Kennedy/Jenks Consultants

32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435

Final Soil Vapor Extraction System Interim Action Plan, Former Frank Wear Cleaners Site, Yakima, Washington

13 March 2012

Prepared for

Washington State Department of Ecology
Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, Washington 98902

K/J Project No. 1196016.00

Table of Contents

Table of Contents (cont'd)

List of Tables

List of Figures

List of Appendices

Section 1: Introduction

Kennedy/Jenks Consultants (Kennedy/Jenks) has prepared this Interim Action Plan (Plan) describing the installation, operation, and monitoring of a soil vapor extraction (SVE) system at the former Frank Wear Cleaners site (site) located at 106 South Third Avenue in Yakima, Washington (Figure 1). The Interim Action is being performed in general accordance with Model Toxic Control Act (MTCA) requirements specified in the Washington Administrative Code (WAC) 173-340-430. The intent of the Interim Action is to mitigate vapor intrusion to Site buildings and to remove volatile organic compound (VOC) mass from the subsurface. The Interim Action is being performed consistent with the selected cleanup action for the site that includes bioremediation of chlorinated hydrocarbons within the saturated zone through groundwater recirculation system of a carbon substrate [Alternative 2B as stated in the Feasibility Study (Hart Crowser, 2007)]. This Interim Action (i.e., removal of VOCs from the vadose zone) will augment Alternative 2B and enhance the remediation timeframe.

This Interim Action Plan (Plan) is prepared in conjunction with the engineering plans and specifications that will serve as the basis for contractor procurement. This Interim Action Plan includes a description of the following:

- Pertinent site background information.
- SVE system implementation objectives.
- SVE system installation, operation, and maintenance.
- SVE system monitoring, including system operational parameter measurements and sampling and chemical analyses.
- Waste management handling and disposal.
- Project reporting.

In conjunction with the engineering design documents, a *New Source Review Application* (air discharge permit application) including air dispersion modeling, was prepared to satisfy requirements associated with the Yakima Regional Clean Air Agency (YRCAA). A copy of the air discharge permit application is presented in Appendix A.

Section 2: Site Background

This section presents a brief summary of site background and environmental conditions pertinent to the development of this Plan. For additional Site information, please refer to the *Feasibility Study Report* (Hart Crowser 2007) and Ecology's *Vapor Intrusion Study Scope of Work – Frank Wear Site (SOW)* (Ecology 2011a).

2.1 Environmental Conditions

The site was historically used as a dry cleaner from the early 1940s to 2000. During many of those years, the dry cleaners used tetrachloroethene (PCE) as the dry cleaning solvent. As a result of the dry cleaning operations, PCE has been detected in soil and groundwater at and adjacent to the site. PCE was also detected in soil vapor samples during a Soil Vapor Survey conducted in 1995 (AGRA Earth and Environmental 1995). A building is located adjacent to the site that is currently operated as a childcare center (Buckle My Shoe Early Learning Center). The location of the former Frank Wear Cleaners building and childcare center is shown on Figure 1.

Starting in approximately 1995, several groundwater monitoring wells were installed and sampled to assess site conditions. In April 2007, 14 groundwater monitoring wells associated with the site were monitored and sampled. Groundwater flow direction was reported to be towards the south and southeast, and the highest PCE concentrations were detected in wells MW-10 [9,200 micrograms per liter (µg/L)] and SPW-12 (2,200 µ/L). These two wells are located northwest (hydraulically upgradient) of the existing childcare center building. Historically, maximum PCE concentrations at the site were reported in well MW-10, ranging from 6,900 µg/L to 43,500 µg/L, with increasing concentrations between 2005 and 2007. PCE was also detected in well SPW-15, ranging from 327 µg/L to 3,190 µg/L, during the same time period.

In June 2011, shallow-zone and deep-zone groundwater wells associated with the nearby regional Yakima railroad area (YRRA) investigation were sampled. A total of 15 deep-screened wells and 44 shallow-screened wells were monitored. Groundwater flow direction in the region was reported to be towards the southeast. Historical concentrations of chlorinated solvents, such as PCE, trichloroethylene (TCE), 1,1-dichloroethene, cis- and trans-1,2-dichloroethene, and vinyl chloride were presented in the memorandum prepared by Kane Environmental in July 2011 (Kane 2011).

Soils that were sampled either through previous site characterization or post-excavation confirmation sampling have shown that there are presently no areas on the site where concentrations exceed the established cleanup levels (Hart Crowser 2007). However, based on the consistently high concentrations of PCE detected in groundwater wells MW-10 and SPW-12, residual PCE mass appears to remain in the vadose zone or groundwater fluctuation zone.

Interim remedial actions completed at the site have included soil excavation from the former heating oil underground storage tank (UST) area, demolition of the dry cleaner building with excavation of underlying impacted soils, and operation of an ozone sparging system.

2.2 Vapor Investigation Study (2011)

Existing data from the site indicate soil and groundwater have been impacted by PCE from the dry cleaning operations at the site. The PCE-impacted groundwater appears to extend below the adjacent childcare center, providing the potential for vapor intrusion at this building into the childcare facility and downgradient properties.

In September and October 2011, Kennedy/Jenks Consultants performed a vapor intrusion study to evaluate whether vapor intrusion is occurring at the childcare center. In September 2011, the vapor intrusion study consisted of the collection of four 24-hour indoor air samples from within the childcare center, two 24-hour ambient air samples from outside and upwind of the building, and three subslab soil vapor samples from beneath the concrete slab. The September 2011 indoor air samples were collected under expected worse case conditions [i.e., windows and doors shut, heating, ventilation and air conditioning (HVAC) system turned off, etc.]. Ambient, indoor air, and subslab vapor samples were analyzed for VOCs using U.S. Environmental Protection Agency (EPA) Method TO-15 with selected compounds analyzed in selective ion monitoring (SIM) mode.

A second round of indoor air samples were collected in October 2011. In October 2011, 12-hour ambient indoor air samples were collected under normal building operating conditions (i.e., building is ventilated with ceiling fans, HVAC system is running, etc.).

Results of the vapor intrusion study are as follows:

- For the September 2011 sampling event, PCE was detected in indoor air vapor samples ranging from 5.7 to 6.6 micrograms per cubic meter ($\mu g/m^3$), above the Model Toxics Control Act (MTCA) Method B cleanup level of 0.42 $\mu g/m^3$. PCE concentrations in October 2011 indoor air samples were similar to those measured during the first sampling event. PCE was not detected in ambient air samples.

- PCE was detected in subslab vapor samples at concentrations ranging from 3,600 to 50,000 $\mu g/m^3$, above the MTCA Method B cleanup level of 4.2 $\mu g/m^3$.

For additional details regarding the September/October 2011 vapor intrusion study, please refer to the *Vapor Intrusion Study Report* (Kennedy/Jenks 2011b).

Section 3: Interim Action Objectives

In accordance with Ecology guidance (*Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State*, Ecology 2009), when indoor air and subslab vapor concentrations are greater than 10 times the screening level, vapor mitigation is warranted. As stated in Section 4.4 of the *Vapor Intrusion Report* (Kennedy/Jenks Consultants 2011b), Kennedy/Jenks recommended the installation of a SVE system that would serve two purposes: (1) mitigate the potential for chlorinated VOCs vapors to migrate into the childcare center; and (2) remove chlorinated VOC mass in the vadose and groundwater fluctuation zone.

Source control and treatment alternatives were evaluated in the FS (Hart Crowser 2007) that included the following:

- Alternative 3A - Excavation, removal, and disposal of impacted soils, while maintaining a buffer zone adjacent to the childcare facility to prevent undermining of its foundation.

- Alternative 3B - In situ treatment through delivery of a chemical oxidant to the subsurface via horizontal wells installed within a buffer zone adjacent to the childcare facility.

The intent of these alternatives were to remove the source of COCs present in vadose zone soils (i.e., reduce contribution to groundwater) and to address residual contamination that was not removed by previously completed excavations at the Site. These alternatives would not directly address contaminated groundwater and excavation may require demolition of the childcare facility if VOC mass is present below this building.

The installation and operation of an SVE system provides the ability to remove VOC mass from inaccessible soils (i.e., adjacent to and beneath buildings). In addition, the installation and operation of an SVE system does not pose the technical constraints that are inherent to excavation and disposal (i.e., safety concerns associated with excavations adjacent to building foundations and utilities, the potential requirement to dewater soils if impacted soils are removed from below the vadose zone, and the potential for transport and disposal of hazardous waste resulting in increased project cost). Overall, it is expected the operation of an SVE system will be effective at both vapor intrusion suppression and VOC mass removal.

3.1 Vapor Mitigation

The primary objective of the SVE system operation is to induce a negative pressure beneath the concrete slab and prevent chlorinated VOC vapor migration into the childcare center. Performance/compliance monitoring will be conducted to demonstrate vapor suppression and will include the following:

- Vacuum measurements will be performed at subslab monitoring points installed within the concrete slab of the childcare center. A vacuum pressure of 0.005 inches water (in H_2O) or more will be used to assess if a negative pressure is achieved below the subslab.

- Indoor air samples will be collected from within the childcare center and submitted for chemical analyses. The laboratory analytical data will be compared to historical data and the MTCA Method B air cleanup level of 0.42 µg/m^3 (or calculated site-specific level as approved by Ecology).

