for attainment of standards, criteria and guidance values for groundwater quality at the limits of the area of concern to the extent practicable.

Ultimately, these remediation goals can be met by attaining the Remedial Action Objectives (RAOs) identified in the FS.

The ROD's selected remedial alternative for the Crosman facility was identified in the FS as being able to meet the RAOs . This section identifies each of the RAOs and describes how each component of the selected alternative will meet these RAOs.

- RAO #1: Continued hydraulic control over the TCE containing groundwater to preclude off-Site migration.

  To prevent off-site migration of TCE containing groundwater, the operation of the existing IRM and PW-1 systems will be continued. The operation of PW-1 results in hydraulic control over the entire Site, thus eliminating the off-site migration of TCE. The IRM system, in contrast, is primarily a source control remedy in that hydraulic control over groundwater in the source area is provided by continued pumping at IRM-1, resulting in the prevention of further downgradient movement of TCE from the source area. These continued measures will assure the RAO #1 will be met.

- RAO #2: Reducing groundwater concentrations of TCE.

  To reduce the concentrations of TCE in the groundwater, the IRM system will continue in operation while the groundwater in the source area has a significantly higher TCE concentration than the downgradient portion of the plume. In addition, full-scale operation of a soil vapor extraction system to remove the moderate mass of TCE remaining in the vadose zone soils will be implemented, thus minimizing the continued migration of TCE in the vadose zone to the groundwater.

- RAO #3: Reducing downward migration of TCE in the vadose zone to the groundwater.

  As previously stated in RAO #2, to reduce the downward migration of TCE from the vadose zone, the full-scale operation of a soil vapor extraction system to remove the moderate mass of TCE remaining in the vadose zone soils will be implemented.

1.6 Report Organization

This RD/RA Work Plan for the Crosman facility has been organized into six sections. Following this introductory section, Section 2 presents the remedial design for the selected remedy, which includes: a soil vapor extraction system, the continued operation of the IRM groundwater recovery and treatment system, and the continued operation of PW-1. The anticipated schedule for the remedial action is presented in Section 3. Section 4 presents an Operation, Maintenance, and Monitoring (O, M & M) Plan for the soil vapor extraction and IRM systems. Section 5 presents the Contingency Plan for these remedial activities. The health and safety requirements for the operation of the SVE and IRM systems are presented in Section 6, and the Quality Assurance/Quality Control Plan is presented in Section 7. Finally, the Citizen Participation Plan is presented in Section 8.

2.0 Remedial System Design

2.1 General

This section of the RD/RA Work plan describes the remedial actions to be undertaken at the Crosman facility to meet the RAO's, as described in Section 1.5 of this Work Plan. The selected remedy incorporates both newly designed remedial systems and existing recovery/treatment systems that have been demonstrated as effective in meeting the RAOs established for the Site.

The Site remedy will consist of three operations, as described below:

- Continued operation of the IRM groundwater recovery and treatment system. The IRM-1 system currently consists of a single groundwater recovery well, IRM-1, a submersible groundwater pump, and a shallow tray air stripper, consisting of two trays. Groundwater is pumped to and treated in the air stripper, and discharged to the Crosman storm sewer which flows to the on-Site retention pond and ultimately discharges via Crosman's SPDES outfall #001.

- The design, installation, and operation of a soil vapor extraction (SVE) system. The SVE system design, based upon the results of a SVE pilot test, will address the moderate mass of TCE remaining in the vadose zone soils in the source area. The SVE system will collect vapor-phase TCE from the vadose zone, and will remove the TCE with granular activated carbon (GAC) prior to discharge of the air stream to the atmosphere; and

- Continued operation of Crosman's production well, PW-1, which is primarily used as a supply for non-contact cooling water. Operation of PW-1 results in complete hydraulic control over the downgradient portion of the Site, and therefore ensures that the downgradient component of the TCE plume is contained on-Site.

Each of these operations is described in the following sections.

2.2 Soil Vapor Extraction System

2.2.1 General

An aggressive SVE system design has been prepared by Terra Vac, of Westford, MA, and is included as Appendix A. Results from the SVE pilot test performed in October 1996 by Terra Vac were used to develop the full-scale SVE system design. For design of the full-scale system, however, a blower with 50% greater power than that utilized in the pilot test (3 hp vs. 2 hp), was selected to ensure extraction of residual TCE. This additional capacity, coupled with any necessary operational/design enhancements, described below, will ensure that operation of the SVE system will be more aggressive. The following discussion presents an overview of the SVE system components. Appendix A presents a more detailed discussion of the system design.

2.2.2 Extraction Wells

The extraction well system consists of a nested SVE well cluster that contains two, 2" diameter SVE extraction wells which were installed during the SVE pilot test. Each extraction well is constructed of Schedule 40 PVC, and contains a ten-foot section of 0.02-inch slotted screen. They are screened at depths of 15' to 25' (VE-1S), and 38' to 48' (VE-1D). Well construction details and locations are presented in the Terra Vac Design Report (Appendix A).

Each extraction well will be connected to a single extraction pipe that leads into a shed that houses the SVE equipment. Each extraction well will be equipped with a throttling valve, a vapor sampling port, a vacuum gauge, and a flow measuring port, all of which will be located inside the equipment shed. Inside the building, each pipe will be manifolded to a common header that will convey extracted air and vapors through a water/vapor separator, carbon treatment drums, and blower. The Terra Vac Design Report contains a more detailed description, including piping schematics, of the piping system.

2.2.3 Piezometers

Three nested piezometer clusters were installed around the extraction well at radiuses of 10, 20, and 32 feet from the extraction well. Each nested piezometer consisted of two, 1" diameter Schedule 40 PVC casings, with a ten foot section of 0.02 inch slotted screen. The shallow piezometers were installed at depths of 15' to 25' with the deep piezometers being installed at depths of 38' to 48'. Piezometer construction details and locations are presented in Figure 5 and 3, respectively, of the Terra Vac Design Report (Appendix A). Each of the piezometers was constructed in such a manner that, if necessary, could be utilized as an extraction well although the piezometer located in the center of the driveway (32' from the extraction well) cannot easily be used for vapor extraction because of traffic interference.

2.2.4 Vacuum System

The vacuum system will consist of a blower, blower motor, system startup/shutdown controls, a water/vapor separator, and a shed to house the equipment. The extraction blower will consist of a 3 hp regenerative blower rated for 100 scfm at 60" inches of water vacuum. It is powered by a 3.0 hp explosion proof motor, rated for use in Class I, Group D environments. The blower is controlled by a motor starter which will provide manual start and stop controls for the extraction blower, and secures power to the blower in the event of a thermal overload or high water level in the water/vapor separator. The water/vapor separator will remove entrained moisture from the extracted vapor stream prior to the vapors entering the blower and carbon drums. The blower will contain a float switch to shut off the blower in the unlikely event the water tank, which has a 40 gallon capacity, is full. Contained water can be manually drained into containers by opening a bottom discharge valve. Water from the tank will be treated by the IRM system's air stripper.

2.2.5 Air Purification System

2.2.5.1 System Design

Activated carbon will be utilized to remove TCE from the extracted vapors. Generally, two, 200 lbs. drums of coconut-shell based carbon will be utilized to remove TCE vapors. These drums have a capacity to handle a maximum flow of 300 scfm and a maximum vacuum of 62" of water. During initial start-up, however, the existing 600 lbs. carbon vessel initially used for the IRM system will be tied into the 2 drums. The NYSDEC, in their approval letter dated December 26, 1996, allowed Crosman to disconnect this vessel from the IRM system. This will result in 1,000 lbs. of carbon to be utilized as air pollution control during the initial operating period, when TCE removal rates would be at their highest, allowing for the greatest level of protection. Following the full utilization of the 600 lbs. carbon vessel, continued operations will utilize two, 200 lbs. carbon drums as described above.

2.2.5.2 Ambient Air Impact Evaluation

An ambient air impact evaluation was performed to fulfill the substantive requirements for a NYSDEC air permit application. Because this remedial activity will be performed under an Administrative Order on Consent, an actual air permit is not required, but the technical requirements for an air permit will be fulfilled, as outlined in 6NYCRR Part 375-1.7.

Under NYSDEC Air Guide-1 (AG1), October, 1995, an ambient air quality impact evaluation is required to estimate the potential effects air emissions would have on surrounding ambient air. The ambient air quality impact evaluation for the SVE system included the following steps:

1) Estimation of worst-case TCE removal rates;
2) Incorporation of assumed carbon removal efficiencies; and
3) Estimation of ambient air impacts using AG1 methodologies (basic cavity impact analysis and the standard point source method).

Table 1 presents a summary table of the AG1 evaluation. A range of potential TCE emission rates was evaluated, based on the expected range of TCE vapor-phase concentrations to be encountered throughout system operation. It is anticipated that initial operating conditions will have relatively high associated TCE vapor-phase concentrations, with a fairly rapid drop in extracted TCE concentrations. In preparation of this evaluation, it was assumed that the blower would operate at a capacity of 80 scfm and that the carbon removal efficiency would be equivalent to 99%, which is anticipated to be feasible, given the relatively low (i.e., <1,000 ppm) vapor concentrations to be encountered.

The AG1 evaluation demonstrates that the proposed two, 200 lbs. carbon drums will provide sufficient treatment for the air discharge to meet the technical requirements for an air permit.

2.3 Groundwater Recovery and Treatment System

Two groundwater recovery systems are currently being operated at the Site. The IRM system consists of an extraction well and air stripper to remove and treat source area groundwater. In addition to the IRM system, Crosman also operates a production well, PW-1, which collects groundwater from the downgradient portion of the Site primarily for use as non-contact cooling water in the building. The PW-1 well provides Sitewide hydraulic containment of the downgradient portion of the TCE plume, preventing off-site migration of TCE. Water pumped from PW-1 after use in the facility is discharged to an on-Site retention pond, and then to a drainage swale via Crosman's SPDES permit outfall #001. The discharge at outfall #001 has been in compliance with the SPDES permit's 10 ug/L discharge limitation for TCE. The maximum detected concentration of TCE in outfall #001 has been 1.5 ug/L. Typically, TCE concentrations at this outfall are below detections limits.

2.3.1 Groundwater Extraction Well IRM-1

The IRM system consists of a single recovery well, IRM-1, a low-profile air stripping unit, and ancillary equipment (double-wall piping, valves, flow meters, etc.) contained within a pre-constructed building enclosure. The system had previously utilized a GAC treatment bed for treatment of released vapor-phase TCE. However, the GAC treatment bed was taken off line because it was not needed, as approved by the NYSDEC in their letter dated December 26, 1996. The system, which has been in operation since October 30, 1995, is primarily considered a source control remedy, in that hydraulic control over the groundwater in the source area is provided by the capture of groundwater immediately downgradient of the source area, effectively eliminating continued migration of groundwater containing the highest concentrations of TCE. The IRM is a continuous operation system with the intent of preventing further downgradient movement of TCE from the source area. Following treatment, groundwater is discharged to the on-Site retention pond. The IRM system is currently removing and treating groundwater at a rate of approximately 2 gallons per minute (gpm). Evaluation of the long-term operational requirements of this system will be made based upon the positive benefits anticipated to be gained from operation of the SVE system described in Section 2.2. Operation of the IRM system may be terminated upon determination that no significant environmental benefit is being gained from its continued operation. It is anticipated that operation of the SVE system will allow for the future discontinuation of the IRM-1 operation.

2.3.2 Groundwater Extraction Well PW-1

Continued operation, maintenance, and monitoring of PW-1 will be an integral component of this remedy. Several rounds of groundwater elevation monitoring performed over the last few years have demonstrated that operation of PW-1 has maintained continued hydraulic control over the Site, thus preventing off-Site migration of TCE. Off-site monitoring in MW-15 has also indicated that TCE has not migrated off-Site.

3.0 Remedial Schedule

Figure 3-1 presents a proposed schedule for the implementation of the remedial activities identified in this Work Plan and post-remedial action activities associated with the approved remedy. This schedule has been based upon certain assumptions regarding the work methods and procedures, and requirements of the remedial alternative. Changes in this schedule may be required based upon unforeseen weather conditions or other information not currently available at this time.

4.0 Operation, Maintenance, and Monitoring Plan

4.1 General

This Operation, Maintenance, and Monitoring (O, M & M) Plan has been prepared to provide an overview of the operations that will be undertaken to ensure that the remediation meets the requirements of the RAOs, as described in Section 1.5 of this Work Plan.

4.2 Soil Vapor Extraction System

The operations and maintenance requirements for the SVE system are presented in Appendix A. Operation and maintenance of the SVE system will include regularly scheduled visits by Terra Vac personnel to monitor the system performance and to perform routine inspections and maintenance on the system components. The O, M & M program will include equipment inspections, routine maintenance, non-scheduled maintenance, flow/vacuum measurements, and VOC sampling/analysis. The flow/vacuum measurements, and the VOC sampling/analysis components of the SVE operation have been separated into two components: start-up operations and routine operations. The primary differences between each phase of operations are the frequency and types of samples to be collected as part of system operation and maintenance. These components are summarized below and discussed in more detail in Appendix A.

4.2.1 System Start-up Operations

System start-up operations will be initiated following installation of the system. The start-up phase of operations will include the first month of activities during which the long-term operating parameters (i.e., flow rates, well head vacuums) will be established.

The initial start-up of the SVE system will involve establishing flow rates in each extraction well (VE-01D and VE-01S) in order to maximize system performance. Following this step, baseline measurements of flow rates and vacuums will be collected at each of the piezometers, the extraction well heads, and system influent. In addition, baseline TCE vapor samples will be collected for analysis by organic vapor monitor (OVM) from each extraction well, and the post-carbon vapor effluent.

The first month of operations will be the second phase of system start-up operations. Based on data collected during the pilot test, a fairly rapid drop in TCE extraction rates is anticipated during the first month of operation. In order to more accurately monitor the rate of TCE extraction, during this period, more frequent monitoring of SVE system operations will be performed. This will include collection of monitoring data at frequencies of 1, 7, 14, and 28 days after system start-up. Vapor samples will be collected for TCE analysis by gas chromatograph (GC) from the extraction wells, carbon midpoint, and discharge stack. In addition, flow and vacuum monitoring will be performed for each extraction well. OVM measurements will also be made at each location of vapor sampling, including the carbon influent. Measurements of subsurface vacuums will be collected from each of the surrounding piezometers in order to establish the radius of influence. Sampling and analysis procedures are presented in Appendix A.

4.2.2 Routine Operations

During routine operations, sample collection, flow monitoring, and vacuum measurements, will be performed on the system on a monthly basis. During the first two months of routine operations, the sampling protocols will be identical to those utilized during startup operations.

Following the first two months of routine operations (months 2 - 3), the frequency of sample collection for TCE analysis by GC of the carbon midpoint and effluent will be reduced to a quarterly basis. Routine monthly monitoring of the carbon midpoint and effluent will still be performed using an OVM. Samples from the shallow and deep extraction wells for TCE analysis by GC will continue to be collected on a monthly basis. Flow and vacuum measurement requirements will be identical to the protocols utilized for the first two months of routine operations.

4.2.3 Quarterly Performance Review

In order to ensure optimal performance of the SVE system, a quarterly performance review of SVE system operations will be performed. The quarterly review will allow for Crosman and NYSDEC to evaluate SVE operations and make any required modifications to the system that may be required. Additional quarterly performance reviews will be performed following subsequent three month periods, if necessary. The quarterly performance review(s) will include the following:

- Review of flow rates, estimate of radius of influence, TCE extraction rates;
- Extrapolation of TCE removal rates over time;
- A review of the presence of asymptotic removal rates, or that significant removal of TCE is no longer occurring;
- Identification of potential enhancements to SVE system operations. These operations could potentially include:
  - Incorporation of additional extraction wells and/or piezometers;
  - Recommendations for winterization of the SVE system, if necessary; and
  - Utilization of pulsing.

4.2.4 Management of Treatment System Residuals

Treatment system residuals generated during SVE operations will consist of spent GAC and condensate collected in the water/vapor separator. Spent GAC will be characterized, and transported off-site for regeneration or treatment/disposal. Condensate collected in the water/vapor separator will be drained into a drum or other appropriate container. The storage container will be moved to the IRM system, where condensate will be pumped to the air stripper via the IRM well influent line for removal of residual TCE prior to discharge to the retention pond.

4.3 IRM Groundwater Collection/Treatment System

The IRM system consists of a single recovery well, IRM-1, a low-profile air stripping unit, and a vapor phase GAC treatment unit. The system has been in operation since October 30, 1995 and will be operated and maintained in accordance with the manufacturer's recommendations and the associated Operations and Maintenance Manual prepared for the system. In addition, an annual cleaning and maintenance will be performed on recovery well IRM-1. The cleaning and maintenance procedure will include the following:

- Removal of submersible pump, level probes and discharge piping within IRM-1;
- Steam clean pump, probes, and piping followed by a wash using a solution of sodium hypochlorite (1%) and water wash;
- Surge and/or pressure jet IRM using a 1% solution of sodium hypochlorite and water;
- Dechlorination of the waste sodium hypochlorite solution using a solution of sodium thiosulphate (10%) and water prior to disposal via Crosman's waste water pretreatment facility; and
- Reinstallation and start-up of equipment.

4.4 PW-1 Operation

Groundwater is pumped via a submersible pump from production well PW-1 to two pressurized storage tanks located within the manufacturing facility. The production well, which was installed in 1970 and is located in the north central part of the Site, is a pressure demand type system and pumps at an overall average flow rate of approximately 55 gpm, yielding approximately 80,000 gpd. In order to proactively optimize operations and minimize significant down time, Crosman replaced the former well pump shortly after identifying the presence of TCE in the groundwater. The former pump was an above grade centrifugal pump. This pump was replaced with a deep well submersible pump which required less maintenance and that could be more easily replaced or repaired if need be. A spare replacement pump has also been purchased and is kept on-site to allow quick changeout in the event that current pump fails. These procedures have reduced the potential downtime for PW-1 failure to a maximum of a few days.

Eighty to ninety percent of the water that is pumped from PW-1 is used as non-contact cooling water. The water is pumped through a series of manifolds to manufacturing equipment (primarily air compressors) located throughout the plant. The non-contact cooling water is then discharged to the retention pond via the storm water drain system and ultimately discharge via Crosman's SPDES Outfall #001. The remainder of the water which is used in various production processes is discharged to Crosman's on-site wastewater pre-treatment plant prior to discharge to the local sanitary sewer.

4.5 Groundwater Monitoring Program

4.5.1 Interim Groundwater Monitoring Program

The interim groundwater monitoring program for the Site will include a Site-wide monitoring program that includes those monitoring wells agreed upon by the NYSDEC and the New York State Department of Health (NYSDOH). This initial monitoring program will be performed for a period of two years, and will include the semi-annual collection of groundwater samples from the following monitoring wells:

- MW-5
- MW-9
- MW-10
- MW-11 (annually)
- MW-13
- MW-15
- MW-17
- MW-18
- MW-19
- PW-1

In addition, influent and effluent samples from the IRM system will be collected. Samples will be analyzed for volatile organic compounds by USEPA Method 8240. Sample collection and QA/QC protocols will be in accordance with procedures outlined in the RI/FS Work Plan, and utilized at the Site during the ongoing groundwater monitoring program. A round was collected on March 24, 1997.

4.5.2 Long-Term Groundwater Monitoring Program

Following completion of SVE operations, a review of the interim groundwater monitoring program will be made in order to design a long-term groundwater monitoring program. The review will take into account SVE system operations, IRM system operations (if applicable), the operation of PW-1, and results of the overall monitoring program in order to develop the long-term groundwater monitoring program requirements.

4.6 Reporting Requirements

Performance evaluation of the SVE system will commence after initial start-up of the system. In addition, continued evaluation of the effectiveness of the IRM and PW-1 systems will be conducted. For the first two years, a letter report summarizing the operation of the IRM, PW-1, and SVE systems will be submitted to the NYSDEC on a quarterly basis. After the first two years, a letter report will be submitted according to the schedule set during the design of the long-term groundwater monitoring program. As applicable, the letter report will include those components relating to SVE system operations, as identified in Section 4.2.3, in addition to the following information relating to the operation of the IRM system, PW-1, and the groundwater monitoring program:

- A summary of the water-level data obtained, including groundwater contour maps. The effects of the PW-1 and IRM systems on the Site's groundwater flow system will be addressed;
- A summary of the groundwater quality conditions at the monitoring wells to be sampled as described in Section 4.5 of this work plan;
- A summary of IRM influent and effluent analytical results, and overall removal efficiency;
- Identification of trends in the TCE concentration entering the IRM system;
- A summary of PW-1 influent analytical results and analytical results collected from the SPDES discharge (continued compliance with the SPDES permit will be verified);
- Recommended operational modifications will be presented, as necessary, for NYSDEC approval including recommended modifications to the monitoring plan following the completion of SVE operations; and
- Evaluation of the need to continue operation of the SVE system based upon identification of asymptotic removal rates and that significant amounts of TCE are no longer being removed by the system, and of the IRM based upon significantly higher concentrations of TCE in source area groundwater no longer being present.