3.2 Mass Removal

Soil removal interim actions were completed in 1995 and 2001. In 1995, impacted soils in the former heating oil UST area were excavated to depths ranging between 3 and 12 feet below ground surface (bgs) (310 of the 610 tons of excavated soil disposed at a landfill facility). Following demolition of the dry cleaner building and concrete foundation in 2001, impacted soils were excavated to depths between 2 and 9 feet bgs and disposed offsite at an asphalt and gravel recycling facility.

Based on past characterization, soil removals, and recent groundwater monitoring, impacted soils appear to be distributed between the western end of the property, and under and to the north of the former dry cleaning building footprint. Given the possibility that high concentrations of PCE remain in the soil, either as residual contamination sorbed to the soil mass or as dense non-aqueous phase liquid (DNAPL), vapor extraction will be conducted to remove VOC mass from the vadose and groundwater fluctuation zone. Removal of VOC mass from the unsaturated zone will reduce the potential for vapor intrusion and leaching to groundwater.

Performance monitoring will be conducted to confirm the effectiveness of the SVE system at inducing a negative pressure below the childcare center and to assess VOC mass removal. The following field monitoring will be performed:

- Vacuum measurements will be performed at existing monitoring and SVE wellheads to assess the radius of influence (ROI). The ROI will be defined at a minimum vacuum measurement of 0.1 in H_2O.

- Vacuum measurements will be performed at subslab monitoring points installed within the concrete slab of the childcare center. A vacuum pressure of 0.005 in H_2O or more will be used to assess if a negative pressure is achieved below the subslab.

- Influent vapor samples (total influent) will be collected for chemical analyses. System operations and laboratory analytical data will be used to assess relative vapor contribution from individual wells and estimate VOC mass removal over time. It is expected the VOC mass removal rate will decline over time (i.e., achieve asymptotic conditions at some point in the future).

Performance monitoring activities are described in detail in Section 5.0.

Section 4: SVE System Construction, Operation, and Maintenance

This section presents a description of SVE system construction, operation, and maintenance activities. In general, the system will consist of vapor extraction from five wells, treatment using granular activated carbon (GAC), and subsequent discharge of treated vapor to the atmosphere under an air permit. SVE system piping layout and the location of the treatment compound is shown on Figure 2 (Design Sheet C-2).

4.1 Site Preparation Activities

Prior to implementation of the interim action, preliminary activities will be completed as follows:

- Design documents will be developed, including engineering plans and specifications for contractor procurement.
- An Air Operating Permit will be obtained from the YRCAA.
- Access agreements with the property owners will be obtained by Ecology.
- Kennedy/Jenks will prepare a Health and Safety Plan (HASP) in accordance with applicable health and safety regulations. The HASP will be prepared under separate cover and will be followed by Kennedy/Jenks personnel. The selected contractor will also develop a HASP for their personnel.
- Prior to well installation and SVE system construction activities, the Utility Notification Center will be contacted to identify public underground utilities. In addition, the selected contractor will coordinate with a private utility locating service to locate underground utilities in the work area.

Note: The State Environmental Policy Act (SEPA) checklist has been completed and Ecology has determined the interim action does not have a probable significant impact on the environment; an environmental impacted statement (EIS) is not required. The SEPA comment period concluded on 16 January 2012; public comments were not received. The SEPA Determination is presented in Appendix A (Attachment I).

4.2 Vapor Extraction Well Location and Construction

4.2.1 Well Locations

Soil vapor will be extracted from five newly installed wells at the locations shown on Figure 2 (Design Sheet C-2). The locations of these wells are supported as follows:

- SVE-1 would be installed on the western end of the property. During past dry cleaning operations, still bottoms containing PCE were historically dumped in the gravel lot. In

addition, sources from the dry cleaning machine and associated equipment were discharged in floor drains which carried wastewater out the western end of the building.

- SVE-2 would be installed in the vicinity of monitoring wells SPW-12 and SPW-13 as PCE was detected at relatively high groundwater concentrations in these wells.

- SVE-3 through SVE-5 would be installed at three corners of the childcare center building with the primary purpose of inducing a negative pressure beneath the concrete slab to prevent chlorinated VOC vapors migration into the childcare center. Vapor extraction well SVE-4 would be installed in the vicinity of a historical catch basin/overflow tray (i.e., located outside the southwestern corner of the building; reported historical overflow from dry cleaning machine); SVE-5 would be installed adjacent to monitoring well MW-10 where the highest PCE concentrations were detected in groundwater (up to 43,500 µg/L).

4.2.2 Well Construction

The soil borings for vapor extraction well construction will be drilled using hollow-stem auger or sonic drilling techniques to a depth of approximately 20 to 25 feet bgs (i.e., low groundwater conditions). The soil from the borings will be logged and field-screened to assess the potential presence of VOCs. Field screening techniques will include visual inspection of soils, sheen tests, and organic vapor headspace monitoring using a photoionization detector (PID).

The vapor extraction wells will be constructed using 4-inch-diameter Schedule 40 polyvinyl chloride (PVC) casing and 0.020-inch machine slotted screen and packed with 10-20 sand. The wells will be completed with an upper and lower screened interval separated by a 2-foot blank section of casing surrounded by an annular bentonite seal. This construction will provide the option to extract from both intervals at the same time or to isolate the upper and lower screen intervals for vapor extraction, based on varying groundwater levels.

Site groundwater elevations fluctuate seasonally as a result of localized recharge created from irrigation channels. During the winter months (January through March), the water table is typically present at a depth of about 20 to 25 feet bgs, and through autumn months, the water table is generally between 12 to 18 feet bgs. Based on this seasonal groundwater trend, the upper and lower screen intervals will generally be positioned between 7 to 12 feet bgs and 15 to 20 feet bgs, respectively.

Note: The wellhead/extraction system for the SVE wells have been designed so future remedial actions planned for the site can be supported (i.e., potential incorporation into the proposed groundwater recirculation system under design by Hart Crowser, Inc.).

4.3 System Components

A process and instrumentation diagram for the SVE system is shown on Figure 3 (Design Sheet P-2). The system will include the following components:

- **Extraction Well Piping/Wellhead.** As discussed in Section 4.2.2, each vapor extraction well will be completed with an upper and lower screened interval separated by a 2-foot

blank section of casing. A 2-inch PVC drop pipe will be installed in each well with a rubber packer positioned within the blank section (i.e., effectively separating the upper and lower screen intervals). The 2-inch PVC inner drop pipe (i.e., lower zone extraction) and 4-inch PVC outer casing (i.e., upper zone extraction from the annular space) will permit selective extraction from the upper and/or lower zones.

The wells will be housed within traffic rated monuments. Each wellhead will be equipped with ports for vacuum measurement of the upper and lower well screen intervals.

- **Trenching/Piping.** For each well, soil vapor from the upper and lower zones will be individually piped to the extraction manifold (i.e., two pipes for each well; total of 10 pipes). The piping associated with vapor extraction well SVE-3 may be installed along the western wall of the childcare center to minimize disruption within the playground area. All other piping will be installed in common trenches.

- **Extraction Manifold.** Individual piping at the system manifold will contain a ball valve, vacuum gauge, and sample/flow measurement port.

- **Moisture Separator.** The moisture separator (knockout) will remove moisture from the extracted vapor prior to GAC filtration. Standard features include site gauge and level switches (low control, high control, and high-high alarm). Accumulated moisture will be pumped to a polyethylene tank located in the treatment compound via a transfer pump. The concrete pad will serve as secondary containment for the polyethylene tank.

- **GAC Vessels.** The vapor-phase GAC filter system will consist of two, 2,000-pound GAC units plumbed in series. The GAC filtration system will be positioned upstream of the vacuum blower to minimize adsorption effects due to increased temperature (i.e., effluent discharge temperature may affect sorption of chlorinated ethenes to vapor phase GAC, particularly vinyl chloride). The vessels will be equipped with pressure gauges, sample ports, and manual drain (i.e., for removal of accumulated moisture). The GAC vessels will be placed on a concrete foundation exterior to the treatment building.

- **Vacuum Blower.** The vacuum blower will provide 200 standard cubic feet per minute (scfm) at 60 in H_2O vacuum. The blower skid will consist of a blower, inlet filter, vacuum relief valve/switch, temperature sensors (inlet and outlet), vacuum gauges, and a pitot tube assembly for measuring total influent flow. A dilution valve will be provided for added vacuum control.

- **Discharge Stack.** The treated soil vapor will be discharged through an exhaust stack from the vacuum blower. At a minimum, the stack height will be sufficient that the discharge point will facilitate dispersion. Note: Air dispersion modeling was performed using the AERSCREEN model to support the YRCAA Air Operating Permit and to evaluate the potential exposures of discharge to receptors. Supporting information and results of the dispersion model is presented in Appendix A.

- **Control Panel.** The control panel will consist of main disconnect, on/off/auto switch, system alarm notifications, alarm reset, and emergency stop. The system will

telephonically alert operation personnel when alarms and shutdown occurs. An hour meter will provide cumulative operational time.

- **System Alarm Response.** System alarms will include: (1) high-high level alarm in moisture separator; (2) high-high level alarm in polyethylene tank with automatic blower shut-off; (3) high vacuum alarm with automatic blower shut-off.

- **Electrical Service.** A separate electrical service will be installed to serve equipment at the treatment compound; power drop located at the northwestern corner of property near the alley.

- **Security Fencing and Signage.** The treatment compound will be secured by a chain-link fence with slats. Emergency contact information and "no trespassing" warnings will be posted on signs on the fencing.

- **Pressure Monitoring Points.** Three concrete cores were drilled in the childcare center concrete slab for collection of subslab vapor samples as part of vapor intrusion activities conducted in September/October 2011 [see Figure 2 of the *Vapor Intrusion Study Report* for coring locations (Kennedy/Jenks 2011b)]. Upon completion of subslab vapor sample collection, the cores were sealed with bentonite. To evaluate vapor mitigation, these cores will be accessed and utilized as measurement points to confirm negative pressure beneath the childcare center concrete slab. Two additional monitoring points will be drilled to supplement the existing monitoring points to provide coverage aerially over the concrete slab.

4.4 System Construction and Startup

In general, system construction activities will consist of soil excavation, piping installation, backfilling and compaction, and installation of system components within a treatment building/compound. Quality assurance and quality control (QA/QC) will include construction observation to ensure general conformance with the engineering plans and specifications. QA/QC procedures include, but not limited to, pipe pressure testing and backfill material compaction testing. Upon completion of system construction, startup activities will be performed during the first week of operation to establish system operations and optimize treatment performance. Startup activities will include the following:

- System components will be checked for proper operation (i.e., alarm conditions).

- A step test will be performed for each well by incrementally increasing applied vacuum to the upper and lower screened intervals independently and then to both zone combined. For each step test, sufficient time will be allowed for vacuum and extraction flow rates to equilibrate. Vacuum measurements will be performed at the extraction wellheads, adjacent monitoring wells (screened between 10 and 35 feet bgs), and pressure monitoring points. Flow rates and PID measurements for each well/zone would be also performed. Applied vacuum at the blower and other system operational set-points will be based on step testing results.

4.5 System Operation and Maintenance

System operation and maintenance (O&M) will be generally conducted on a monthly basis to ensure proper operation of equipment. O&M activities will include the following:

- Mechanical inspection and maintenance of the SVE blower, moisture transfer pump, and associated instrumentation.
- Removal and disposal of spent GAC (see Section 6.0), as required.
- Removal and disposal of accumulated water from the moisture separator (see Section 6.0), as required.
- Responding to system alarms (if any).

Kennedy/Jenks will prepare an O&M Plan under separate cover and subcontract with O&M contractor.

Section 5: Performance and Compliance Monitoring

This section presents the interim action performance and compliance monitoring program. As the primary objective of the interim action is to prevent chlorinated VOC vapor migration into the childcare center, monitoring will focus on pressure measurements from monitoring points installed within the concrete slab and collection of indoor air samples for chemical analyses. Desired conditions to minimize vapor intrusion will be demonstrated through negative subslab pressure measurements and reduction in indoor air VOC concentrations.

Additional monitoring will be performed to assess the effectiveness of VOC mass removal from the subsurface through vacuum, flow, and PID measurements and collection of system vapor samples for chemical analyses. The monitoring program is summarized in Table 1.

5.1 Monitoring

Monitoring during operation of the SVE system is anticipated to include the following activities:

- Vacuum measurements at existing subslab monitoring points using a macromanometer.
- Vacuum readings from permanently installed vacuum gauges on the extraction manifold and within the system (e.g., before, between, after carbon vessels).
- Vacuum measurements at vapor extraction and existing monitoring wellheads using Magnahelic® gauges.
- Flow measurements for individual wells at the extraction manifold using a hot-wire anemometer.
- Total influent flow at the blower using the pitot tube assembly.
- PID readings for individual wells at the extraction manifold and within the system.
- Temperature measurements at the blower inlet and discharge.
- Vapor sample collection as described in Section 5.2.

5.2 Vapor Sample Collection and Chemical Analyses

5.2.1 Indoor Air Samples

Indoor air samples will be collected from within the childcare center consistent with the Vapor Intrusion Study Technical Memorandum (Kennedy/Jenks 2011a). The indoor air samples will be collected after demonstrating vapor suppression through sustained negative pressure measurements of greater than 0.005 in H_2O beneath the concrete slab. At periodic intervals in the future, additional indoor air samples may be collected for chemical analysis to confirm PCE concentrations are below cleanup levels.

5.2.2 System Vapor Samples

System vapor samples will be collected at the influent (total influent from all wells), midpoint (between the GAC vessels), and effluent sampling ports. During system startup, vapor samples will be collected from each of the ports to serve as a baseline for the operating system. Following system startup, vapor samples will be collected monthly for 6 months to assess total influent mass removal and possible breakthrough conditions. (Note: Depending on the requirements of the air discharge permit, additional monitoring requirements may be identified.) System vapor samples will be collected using Summa™ canisters and submitted for chemical analysis using EPA Method 8260 or TO-15, as appropriate. In addition, vapor monitoring will be performed using a hand-held PID for future correlation.

5.3 Quality Control

Quality control measures during system monitoring include calibration of field equipment, collection of quality control samples, and laboratory quality control. Field equipment will be calibrated in accordance with the manufacturers' instructions prior to collection of data. Quality control samples will include duplicate vapor samples.

5.4 Data Evaluation

5.4.1 Vapor Intrusion

Indoor air vapor data will be compared to historical data and the MTCA Method B air cleanup level of 0.42 $\mu g/m^3$ (or calculated site-specific level as approved by Ecology). The industry standard of 0.005 in H_2O will be used as the minimum effective vacuum metrics for mitigation of subslab soil vapor.

5.4.2 Mass Removal

System effects on the subsurface vapor flow will be evaluated by estimating the ROI based on vacuum response at extraction and existing monitoring wellheads. PID measurements will be evaluated to assess relative mass contribution from individual wells and allow for qualitative correlation to vapor laboratory analytical data. Cumulative VOC mass removal over time will be estimated using influent vapor sample data from the extraction wells and measurements of air flow. Collected influent, midpoint, and effluent vapor data will be used to estimate the VOC mass loadings on the carbon units as well as develop breakthrough curves for various VOC constituents through the GAC vapor treatment unit.

Section 6: Waste Management

This section presents the handling and disposal of waste generated as part of interim action activities. Generated wastes include well installation drill cuttings, excavation spoils, accumulated water from moisture separation, and spent GAC.

6.1 Soil

Drill cuttings generated during vapor extraction well installations will be temporarily stored onsite in drums pending waste characterization and disposal at a permitted facility.

Excavation spoils generated during building foundation preparation, wellhead construction, and piping installation will be stockpiled onsite. Representative composite soil samples will be collected from the stockpile(s) and submitted for the required chemical analyses to determine final deposition (i.e., onsite re-use or off-site disposal based on comparison of data to applicable MTCA cleanup level criteria).

6.2 Accumulated Moisture Separator Water

Water accumulated within the moisture separator (if any) will be transferred to a 160-gallon polyethylene tank located in the treatment compound via a transfer pump. A representative water sample will be collected from the tank and submitted for VOC chemical analyses using EPA Method 8260. Laboratory analytical data associated with the collected water sample will be used for waste characterization and profiling. Accumulated moisture separator water may be disposed of at an approved facility or discharged to the City of Yakima Wastewater Treatment Plant pending approval.

6.3 Spent GAC

A representative spent GAC sample will be collected and submitted for VOC chemical analyses using EPA Method 8260 and Toxic Characteristic Leaching Procedures (TCLP) VOCs by EPA Method 1311/8260. Laboratory analytical data associated with the collected solid sample will be used for waste characterization and profiling. Spent carbon may be disposed of at a licensed landfill facility or recycled (i.e., reactivation if possible).

Section 7: Reporting

Project reporting will include preparation of an Interim Action Report and monthly Compliance/Discharge Reports as presented below.

7.1 Interim Action Report

After 3 months of SVE system operation, an Interim Action Report will be prepared summarizing SVE system installation, start-up, operation, and monitoring activities. The report will include the following:

- Summary of drilling activities, including soil borings/extraction well construction logs.
- Summary of SVE system construction and start-up activities, including as-built drawings.
- Tabulation of system operation/monitoring data (i.e., vacuum, flow, PID, temperature; Table 1) and vapor laboratory analytical data.
- Estimation of the aerial influence of the SVE system (i.e., ROI determination beneath childcare center concrete foundation).
- Estimation of VOC mass removal, including a plot of cumulative mass removal.
- PID measurement correlation to influent vapor concentration data to assess relative contribution from individual wells.
- Recommendations for future system operation and monitoring.

7.2 Monthly Compliance/Discharge Reports

Monthly reports will include a brief discussion of system operation and monitoring and an evaluation of vapor suppression compliance. The monthly reports will also include updated tables summarizing system operation, monitoring, and laboratory analytical data and an estimate of VOC mass removal. Reports will be submitted to the YRCAA as required by the air operating permit.

References

AGRA Earth and Environmental Inc. 1995. Soil Vapor Survey – 106 South Third Avenue, Yakima, Washington. January 1995.

Hart Crowser, Inc.. 2007. Feasibility Study Report. 31 July 2007.