5.0 Contingency Plan

5.1 General

This Contingency Plan was prepared to provide an evaluation for the contingency that the proposed remedial system does not adequately address the Remedial Action Objectives presented in Section 1 of this Work Plan.

No contingency plan has been prepared for the soil media to be addressed as part of the SVE System operation, since SVE system operations will be continued until it is determined that a sufficient mass of TCE has been removed from the vadose zone. It has been agreed between Crosman and the NYSDEC, however, that the SVE system will not be operated longer than a period of two years. In order to allow for the prospect of shutdown of the SVE system even occurring prior to the end of the two year period, the SVE system has been designed with sufficient extra capacity to incorporate additional extraction points, if necessary. In addition, Crosman and the NYSDEC have agreed to review SVE operations on a quarterly basis to ensure that operational enhancements can be incorporated into the system in an expedient manner where appropriate.

5.2 Conditions of Implementation

This Contingency Plan will be implemented if the proposed groundwater recovery system fails to meet the RAOs specified. A failure to meet the RAOs will be evaluated through scheduled groundwater monitoring of selected on-site and off-site monitoring wells discussed in Section 4.5, Groundwater Monitoring.

The following conditions, although unexpected, would trigger contingent operations.

- Detection of increasing TCE concentrations in downgradient monitoring well MW-15, which is located immediately off-site;

- TCE concentrations detected at or near the discharge limitation of 10 ug/L TCE contained in Crosman's SPDES permit.

- Decreased utilization of PW-1 due to a process change (i.e., utilization of a greater volume of public water) or general reduction in process needs by Crosman which could impair hydraulic control at PW-1.

5.3 Contingent Operations

Occurrence of any of the above contingent conditions would trigger an evaluation of potential contingent operations to be undertaken. Based on the potential contingent conditions which may occur, the level of contingent operations will vary. Contingent operations may include the following:

1) Enhance PW-1 operations. This may include increasing the pumping rate of PW-1 through use of operational modifications to Crosman's water distribution system.

2) Connect potentially impacted residents located downgradient of the site that are currently utilizing private drinking water wells to the existing public water supply system.

Data collected during operation of the remedial system will be used to evaluate potential contingent operations, if required. The feasibility and cost-effectiveness of potential contingent operations will be evaluated, with the results of the evaluation presented to the NYSDEC, with conclusions and recommendations, for NYSDEC approval.

6.0 Health and Safety Requirements

This section presents the overall health and safety requirements to be employed during Site remedial activities. There will be three basic activities performed as part of the remedy. Health and safety requirements for each basic activity are presented below.

6.1 Soil Vapor Extraction System Operation

Installation and operation of the SVE system will be in accordance with Terra Vac's Health and Safety Plan, presented in the Terra Vac Remedial Design Report (Appendix A). Activities addressed under this plan include system installation, operations, maintenance, and sampling activities.

6.2 IRM Performance Evaluation and Groundwater Monitoring

The IRM system is currently being operated and will continued to be operated by Crosman personnel throughout the duration of this remedy. As in the past, Crosman personnel follow their internal health and safety protocols in operation of this system. In addition, the system is checked quarterly by BBL personnel.

6.3 Groundwater Monitoring

Groundwater monitoring will be performed by BBL throughout the duration of this remedy. Groundwater monitoring will be performed in accordance with BBL's existing Health and Safety Plan for the Site, which has been in place for the RI and subsequent groundwater monitoring activities.

7.0 Quality Assurance/Quality Control

7.1 SVE System Operations

Appendix A presents the Quality Assurance/Quality Control (QA/QC) Plan for the SVE system operation.

7.2 Groundwater Monitoring

QA/QC procedures for the groundwater monitoring program will be consistent with current QA/QC procedures utilized during the previous groundwater monitoring events performed at the Site. QA/QC for the groundwater monitoring events has been in accordance with the RI/FS Work Plan, with the exception that independent data validation is no longer performed on collected samples as approved by the Department. In general, QA/QC requirements for the Site include collection of the following QA/QC samples during each sampling event:

QA/QC Sample	Frequency
Trip Blank	one per day
Field Blank	5%
Duplicate	5%
Matrix Spike/Matrix Spike Duplicate	5%

8.0 Citizen Participation Plan

The purpose of this plan is to present the means by which the proposed remedial activities will be communicated to nearby residents, and the mechanism by which public comments are evaluated.

Throughout the investigatory and remedial activities at the Site, Crosman has been very proactive in communicating these activities with the nearby residents. Crosman has held public meetings at the Crosman facility to communicate activities and to identify concerns of residents. Crosman's philosophy of maintaining open communications with its neighbors has resulted in general acceptance of proposed activities at the Site.

It is the goal of Crosman to maintain continued communication during remedial activities at the Site. To maintain this communication, the existing procedures that have been utilized to inform the public of Site investigatory/remedial activities will continue. A copy of each report submitted to NYSDEC under this program will be sent to the Town Clerk's office, and be made available to the public for review. In addition, a notice for public comment will be sent out prior to the SVE system and/or IRM system operations being terminated. If required, a public meeting will be held to discuss the rationale for shutting down specific systems.

Tables

TABLE 4-1
CROSMAN SITE
SOIL VAPOR EXTRACTION SYSTEM
AIR QUALITY IMPACT ANALYSIS

Influent Vapor-Phase TCE Concentration (ppmv)	Influent Vapor-Phase TCE Concentration (mg/m^3)	TCE Removal Rate (lb/hr.)	TCE Air Discharge Rate* (lb/hr)	TCE Air Discharge Rate (lb/day)	TCE Air Discharge Rate (lb/year)	Basic Cavity Impact Method		Standard Point Source Method		
						Worst-Case Cavity Annual Impact (Cc) (ug/m^3)	Worst-Case Cavity Short-Term Impact (Ccst) (ug/m^3)	Maximum Actual Impact Point Source (Ca) (ug/m^3)	Maximum Potential Impact Point Source (Cp) (ug/m^3)	Maximum Short-Term Impact Point Source (Cst) (ug/m^3)
1,000	5460	0.027	2.71E-04	6.51E-03	2.4	0.028	40.9	0.381	0.381	24.8
950	5187	0.026	2.58E-04	6.19E-03	2.3	0.027	38.8	0.362	0.362	23.5
900	4914	0.024	2.44E-04	5.86E-03	2.1	0.026	36.8	0.343	0.343	22.3
850	4641	0.023	2.31E-04	5.53E-03	2.0	0.024	34.7	0.324	0.324	21.1
800	4368	0.022	2.17E-04	5.21E-03	1.9	0.023	32.7	0.305	0.305	19.8
750	4095	0.020	2.03E-04	4.88E-03	1.8	0.021	30.7	0.286	0.286	18.6
700	3822	0.019	1.90E-04	4.56E-03	1.7	0.020	28.6	0.267	0.267	17.3
650	3549	0.018	1.76E-04	4.23E-03	1.5	0.018	26.6	0.248	0.248	16.1
600	3276	0.016	1.63E-04	3.91E-03	1.4	0.017	24.5	0.229	0.229	14.9
550	3003	0.015	1.49E-04	3.58E-03	1.3	0.016	22.5	0.210	0.210	13.6
500	2730	0.014	1.36E-04	3.26E-03	1.2	0.014	20.4	0.191	0.191	12.4
450	2457	0.012	1.22E-04	2.93E-03	1.1	0.013	18.4	0.172	0.171	11.1
400	2184	0.011	1.09E-04	2.60E-03	1.0	0.011	16.4	0.153	0.152	9.9
350	1911	0.009	9.50E-05	2.28E-03	0.8	0.010	14.3	0.134	0.133	8.7
300	1638	0.008	8.14E-05	1.95E-03	0.7	0.009	12.3	0.114	0.114	7.4
250	1365	0.007	6.78E-05	1.63E-03	0.6	0.007	10.2	0.095	0.095	6.2
200	1092	0.005	5.43E-05	1.30E-03	0.5	0.006	8.2	0.076	0.076	5.0
150	819	0.004	4.07E-05	9.77E-04	0.4	0.004	6.1	0.057	0.057	3.7
100	546	0.003	2.71E-05	6.51E-04	0.2	0.003	4.1	0.038	0.038	2.5
50	273	0.001	1.36E-05	3.26E-04	0.1	0.001	2.0	0.019	0.019	1.2
0	0	0.000	0.00E+00	0.00E+00	0.0	0.000	0.0	0.000	0.000	0.0

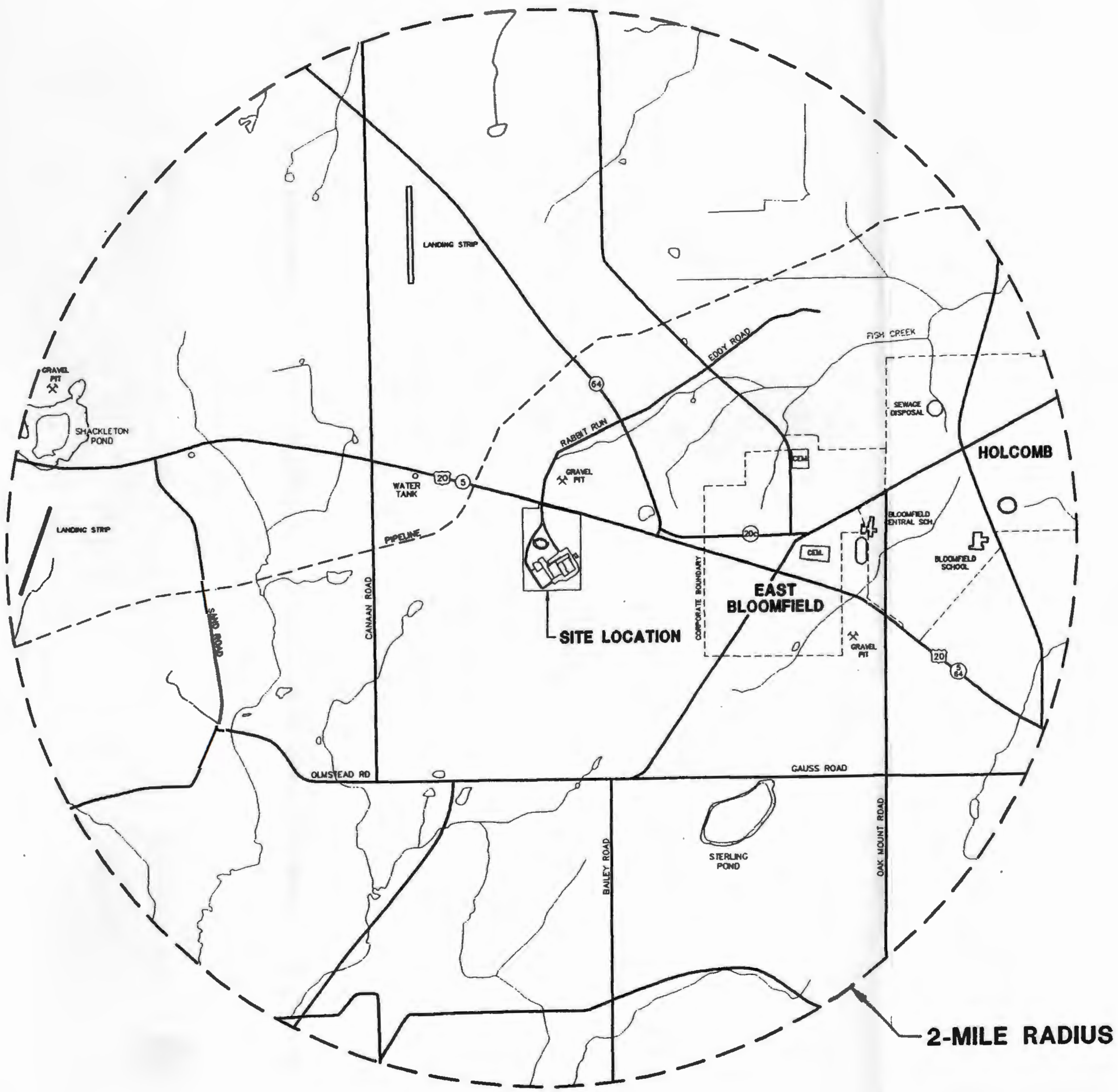
"Constants"

Assumed Flow Rate: 80.0 scfm
1 ppm = 5.46 mg/m^3
Design Removal Efficiency (%): 99.0%
Building Height (ft): 12
Stack Height (ft): 5

Annual Impact Limit: **0.45** **ug/m^3**

Short-Term Impact Limit: **33,000** **ug/m^3**

Figures



NOTE: LOCATIONS ARE APPROXIMATE.

SOURCE: USGS 7.5 MIN. TOPOGRAPHIC QUADRANGLES: BRISTOL CENTER, NEW YORK, 1976 AND VICTOR, NEW YORK, 1978.

SCALE:

3000' 0 3000'

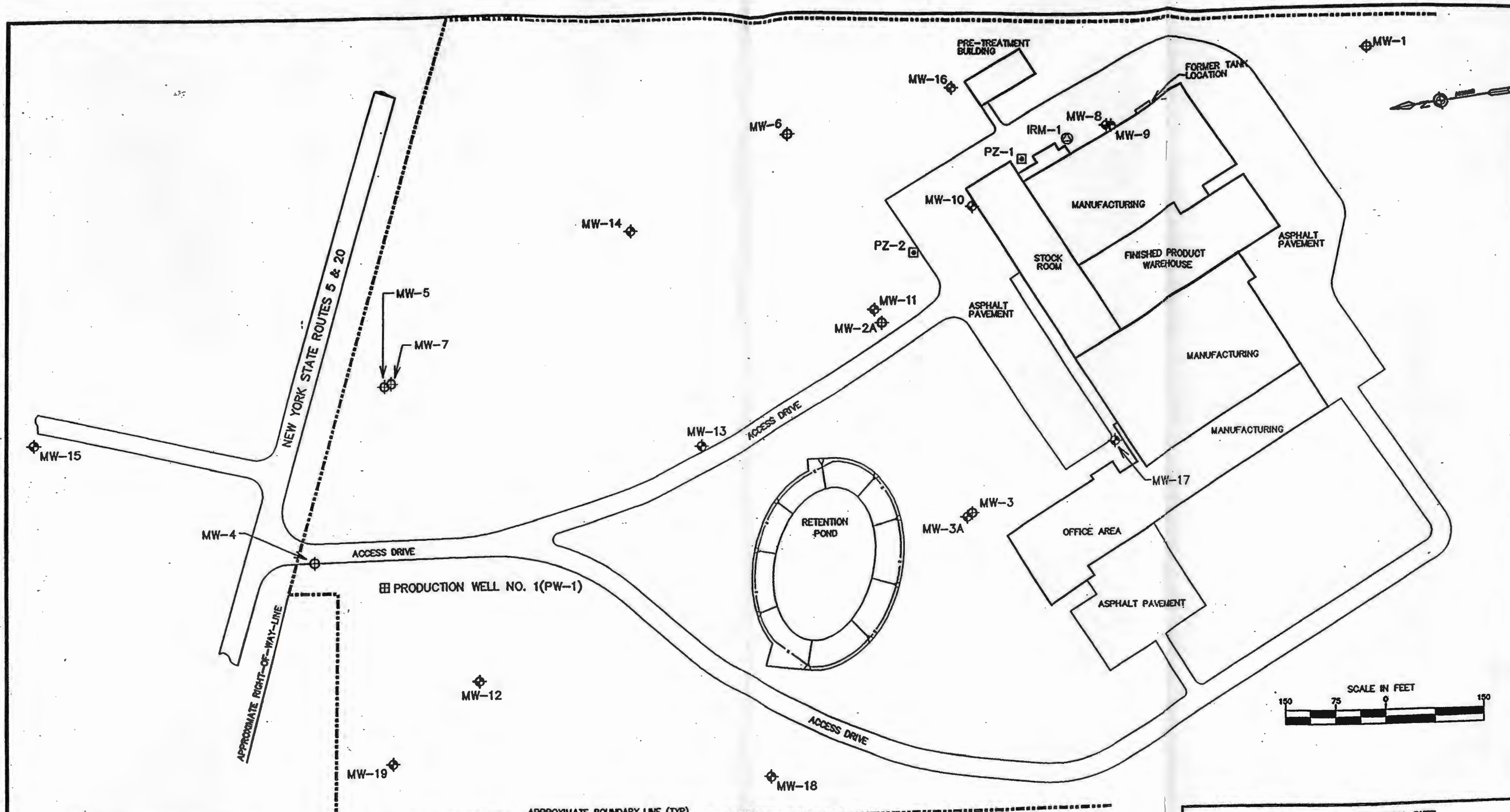
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NEW YORK
RD/RA WORK PLAN

LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **1-1**

9/16/94 54-DMW 1/3/97 RCB
41501023/41501LU2.DWG



NOTES:

1. THE PLANIMETRIC DETAIL AND BOUNDARY LINES SHOWN HEREON WERE TAKEN FROM A PLAN ENTITLED "CROSMAN CORPORATION, REMEDIAL INVESTIGATION/INTERIM REMEDIAL MEASURES," PREPARED BY LABELLA, HAVING FILE NUMBER 9124301, AND BEING LAST DATED JUNE, 1993. PLANIMETRIC AND BOUNDARY INFORMATION WAS SHOWN ONLY FOR THE PURPOSE OF ORIENTATION TO MONITORING WELL LOCATIONS. LOCATION OF IRM-1 AND ADJACENT BUILDING ARE APPROXIMATE.