Kane Environmental. 2011. Memorandum - YRRA June 2011 Groundwater and PCE Data (Contract No. YRRA3). 21 July 2011.

Kennedy/Jenks Consultants. 2011a. Vapor Intrusion Study Technical Memorandum, Former Frank Wear Cleaners Site. 20 September 2011.

Kennedy/Jenks Consultants. 2011b. Vapor Intrusion Study Report, Former Frank Wear Cleaners Site. November 2011.

Washington State Department of Ecology. 2009. Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action. October 2009.

Washington State Department of Ecology. 2011a. Vapor Intrusion Study Scope of Work, Frank Wear Site, Yakima, Washington. August 2011.

Washington State Department of Ecology. 2011b. E-mail communication from Richard Bassett on 2 September 2011.

Table

Table 1: Monitoring Program

Location	Type	Vacuum (in H_2O)[a]	Flowrate (acfm)[b]	PID[c]	Temperature (degree F)[d]	Chemical Analyses[e]
SVE-1 (upper)	Vapor Extraction Well	X[f]	X	X		X
SVE-1 (lower)	Vapor Extraction Well	X	X	X		X
SVE-2 (upper)	Vapor Extraction Well	X	X	X		X
SVE-2 (lower)	Vapor Extraction Well	X	X	X		X
SVE-3 (upper)	Vapor Extraction Well	X	X	X		X
SVE-3 (lower)	Vapor Extraction Well	X	X	X		X
SVE-4 (upper)	Vapor Extraction Well	X	X	X		X
SVE-4 (lower)	Vapor Extraction Well	X	X	X		X
SVE-5 (upper)	Vapor Extraction Well	X	X	X		X
SVE-5 (lower)	Vapor Extraction Well	X	X	X		X
SS-1	Subslab Pressure Monitoring Point	X				
SS-2	Subslab Pressure Monitoring Point	X				
SS-3	Subslab Pressure Monitoring Point	X				
SS-4	Subslab Pressure Monitoring Point	X				
SS-5	Subslab Pressure Monitoring Point	X				
Influent	Sample Port (Total Influent)	X	X[g]	X	X	X
Midpoint	Sample Port (Between Lead and Lag Carbon Vessels)	X	X	X	X	X
Effluent	Sample Port (Blower Discharge)	X	X	X	X	X

Notes:

(a) Vacuum measurements performed using macromanometer or Magnahelic® gauges; readings from permanently installed vacuum gauges on the extraction manifold. Reported in inches water (in H_2O). Measurement performed on monthly basis except at extraction wellheads (see note f).

(b) Flowrate measurements performed using hot-wire anemometer; reported in actual cubic feet per minutue (acfm). Measurement performed on monthly basis.

(c) Volatile organice compound (VOC) content measured using photoionization detector (PID). Measurement perfromed on monthly basis.

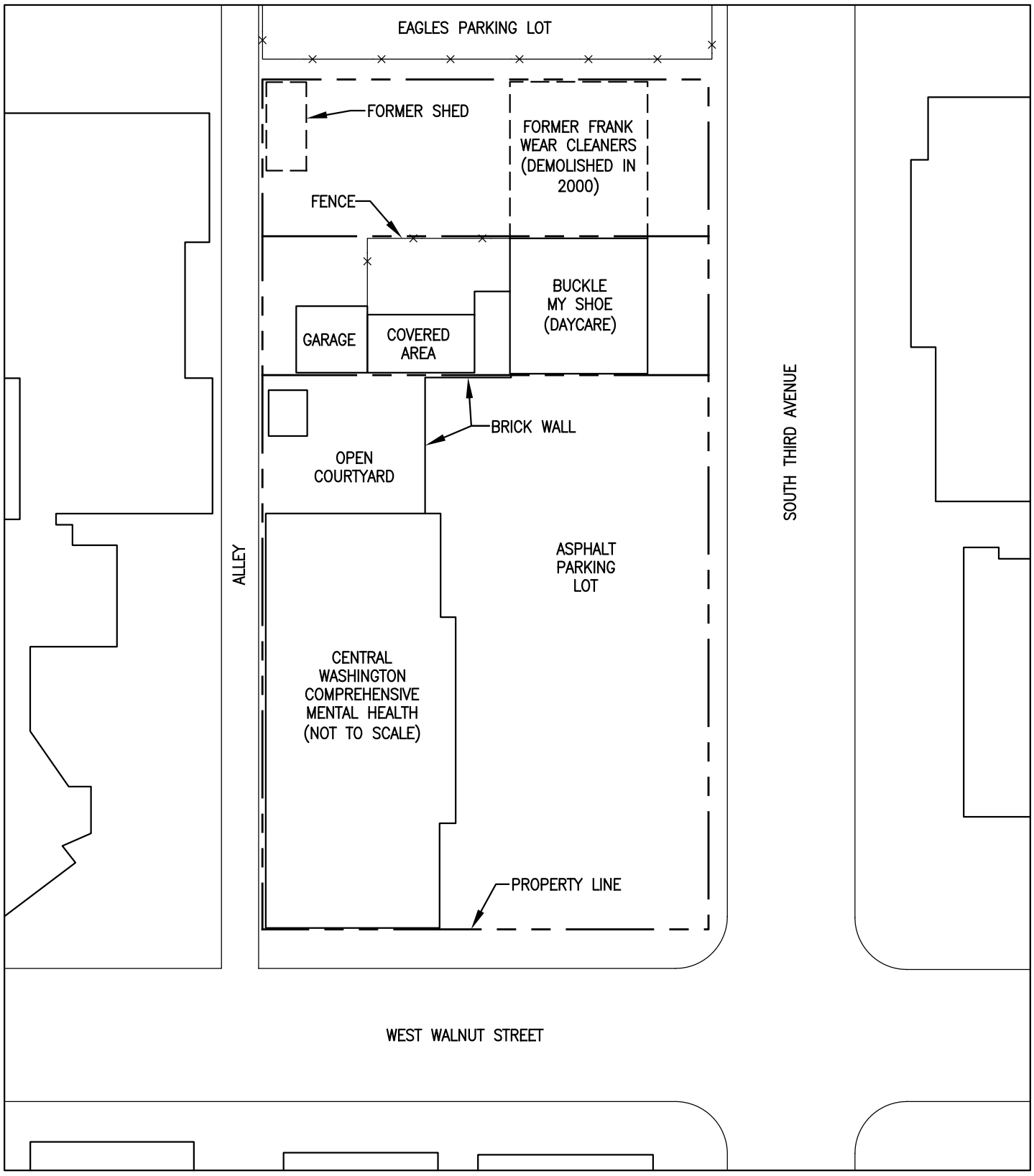
(d) Temperature measured at total influent port and blower discharge; reported in degrees Fahrenheit (F). Measurement performed on monthly basis.

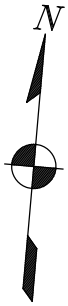
(e) VOC chemical analyses using EPA Method 8260 or TO-15, (Summa Canister). Influent, midpoint, and effluent vapor samples submitted for chemical analyses on a monthly basis.

(f) Vacuum measured at wellhead head upper/lower ports on periodic basis.

(g) Recorded from blower pitot tube assembly.

Figures





0 50 100

APPROXIMATE SCALE 1"=50'