2. PROJECT BENCHMARK AT TOP OF CASING ON MW-7, ASSUMED LABELLA DATUM ELEV.= 979.71'

LEGEND:

- MONITORING WELL BY BBL
- MONITORING WELL BY LABELLA
- PRODUCTION WELL
- PIEZOMETER
- GROUND-WATER RECOVERY WELL

LEVELS ON 1/4-8
12/12/94 64-PGL 3/11/96 64-ATJ
C:/PJDON/1995/4150111/4150111LDCN

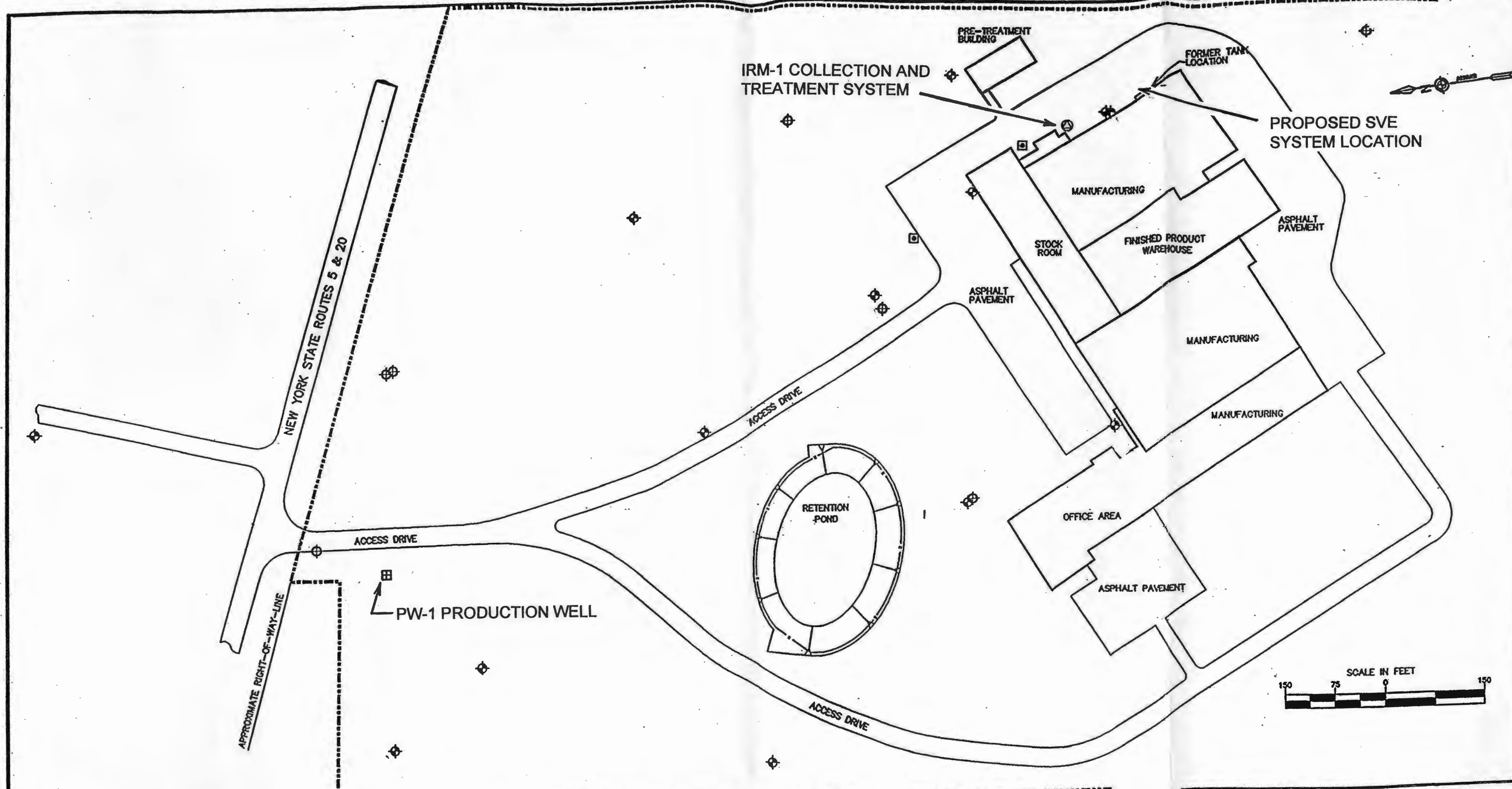
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NEW YORK

RD/RA WORK PLAN

SITE PLAN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1-2



NOTES:

1. THE PLANIMETRIC DETAIL AND BOUNDARY LINES SHOWN HEREON WERE TAKEN FROM A PLAN ENTITLED "CROSMAN CORPORATION, REMEDIAL INVESTIGATION/INTERIM REMEDIAL MEASURES," PREPARED BY LABELLA, HAVING FILE NUMBER 9124301, AND BEING LAST DATED JUNE, 1993. PLANIMETRIC AND BOUNDARY INFORMATION WAS SHOWN ONLY FOR THE PURPOSE OF ORIENTATION TO MONITORING WELL LOCATIONS. LOCATION OF IRM-1 AND ADJACENT BUILDING ARE APPROXIMATE.
2. PROJECT BENCHMARK AT TOP OF CASING ON MW-7, ASSUMED LABELLA DATUM ELEV.= 979.71'

LEGEND:

- MONITORING WELL BY BBL
- MONITORING WELL BY LABELLA
- PRODUCTION WELL
- PIEZOMETER
- GROUND-WATER RECOVERY WELL

LEVELS ON 1/4-8
12/12/96 84-PCL, 3/11/98 84-ATJ
C:/PJDCN/1995/4150111/4150111LDCN

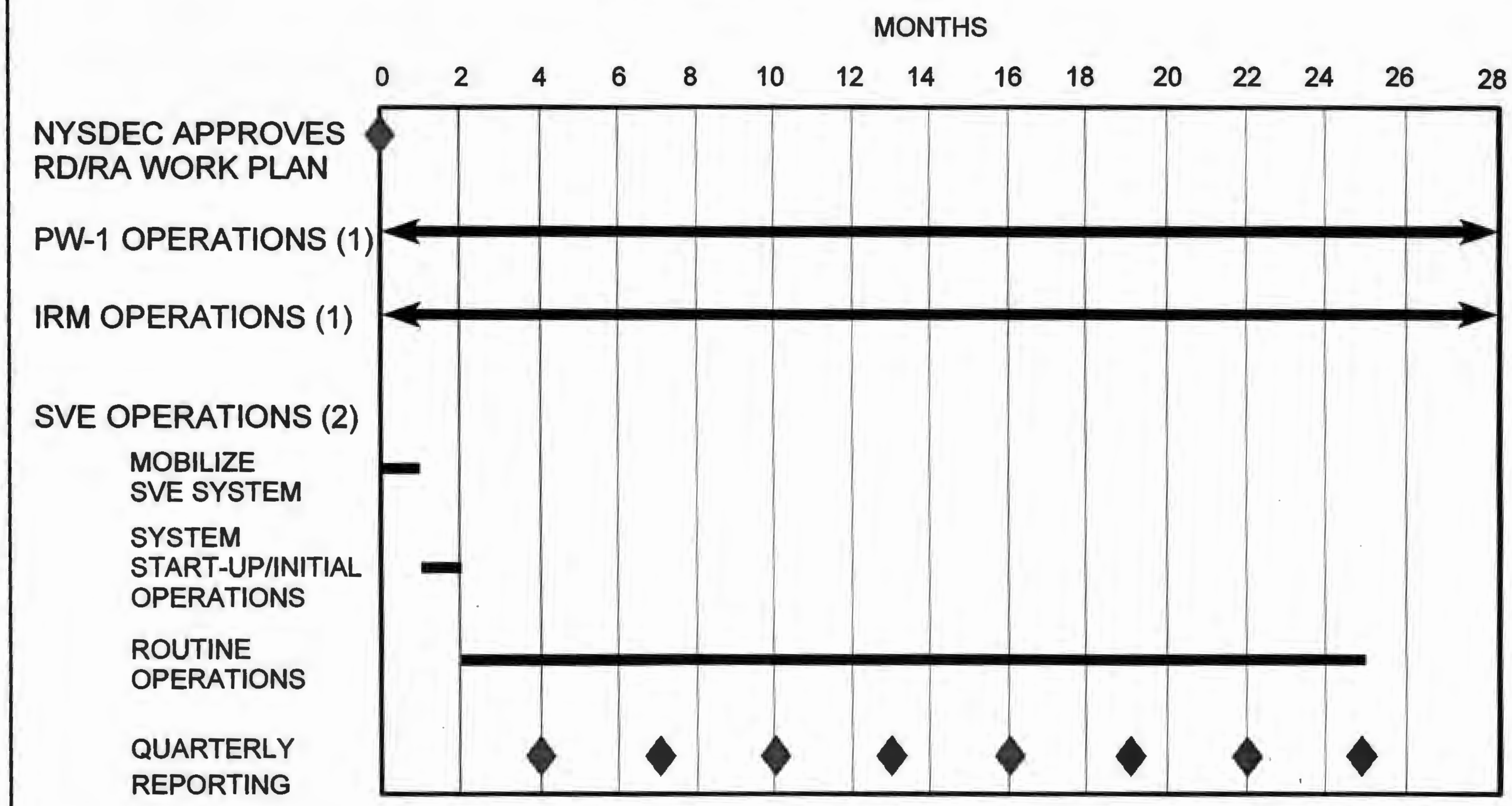
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NEW YORK
RD/RA WORK PLAN

AREAS OF REMEDIATION

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1-3

FIGURE 3-1
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NEW YORK
REMEDIAL SCHEDULE



NOTES:

1) PW-1 and IRM-1 Operations will be continuous throughout the SVE system operation.

2) SVE routine operations may be terminated after quarterly review when asymptotic removal rates are identified and a significant mass of TCE is no longer being removed. This may occur within the time frames illustrated.

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Appendix A

APPENDIX A
TERRA VAC REMEDIAL DESIGN REPORT

REMEDIAL DESIGN
CROSMAN CORPORATION
EAST BLOOMFIELD, NEW YORK
Terra Vac #42-0216

REMEDIAL DESIGN
CROSMAN CORPORATION
EAST BLOOMFIELD, NEW YORK
Terra Vac #42-0216

Prepared for:

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May 13, 1997

STATE OF NEW YORK
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Operations Manager

Robert Roth, P.E.
Supervising Engineer

REMEDIAL DESIGN
CROSMAN CORPORATION
EAST BLOOMFIELD, NEW YORK
Terra Vac #42-0216

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REMEDIAL DESIGN
CROSMAN CORPORATION
EAST BLOOMFIELD, NEW YORK
Terra Vac #42-0216

1.0 INTRODUCTION

This remedial design covers the installation and operation of a soil vapor extraction system (SVE) at the Crosman Corporation Site located in East Bloomfield, New York (Figure 1). The system is designed to remediate the moderate mass of trichloroethylene (TCE) in the vadose zone of the source area on the east side of the facility.

Included as an appendix to this document is Terra Vac's site specific *Health and Safety Plan.*

2.0 BACKGROUND

2.1 Site Conditions

The soils underlying the former aboveground storage tank (AST) location in the source area, consist of various layers of sands, gravels, and silty sands. A silt zone has been noted at approximately 50 feet below grade in some borings. A glacial till has been encountered at approximately 80 feet below grade. The depth to bedrock is approximately 156 feet below ground surface (BGS).

Groundwater is encountered at approximately 51 feet below grade. The general groundwater gradient is to the north, where a water production well PW-1 is currently active. However, a recently-installed groundwater extraction well in the source area (IRM-1) has modified the local gradient.

Data from the SVE pilot test indicated a significant vacuum radius of influence of 72 feet was achieved. Operating data indicates a soil air permeability of 1.2×10^{-5} cm^2. The calculated soil permeability to air indicates a well-sorted sand, which correlates to the visual soil classification.

3.0 TECHNICAL APPROACH

Based on the available site information, Terra Vac recommends implementing a soil vapor extraction remedial program to achieve the most cost-effective solution to the remediation of the site soils. The site provides optimal conditions for soil vapor extraction. The soils are well sorted sands and groundwater is at a depth of 51 feet.

The remediation area is paved and provides a cover that will help prevent water infiltration.

The blower chosen for the full scale remediation of this site is 50% larger than the blower used during the pilot study. This increased capability will even allow an additional extraction point (one of the existing piezometers) to be added to the system without changing blowers, if necessary.

The SVE system will operate until acceptable identification of asymptotic removal rates and until an evaluation that significant amounts of TCE are no longer being removed. This level should be achievable in less than two years with this remedial design. This *in situ* approach will:

* Minimize disruption to operations by avoiding significant excavation,
* Remediate TCE in the soils,
* Achieve the remedial goals in a reasonable time frame.

The component technology is discussed further below.

3.1 Soil Vapor Extraction

In general, the soil vapor extraction process uses a physical means to remediate soils *in situ*. The primary components of a SVE system include extraction wells, piping, an air/liquid separation vessel, a vacuum extraction unit, and a vapor treatment system.

As the subsurface is subjected to a vacuum, airflow is induced through the zone of contamination. The subsurface negative pressure gradient induces the migration of vapor phase TCE toward the extraction wells, and drives them to the surface for recovery and treatment. The process also enhances the partitioning of liquid, adsorbed and dissolved phase TCE to the vapor phase, thereby recovering all phases of TCE from the subsurface.

4.0 OVERALL SYSTEM DESIGN

Terra Vac's system includes one SVE well cluster, located adjacent to the former tank location. The well cluster is screened in both the deep and shallow vadose zones. These wells will remediate the unsaturated zone, in the source area.

The calculated vacuum radius of influence during the vacuum extraction pilot test was 72 feet. The blower which will be used for the full scale system is 50% larger than the pilot test blower, thus an even greater radius of influence is expected with the larger blower.

Terra Vac will use the existing SVE well cluster, which was installed for the pilot study, for vapor extraction and use the piezometer clusters for system monitoring. The extraction wells are screened in the deep vadose zone (38 to 48 feet below grade) and the shallow vadose zone (15 to 25 feet below grade). The piezometer clusters each contain two wells; one for monitoring vacuums in the upper portion of the vadose zone (15 to 25 feet bgs), and one for monitoring vacuums in the lower portion of the vadose zone (38 to 48 feet bgs). The piezometers are spaced radially around the extraction well at varying distances (10, 20, and 32 feet). The piezometers can be connected to the SVE manifold as SVE wells, if it is determined that additional SVE wells are required.

The remediation equipment will be placed inside a pre-built shed, located in an area adjacent to the existing SVE well cluster. The piping to connect the extraction wells will be field run above ground to the equipment shed.

The extraction system will include an extraction blower, a water/vapor separator, and an activated carbon vapor treatment system.

5.0 PROJECT PLAN

5.1 Permitting

Terra Vac will obtain the required construction permits for the full scale system, including an electrical permit and building permit as required. BBL will obtain any permits necessary from the NYSDEC.

5.2 Well Installation

<u>5.2.1 SVE Well Installation</u>

During Pilot Study activities, one SVE well cluster containing two, 2" diameter SVE extraction wells was installed within the area of concern. The borehole was advanced, using a hollow-stem auger, to a total depth of 48 feet. Each well was constructed of Schedule 40 PVC pipe, and a 10 foot section of screen. The shallow SVE well (VE-1S) was screened from approximately 15 to 25 feet below grade and the deep SVE well

(VE-1D) was screened from 38 to 48 feet below grade. Well locations are indicated in Figure 3. Well construction is detailed in Figure 4.

The well screen for each extraction well is constructed with 0.02 inch slot, with 0.25 inch spacing between slots. An 11 foot thick layer of bentonite was used to isolate the two screened intervals, and to allow for the evaluation of SVE efforts between the shallow and deep vadose zones.

During split spoon sampling, groundwater was encountered at approximately 51 feet below grade.

The SVE well cluster was fitted with a flush-mounted road box.

5.2.2 Piezometer Installation

Three piezometer clusters were installed for the purposes of monitoring subsurface vacuums. The piezometers were completed in a nested manner similar to the SVE well cluster as described in section 5.2.1. Each piezometer cluster consists of two, 1" diameter, Schedule 40 PVC piezometers, with 0.02 inch slotted screen with 0.25 inch spacing.

Each shallow piezometer was screened in the upper portion of the vadose zone, from 15 to 25 feet below grade. The deep piezometer in each cluster was screened in the lower portion of the vadose zone, from 38 to 48 feet below grade. An 11-foot layer of bentonite was used to isolate the two screen intervals, and thereby allow for the evaluation of both the shallow and the deep zones. The piezometer nests are located approximately 10, 20, and 32 feet from the SVE well nest. Piezometer construction is detailed in Figure 5.

5.3 Manifolding

Terra Vac will install piping from the vacuum extraction well cluster to the equipment location as shown in the Vacuum Manifold Layout (Figure 6). The piping will be installed above ground and pose no hinderance to on-going site operations.

Piping from each of the extraction wells will be run separately to the equipment shed. Piping from each of the extraction wells will be constructed of two inch Schedule 40 PVC piping and manifolded at the shed. The piping will be solvent welded at the manifold. The valves will be PVC and solvent welded. The sample ports and flow ports will be either brass or PVC and tapped into the PVC piping. All valving and instrumentation for the extraction well piping will be located in the equipment shed.

5.4 Shed Installation

Terra Vac will provide a shed to house the remedial equipment. This shed will be erected, and insulated. Doors will be provided to allow installation of the remediation equipment, and access for monitoring and maintenance.

Utilities will be run into the shed, including 480 volt, three-phase electrical power, and 110 volt power for outlets.

5.5 Equipment Installation

The two vapor extraction lines will be run into the equipment shed, and fitted with the necessary valves, sampling ports, and gages. Terra Vac will supply and install the remedial equipment, to include an extraction blower, and a water/vapor separator. The 600# carbon vessel removed from the on-site air stripper discharge and two 200# carbon drums presently on-site will be located directly outside the equipment shed. The general system schematic is shown on the Process Flow Diagram (Figure 7), while the shed layout is shown on the Equipment Shed Layout (Figure 8). Equipment specifications are provided in Appendix A.

5.5.1 Extraction Blower

The extraction blower will be a 3 hp regenerative blower rated for 100 scfm at 60" of water vacuum. The vacuum extraction blower is used to draw TCE containing vapors from the soil and through the carbon absorption system. The blower is a Rotron regeneratiive type, model #EN606. It is powered by a 3.0 horsepower explosion proof motor, rated for use in Class I, Group D environments. It is rated for a maximum air flow of 200 standard cubic feet per minute (SCFM), or a maximum vacuum of 75 inches of water ("H_2O).

The extraction blower is controlled by a motor starter. The starter provides manual start and stop controls for the extraction blower, and secures power to the extraction blower in the event of a thermal overload in the blower windings or a high water level in the water/vapor separator.

It is anticipated that the blower will operate at between 70 and 80 SCFM with both of the wells on line. If a piezometer cluster is added the system will most likely operate between 80 and 90 SCFM.

5.5.2 Water/Vapor Separator

The water/vapor separator is used to remove entrained moisture from the vapor stream prior to the vapors entering the carbon and the blower. Collected moisture is retained in the separator tank until drained by a system operator.

The moisture separator is an EG&G Rotron model MS350B. It separates the moisture from the vapors using a high efficiency cyclonic process. It has a capacity of 40 gallons, and can handle air flows up to 350 cubic feet per minute (cfm).

The separator is equipped with a float switch. To prevent drawing water into the blower, the float switch will turn off the blower if the separator tank is full. When the liquid level returns to normal, the switch will allow the blower to be restarted.

The separator is manually drained into drums by connecting a hose to the drain valve, for ultimate disposal by others.

5.5.3 Activated Carbon Drums

The two activated carbon drums hold 200 pounds of activated coconut-shell based carbon. In general the drums are rated for 62 inches of water vacuum, and a flow of 300 scfm. Each drum is approximately 2 feet in diameter and approximately 3 feet high.

The existing 600 pound vapor phase carbon vessel from the on site air stripper will also be used in conjunction with the 200 pound units.

5.6 System Controls

System controls will be provided for normal equipment operations and safety shutdowns. A high discharge temperature condition at the exhaust of the extraction blower will cause the system to shut down. A high water level in the separator tank will shut down the extraction blower unit, thereby also shutting down the system. Extra capacity will be provided in the electrical panel in the event that heat tracing and winterization is required. An electrical distribution diagram is provided in Figure 9.

5.7 System Piping

Each extraction well header will be fitted with a throttling valve, a vapor sampling port, a vacuum gage, and a flow measuring port which will be located inside the equipment shed. These will be installed on a two-inch diameter pipe which will be connected to a two-inch main header inside the shed, which will run into the water/vapor separator, and then continue to the carbon absorption drums and then on to the extraction blower inlet. A combination of cast-iron and CPVC piping will lead out of the blower discharge to the discharge stack. The discharge stack will be fitted with a rain cap to prevent water infiltration.

Vapor sampling ports will be installed on the inlet, midpoint, and effluent of the carbon drums. Vacuum gages will be installed on the inlet to the separator. A flow port will be provided on the inlet to the separator. A pressure and temperature gage will be installed on the discharge of the extraction blower.

6.0 INITIAL START-UP

Upon completion of the installation, Terra Vac will test start the system. Flow rates and vacuums will be measured at the extraction wells and the system influent. Vapor samples will be drawn from the extraction wells, total system influent, the carbon midpoint and vapor effluent. These samples will be analyzed using a field organic vapor monitor (OVM). Routine system maintenance will be performed, and the SVE system will be checked for proper operation.

The following steps will be performed during start-up:

1) The throttling valve for VE-01D will be opened fully.

2) Once flow is seen in VE-01D, VE-01S will be turned on.

3) The system will be balanced with the throttling valves from each well in order to maximize system performance.

7.0 SAMPLING AND ANALYSIS

7.1 System Start-up Operations Phase

During the start-up operations phase (4 weeks), vacuum extraction wells will be initially monitored for vacuum levels, and flow on a weekly basis for the start-up operations period. Terra Vac will run one set of samples from the two vapor extraction wells, the carbon midpoint, and the carbon effluent using a gas chromatograph (GC) equipped with dual flame ionization detectors. Terra Vac will also run one set of samples from the two vapor extraction wells, the carbon midpoint, the carbon effluent and the total vapor influent using an organic vapor monitor (OVM) equipped with a photoionization detector. The carbon inlet will be monitored with an OVM.

VOC sample locations will include the following SVE process areas:

1. VE wells (GC & OVM);
2. Carbon inlet (OVM);
3. Carbon midpoint (GC & OVM);
4. Discharge stack (GC & OVM).

Upon completion of the start-up operations phase activities, a letter report will be submitted to BBL detailing the results of the start-up testing. This report will provide the analytical data gathered and will estimate the total mass removed; as well as detailing the field operations.

The first month of monitoring will include weekly site visits (at a minimum, at 1, 7, 14, and 28 days after system start-up). After the first month of start-up, site visits will be conducted monthly.

7.2 Full-scale Operations Phase

Process sampling during operation of the vacuum extraction system is conducted in order to evaluate and optimize the effectiveness of the remediation system and to verify compliance with limitations for vapor discharge to atmosphere.

During full-scale operations, samples of process vapor will be collected and analyzed and various operating parameters, such as flow and vacuum, recorded. Sufficient data will be gathered during this phase to monitor site remediation progress and to provide performance and reliability data. Routine, on-going sample locations will be identical to those identified for start-up operations.