Kennedy/Jenks Consultants

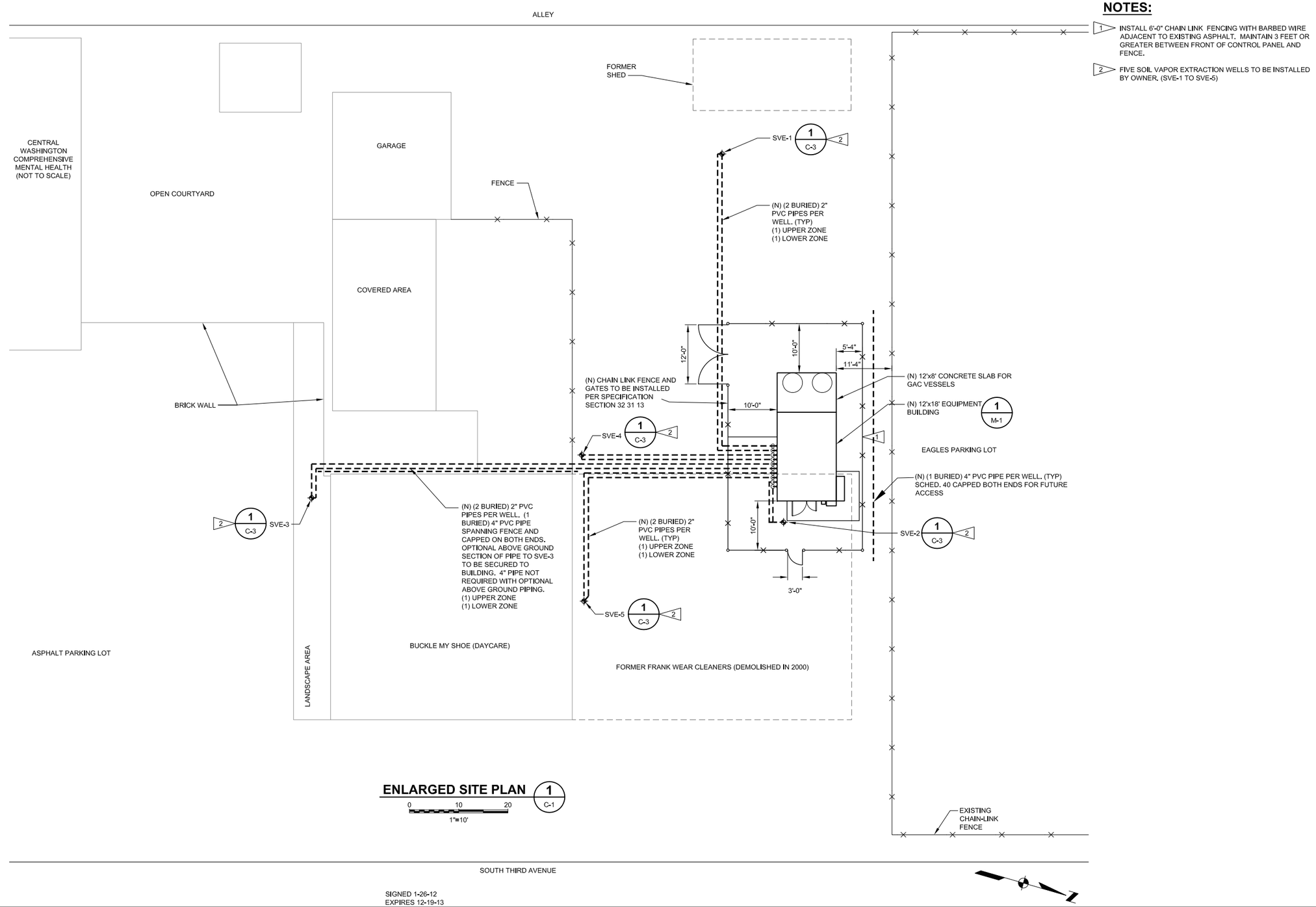
WASHINGTON STATE DEPARTMENT OF ECOLOGY
FORMER FRANK WEAR SITE
YAKIMA, WASHINGTON

SITE MAP

119016.00\FIG-01

10/11

FIGURE 1



NOTES:

1. INSTALL 6'-0" CHAIN LINK FENCING WITH BARBED WIRE ADJACENT TO EXISTING ASPHALT. MAINTAIN 3 FEET OR GREATER BETWEEN FRONT OF CONTROL PANEL AND FENCE.
2. FIVE SOIL VAPOR EXTRACTION WELLS TO BE INSTALLED BY OWNER. (SVE-1 TO SVE-5)

ENLARGED SITE PLAN (1/C-1)

0 10 20

1"=10'

SIGNED 1-26-12
EXPIRES 12-19-13

RICHARD C. GUGLIOMO — STATE OF WASHINGTON — 11523 — REGISTERED PROFESSIONAL ENGINEER

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.

NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

DESIGNED JMF
DRAWN BBH
CHECKED RCG

WASHINGTON STATE DEPARTMENT OF ECOLOGY

FRANK WEAR SOIL VAPOR EXTRACTION SYSTEM
YAKIMA, WASHINGTON

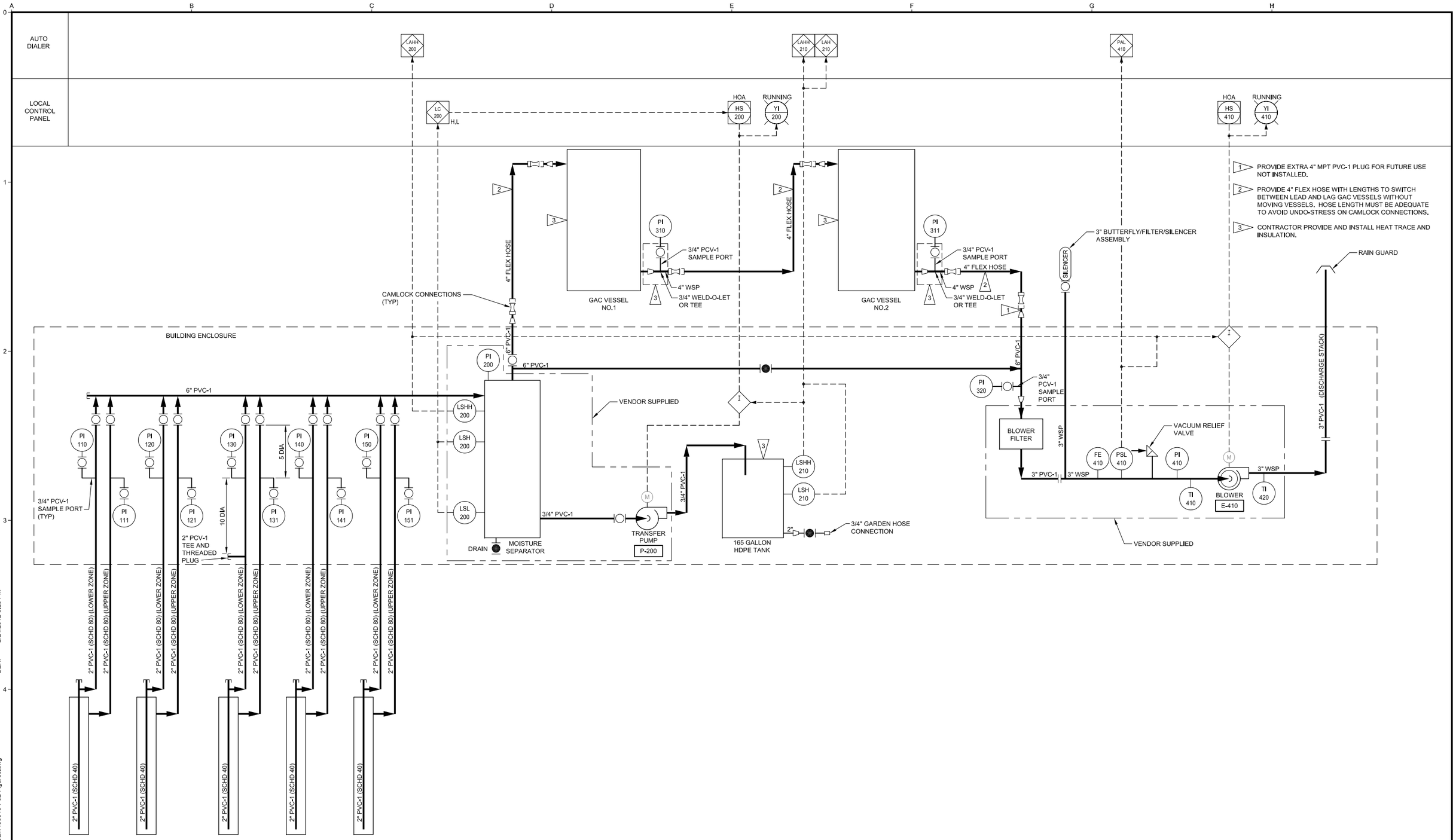
Kennedy/Jenks Consultants
FEDERAL WAY, WA

ENLARGED SITE PLAN

FIGURE 2

FILE NAME 1196016_C02
JOB NO. 1196016*00
DATE JAN. 2012
SHEET C-2 OF

BENF 2/21/2012 3:23 PM
P:\CAD\11\1196016.00 Washington DEQ\1196016-C02-Figure2.dwg



BENF 2/21/2012 3:25 PM

P:\CAD\11\1196016.00 Washington DEQ\1196016-P02-Figure3.dwg

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.

NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

SIGNED 1-26-12
EXPIRES 12-19-13

RICHARD C. GUGLIOMO — STATE OF WASHINGTON — 11523 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED JMF

DRAWN BBH

CHECKED RCG

WASHINGTON STATE DEPARTMENT OF ECOLOGY

FRANK WEAR SOIL VAPOR EXTRACTION SYSTEM
YAKIMA, WASHINGTON

Kennedy/Jenks Consultants
FEDERAL WAY, WA

PROCESS AND INSTRUMENTATION DIAGRAM

FIGURE 3

FILE NAME 1196016_P02

JOB NO. 1196016*00

DATE JAN. 2012

SHEET P-2 OF

Appendix A

Dispersion Modeling Supporting Information

Kennedy/Jenks Consultants
32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435
www.KennedyJenks.com

Transmittal

TO: Yakima Regional Clean Air Agency
329 North First Street
Yakima, Washington 98901-2303

FROM: Sherri Peterson
DATE: 27 January 2012
K/J #: 1196016*00
SUBJECT: Air Permit Application

VIA: ☐ Fax ## pgs. (inc. cover) ☐ USPS ☒ Other (UPS Overnight)

PLEASE FIND ENCLOSED:

Copies	Date	No.	Description
1			New Source Review Application – Former Frank Wear Site
1			$400 Application fee

THESE ARE SUBMITTED AS CHECKED BELOW:

- ☐ As requested
- ☐ For information and coordination
- ☐ Return material when review complete
- ☐ Return after loan to us
- ☐ For approval by: _____ Return to:
- ☐ For review and comment by: _____ Return to: _____
- ☐ Other: _____

REMARKS: Submitted on behalf of the Washington State Department of Ecology, enclosed is the New Source Review Application for the Former Frank Wear Site.