During the second and third months following start-up, vapor samples will be collected and analyzed on a monthly basis as follows:

1. VE wells (GC & OVM);
2. Carbon inlet (OVM);
3. Carbon midpoint (GC & OVM);
4. Discharge stack (GC& OVM).

Following the first quarter of operations (months 1-3), routine monthly monitoring will involve collection of VOC samples from the following process areas:

1. VE wells (GC & OVM);
2. Carbon inlet (OVM);
3. Carbon midpoint (OVM);
4. Discharge stack (OVM).

In addition to the routine monthly sampling schedule shown above, samples from the carbon midpoint and the discharge stack will be collected on a quarterly basis for GC analysis. A monitoring frequency plan is presented in Table 1.

7.3 Sample Designation

Samples collected from the site will be designated by unique sample identification numbers. Sample identification numbers will be composed of an alphanumeric series which can be used to cross-reference a sample to a particular sampling point, location or event. Assigned sample numbers will be recorded in the field and referenced on all associated documents.

7.4 Sampling Procedures and Equipment

This section details the procedures to be used for all sampling conducted during the source removal remedial action including systems start-up and full-scale operations. Sampling activities will include the collection of vapor samples and specific process operating data.

7.4.1 Process Vapor

During start-up and operation of the vacuum extraction system, Terra Vac will sample and analyze the extracted vapors. These locations include: a) wellheads; b) carbon inlet; c) carbon midpoint and d) vapor treatment system stack.

During start-up, the vapor samples from the locations described above will be taken once per week. Vapor sampling during full scale operations will then occur monthly, as described in Section 7.2.

The technique planned for use under the project is a modification of the method described in ASTM D1391-78, measurement of Odor in Atmospheres. Vapor samples will be obtained using a desiccator and tedlar bags in the following manner:

1) The tedlar bag is attached to the sampling point, and placed inside a desiccator.

2) A vacuum is applied to the desiccator, and the vapor sample is drawn into the tedlar bag.

3) The sample time, number, vacuum level, and flow rate will be recorded.

4) These samples will be accompanied with sample tracking records and analyzed either using the direct injection method on a laboratory grade gas chromatograph or organic vapor monitor (OVM).

8.0 ROUTINE MONITORING

During routine monitoring the following tasks will be performed during each site visit:

- Equipment inspection;
- Routine maintenance;
- Non-scheduled maintenance;
- Flow/Vacuum measurements; and
- VOC sampling and analysis.

Each month flow rates and vacuums will be measured at the extraction wells and the system influent. Vapor samples will be drawn from the extraction wells, total system influent, carbon midpoint, and vapor effluent. These samples will be analyzed using an organic vapor monitor (OVM). Routine system maintenance will be performed, and the SVE system will be checked for proper operation.

Once per month for the first three months, including start-up, Terra Vac will analyze one set of samples from the two vapor extraction wells, the carbon midpoint, and the carbon effluent using a gas chromatograph (GC). In addition, all of these samples and the carbon inlet will be analyzed using an organic vapor monitor each month. After the initial three months, the GC analysis of the carbon midpoint and carbon effluent samples will occur quarterly. Once per quarter, Terra Vac will analyze one set of samples from the two vapor extraction wells, the total vapor influent, the carbon midpoint and the carbon effluent using a organic vapor monitor (OVM). In addition, a sample from each vapor extraction well will be analyzed using a GC on a monthly basis.

9.0 REPORTING

A monthly letter report will be submitted detailing the activities performed and data gathered during that month. The report will include all data generated during each month of system operation, an analysis of the data, and analysis of trends in VOC extraction rates, a determination and recommendation for any changes in the system design and operation.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) Samples will be performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. Quality Assurance objectives are qualitative and quantitative statements specifying the quality of the environmental data required to support the decision making process. Quality assurance objectives for measurement data can be stated in terms of precision, accuracy, representativeness, completeness and comparability. These terms are described below.

Precision - normally measures the reproducibility of measurements under a given set of conditions. Accuracy is a measurement of the standard error or bias that is inherent in the analytical process.

Representativeness - is a function of the sampling method used and the processing of the sample. The objective is to demonstrate the degree of quality of the data and the degree to which it represents the actual environmental condition. This can be determined by a comparison of the quality control data for samples analyzed against other data for similar samples under the same conditions and circumstances.

Completeness - is addressed by maximization of successful sample collection and analysis. The indicator for completeness is the percent of samples judged to be valid compared to the total number of samples collected.

Comparability - is an expression of the confidence with which one data set can be compared to another. By using standard methodology and QA/QC procedures, the results of the analyses can be compared to other analyses by other laboratories.

The following table presents the quality assurance objectives (QAOs) to be implemented during this full scale remediation. These QAOs define the total uncertainty in the data that is acceptable for each specific activity during the investigation. This uncertainty includes both sampling error and analytical instrument error. Ideally, zero uncertainty is the intent. However, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. In order to achieve this objective, specific data quality requirements such as detection limits, criteria for accuracy and precision, sample representativeness, data comparability and data completeness will be specified herein. The overall objectives and requirements will be established such that there is a high degree of confidence for the intended use of the data.

QUALITY ASSURANCE OBJECTIVES FOR PRECISION, ACCURACY AND COMPLETENESS			
MATRIX/ PARAMETER	**PRECISION (%)**	**ACCURACY (% RECOVERY)**	**COMPLETENESS (%)**
Chemical Analysis:			
Vapors	20	80-120	90

Note:

$$\% \text{ RPD} = \frac{(\text{duplicate 1 - duplicate 2})}{(\text{duplicate 1 + duplicate 2})/2} * 100$$

$$\% \text{ Recovery} = \frac{\text{spiked sample - unspiked sample}}{\text{spike amount}} * 100$$

$$\% \text{ Complete} = \frac{\text{number of samples within QA/QC criteria}}{\text{total number of samples}} * 100$$

10.1 Calibration Procedures and Frequency

This section describes calibration procedures and policies pertinent to the analysis of samples collected during the full scale remediation. In order for QA/QC objectives to be achieved, it is imperative that the response of all analytical equipment be calibrated to known standards.

In order to maintain direct quality control over the implementation of the QAPP, Terra Vac will operate an analytical laboratory, equipped with, but not limited to:

- One Shimadzu Model 15A Gas Chromatograph (GC),
- One Shimadzu CR4A Chromatopac computer and printer,

GC analyses will be carried out utilizing dual capillary columns (30M), two flame ionization detectors and a temperature-controlled compartment to insure retention time stability of peaks.

Initially, a three-point vapor calibration curve will be made for each detector to verify linearity. The range of this curve will correspond to the expected range of concentrations found in real samples. If the percent relative standard deviation (% RSD) of the calibration factors derived from each calibration point is less than 20% over the working range, linearity through the origin is assumed and the average calibration factor will be used in place of a calibration curve.

The working calibration curve or calibration factor will be verified daily by the injection of one or more calibration standards. Before any set of standards can be used in the preparation of a calibration curve, the concentration must be verified by either analysis of a U.S. EPA QC check sample, or analysis of two independently prepared check standards. If the response for any analyte varies from the initial calibration by more than ±15%, corrective action will be taken. A calibration check shall be run, at a minimum, every shift or every 8 hours, whichever is less.

Calibration and check standards will be performed using the following method: a static bulb dilution standard for the same components. The static bulb dilution standard method has been approved and is routinely used at several Superfund sites by Terra Vac, most notably, the Tyson's Site, King of Prussia, Pennsylvania.

This method has been proven to result in low variability. For the static bulb dilution method, the standard is prepared from a neat standard available in 99+% purity and packaged under nitrogen in Sure-Seal bottles (Aldrich).

10.2 Calibrations Standards

Calibration standards will be made by combining equal volumes of the compounds of interest in a small vial fitted with a teflon-faced septum. The vial will be refrigerated when not in use and a fresh calibration standard will be prepared bi-weekly.

10.3 Blanks

Syringes are an indispensable part of any analytical protocol whether the matrix is soil, water or process gas. Therefore, steps are taken to ensure quality and suitability for a particular analysis. The steps are:

- Each syringe and its plunger bear a unique code which becomes part of the analysis.
- After each use, a syringe is purged for approximately ½ hour.
- Certain syringes may be dedicated to specific tasks to facilitate quality control efforts.
- Syringes are equipped with side-port needles to prevent the problems of "coring" associated with the straight-needle types.

Method blank analyses will be performed in the laboratory to demonstrate that all sampling glassware and syringes are interference-free on a frequency of 1 in 20 samples. Should problems associated with the cross-contamination of syringes or glassware arise, a compressed air cylinder will be used for cleaning purposes

Trip blanks for vapor samples will be a tedlar bag containing laboratory air, carried through the field sampling routine, returned to the laboratory and analyzed along with the other samples.

10.4 Replicates/Duplicates

As a quality control check on the precision of the method used in a particular matrix, replicate/duplicate samples will be analyzed. For process gases, duplicate samples will be collected from identical points in the process at the same time. Duplicates will be analyzed at a frequency of 1 in 20 samples per matrix.

11.0 DATA REDUCTION, VALIDATION AND REPORTING

QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information, followed by clear and concise reporting of the data, is a primary goal in all projects.

Analytical and process data are generated by two primary sources: field and laboratory testing. Field data is generated by flow meter, temperature, pressure measurements, and OVM measurements. Laboratory data is generated primarily by Gas Chromatography and supporting volumetric and gravimetric equipment (syringes, pipettes, balances, etc.).

11.1 Data Reduction

Laboratory data from the gas chromatograph will be recorded directly into the analytical logbook for reduction and organization. The logbook will be customized to the vapor analytical requirements at the Crosman Corporation site. Other inputs will include the field measurements of flow rates, temperature, pressure, and VOCs. Once all input data has passed initial QA/QC scrutiny, the information will then be transferred to an appropriate spreadsheet computer program. Typical outputs include both tabular listings and graphical displays of subsurface contaminant profiles, mass flux of contaminants through the vacuum extraction system, mass balances, water contaminant levels and treatment results, cumulative mass removed, and others.

11.2 Data Validation

Data validation is the process of filtering data and accepting or rejecting it on the basis of sound criteria. Terra Vac supervisory and QC personnel will use validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data will be maintained, even data judged to be an "outlying" or spurious value. The persons validating the data will have sufficient knowledge of the vacuum extraction process to identify questionable values.

Field sampling data will be validated by the field personnel and/or the Analytical Supervisor based on their judgement of the representativeness of the sample, maintenance and cleanliness of sampling equipment (blanks) and the adherence to approved, written sample collection procedures. Analytical data will be validated by the laboratory QC or supervisory personnel using the criteria described in this QAPP. Results from field and laboratory method blanks, replicate samples and internal QC samples will be used to validate analytical results. Analytical results on field blanks and replicate field samples are valuable for validation of sample collection also.

The following criteria will be used to evaluate the field sampling data:

- Use of approved test procedures.
- Proper operation of the process being tested.
- Use of properly operating and calibrated equipment.
- Use of reagents that have conformed to QC specified criteria.
- Proper chain-of-custody maintained.

The criteria listed below will be used to evaluate the analytical data:

- Use of approved analytical procedures.
- Use of properly operating and calibrated instrumentation.
- Precision and accuracy achieved should be comparable to that achieved in previous analytical programs and consistent with objectives stated in this Work Plan.
- Acceptable results from analysis of QC samples.

11.3 Reporting

Data will be reported in both tabular form and in spatial plots. The Chemist will conduct a review of all completed sample data. A review of the data includes:

- Verification that no chemicals are within limits in associated blanks.
- Comparison of standards and duplicates for consistency of data results.
- Review of all data to make sure they are within acceptable quality limits.

12.0 HEALTH AND SAFETY

A task specific Health and Safety Plan (HASP) has been prepared for the installation and operation of the full scale remedial system. The HASP covers planned activities during the pilot study. A copy of the HASP is included in Appendix B.

The safety and protection of Terra Vac's employees, clients, and the community are of prime importance to Terra Vac. Besides our field operations, this concern for safety extends to our shop facilities and office surroundings.

The primary functions of Terra Vac's health and safety program is to:

- Promote health and safety awareness throughout the company,
- Audit Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulatory compliance,
- Prepare site health and safety plans,
- Provide safety training and maintain records,
- Administer the medical surveillance program, and
- Act as internal health and safety consultants.

Terra Vac administers its health and safety program in each Division by designated Health and Safety Coordinators. The program is the responsibility of a designated Vice President, who is assisted by the Corporate Health and Safety Coordinator.

Each Terra Vac project has a formally assigned individual responsible for implementing the health and safety program. All of Terra Vac's United States field staff have completed the 40-hour OSHA 29CFR1910.120 training requirements. All supervisory personnel have completed the OSHA Site Supervisory training course. Each Division has a program of regularly scheduled health and safety training sessions, supervised by the Corporate Health and Safety Coordinator.

Terra Vac maintains a strict medical surveillance program that covers Terra Vac personnel who work at remedial operations. The program seeks to protect the health of our field operations staff from potential chemical exposure as well as other hazards, and follows the guidelines and regulations developed by the National Institute of Occupational Health (NIOSH), U.S. Coast Guard, U.S. EPA, and OSHA.

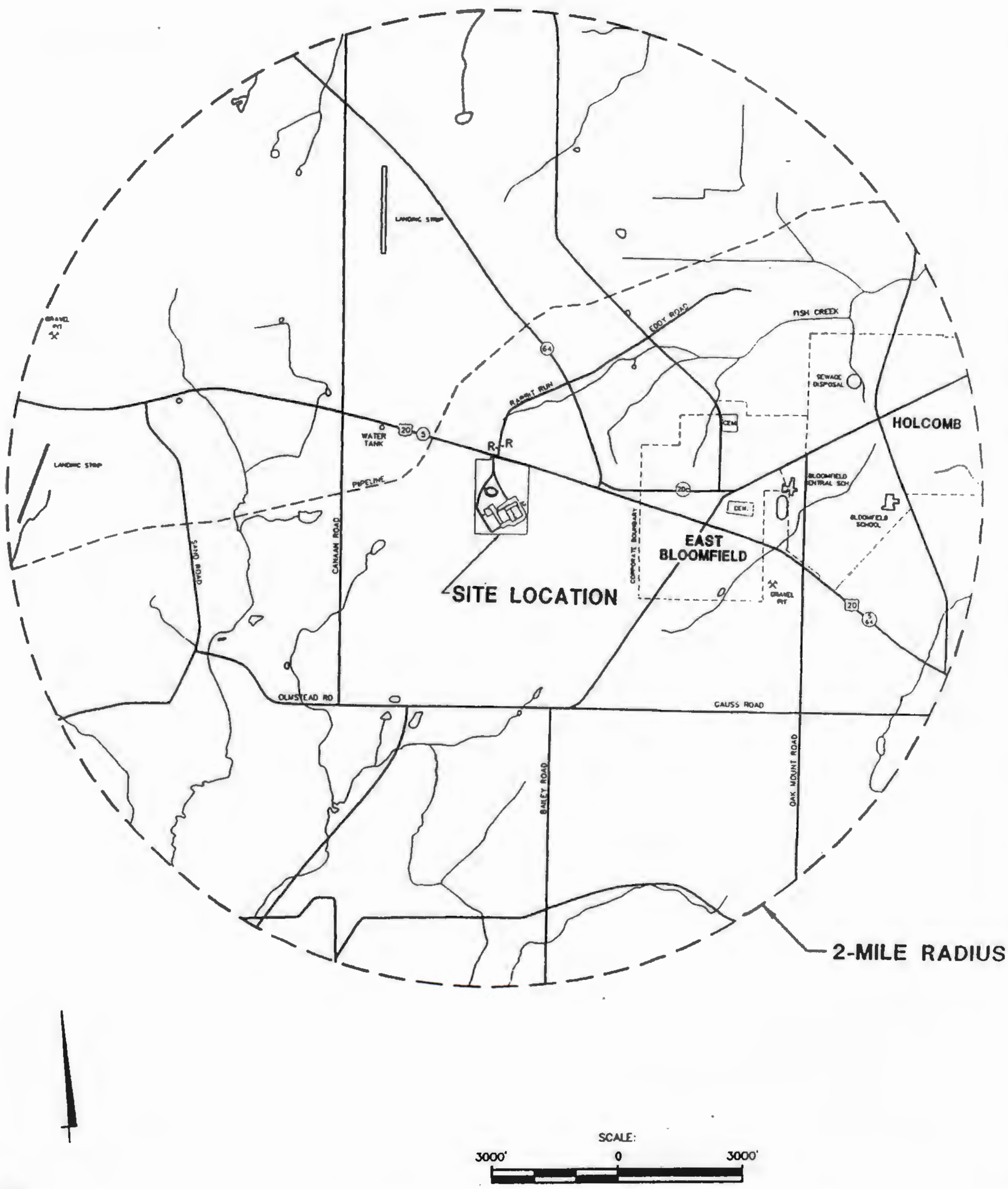
Tables

Table 1 - Monitoring Frequencies
Crosman Corporation Site
East Bloomfield, NY
Terra Vac Project #42-0216

Sample Location	Start-up		Months 2 & 3		Routine Monitoring	(months 4+)
	Frequency	Method	Frequency	Method	Frequency	Method
VE-01D	1 per week	GC	1 per month	GC	1 per month	GC
VE-01S	1 per week	GC	1 per month	GC	1 per month	GC
Total Vapor Influent	1 per week	OVM	1 per month	OVM	1 per month 1 per quarter	OVM GC
Carbon Midpoint	1 per week	GC	1 per month	GC	1 per month 1 per quarter	OVM GC
Carbon Effluent	1 per week	GC	1 per month	GC	1 per month 1 per quarter	OVM GC

GC = Analysis by laboratory grade gas chromatograph
OVM = Analysis by an organic vapor monitor
Note - All samples analyzed by GC will also be analyzed by an OVM

Figures

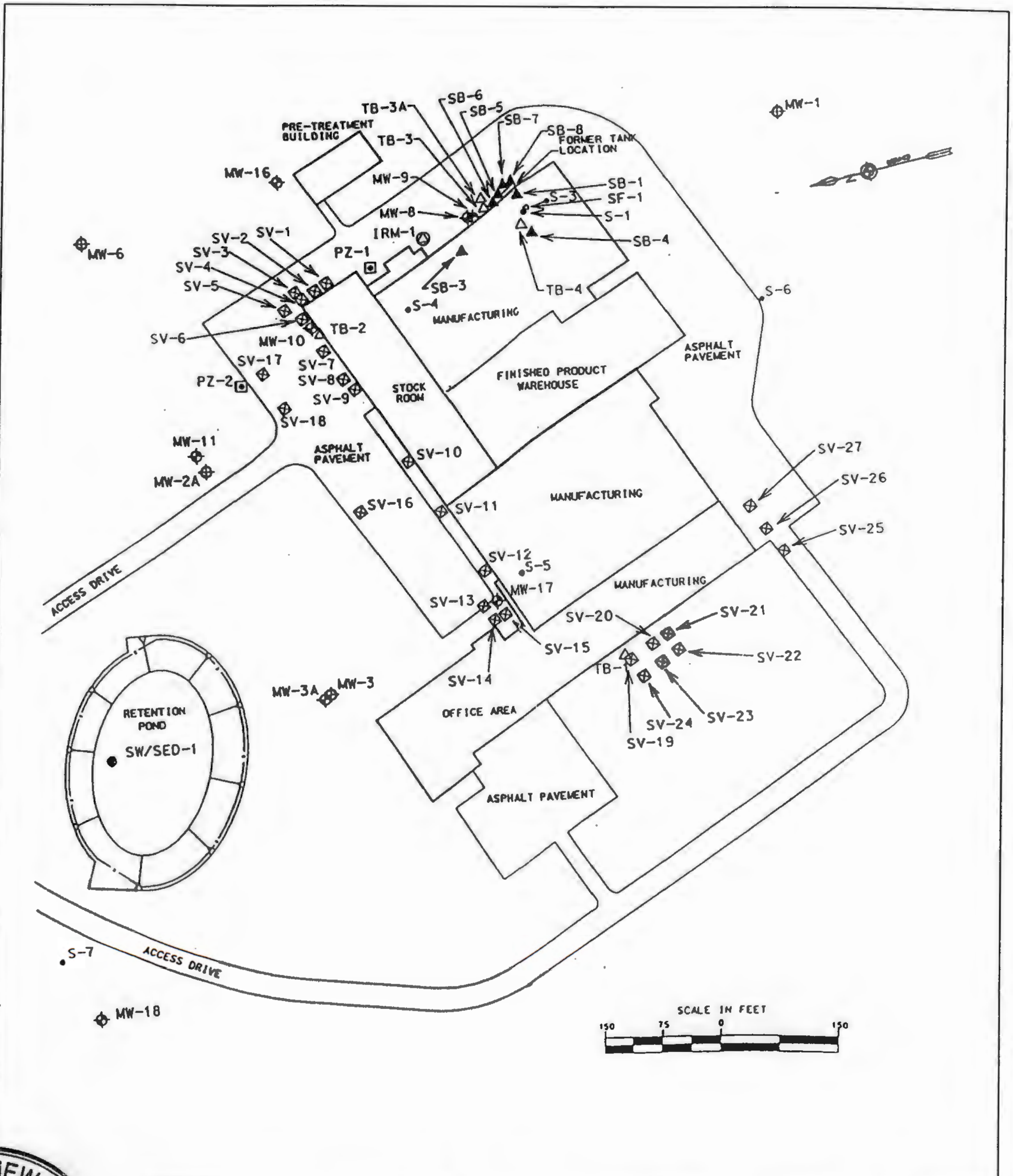


STATE OF NEW YORK
ROBERT J. ROTH
072249
LICENSED PROFESSIONAL ENGINEER
5-13-97

REV. NO.	DESCRIPTION	BY	DATE

TERRA VAC

CROSMAN CORPORATION SITE EAST BLOOMFIELD, NY			
LOCATION MAP			
DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 1
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: AS SHOWN