If there are any questions about this submittal, please contact me.

Signed: Sherri L Peterson
Sherri L. Peterson, P.E.

Copies to: Jason Shira, Dept. of Ecology

Yakima Regional Clean Air Agency
INSTRUCTIONS FOR PERMIT APPLICATION

Use this sheet as a checklist to determine when your application is substantially complete.

☞ Each PERMIT APPLICATION for the construction, installation or establishment of a new air contaminant source, or modification of existing air pollution source or control equipment or permit, needs to be accompanied by the following information to be considered complete:

Included	N/A	
☒	☐	Process flow sheets and equipment layout diagrams.
☒	☐	Control equipment manufacturer, model number, size, serial numbers (for each piece of control equipment).
☒	☐	Quantify average and maximum hourly throughput values, average yearly totals, and maximum concentrations for each pollutant.
☒	☐	Applicant's calculation of the kinds and amounts of emissions for each emission point, materials handling operation or fugitive category (both controlled and uncontrolled).
☒	☐	Plot plan including identification of proposed emission points to the atmosphere, distance to property boundaries, height of buildings and stack height above ground level.
☒	☐	Identification of raw materials and/or product specifications (physical and chemical properties) and typical ranges of operating conditions as related to each emission point (toxic air contaminants require a separate summary); Material Safety Data Sheets (MSDS) should be included in the PERMIT APPLICATION for all compounds used.
☒	☐	Identification of the methods/equipment proposed for prevention/control of emissions to the atmosphere.
☒	☐	Information sufficient to demonstrate the ability of the emission controls proposed as being consistent with those provided in the applicable regulations (BACT/NSPS/RACT/NESHAPS/LAER analysis), see attached worksheet for typical layout of BACT analysis information.
☐	☒	The kinds and amounts of emission offset credits proposed for assignment when operations are within a non-attainment boundary (see WAC 173-400-120 and 131).
☒	☐	Estimates of the proposed project ambient impact under average and least favorable conditions where pertinent to PSD (WAC 173-400-720) or Toxic Air Pollutants (WAC 173-460) requirements.
☐	☐	Additional information, evidence, or documentation as required by the Board of Directors, or the Control Officer, to show that the proposed project will meet federal, state and local air pollution control regulations.
☐	☒	For applications that include equipment that has previously been approved, authorized or registered, a lapse is considered to have occurred if the registration fees are delinquent for more than one calendar year or the source has not operated within five years prior to the receipt of any required PERMIT APPLICATION (WAC 173-400-110).
☐	☒	Applications that include previously approved or authorized equipment require that additional information regarding previous owners or approvals be provided so that YRCAA records can be updated. Equipment registered and/or approved for a given company cannot be authorized without a legal name change, purchase of company or equipment, or a legal contract or subcontract to do business with or for the approved source. Responsibility for operation of authorized equipment rests with the registered source.
☒	☐	All applications need to be accompanied with a completed SEPA checklist or SEPA determination.

☞ The application transmittal shall conform to YRCAA review requirements wherever possible as detailed in the General Regulations for Air Pollution Sources (WAC 173-400).

☞ Each drawing, document, or other form of transmittal considered by the applicant to be proprietary and confidential must be suitably identified as confidential in red ink, and signed and dated by the applicant or its agent. Be aware that YRCAA follows the requirements in 40 CFR 2 for determination of confidentiality. YRCAA may not process company sensitive information as confidential.

☞ Order of Approval (to construct, modify, or install) are issued for specific equipment or processes described in the application. Changes to the processes or control equipment are not allowed without new source review (Permit Application and Permit) if these changes result in an emission of a different type or an increase in emissions (WAC 173-400-110). Process equipment changes that result in decreased emissions require notification to YRCAA.

☞ The SIC code is identified as the four digit major group classification in the 1987 Standard Industrial Code Classification Manual listing of SIC codes can be obtained for free from the internet.

☞ Mail or deliver in person the completed application package to: Yakima Regional Clean Air Agency
329 North First Street
Yaki ma, WA 98901-2303

☞ **Application fees must accompany application for the application to be considered complete. An invoice will be sent out for the Engineering review after final decision on the application. Make checks payable to "Yakima Regional Clean Air Agency" or "YRCAA".**

☞ **The PERMIT APPLICATION package submitted must be complete. All applications are screened for completeness before processing. Applicants submitting incomplete application packages will be notified of their incomplete status and may result in a delay in processing the application.**

Kennedy/Jenks Consultants

32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435

New Source Review Application Former Frank Wear Site

20 January 2012

Prepared for

Washington State Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, Washington 98902

K/J Project No. 1196016*00

YAKIMA REGIONAL CLEAN AIR AGENCY

Filing Fee: $400.00

329 North First Street, Yakima WA 98901
Phone: (509) 834-2050 Fax: (509) 834-2060
Website: http://www.yakimacleanair.org

New Source Review Application (NSR)

Stationary/Permanent Source

INSTALLATION OR ESTABLISHMENT OF NEW AIR CONTAMINANT SOURCES

NSR Application is Required for Construction, Installation or Establishment of an Air Pollution Source
Or
Replacement or Substantial Alteration of Emission Control Technology on an Air Pollution Source or Equipment

I. General Information:

BUSINESS NAME Former Frank Wear Site, Soil Vapor Extraction System

MAILING ADDRESS WA Dept. of Ecology, 15 W. Yakima Ave., Suite 200, Yakima, WA 98902

PHONE NUMBER (509) 454-7834 FAX No. ( ) _____

NATURE OF BUSINESS Former dry cleaners cleanup site

TYPE OF PROCESS, EQUIPMENT, OR APPARATUS Project includes soil vapor extraction (SVE) system to remove solvents from soils

LIST OF AIR CONTAMINANT(S) WHICH WILL BE PRODUCED AND/OR CONTROLLED Tetrachloroethylene (PCE) and daughter products (trichloroethylene, 1,2 - dichloroethylene, vinyl chloride)

ESTIMATED COSTS: OF BASIC SOURCE EQUIPMENT $ $76,350 (total annualized cost)

OF CONTAMINANT CONTROL APPARATUS $ _____

ESTIMATED STARTING DATE: February 2012

ESTIMATED COMPLETION DATE: January 2013

ADDRESS WHERE EQUIPMENT WILL BE LOCATED: 106 South Third Avenue in Yakima, WA

Describe Input to Output Process (Attach drawings, schematics, prints, or block diagrams) See process flow sheets and equipment layout diagrams attachment

Process: Production Output per Year (tons, pounds, etc) Not applicable

Maximum Output per Hour (tons, pounds, etc) _____

Percentage of Production (%)

Dec - Feb _____ Mar – May _____

Jun - Aug _____ Sep – Nov _____

Operating Schedule: Hrs/Day 24 Days/Wk 7 Wks/Yr 52

Compliance with SEPA (State Environmental Policy Act) - Check One of the Options Below:

☒ A DNS or EIS has been Issued by Another Agency for this Project and a Copy is Attached.

☐ If no DNS or EIS Exists for this Project, a Completed Checklist for this Project is Attached.

YRCAA SEPA checklist is available by phone, or by our website at htttp://www.yakimacleanair.org

☐ The city/county has established an exemption for this project.

☐ I certify that the SEPA has been satisfied or this project is exempt:

_____ *by* _____

Date *Government Agency*

II. Emissions Estimations and Calculations:

1. Criteria Pollutants (gr/dscf, tons/yr, lbs/hr., ppm, etc.)

Particulate (PM_{10},$PM_{2.5}$) n/a

Volatile Organic Compounds

Nitrogen Oxides n/a

Sulfur Oxides n/a

Carbon Monoxide n/a

Lead n/a

2. Toxic Pollutants (Name)	Quantity (in gr/dscf, tons/yr, lbs/hr. ppm, etc.)
Tetrachloroethylene	Total VOCs - Maximum Emission
Trichlororethylene	0.025 tons/yr
1,2-Dichloroethylene	
Vinyl chloride	

3. Fugitive Pollutants (Source)	Quantity (in gr/dscf, tons/yr, lbs/hr. ppm, etc.)
n/a	

4. Air Pollution Modeling

Results See Estimates of Proposed Project Ambiant Impact attachment

Computer Printout Attached? (Yes) No

III. Emission Data:

1. Stack Height (Feet) 15 Insi de Diameter (feet) 0.5

Gas Exit Temp (degrees F) 100 Gas Exit Velocity (ft/min) 91,673 ft/min

Flow Rate (cfm) 300

Shared Stack? If a shared stack, identify process (es) or point(s) which share the stack. No

Distance from Stack to Property Line See Plot Plan attachment

2. Discharge Point or points (if no stack or other than stack)

Height (feet) Insi de Diameter (feet)

Gas Exit Temp (degrees F)_____ Gas Exit Velocity (ft/min)_____

Flow Rate (cfm) _____

Shared discharge point? If a shared discharge point, identify process (es) or point(s) which share the discharge point. _____

_____

Distance from discharge point to Property Line _____

3. Fuel Type n/a % Sulfur_____

% Ash_____ Unit _____ of Measure (gal./cu.ft./etc.)_____

B TU per Unit of Measure_____ C _____ onsumption Units per Year_____

Maximum Consumption Units per Hour _____

4. Building Dimensions

Height (feet)_____ Length (feet)_____ Width (feet)_____

IV. Air Pollution Control Equipment:

Baghouse Type n/a Efficiency _____

Bag Height (feet)_____ Bag Diameter (feet) _____

Filter Area (feet squared)_____ Blower Flow Rate (cfm)_____

Filter Media_____ Dim ensions (feet)_____

Discharge Area Dimensions (feet)_____

Cleaning Mechanism (shake) (air psi)_____

Other Data _____

Scrubber Type n/a Efficiency_____

Gas Differential Pressure (psi)_____ Liqu or Differential Pressure (psi)_____

Liquor Flow (gpm)_____ Di scharge Area Dimensions (feet^2)_____

Gas Flow (cfm)_____ Other Data_____

Cyclone Type_____ Efficiency_____

Gas Flow (cfm)_____ Discharge Area Dimensions (feet^2) _____

Other Data _____

Precipitator Type n/a Efficiency_____

Gas Flow (cfm)_____ Gas Velocity (ft/sec)_____

Residence Time _____ Gas Differential Pressure (psi)_____

Precipitation Rate (ft/sec)_____ Discharge Area Dimensions (feet^2)_____

Other Data _____

Ad/Absorp Type Carbon - See Attachment Efficiency 99.9 percent at start-up

Gas Flow_____ Gas Velocity (ft/sec)_____

Gas Temp (degree F)_____ Bed Volume (ft^3)_____

Bed Dimensions (feet)_____ Capacity (hours)_____

C ontaminant (lb/day)_____ R egeneration time (hours)_____

Other Type n/a Efficiency _____

Gas Flow (cfm)_____ Di scharge Area Dimensions (feet)_____

Other Data _____

V. Additional Information:

2. Fugitive Dust Control Plan (Attach if Necessary) n/a

3. Attach Operation and Maintenance Manual of Pollution Control Equipment.

(Yes) No, if not, why? _____

3. Attach Vendor Information or Manufacturer's Instructions on Pollution Control Equipment.

(Yes) No, if not, why? _____

4. Attach Related Information on Chemicals or Materials that will be emitted

(MSDS Sheets, Company Information, etc.) (Yes) No, if not why? _____

_____

APPLICANT: I hereby certify that the information contained in this application, including supplemental forms and data, when required, is, to the best of my knowledge, complete and correct. I also agree to all fees for processing this permit and grant permission for YRCAA staff to enter the premises for inspection.

Signature Sherri L Peterson for Department of Ecology Date 1/27/2012

Title Engineer Date 1/27/2012

Name and Title of Individual Filling out Form:

Name (print) Sherri Peterson, P.E.

Signature Sherri L Peterson

Name and Title of Contact Person, if Different from Above:

Name Jason Shira

Title Engineer

Filing fee of $400.00 must be paid before review will begin. A surcharge fee for time required to prepare and process the application will be invoiced after the permit to operate is issued.

OFFICAL USE ONLY

YRCAA NSR No: _____ Date Fee Paid: _____

Received by: _____ Filing Fee: **$400.00**

Yakima Regional Clean Air Agency Permit
Supporting Information

1. Introduction

This document provides the supporting information for the permit conditions for the New Source Review (NSR) permit application to Yakima Regional Clean Air Agency (YRCCA). The NSR application is required for construction, installation, and operation of a soil vapor extraction (SVE) system at the Former Frank Wear Dry Cleaners property (subject site) located at 106 South Third Avenue in Yakima, Washington. The project includes design and construction of a SVE system to remove solvents from unsaturated soils and create a negative system below the adjacent daycare building. Kennedy/Jenks is completing the design and installation of the SVE system on behalf of Washington Department of Ecology (Ecology).

This NSR permit application includes the YRRCCA NSR Application form with the following attachments:

- Attachment A: Process Flow Sheets and Equipment Layout Diagrams
- Attachment B: Equipment Model Numbers
- Attachment C: Average Throughput Values and Emissions
- Attachment D: Plot Plan
- Attachment E: Material Safety Data Sheets
- Attachment F: Prevention/Control Methods and Equipment
- Attachment G: BACT Supporting Information
- Attachment H: Estimates of Proposed Project Ambient Impact
- Attachment I: SEPA Determination

2. System Operation

A SVE system will be installed at the subject site for environmental remediation. The objectives of SVE system operation is to (1) serve as a vapor mitigation system to prevent vapor intrusion into site buildings; and (2) remove contaminants from the subsurface soils to meet Ecology soil cleanup levels. The primary constituent of concern (COC) is tetrachloroethylene (PCE) but may also include the PCE daughter products trichloroethylene (TCE), 1,2-dichloroethylene, and vinyl chloride. Material Data Safety Sheets (MSDSs) for the COCs are presented in Attachment E. The site layout is shown on Attachment D.

The SVE system operates by inducing a vacuum to the subsurface (i.e., unsaturated zone soils) and extracting volatile components. In general, contaminant mass is removed with rates decreasing over time. Vacuum is applied using a blower and treatment will consist of moisture separation (air-water separator) and carbon adsorption. Carbon adsorption will consist of two- 2,000 pound activated carbon vessels aligned in series. Treated air will be discharge to via a stack to the atmosphere. A process flow/instrumentation diagram and equipment layout are provided in Attachments A and B.

3. System Equipment

System equipment will include the following:

- Blower. Rotron Regenerative Model EN 808 Series, GAST Model R6P355R-50 Series, or equal.
- Air-Water Separator.
- Activated Carbon Vessel. Calgon Corporation Protect V Series V2M, or equal.
- Activated Carbon. VPR 4x10 by Calgon Corporation or equivalent

Supporting information for the specified equipment is provided in Attachments A, B, and F.

4. System Duration Timeframe

As stated above, the primary purpose of the SVE system is to mitigate vapor intrusion to adjacent buildings. Vapor migration into buildings is due to volatilization of COCs from both soil and groundwater. SVE system operation targets COC removal in the unsaturated zone. In the Summer of 2012, it is anticipated a remediation system will be constructed for groundwater cleanup. The groundwater remediation system is anticipated to reduce the VOCs influent concentrations to the SVE system. Attachment C presents the anticipated timeframe for the duration of the SVE system operation and also the decreasing VOC influent concentrations over this timeline.

5. Best Available Treatment Technology

Best available control technology (BACT) is defined as "an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under the Washington Clean Air Act emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each pollutant.or applied at an identical or similar source[1]. An air permit applicant may choose to demonstrate that the highest level of emissions control is not financially feasible (not cost-effective) to implement or has adverse environmental or energy impacts. In this case, the applicant evaluates the economic, environmental, and energy impacts of the next most stringent level of control until a level of control is demonstrated to be economically feasible.

The SVE system must achieve the maximum level of reduction for each air pollutant or provide it is technically or economically infeasible before a less stringent level of control is allowed. The proposed treatment technology for reducing air pollutant discharge of the SVE system is activated carbon filtration. To provide a BACT technology analysis, Kennedy/Jenks conducted a search of readily available data on comparative

[1] RCW 70.94.030(7) and WAC 173-400-030(12)

technologies for treating VOCs in effluent discharge from groundwater treatment systems. The following information sources on BACT for emission controls were reviewed:

- United States Environmental Protection Agency (USEPA) Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

- California Environmental Protection Agency Air Resources Board (CARB) Statewide Best Available Control Technology Clearinghouse

Control technologies for treating VOCs in effluent discharge from groundwater treatment systems were not listed in either of the USEPA or CARB BACT databases.

The USEPA[2] presents the following discussion regarding choice of control technologies for treating off-gas effluent discharges from SVE groundwater treatment systems:

> Thermal oxidation and carbon adsorption are the two most common technologies used for SVE off-gas treatment. These two technologies are robust, demonstrated, and mature vapor treatment methods that can address a wide variety of contaminants and concentrations. At present, the selection of off-gas treatment technologies for SVE is based on cost and operational considerations that differentiate thermal oxidation and carbon adsorption systems. Although many factors affect the cost of off-gas treatment, the general rule for selecting thermal oxidation or carbon adsorption is that dilute off-gases are more cost-effectively treated by carbon adsorption.

To supplement the BACT Impact Analysis, a copy of the USEPA (2006) comparison of thermal oxidation technology and activated carbon control technologies used for SVE off-gas treatment is provided in Attachment G. Activated carbon is considered to be the best available control technology for the subject SVE system given that the treated effluent will consist of dilute (i.e., less than 1,000 parts per million volume [ppmv] vapor concentrations of chlorinated hydrocarbons.

The BACT Impact Analysis Worksheet, provided with the permit application form, presents the anticipated emissions and costs for the subject SVE system with the chosen control technology of carbon absorption. Supporting information for costs is provided in Attachment G.

6. Ambient Air Impacts

The SVE system is designed to purge PCE in groundwater and discharge to the atmosphere. Dispersion modeling of the stack discharge of the SVE system was performed to evaluate requirements for treatment (e.g., carbon filtration) of the effluent prior to stack discharge to the atmosphere. The dispersion modeling provides supporting data for estimates of the proposed project ambient impacts, as required by the YRCAA NSR permit application.

[2] USEPA. 2006. Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice. EPA-542-R-05-028.