REV. NO.	DESCRIPTION	BY	DATE

TERRA VAC

CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY

SITE LAYOUT

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 2
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: AS SHOWN

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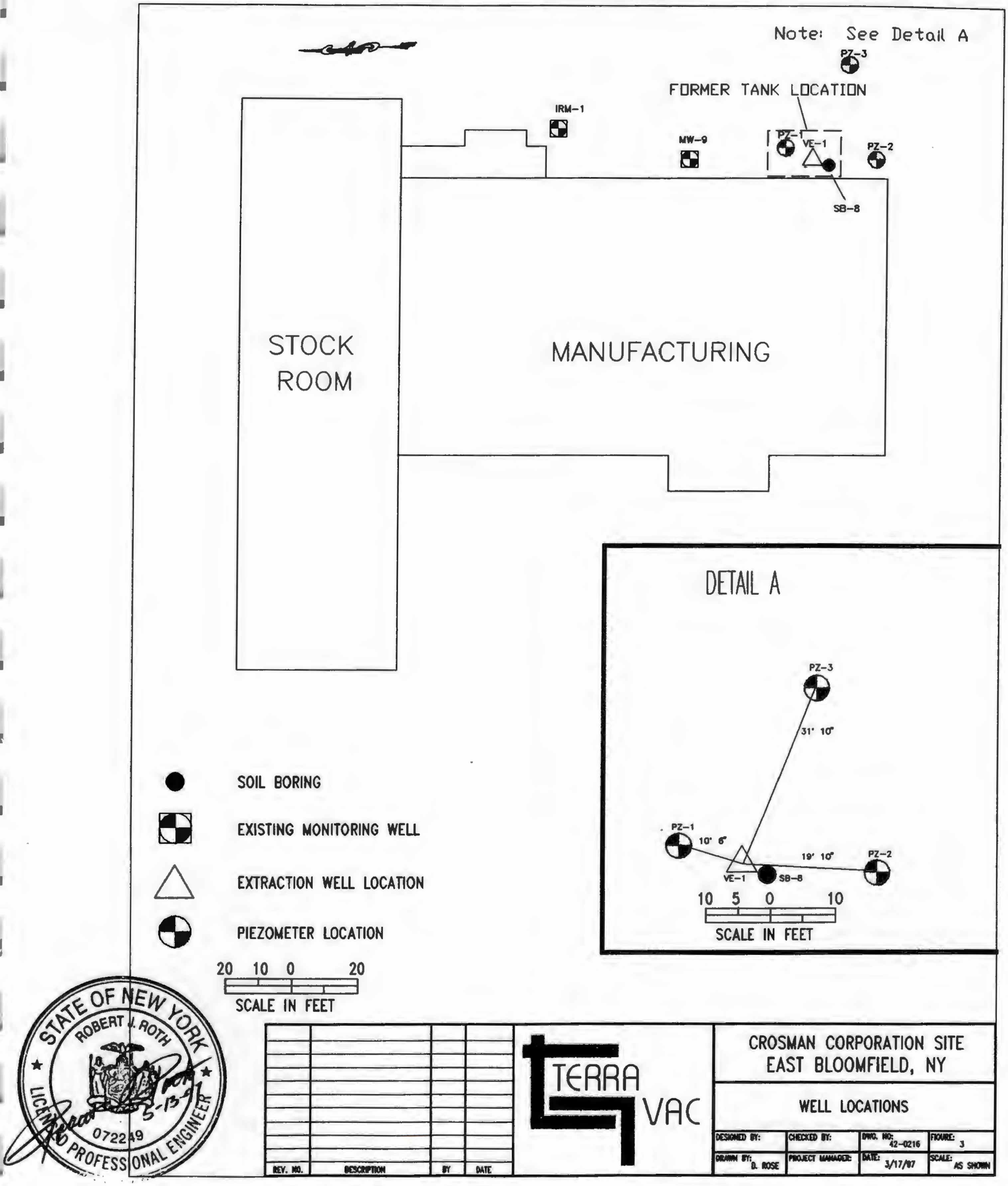
Note: See Detail A
PZ-3
FORMER TANK LOCATION
IRM-1
MW-9
PZ-1
VE-1
PZ-2
SB-8
STOCK ROOM
MANUFACTURING
DETAIL A
PZ-3
31' 10"
PZ-1
10' 6"
19' 10"
PZ-2
VE-1
SB-8
10 5 0 10
SCALE IN FEET
SOIL BORING
EXISTING MONITORING WELL
EXTRACTION WELL LOCATION
PIEZOMETER LOCATION
20 10 0 20
SCALE IN FEET
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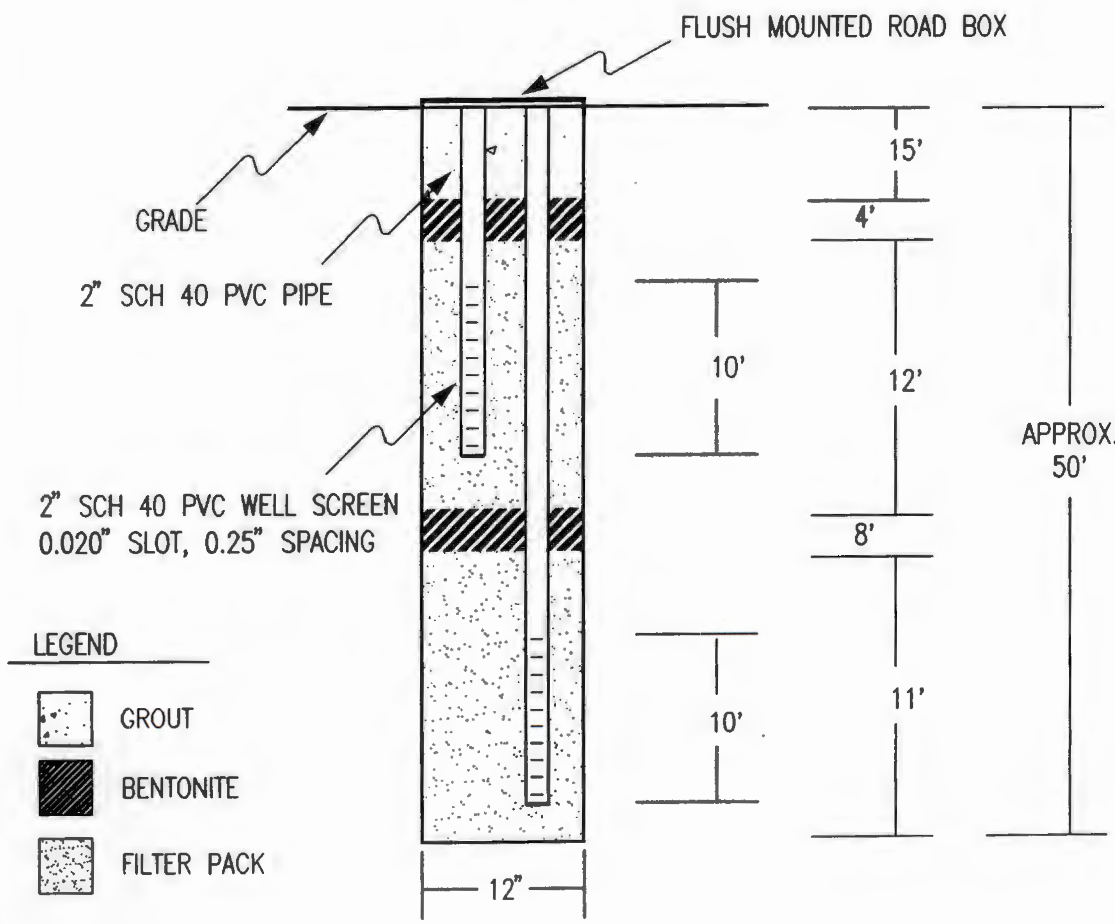
DESCRIPTION
BY
DATE
TERRA VAC
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY
WELL LOCATIONS
DESIGNED BY:
CHECKED BY:
DWG. NO: 42-0216
FIGURE: 3
DRAWN BY: D. ROSE
PROJECT MANAGER:
DATE: 3/17/97
SCALE: AS SHOWN



REV. NO.	DESCRIPTION	BY	DATE

TERRA VAC

CROSMAN CORPORATION
EAST BLOOMFIELD, NY

WELL CONSTRUCTION

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 4
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: NTS

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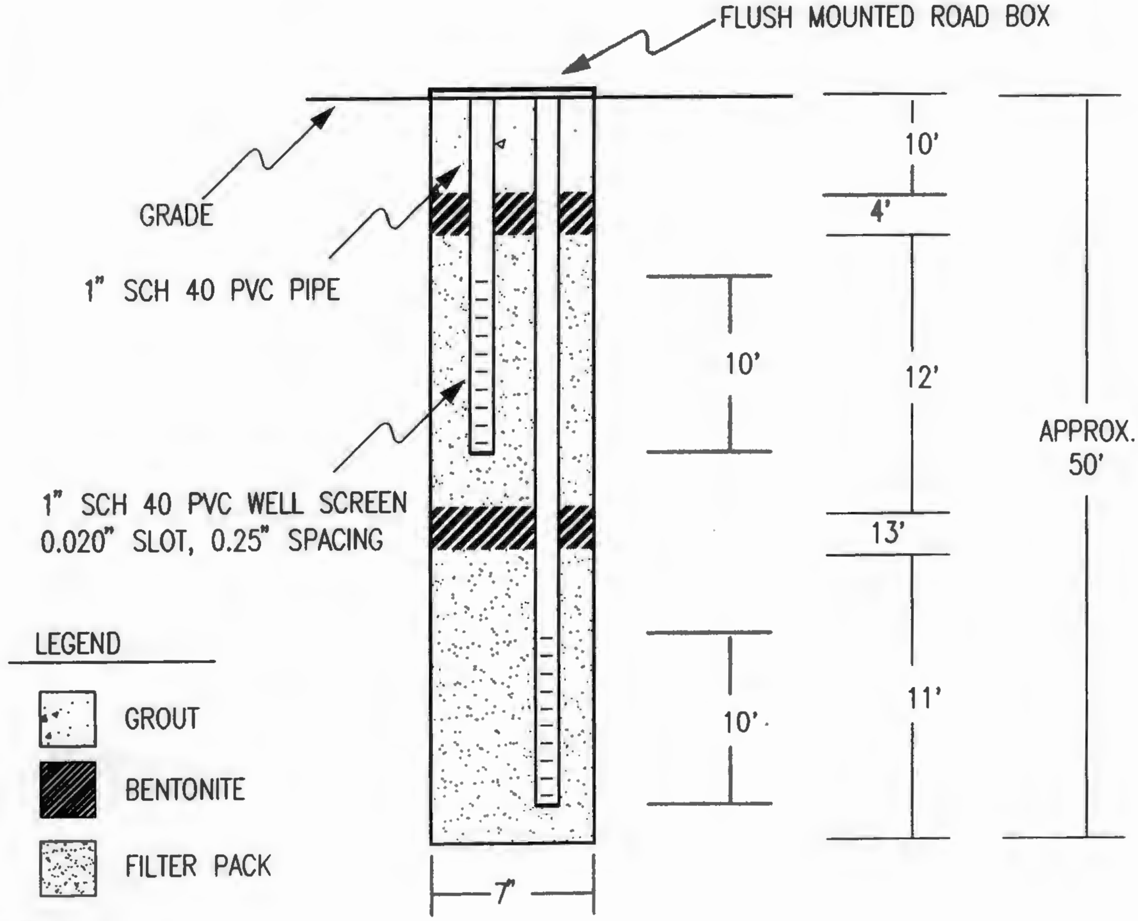

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REV. NO.	DESCRIPTION	BY	DATE

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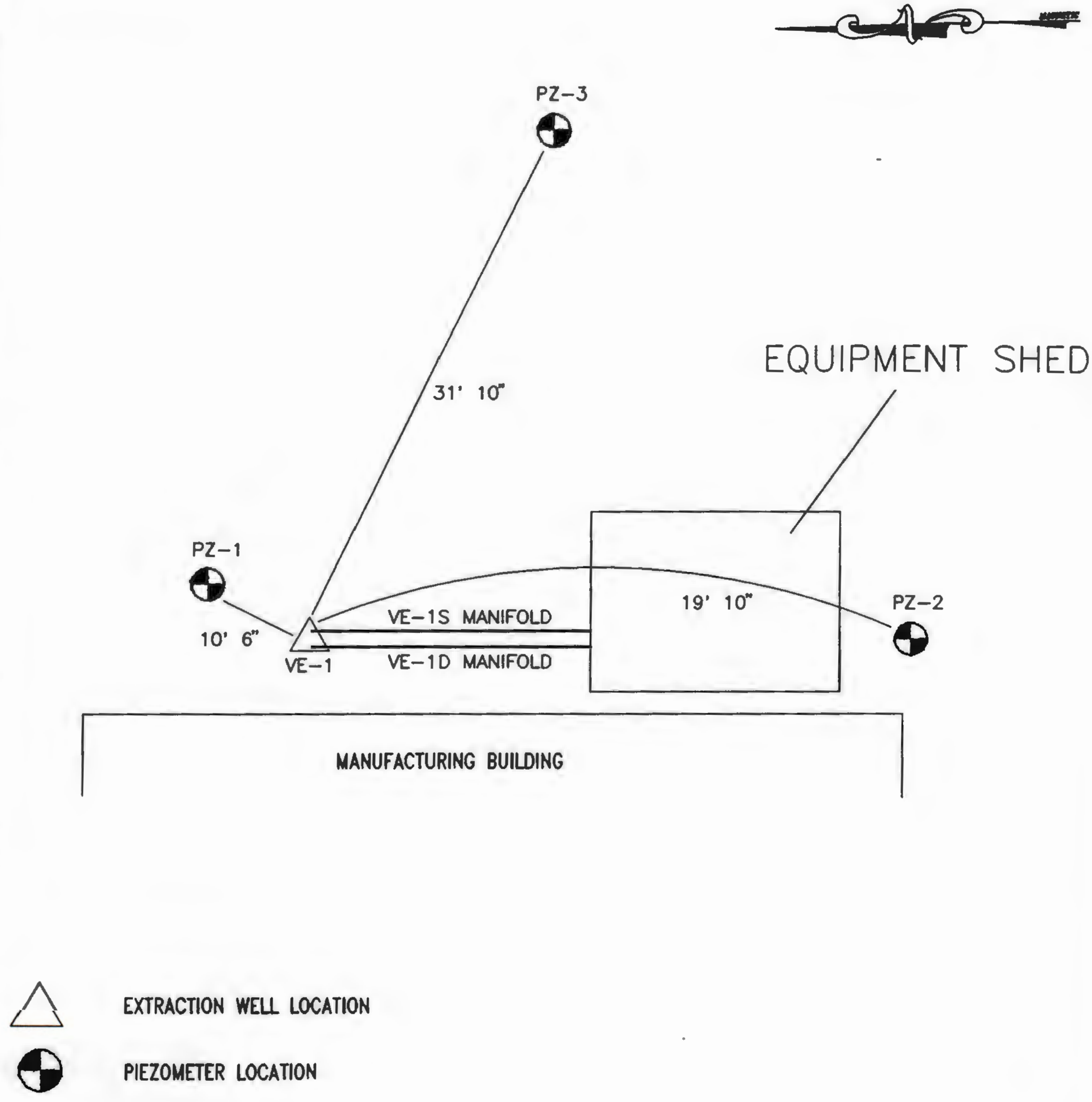
EAST BLOOMFIELD, NY

PIEZOMETER CONSTRUCTION

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 5
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: NTS



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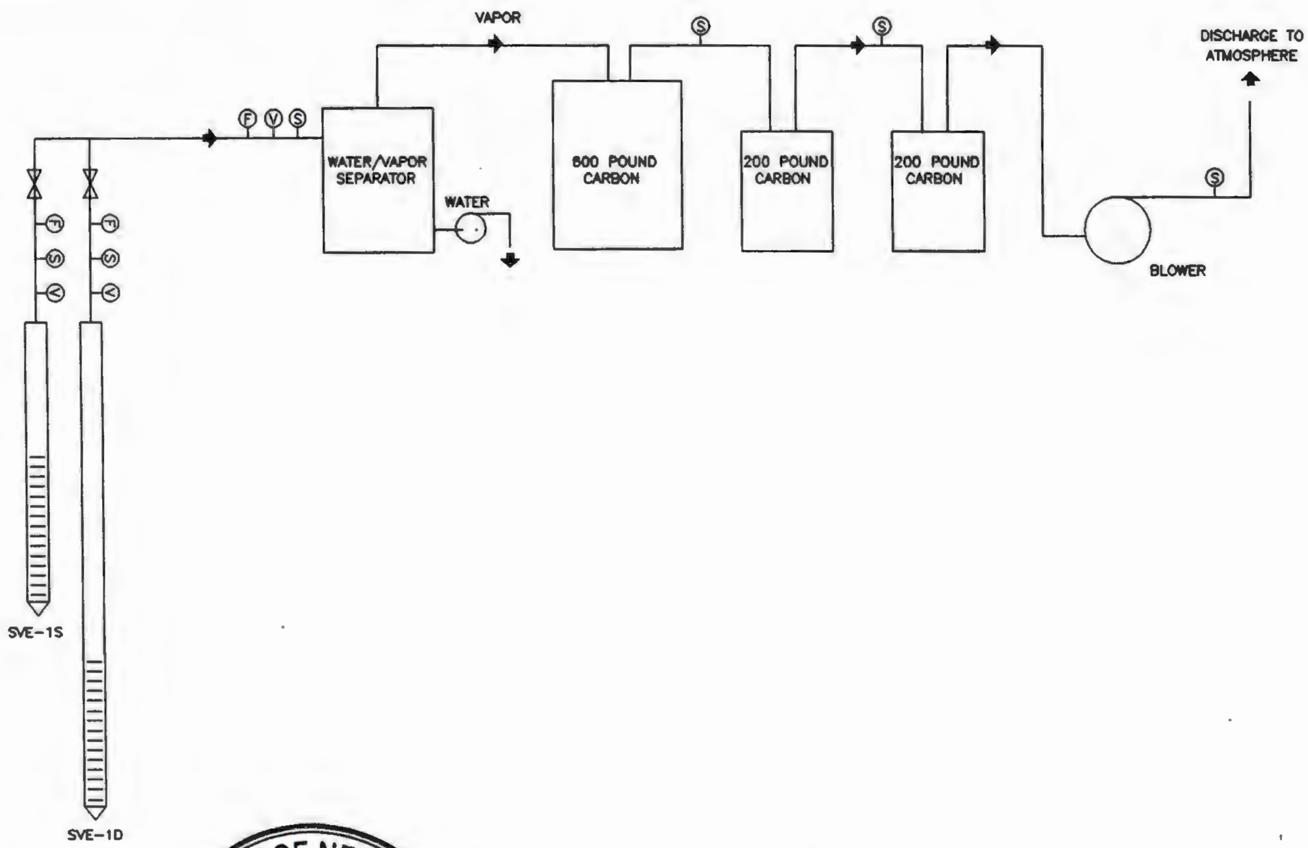
TERRA VAC

CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY

VACUUM MANIFOLD LAYOUT

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE:
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: NOT TO SCALE



LEGEND

- Ⓕ FLOW PORT
- Ⓢ SAMPLE PORT
- Ⓥ VACUUM GAGE

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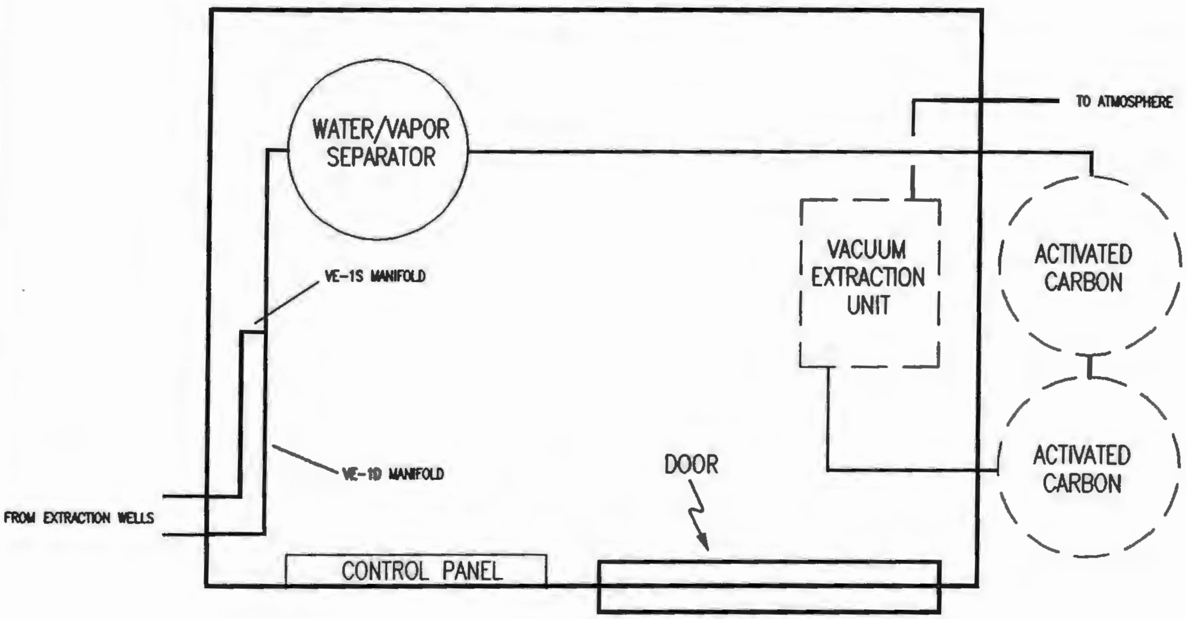
CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY

PROCESS FLOW DIAGRAM

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 7
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: NTS



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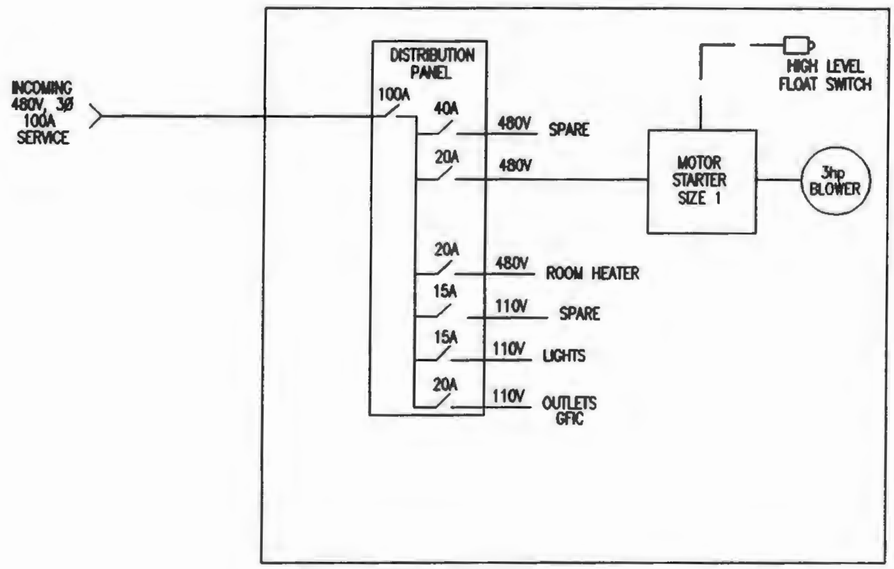
REV. NO.	DESCRIPTION	BY	DATE

TERRA VAC

CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY

EQUIPMENT SHED LAYOUT

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 8
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/97	SCALE: NTS



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TERRA VAC

CROSMAN CORPORATION SITE
EAST BLOOMFIELD, NY

ELECTRICAL DISTRIBUTION

DESIGNED BY:	CHECKED BY:	DWG. NO: 42-0216	FIGURE: 9
DRAWN BY: D. ROSE	PROJECT MANAGER:	DATE: 3/17/07	SCALE: NTS

Appendix A

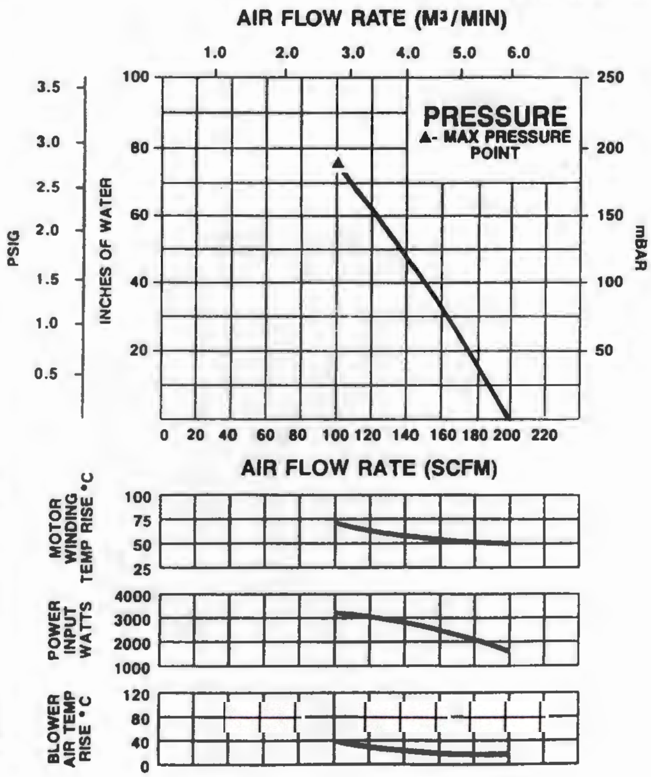
EN 606
Explosion-Proof Regenerative Blower

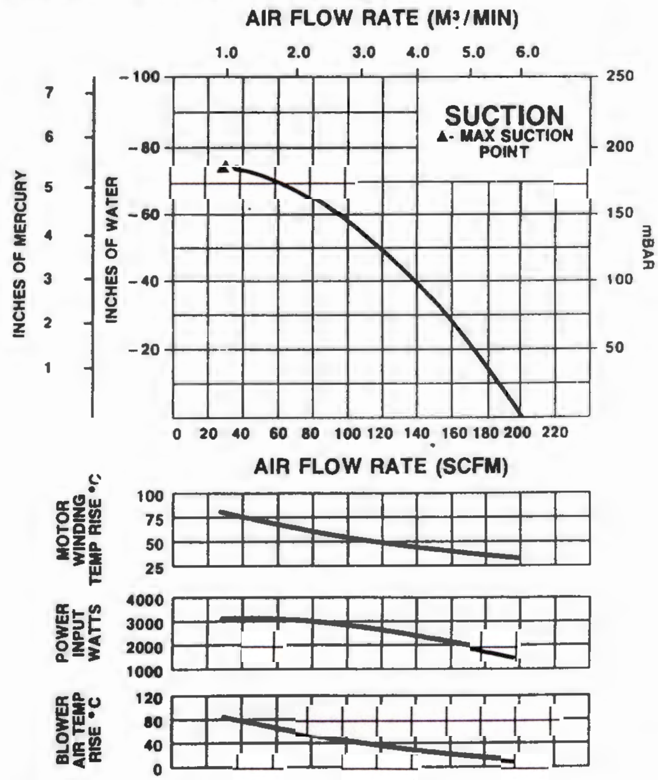
FEATURES
- Manufactured in the USA
- Maximum flow: 200 SCFM
- Maximum pressure: 75″ WG
- Maximum vacuum: 75″ WG
- Standard motor: 3.0 HP
- Blower construction — cast aluminum housing, cover, impeller & manifold; cast iron flanges
- UL & CSA approved motors for Class I, Group D atmospheres
- Sealed blower assembly
- Quiet operation within OSHA standards

OPTIONS
- TEFC motors
- 50 Hz motors
- International voltages
- Other HP motors
- Corrosion resistant surface treatments
- Remote drive (motorless) models

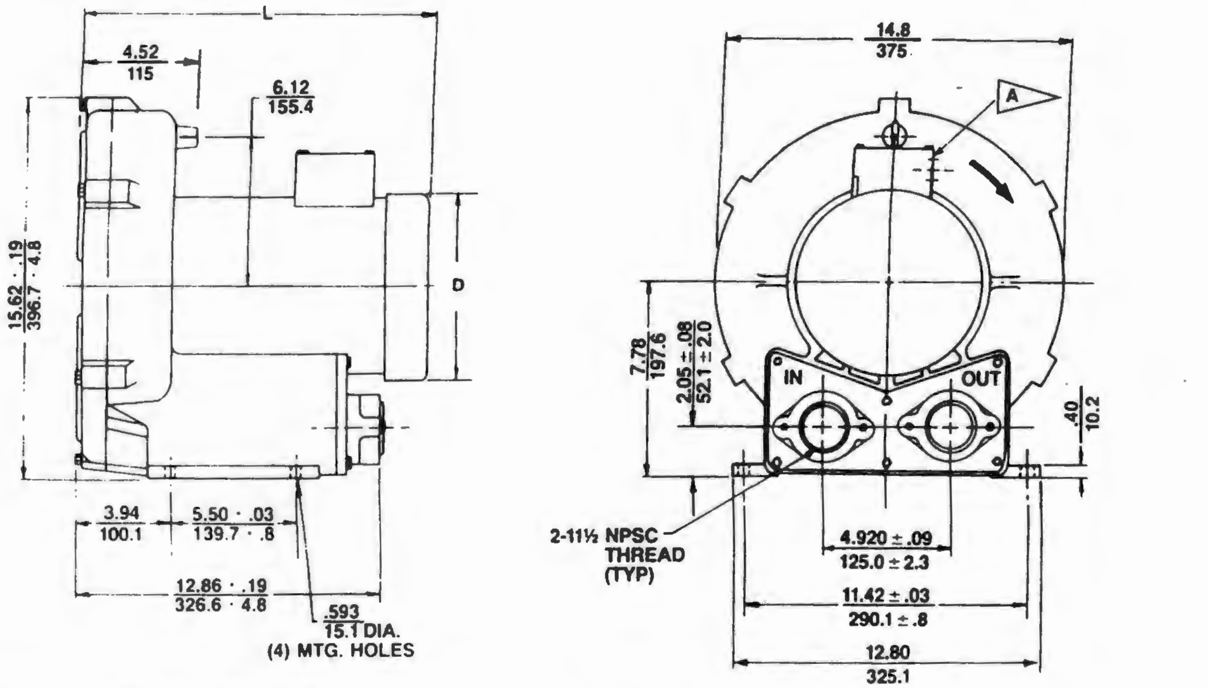
ACCESSORIES
- Moisture separators
- Explosion-proof motor starters
- Inline & inlet filters
- Vacuum & pressure gauges
- Relief valves
- External mufflers

BLOWER PERFORMANCE AT STANDARD CONDITIONS





EN 606
Explosion-Proof Regenerative Blower



DIMENSIONS: IN/MM
TOLERANCES: .XX ± .1/2.5
(UNLESS OTHERWISE NOTED)

MODEL	L (IN) ± .3	L (MM) ± 8	D (IN) ± .1	D (MM) ± 3
EN606M72L	17.7	456	7.2	182
EN606M5L	19.9	505	8.5	216

A ▷ 0.75" NPT CONDUIT CONNECTION

SPECIFICATIONS

MODEL	EN606M5L	EN606M72L	
Part No.	038222	038179	
Motor Enclosure Type	Explosion-proof	Explosion-proof	
Horsepower	3.0	3.0	
Phase — Frequency	Single — 60 Hz	Three - 60 Hz	
Voltage	208-230	230	460
Motor Nameplate Amps	15.5-14.5	7.4	3.7
Maximum Blower Amps[1]	18.1-16.7	7.6	3.8
Inrush Amps	94-88	65	32.5
Starter Size	1	0	0
Service Factor	1.0	1.0	
Thermal Protection	Pilot Duty	Pilot Duty	
Bearing Type	Sealed, Ball	Sealed, Ball	
Shipping Weight	130 lb (59 kg)	106 lb (48 kg)	

BLOWER LIMITATIONS

Min. Flow @ Max. Suction	30 SCFM @ −75" WG	30 SCFM @ −75" WG
Min. Flow @ Max. Pressure	105 SCFM @ 75" WG	105 SCFM @ 75" WG

[1]Corresponds to the performance point at which the blower and/or motor temperature rise reaches the limit of the thermal protection in the motor.

Specifications subject to change without notice. Please contact factory for specification updates.

EG&G ROTRON, SAUGERTIES, N.Y. 12477 • 914/246-3401 • FAX 914/246-3802

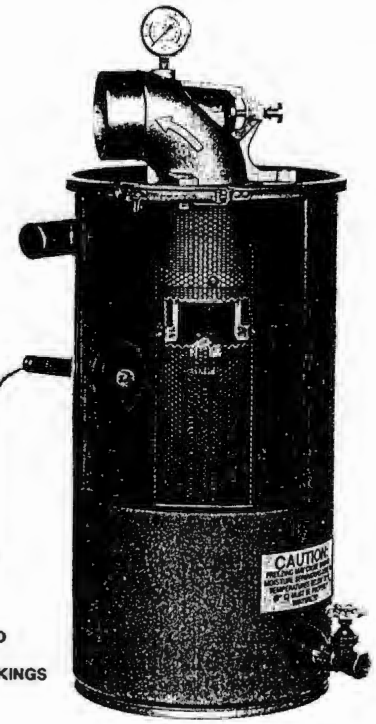
Accessories

Moisture Separator

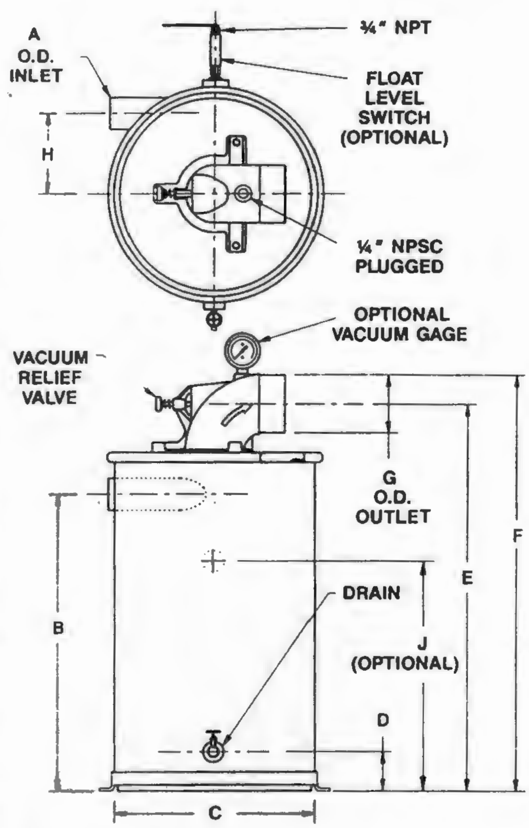
By separating and containing entrained liquids, Rotron's moisture separator helps protect our regenerative blowers and the end treatment system from corrosion and mineralization damage. Recommended for all soil vacuum extraction applications.

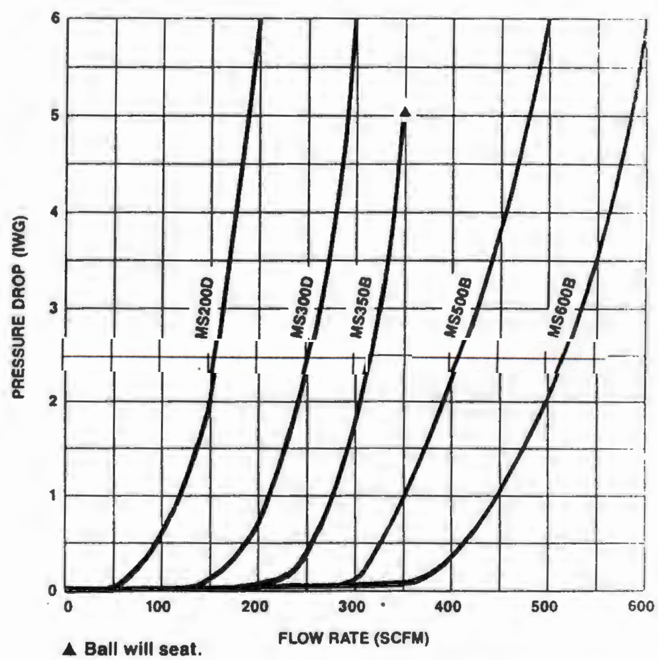
SPECIFICATIONS:

SEPARATION METHOD — High Efficiency Cyclonic
RELIEF VALVE MATERIAL — Brass & Stainless Steel
INTERIOR — Epoxy Coated Steel
FLOAT MATERIAL — Copper
OPTIONAL FLOAT SWITCH — SPDT, Explosion-proof NEMA 7&9, 5 Amp max.



CUTAWAY PHOTO DEPICTING INTERNAL WORKINGS





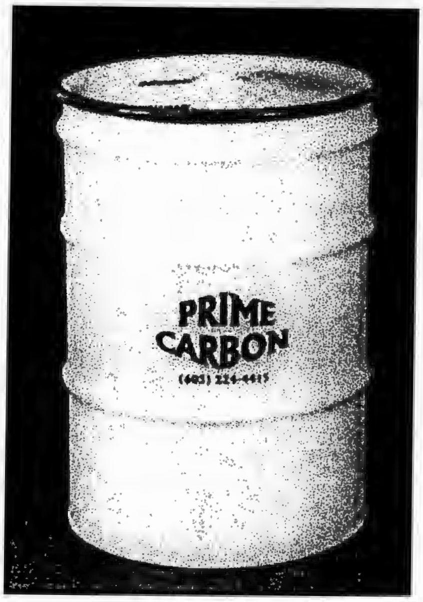
▲ Ball will seat.

Model	Part Number	Capacity Gal.	CFM Max.	Dimensions (Inches)									Drain Internal THD	Shipping Weight
				A Dia.	B	C Dia.	D	E	F	G Dia.	H	J		
MS200D	038275	10	200	2.00	24.50	14.00	3.00	30.75	33.00	4.50	8.00	16.06	¾" NPT	42 lb.
MS300D	038276	10	300	2.50	24.50	14.00	3.00	30.75	33.00	4.50	8.25	16.06	¾" NPT	42 lb.
MS350B	038277	40	350	3.00	28.37	23.00	5.00	39.00	41.25	4.50	9.75	19.87	1" NPT	82 lb.
MS500B	038075	40	500	3.00	28.37	23.00	5.00	37.37	54.50	6.63	9.75	19.87	1" NPT	95 lb.
MS600B	038003	40	600	4.00	27.87	23.00	5.00	37.37	54.50	6.63	9.25	19.87	1" NPT	96 lb.

*For optional installed level switch, contact factory for correct part number.

V1

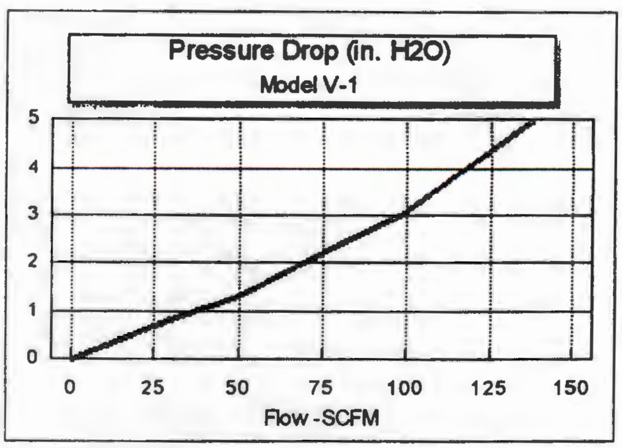
Vapor Phase Carbon Filter



The V1 is Prime carbon's work horse of the vapor phase family

It utilizes a false bottom style diffuser to eliminate channeling and decrease back pressure

The efficient design of this model makes it very economical for applications of moderate flow rates



★ Epoxy phenolic lined drum

★ 2" influent/effluent ports

★ Additional access port in cover

PRIME CARBON

10 Dunklee Road, Suite 36 Bow, New Hampshire 03304
(603) 224-4415
Fax: (603) 224-1004

Appendix B

APPENDIX B

HEALTH AND SAFETY PLAN

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1.0 INTRODUCTION

The following Heath and Safety Plan (HASP) describes personal protection standards and procedures to be followed during work conducted at the Crosman Corporation site located in East Bloomfield, New York (See Figure 1). This work will include but is not limited to; sampling of TCE-containing materials and installation of remedial systems. By providing this plan to all Terra Vac personnel involved in the activities mentioned above, the risk from health and safety hazards can be minimized.

The HASP establishes mandatory safety procedures and personal protection standards pursuant to the Occupational Safety and Health Administration (OSHA) regulations 29 Code of Federal Regulations (CFR) 1910.120. The HASP applies to all Terra Vac personnel conducting any site work, as defined in 29 CFR 1910.120(a). All personnel involved in the mentioned activities must familiarize themselves with this HASP, comply with its requirements and have completed the required health and safety training pursuant to 29 CFR 1910.120 OSHA regulations prior to beginning any work on site.

Site-specific information provided in the HASP may change or undergo revision based on additional information made available to health and safety personnel, monitoring results, or changes in the technical scope of work. Any proposed changes must be reviewed by the Terra Vac Health and Safety Officer (HASO) assigned to the project.

1.1 Site Description

The Crosman Corporation site is located on a 50-acre parcel in a rural area of the Town of East Bloomfield, New York (Figure 1). The site contains a 225,000 square foot (ft^2) manufacturing facility and office building, a 5,000 ft^2 wastewater pre-treatment building, parking areas, and a retention pond. The site is bordered primarily by agricultural and residential land, with another manufacturing facility located to the east-southeast.

1.2 Site Background

Trichloroethylene (TCE) was used as a degreasing agent at the plant from 1966 to 1995, and was stored in a above-ground storage tank (AST) on the east side of the facility until the mid 1980's. This tank was formerly located just outside the eastern wall of the manufacturing facility, and reportedly had a capacity of 175 gallons

(Source Area). Since removing the tank, TCE has been stored in 55-gallon drums inside the building. The former tank area had a gravel surface until the late 1970's, when the area was paved.

1.3 Site-Specific Chemicals

TCE is the compound of concern of this site. The air monitoring action levels will be based on the exposure limits TCE with a margin of safety built into the action levels, which have been set at 20 ppm total VOC's. This is justifiable, as this is the most hazardous volatile compound found in significant concentrations. Exposure limits for less hazardous compounds will be met by meeting the exposure limits for TCE. Table 1 outlines the associated properties and exposure limits of TCE.

Exposure to TCE will be minimized by preventing ingestion, by limiting dermal contact, and by limiting respiration through the air monitoring.

2.0 ORGANIZATION

The following Terra Vac personnel will be involved in operations at the Crosman Corporation site:

2.1 Principal-In-Charge - Jim Malot

Jim Malot will serve as the Principal-in-Charge for this full scale remediation prokect. He will control the overall direction of the project and will position the resources of the Project Team in an organizational structure capable of managing the project as an integrated entity. He is the President and Principal of Terra Vac with over 20 years of experience in the remediation industry.

2.2 Project Manager - Joleen Kealey

Ms. Joleen Kealey will serve as the Project Manager for the project. Currently the Operations Manager of Terra Vac's New England Division, Ms. Kealey will provide the day-to-day management of Terra Vac's efforts at the Crosman Corporation Site. She will also be the primary contact between Terra Vac and Blaslund, Bouck & Lee. She will be responsible for reporting, budgets, invoicing, and scheduling. Ms. Kealey has been managing remedial projects for Terra Vac for over three years.

2.3 Site Safety Officer

Joleen M. Kealey will serve as Site Safety Officer during this project and will be supported by Terra Vac's Health and Safety Coordinator, C. Pete Desrocher, as required. The activities for which she is directly responsible include the following:

- Implementation of the Health and Safety Program,
- All health and safety monitoring,
- Calibration and documentation of any health and safety equipment, and
- Hazard Communication Program

2.4 Team Members

All team members will be responsible for understanding and complying with the site health and safety requirements.

3.0 MEDICAL MONITORING AND PERSONNEL TRAINING REQUIREMENTS

3.1 Medical Surveillance

The Occupational Safety and Health Administration (OSHA) has established requirements for a medical surveillance program designed to monitor the health of and reduce health risks to employees potentially exposed to hazardous materials (29 CFR 1910.120). This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations and to determine his/her ability to wear personal protective equipment, such as chemical resistant clothing and respirators.

The medical examinations must be administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. For the purposes of this Health and Safety Plan, all subcontractors shall assume the employer's responsibility in obtaining the necessary medical monitoring and training for their employees pursuant to 29 CFR 1910.

All site personnel involved in activities with potential exposure to the hazards inherent at the Site will be required to participate in a medical monitoring program meeting specifications of 29 CFR 1910.120. Exhibit 3-1 provides a list of minimum medical monitoring requirements. The examining physician is required to make a report to the employer of any medical condition which would place such employees at increased risk of wearing a respirator or other personal protective equipment. Employers engaged in site work shall assume the responsibility of maintaining appropriate site personnel medical records as required by 29 CFR 1910.120.

Employees who wear or may wear respiratory protection must be provided respirators as required by 29 CFR 1910.134. The medical monitoring program must evaluate an individual's ability to wear respiratory protection while performing designated duties.

EXHIBIT 3-1

MEDICAL MONITORING REQUIREMENTS

The following components must be included in the medical monitoring program required for on-site personnel, unless otherwise noted:

A. Medical History and Physical, including:

- Medical history questionnaire
- Completion of medical history with occupational risk factor analysis
- Examination by physician
- Evaluation of test results
- Brief report sent to employer covering specific requested areas as well as pertinent positive findings; report sent to family physician and employee by request.

B. Pulmonary Function Testing (FEV1, FVC)

C. EKG (12-lead)

D. Lab tests, including:

- Complete blood count
- SMA 24 Multiphasic Blood Chemistry (including metals)
- Urinalysis

E. Chest X-ray (every 2 years or at the discretion of the attending physician)

F. Electrocardiogram (6 - 12 electrodes)

G. Vision Test

H. Hearing Test/Audiogram

3.2 Personnel Training

All site personnel who will be involved in any activities which have a potential for exposure to hazardous levels of volatile compounds or hazardous work areas will be required to participate in a Health and Safety Training Program that complies with the OSHA requirements of 29 CFR 1910.120.

Site-specific training prior to the start-up of any activity will be required for those individuals performing the activity. The training will address a review of the Health and Safety Plan, any potential hazards and associated risks, site operating procedures, and emergency response procedures.

All training requirements will comply with the OSHA requirements of 29 CFR 1910.120. Specialized training will be provided for activities such as boring, excavation and handling of unidentified substances. Employees involved in these types of activities will be given off-site instruction regarding the potential hazards involved with these activities and the appropriate health and safety procedures to be followed. Off-site instruction is meant to include any area where employees will not be exposed to site hazards. Daily site safety meetings will be held covering activities planned for that day.

These training requirements will apply to the Crosman Corporation site based on the application of 29 CFR 1910.120. Exhibit 3-2 lists the areas in which all applicable employees must have received training, at a minimum. All site personnel involved in the field activities will have received the required basic training discussed above.

This Health and Safety Plan shall be distributed to all subcontractors prior to the start of field activities. A pre-operation meeting will be held to discuss the contents of this Health and Safety Plan. Specialty training shall be provided as determined by task and responsibility. All such training of personnel will be conducted under direct supervision of the Site Safety Officer.

All employers contracted to work at the site will be responsible to ensure their employees have received the proper training and medical testing as required by 29 CFR 1910.120 and shall provide Terra Vac with proof of certification.

All subcontractors of Terra Vac will be required to adhere to this Health and Safety Plan. All subcontractors of Terra Vac, who are expected to be exposed to vapor concentrations greater than the threshold limit value/time weighted average (TLV/TWA), will be responsible for ensuring that employees have received the proper training and medical tests as required by OSHA (29 CFR 1910.120) and providing Terra Vac with the appropriate documentation. Work areas will be monitored with an Photo Ionization Detector (PID). If the action levels are exceeded, work activities will be terminated until the health hazard no longer exists.

EXHIBIT 3-2

PERSONNEL TRAINING REQUIREMENTS

All employees shall have, at a minimum, received training in the following areas as required by 29 CFR 1910.120:

1. Site Safety Officer (SSO) and Project Manager Responsibilities - personnel shall know and understand SSO and Project Manager responsibilities and authority.

2. Site-Specific Health and Safety Hazards - personnel shall be informed of specific hazards related to site and site operations, such as health hazards of site chemicals and specific safety hazards of process equipment.

3. Personal Protective Equipment (PPE) - personnel shall be trained in proper use of and care for appropriate levels of personal protective equipment.

4. Safe Work Practices/Engineering Controls - personnel shall be informed of appropriate work practices and engineering controls that will reduce the risk of exposure to site hazards.

5. Safety Equipment Use - personnel shall know and understand the use of monitoring instruments and other safety equipment.

6. Medical Surveillance Program - personnel shall be informed of requirements for medical surveillance of hazardous waste site employees.

7. Site Control Methods - personnel shall know and understand site methods used to reduce exposure to on-site and off-site personnel.

8. Decontamination Procedures - personnel shall be trained in proper decontamination operations and procedures to include decontamination of PPE, equipment and vehicles.

9. Emergency Response - personnel shall be trained in proper emergency response operations and procedures.

10. Confined Space Entry/Special Hazards - personnel involved in specific hazardous activities, such as confined space entry, drum handling, and electrical lock out shall be trained in appropriate techniques during such operations.

4.0 ON-SITE HAZARDS

4.1 Chemical Hazards

The primary chemical hazard on-site is expected to be the release of hazardous levels of TCE from soils as the result of soil disturbance activities. These activities include soil sampling, drilling, the installation of vacuum extraction wells, and related activities. In their pure form, TCE is a colorless liquid with an aromatic odor.

The soil contaminant is volatile, therefore, any activity at the site which causes physical disturbance of the soil can potentially allow the release of contaminant into the air. Such an occurrence may be recognized by noticeable chemical odors. Common symptoms of overexposure to this compound are dizziness, excitement, drowsiness, irritation to the eyes, nose and throat, vomiting, loss of coordination, fatigue, tremors, visual disturbances, and abdominal pains.

In addition, disturbance of the site soils may cause the particulate contaminant to become airbome as dust. Therefore, dust-creating activities should be minimized.

The Site Safety Officer will have available on-site, toxicity data (i.e., Material Safety Data Sheets contained in Appendix A) for hazardous materials identified on-site and all sealed containers of hazardous chemicals brought to the site by either Terra Vac or their subcontractors. Prior to the start of site activities covered by this plan, all site personnel will be briefed as to the nature of the chemical hazards present.

4.2 Physical Hazards

Hazards typically encountered at construction sites will be a concern at this site. These include slippery ground surfaces, uneven terrain, holes/trenches and operation of equipment. The basic safety apparel such as steel-toed shoes and safety glasses will be worn during all construction activities by all employees involved. A hard-hat will be worn when heavy equipment is in operation or overhead hazards exist.

Multi-purpose fire extinguishers, rated A; ordinary combustible, B; flammable liquids, C; electrical, will be readily accessible for use within 50-75 feet of a potential fire source.

4.2.1 Noise

The use of heavy machinery/equipment and operation of the soil vacuum extraction system may result in noise exposures which require hearing protection. Exposure to noise can result in the following:

- Temporary hearing losses where normal hearing returns after a rest period;
- Interference with speech communication and the perception of auditory signals;
- Interference with the performance of complicated tasks;
- Permanent hearing loss due to repeated exposure resulting in auditory nerve destruction.

During the above activities Terra Vac will utilize appropriate hearing protection in accordance with standard company operating procedures. Hearing protection (ear plugs or ear muffs) will be available to all site personnel and visitors who may enter area requiring hearing protection.

All areas identified as posing a potential noise hazard where hearing protection is required, will be clearly marked in accordance with Terra Vac's Hearing Conservation Program (see Appendix B).

4.2.2 Heat Stress/Cold Exposure

This project will be implemented during both fall and winter when heat stress or cold exposure are potential threats to the health and safety of site personnel. The Site Safety Officer under the direction of the Project Manager will determine the timing for work/rest regimens. These regimens will be employed as necessary so that personnel do not suffer adverse effects from heat stress or cold exposure. Special clothing and appropriate diet and fluid intake will also be recommended to further reduce the potential for these temperature-related hazards.

4.2.3 Heavy Machinery/Equipment

Any work involving a drill rig or other heavy equipment has hazards and risks associated with its use. Only trained personnel shall operate the equipment. While drilling or excavating, all observers shall remain at least fifteen (15) feet from the equipment. On the drill rig, a hammer and hook are suspended from a high boom. The hammer and hook often swing while drilling thus creating a hazard overhead. The drilling augers, weighing between 50 to 60 pounds, are connected in five (5) to six (6) foot sections and may pose hazards ranging from pinched fingers to broken toes.

All site employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory protection and protective eyewear must be worn frequently during site activities. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during the operation of equipment to avoid physical injury to themselves or others.

4.2.4 Construction Materials and Site Refuse

All construction materials and site refuse will be contained in appropriate areas or facilities. Site personnel will make certain that nails, lumber, cement, etc. are not scattered throughout the work area, and that all trash and scrap materials are immediately and properly disposed of.

Care should be exercised at all times to prevent accidents from improper and unsafe storage and handling of materials such as well construction materials, piping, and other materials.

4.2.5 Utilities

Abandoned underground utilities maybe located throughout the site. Areas where underground utilities may be encountered will be visibly identified with warning tape, markers or barriers. Site activities will be conducted so that underground piping or wiring systems are not disturbed.

Overhead utilities such as electrical wires and piping may also be present at the site. Site personnel must ensure that equipment and machinery are kept clear of all overhead utilities throughout the site operations.

4.3 Environmental Hazards

Environmental hazards, such as exposure to heat, wind, rain and lightning, may exist at the site. When weather conditions change, the Project Manager and the Site Safety Officer will be responsible for determining if work procedures can be performed safely.

5.0 ENVIRONMENTAL SAMPLING

Environmental sampling may involve one or more of the following media: soils and vapors. In each type of sampling, there is a potential of encountering hazardous materials. Basic hazards of each type of sampling are discussed below:

1. Soil Sampling -This type of environmental sampling involves the excavation of surface soils. As a result, there is a possibility of exposure to hazardous materials by skin contact and inhalation of dust.

2. Vapor Sampling- Exposure is most likely to occur through inhalation. These vapors could present a hazard if in high enough concentrations.

In order to have authorized entry into the controlled portion of the site all personnel should satisfy the following requirements:

1. Examination by a licensed physician within the previous twelve months, having been determined to be capable of performing the work, and have been cleared to wear an air purifying respirator.

2. All required training outlined in 29 CFR 1910.120 (OSHA regulations for hazardous waste site workers) have been satisfied.

3. The details of this Health and Safety Plan have been reviewed, understood and signed-off by the individual.

5.1 Control Zones

Control boundaries will be established within the areas of site activities. Examples of boundary zones include: the exclusion zone, decontamination zone, and support zone. All boundaries will be dynamic, and will be determined by the planned activities for the day. The Site Safety Officer will be responsible for personnel passing through these zones and for the proper decontamination of equipment and personnel.

5.2 Exclusion Zone

The controlled portion of the site will be delineated to identify the exclusion zone, wherein a higher level of personal protective equipment may be required for entry during intrusive activities. This exclusion zone will be established during intrusive activities such as well probes and soil sampling. The limits of the exclusion zone will be designated at each location appropriately. A decontamination zone will be located immediately outside the access opening to the exclusion zone. All personnel leaving the exclusion zone will be required to adhere to proper decontamination procedures.

All personnel entering the exclusion zone will be required to wear the level of protection (D or C) which has been selected by the Project Manager, in consultation with either the Corporate Health and Safety Officer or the Site Safety Officer.

No smoking, eating, or drinking will be allowed within the exclusion zone.

5.3 Support Zone

Operation of the pilot system, certain phases of system installation and non-intrusive work, will be performed in an area designated as the Support Zone. The Support Area will be a zone containing the system equipment and other equipment that poses a hazard to personnel. Access will be limited to only authorized personnel. Safety shoes will be required, at a minimum, in the support zone. No air monitoring is anticipated in this area. Due to normal, mechanical and electrical hazards, however, access will be controlled to limit any potential dangers to personnel.

5.4 Decontamination Zone

The decontamination zone will be located immediately outside the access of the exclusion zone on its apparent upwind side, if feasible, and will be delineated with caution tape and traffic cones. This zone will contain the necessary decontamination materials for personnel decontamination. Decontamination procedures are outlined in section 8.0 of this plan.

6.0 SITE MONITORING/ACTION LEVELS

6.1 Site Monitoring

Field activities associated with the soil excavation and installation of the Soil Vacuum Extraction system may create potentially hazardous conditions from the release of site contaminants into the breathing space. These substances may be in the form of mists, vapors, dusts, or fumes that can enter the body through ingestion, inhalation, absorption, and direct contact. Monitoring for VOCs will be performed to ensure appropriate personal protective measures are employed during site activities. Action levels established for the VOCs of concern are expected to provided the necessary level of safety.

The following describes the conditions to be monitored for during the remediation activities. Recommended instrumentation to be used is also provided in the discussion. All instruments to be used during site activities will meet the established requirements set forth by OSHA, MSHA, NIOSH, and state agencies where applicable. Action levels based on monitoring results are discussed in the following section.

Organic Vapor Concentrations - will be monitored continuously in the work area with an organic vapor analyzer any time the potential for exposure exists. Organic vapor concentrations will be used as the criteria for upgrading or downgrading protective equipment and for implementing additional precautions or procedures.

Draeger indicator tubes, gas chromatography, or other methods will be utilized to determine the presence of TCE in the worker breathing zone. The presence of TCE will require implementation of action levels appropriate for this chemical.

All site monitoring will be conducted by or under the supervision of the Site Safety Officer. All readings obtained will be recorded in a site logbook. The Site Safety Officer will maintain all monitoring instruments to ensure their reliability and proper operation.

Field activities associated with the installation and/or operation of the vacuum extraction process may create hazardous conditions, such as the release of hazardous substances, especially during well installation. Monitoring of these substances will be performed to ensure appropriate personal protective measures are employed during site activities.

Monitoring with an Organic Vapor Monitor (OVM) will be conducted in the work zone and breathing zone when necessary.

Total atmospheric vapor/gas concentrations will be monitored with the OVM to determine appropriate action levels necessary to protect the health and safety of workers. During this sampling survey, it is likely that the instrument readings will reflect a mixture of contaminants. The organic vapor analyzer readings will be recorded for each activity in the daily log.

6.2 Action Levels

During the course of any activity, as long as OVM readings less than 20 ppm above background are encountered in the breathing zone of the exclusion area, Level D protection shall be adequate. Level C protection will be worn when sustained VOC concentrations in ambient air exceed 20 ppm total VOCs above background and remain below 200 ppm total VOCs.

If concentrations in the work zone exceed 200 ppm for a period of 5 minutes or longer, work will immediately be terminated by the Project Manager or Site Safety Officer. The Project Manager or Site Safety Officer may then order Level B protection, or lower the airborne levels through natural attenuation or engineering controls. Engineering controls to limit breathing zone airborne VOC concentrations will take precedence over the continuous wearing of breathing protection for workers. If Level B protection is not used, work may resume once monitoring concentrations have decreased below 200 ppm.

If concentrations in the work zone exceed 2000 ppm for a period of 5 minutes or longer, work will immediately be terminated by the Project Manager. Engineering controls to limit breathing zone airborne VOC concentrations will be initiated as required to reduce the airborne levels. Work may resume once monitoring concentrations have decreased below 2000 ppm.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Based on an evaluation of the hazards at the site, personal protective equipment (PPE) will be required for all personnel and visitors entering the controlled portion of the site.

7.1 Protective Clothing/Respiratory Protection:

Protective equipment for each level of protection is as follows:

Level B

- Pressure-demand full-facepiece Self-Contained Breathing Apparatus (SCBA) or pressure-demand supplied-air respirator with escape SCBA
- Disposable chemical resistant one-piece suit.
- Inner and outer chemical resistant gloves.
- Hard hat.
- Safety boots or shoes with chemical resistant overboot.

Level C

- Full or half face, air purifying, carbon-canister equipped respirator.
- Safety glasses with side shields.
- Disposable chemical resistant one-piece suit.
- Inner and outer chemical resistant gloves.
- Hard hat.
- Safety boots or shoes with chemical resistant overboot.

Level D

- Disposable chemical resistant one-piece suit (optional).
- Hard hat (with overhead hazard or heavy equipment)
- Safety glasses.
- Safety boots or shoes with chemical resistant overboot.
- Protective cotton or leather gloves.
- Dust mask (optional)

General guidelines for determining the level needed as determined by the OVA readings, which must be considered in accordance with other site conditions, are as follows:

Level B: Total vapor readings register between 200 and 2000 ppm above background on the OVM.

Level C: Total vapor readings register between 20 and 200 ppm above background on the OVM.

Level D: Total vapor readings register between background and 20 ppm above background on the OVM.

The following levels of PPE are anticipated for the following activities:

1.	System Operation	D
2.	Secured Zone Area Access	D

8.0 DECONTAMINATION

Personnel involved with the site activity may come in contact with the chemical compound in a nuber of ways, despite the most stringent protective procedures. Site personnel may be exposed to vapors, gases, mists, or particulate in the air, or may come in contact with Site soils while performing work duties. Personnel use of monitoring instruments and equipment can also result in exposure to hazardous substances.

A Decontamination Zone will be established adjacent to the exclusion zone. All personnel and equipment will be required to pass through this zone and perform appropriate decontamination prior to entering the support zone and public areas.

8.1 Personnel Decontamination

Upon leaving the exclusion zone, all personnel must undergo appropriate decontamination. The decontamination requirements will depend on the level of protection used within the exclusion zone and the degree of contamination.

The decontamination area will contain a tub of wash water, a tub of rinse water, a plastic-lined drum for disposal of expendable clothing and a first aid kit.

For complete decontamination, all personnel will observe the following procedures upon leaving the exclusion zone:

1. Wash outer boots and outer gloves in tub of decon solution which shall consist of detergent in water.

2. Rinse outer boots and outer gloves in tub of rinse water.

3. Remove outer boots and outer gloves and place in disposal drum.

4. If using a respirator, remove respirator, dispose of cartridge if necessary, and place respirator in plastic bag.

5. Remove disposable chemical resistant suit and dispose of in drum.

6. Remove and dispose of inner gloves.

Decontamination solutions shall be supplied at the decontamination zone. The wash solution will consist of water and detergent such as Alconox or sodium phosphate, and the rinse solution will consist of clean water.

Contaminated wash solutions shall be collected in drums for disposal. All other disposable health and safety equipment will be decontaminated and disposed of as non-hazardous waste.

8.2 Equipment Decontamination

The equipment decontamination area will be staged in an area to be determined. It will consist of a portable steam generator, long-handled scrub brushes, detergent solution, water, a plastic lined disposal barrel and plastic sheeting.

All equipment will be cleaned of any visible excess material prior to leaving the exclusion zone, if applicable. Soiled equipment will be washed with brushes, detergent solution, rinse water and pressurized steam as deemed necessary. All material collected on the plastic sheeting will be drummed and labeled pending disposal requirements.

9.0 EMERGENCY PROCEDURES

The Site Safety Officer will coordinate emergency procedures and will be responsible for initiating emergency response activities. Emergency communications at the site will be conducted by means of an air horn. All personnel will be informed of the location of the horn. Terra Vac's Project Manager or Site Safety Officer will alert all field personnel and evacuate the area, if necessary.

Three blasts on the air horn will be used to signal distress. All site personnel will respond to a distress signal by proceeding to the desiganated evacuation zones. The Site Safety Officer will assess the emergency situation, contact apropriate on-site and off-site personnel and initiate evacuation procedures if necessary. Additionally, emergency phone numbers and the most direct hospital route will be posted at designated locations at the site. Emergency contacts and hospital route maps are provided in Appendix B of this Health and Safety Plan.

TABLE 1

VOLATILE CONTAMINANTS OF CONCERN

Compound	Route of Exposure	Symptoms	PEL/ TWA*	Monitoring Instruments	Odor Threshold	Physical Characteristics	Target Organs
Trichloroethylene	Inhalation, Ingestion, Contact	(1) (2) (3) (4)	25 ppm	Organic Vapor Analyzer	21.4 - 400 ppm	Colorless liquid, Sweet chloroform - like	Resp. sys., Heart, CNS Liver, Skin, Kidneys

TABLE 1 - DEFINITIONS

(1) Eye, nose, throat, depression, skin irritation or burns
(2) Headache, fatigue, nausea
(3) Lightheaded, some nausea, dull visual and audio response
(4) Potential or known carcinogen
PEL - Permissible Exposure Limits (OSHA)
*TWA - Time Weighted Average

TABLE 2

DIRECTORY OF EMERGENCY INFORMATION

You are located at:

Crosman Corporation
Access Drive
East Bloomfield, New York

In the event of an emergency dial	911
Ambulance	911
Fire Department	911
Police Department	911
F.F. Thompson Hospital (Canandaigua)	(716) 396-6000
Poison Control Center (University of Rochester Medical Center)	(716) 275-5151 (800) 333-0542
Terra Vac New England Office	(508) 688-5280

FIGURE 2

DIRECTIONS TO HOSPITAL

Follow New York State Routes 5/20 east,
As you approach Canandaigua look for signs for the city "BYPASS."
take a right onto the city "BYPASS".
Take a left onto Parrish Street.
The hospital will be on your left.

Hospital Address:

F. F. Thompson Hospital
Parrish Street
Canandaigua, New York
716-396-6000

APPENDIX A

MATERIAL SAFETY DATA SHEETS

chemists helping chemists in research & industry

aldrich chemical co., inc.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA

Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem M
Telex: 26 843 Aldrich MI
FAX: (414) 273-4979

ATTN: SAFETY DIRECTOR
DENNIS GUISTRA
TERRA VAC CORPORATION
57 EAST MAIN STREET
SUITE 205
WEST BOROUGH MA 01581

DATE: 12/29/92
CUST#: 451045
PO#:

MATERIAL SAFETY DATA SHEET

---- IDENTIFICATION ----

PRODUCT #: 37214-5
CAS #:79-01-6
MF: C2HCL3

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

IONYMS
ACETYLENE TRICHLORIDE * ALGYLEN * ANAMENTH * BENZINOL * BLACOSOLV * BLANCOSOLV * CECOLENE * CHLORILEN * 1-CHLORO-2,2-DICHLOROETHYLENE * CHLORYLEA * CHLORYLEN * CHORYLEN * CIRCOSOLV * CRAWHASPOL * DENSINFLUAT * 1,1-DICHLORO-2-CHLOROETHYLENE * DOW-TRI * DUKERON * ETHINYL TRICHLORIDE * ETHYLENE TRICHLORIDE * FLECK-FLIP * FLOCK FLIP * FLUATE * GEMALGENE * GERMALGENE * LANADIN * LETHURIN * NARCOGEN * NARKOGEN * NARKOSOID * NCI-C04546 * NIALK * PERM-A-CHLOR * PERM-A-CLOR * PETZINOL * PHILEX * RCRA WASTE NUMBER U228 * TCE * THRETHYLEN * THRETHYLENE * TRETHYLENE * TRI * TRIAD * TRIAL * TRIASOL * TRICHLOORETHEEN (DUTCH) * TRICHLOORETHYLEEN, TRI (DUTCH) * TRICHLORAETHEN (GERMAN) * TRICHLORAETHYLEN, TRI (GERMAN) * TRICHLORAN * TRICHLOREN * TRICHLORETHENE (FRENCH) * TRICHLORETHYLENE * TRICHLORETHYLENE, TRI (FRENCH) * TRICHLOROETHENE * TRICHLOROETHYLENE * 1,1,2-TRICHLOROETHYLENE * 1,2,2-TRICHLOROETHYLENE * TRICHLOROETHYLENE (ACGIH,DOT,OSHA) * TRI-CLENE * TRICLORETENE (ITALIAN) * TRICLOROETILENE (ITALIAN) * TRIELENE * TRIELIN * TRIELINA (ITALIAN) * TRIELINE * TRIKLONE * TRILEN * TRILENE * TRILINE * TRIMAR * TRIOL * TRI-PLUS * TRI-PLUS M * UN 1710 (DOT) * VESTROL * VITRAN * WESTROSOL *

---- TOXICITY HAZARDS ----

ECS #: KX4550000
ETHYLENE, TRICHLORO-

RITATION DATA

SKN-RBT 2 MG/24H SEV	85JCAE -,106,86
EYE-RBT 20 MG/24H MOD	85JCAE -,106,86

XICITY DATA

ORL-HMN LDLO:7 GM/KG	ARTODN 35,295,76
IHL-MAN LCLO:2900 PPM	NZMJAX 50,119,51
IPR-RAT LD50:1282 MG/KG	ENVRAL 40,411,86
ORL-MUS LD50:2402 MG/KG	NTIS** AD-A080-636
IHL-MUS LC50:8450 PPM/4H	APTOA6 9,303,53
SCU-MUS LD50:16 GM/KG	JPETAB 123,224,58
IVN-MUS LD50:33900 UG/KG	CBCCT* 6,141,54
IPR-DOG LD50:1900 MG/KG	TXAPA9 10,119,67
SKN-RBT LD50:>20 GM/KG	NTIS** AD-A062-138

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CUST#: 451045

PRODUCT #:

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

MF: C2HCL3

---- TOXICITY HAZARDS ----

IEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 50 PPM; STEL 200 PPM 85INA8 5,595,86
IARC CANCER REVIEW:ANIMAL LIMITED EVIDENCE IMEMDT 20,545,79
IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE IMEMDT 20,545,79
IARC CANCER REVIEW:GROUP 3 IMSUDL 7,364,87
MSHA STANDARD-AIR:TWA 100 PPM (535 MG/M3) DTLVS* 3,263,71
OSHA PEL:8H TWA 100 PPM;CL 200;PK 300/5M/2H FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 50 PPM (270 MG/M3);STEL 200 PPM (1080 MG/M3) FEREAC 54,2923,89
NIOSH REL TO TRICHLOROETHYLENE-AIR:10H CA TWA 25 PPM;CL 2 PPM/1H NIOSH* DHHS #92-100,92
NIOSH REL TO WASTE ANESTHETIC GASES AND VAPORS-AIR:CL 2 PPM/1H MMWR** 37(S-7),28,88
NOHS 1974: HZD 73790; NIS 251; TNF 37699; NOS 141; TNE 446588
NOES 1983: HZD 73790; NIS 192; TNF 23225; NOS 143; TNE 401373; TFE 175316
ATSDR TOXICOLOGY PROFILE (NTIS** PB/90/127523/AS)
EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-RLV F344 RAT EMBRYO; HOST-MEDIATED ASSAY
EPA GENETOX PROGRAM 1988, POSITIVE: MOUSE SPOT TEST; SPERM MORPHOLOGY-MOUSE
EPA GENETOX PROGRAM 1988, POSITIVE: S CEREVISIAE GENE CONVERSION; S CEREVISIAE-HOMOZYGOSIS
EPA GENETOX PROGRAM 1988, POSITIVE: S CEREVISIAE-REVERSION
EPA GENETOX PROGRAM 1988, POSITIVE/LIMITED: CARCINOGENICITY-MOUSE/RAT
EPA GENETOX PROGRAM 1988, NEGATIVE: D MELANOGASTER SEX-LINKED LETHAL
EPA GENETOX PROGRAM 1988, INCONCLUSIVE: HISTIDINE REVERSION-AMES TEST
EPA TSCA CHEMICAL INVENTORY, JUNE 1990
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0680-0345;8EHQ-0982-0457; 8EHQ-0979-0310
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0578-0146
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JULY 1992
NIOSH CURRENT INTELLIGENCE BULLETIN 2, 1975
NIOSH ANALYTICAL METHODS: SEE TRICHLOROETHYLENE, 1022; TRICHLOROETHYLENE BY PORTABLE GC, 3701
NCI CARCINOGENESIS BIOASSAY (GAVAGE):CLEAR EVIDENCE:MOUSE NCITR* NCI-TR-2,76
NTP CARCINOGENESIS STUDIES (GAVAGE):CLEAR EVIDENCE:MOUSE NTPTR* NTP-TR-243,83

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MF: C2HCL3

---- TOXICITY HAZARDS ----

NCI CARCINOGENESIS BIOASSAY (GAVAGE);NO EVIDENCE:RAT NCITR* NCI-TR-2, 76
NTP CARCINOGENESIS STUDIES (GAVAGE);INADEQUATE STUDY:RAT NTPTR* NTP-TR-273,88
NTP CARCINOGENESIS STUDIES (FEED);INADEQUATE STUDIES:RAT NTPTR* NTP-TR-243,83

:GET ORGAN DATA
SENSE ORGANS AND SPECIAL SENSES (OTHER EYE EFFECTS)
BEHAVIORAL (SOMNOLENCE)
BEHAVIORAL (HALLUCINATIONS, DISTORTED PERCEPTIONS)
VASCULAR (TUMORS)
LUNGS, THORAX OR RESPIRATION (TUMORS)
GASTROINTESTINAL (OTHER CHANGES)
LIVER (JAUNDICE, OTHER OR UNCLASSIFIED)
LIVER (LIVER FUNCTION TESTS IMPAIRED)
LIVER (TUMORS)
BLOOD (LYMPHOMA INCLUDING HODGKIN'S DISEASE)
SKIN AND APPENDAGES (TUMORS)
PATERNAL EFFECTS (SPERMATOGENESIS)
EFFECTS ON FERTILITY (POST-IMPLANTATION MORTALITY)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (CENTRAL NERVOUS SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (UROGENITAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (OTHER DEVELOPMENTAL ABNORMALITIES)
TUMORIGENIC (CARCINOGENIC BY RTECS CRITERIA)
TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)
ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---- HEALTH HAZARD DATA ----

JTE EFFECTS
HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
CAUSES SEVERE IRRITATION.
HIGH CONCENTRATIONS ARE EXTREMELY DESTRUCTIVE TO TISSUES OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING,

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MATERIAL SAFETY DATA SHEET

CUST#: 451045

PRODUCT #:

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

MF: C2HCL3

---- HEALTH HAZARD DATA ----

WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.
EXPOSURE TO AND/OR CONSUMPTION OF ALCOHOL
MAY INCREASE TOXIC EFFECTS.
EXPOSURE CAN CAUSE:
GASTROINTESTINAL DISTURBANCES
DAMAGE TO THE KIDNEYS
NAUSEA, DIZZINESS AND HEADACHE
NARCOTIC EFFECT
PROLONGED CONTACT CAN CAUSE:
DERMATITIS.

ONIC EFFECTS
CARCINOGEN.
MAY ALTER GENETIC MATERIAL.
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
LIVER, KIDNEYS
HEART
LUNGS

ST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN IMMEDIATELY.
DISCARD CONTAMINATED CLOTHING AND SHOES.

---- PHYSICAL DATA ----

BOILING POINT: 87 C
MELTING POINT: -87 C TO C
SPECIFIC GRAVITY: 1.462

EARANCE AND ODOR
COLORLESS LIQUID

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MATERIAL SAFETY DATA SHEET

CUST#: 451045

PRODUCT #:

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

MF: C2HCL3

- - - - FIRE AND EXPLOSION HAZARD DATA - - - -

FLASHPOINT NONE

INGUISHING MEDIA
NONCOMBUSTIBLE.
USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.

CIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

SUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

- - - - REACTIVITY DATA - - - -

OMPATIBILITIES
OXIDIZING AGENTS
REDUCING AGENTS
STRONG BASES
ALUMINUM
MAGNESIUM
SENSITIVE TO LIGHT

ARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
HYDROGEN CHLORIDE GAS
PHOSGENE GAS

- - - - SPILL OR LEAK PROCEDURES - - - -

PS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

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CUST#: 451045

PRODUCT #:

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

MF: C2HCL3

---- SPILL OR LEAK PROCEDURES ----

;TE DISPOSAL METHOD
DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

---- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ----

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE VAPOR.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
SEVERE IRRITANT.
HARMFUL VAPOR.
CARCINOGEN.
MUTAGEN.
KEEP TIGHTLY CLOSED.
PROTECT FROM LIGHT.
STORE IN A COOL DRY PLACE.

IEL PRECAUTIONARY STATEMENTS
TOXIC
MAY CAUSE CANCER.
MAY CAUSE HERITABLE GENETIC DAMAGE.
HARMFUL BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.
CAUSES SEVERE IRRITATION.
TARGET ORGAN(S):
CENTRAL NERVOUS SYSTEM
LIVER, KIDNEYS
HEART
LUNGS
PROTECT FROM LIGHT.
IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE (SHOW THE LABEL WHERE POSSIBLE).
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

;ULATORY INFORMATION

CONTINUED ON NEXT PAGE

MATERIAL SAFETY DATA SHEET

CUST#: 451045

PRODUCT #:

NAME: TRICHLOROETHYLENE, ANHYDROUS, 99+%

MF: C2HCL3

---- PRECAUTIONS TC BE TAKEN IN HANDLING AND STORAGE ----

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS.

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FORM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

APPENDIX B

TERRA VAC'S HEARING CONSERVATION PROGRAM

TERRA VAC HEALTH AND SAFETY PROCEDURE 7.0

HEARING CONSERVATION POLICY

1.0 INTRODUCTION

The Hearing Conservation program has been established to monitor, protect and inform Terra Vac personnel of the potential hazards associated with the overexposure to noise both at work and at home. The policies outlined meet the requirements of 29 CFR 1910.95.

2.0 DEFINITIONS

Sound: Produced when a sound source sets the air nearest to it in motion. Sound travels in air at a speed of 340 meters per second.

Frequency(Hz): Refers to the number of vibrations per second, measured in units of hertz (Hz).

Decibel (dB): The measurement of sound levels. Terra Vac's instrumentation measures the "A weighted sound level" in units referred to as dB(A)

Standard Threshold Shift (STS): The average shift or change in either ear of 10 dB or more at 2000, 3000 or 4000 Hz.

3.0 GENERAL POLICY

Terra Vac will provide hearing protection, at no cost, to employees who:

A. Are required to work in areas containing sound levels of 85 - 90 decibels or higher as determined by sound level monitoring (dB A).

B. Work in or around operating vacuum extraction and Catox units.

C. Request the use of hearing protection.

Each employee is ultimately responsible to have available and wear the hearing protection provided to them in all operating units, posted areas and when instructed by the Health and Safety coordinator or their supervisor. Essentially, employees should have access to hearing protection at all times while working on a job site.

Supervisors must identify and post areas where hearing protection is required based on the results of sound level monitoring. In addition, supervisors must document that all personnel, including subcontractors, have been informed of the specific areas which require hearing protection and ensure that personnel have access to hearing protection. The Health and Safety Coordinator should be informed of problem areas and/or consulted for additional information.

4.0 AUDIOMETRIC TESTING

All employees with the potential to be exposed to 85 - 90 decibels or greater during a normal eight-hour Time Weighted Average (TWA) will receive an initial audiogram to establish baseline reference and then annually, thereafter, in order to identify changes in hearing ability.

If it is determined by a physician that an employee has lost hearing ability (that is, if a Standard Threshold Shift has occurred) upon comparing the baseline results to the annual test, Terra Vac will:

A. Inform employee within 21 days of receiving the test results,

B. Fit or refit employee with hearing protection,

C. Retrain employee in the proper use and care of hearing protection, and

D. Supervise employee to make certain that the hearing protection is being worn in designated areas.

6.0 SOUND LEVEL MONITORING

Whenever the possibility exists of an employee being exposed to potentially loud or hazardous noises, supervisors must either assume that the area/task is a hazard and require hearing protection or measure sound levels with instrumentation. If a sound level indicator is used, it must be calibrated both before and after use, and all information must be noted in the project log.

TERRA VAC COMPANY HEALTH AND SAFETY MANUAL	
Section: B	Page No: HC-4
Subject: 7.0 Hearing Conservation Plan	Date: 6/12/92
	Supersedes and Replaces:
Approved: AHA	Page No: HC-3
	Dated: 09/14/90

7.0 PERMISSIBLE NOISE EXPOSURES

29 CFR 1910,950 section (a)(2) outlines the following permissible noise exposure limits based upon an eight-hour work day:

DURATION PER DAY, HOURS	SOUND LEVEL dB A SLOW RESPONSE
8	85-90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5	110
.25 (or less)	115

Note: When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect, rather than the individual effect should be considered.

6.0 HEARING PROTECTION

Hearing protection must be worn by all personnel exposed to 85 - 90 dB or greater during an eight-hour Time Weighted Average (TWA) and by employees who have incurred standard threshold shifts since their susceptibility to noise has been demonstrated.

There are three main types of hearing protection available to employees:

A. Disposable Plugs: Disposable plugs are placed inside the ear canal to block out noise. They are commonly made of expandable foam. One size fits almost everyone and are designed to be used once and then thrown away.

B. Reusable Plugs: Reusable plugs are preformed to fit the ear. They are usually made of flexible rubber or silicon. They may be flanged or cone shaped. The plugs must be cleaned after each use following the manufacturers instructions.

C. Muffs: Earmuffs resemble stereo headphones. The soft plastic cushions are filled with either a foam or a liquid. The fit should be checked carefully to insure a tight fit around the outside of the ear.

8.0 TRAINING

Employees with the potential to be exposed to a TWA of 85 - 90 dB and above will be trained regarding hearing conservation upon initial employment and again annually. The effects of noise, the types of hearing protection, selection, fit and care of protectors, the purpose and procedures of audiometric testing and Terra Vac's Hearing Conservation Policy will be discussed.