Washington Administrative Code (WAC) 173-460 provides the toxic air pollutants acceptable source impact level (ASIL) requirements for new air contaminant sources. Table 1 lists the ASILs for PCE and its breakdown products TCE and VC, which are all based on an averaging period of one year. Dispersion model estimates for stack discharges are compared to the ASILs to provide supporting data on estimates of the proposed project ambient air impacts for the permit application. Also listed in Table 1 are the WAC 173-460 requirements for small quantity emissions rates (SQERs) and de minimis emissions[3].

Table 1 WAC 173-460-150 Table of ASIL, SQER, and De Minimis Emission Values.

Chemical	ASIL ($\mu g/m^3$)	SQER (lb/averaging period)	De Minimis Emissions (lb/averaging period)
Tetrachloroethylene	0.169	32.4	1.62
Trichloroethylene	0.5	95.9	4.8
Vinyl chloride	0.0128	2.46	0.123

The USEPA's SCREEN3 model was selected as the dispersion model. SCREEN3 is a model that has been recognized by Ecology and USEPA as suitable for a screening air dispersion model. SCREEN3 is a steady-state Gaussian plume model which uses worst-case meteorological data to predict ambient pollutant concentrations resulting from single continuous emission sources. As a screening model, SCREEN3 is intended to be a conservative screening tool for evaluating stack discharges.

The output file for SCREEN3 model is provided in Attachment H. SCREEN3 was run using a point source option and with the following input parameters:

- **Emission rate (grams/second [g/s])**: Value varied dependant on model scenario and was calculated using estimated compound effluent concentration (micrograms per cubic meter [$\mu g/m^3$) and design stack volumetric flow rate (cubic meters per second [m^3/s]).
- **Stack Height:** 4.572 meters, based on design height of 15 feet.
- **Stack Inside Diameter:** based on design diameter of 3 inches.
- **Stack volumetric airflow:** 0.14 m^3/s, based on design volumetric airflow of 300 cubic feet per minute.
- **Stack gas temperature:** 311 degrees Kelvin, based on design effluent temperature of 100 degrees Fahrenheit.

[3] SQER means a level of emissions below which dispersion modeling is not required to demonstrate compliance with ASIL. De minimis emission means trivial levels of emissions that do not pose a threat to human health or the environment.

- **Receptor Height Above Ground:** 1.7 meters, based on a receptor height of approximately 5.5 feet. 1.7 meters is commonly used by Ecology as receptor height in SCREEN3 model applications.

- **Full meteorology option:** Most conservative option, complete set of stability - wind speed combinations examined for worst case scenario at each downwind location.

- **Simple terrain.** Option assumes terrain height does not exceed stack height.

Buildings and other structures near a relatively short stack can have a substantial effect on plume transport and dispersion, and on the resulting ground-level concentrations. If a stack is within a building's "area of influence" (e.g., a distance of five times the lesser of the building's height or maximum projected width), the stack might be influenced by the wake of the building[4]. The SCREEN3 model was run with and without the building downwash option in order to account for potential building downwash effects of the nearby daycare facility (see Attachment D for site plan) to the dispersion of SVE system stack discharges. The following model input parameters were used to describe the dimensions of the daycare facility:

- **Daycare facility building height, length, and width (in feet):** 15, 50, and 50.

SCREEN3 provides model estimates for maximum 1-hour concentration at distances beyond the stack. To compare SCREEN3 model outputs to ASILs based on annual average concentrations, maximum 1-hour concentrations were converted to annual average concentrations using a conversion factor of 0.08[5].

Table 1 in Attachment H provides a summary of SCREEN3 model estimates for annual average concentrations under the following three SVE off-gas treatment scenarios:

- No treatment of SVE system effluent (baseline)

- Treatment of SVE system effluent using carbon vessels with 90 percent removal efficiency (worst-case scenario before carbon vessel change out)

- Treatment of SVE system effluent using carbon vessels with 99.9 percent removal efficiency (initial removal efficiency at system startup)

The anticipated reduction of PCE and its daughter products as a result of groundwater remediation over the 12-month duration of the system operation will change both the chlorinated VOC total concentration (i.e., decrease) and composition in the stack effluent over the 12-month duration. PCE will sequentially convert to TCE, 1,2-dichloroethylene, and VC during the groundwater remediation process. At system start-up the mass chlorinated VOCs in the influent stream to the carbon vessels is anticipated to be comprised of mostly PCE at a maximum concentration of 50,000 $\mu g/m^3$, based on the groundwater data. Assuming a carbon vessel treatment efficiency of 99.9 percent mass removal at the SVE system start up, the SCREEN3 model estimate for a resultant PCE

[4] USEPA. 1995. SCREEN3 Model User's Guide. EPA- 454/B-95-004.
[5] USEPA. 1992. Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised. EPA-454/R-92-019.

annual average concentration is 0.004 µg/m^3, below the ASIL for PCE of 0.169 µg/m^3. Based on these SCREEN3 model results (Table 1, Attachment H), it is anticipated that the SVE system will not produce emissions that will result in ambient air impacts above ASILs. As described in the following section, a monitoring program will be in place to evaluate requirements for carbon vessel change-out.

7. Monitoring

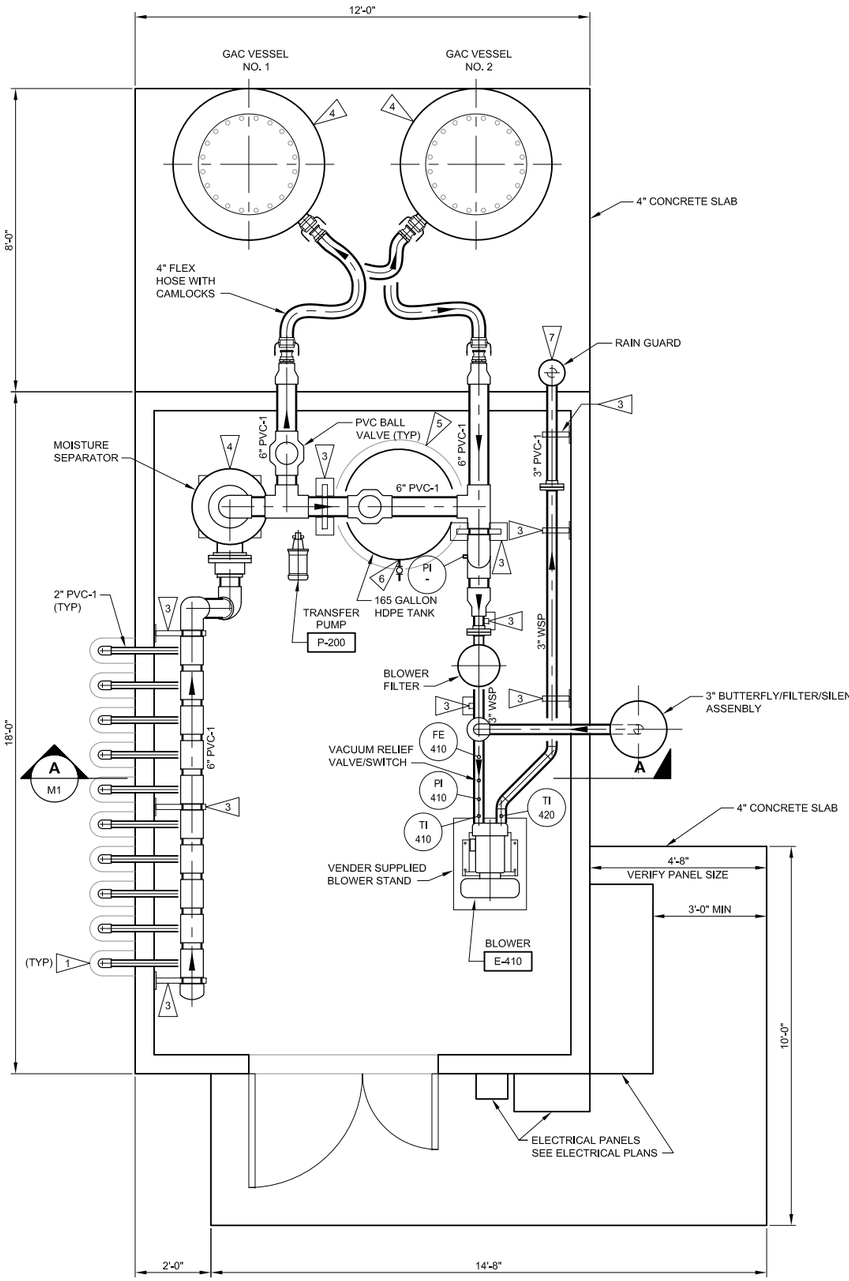
Samples of the effluent from the SVE system will be collected approximately 4 times per month. Results will be used to evaluate the necessity for carbon vessel changeout. Results may be compared to the effluent concentrations requirements to meet ASILs listed below.

Summary Table of SCREEN3 Model Estimates for Effluent Concentrations to Meet ASILs

Chemical	ASIL (µg/m^3 - annual average)	Equivalent Hourly Maximum Concentration (µg/m3)	Effluent Concentration (µg/m^3) to Meet ASIL
Tetrachloroethylene	0.169	2.11	2,101
Trichloroethylene	0.5	6.25	6,217
Vinyl chloride	0.0128	0.16	159

Attachment A

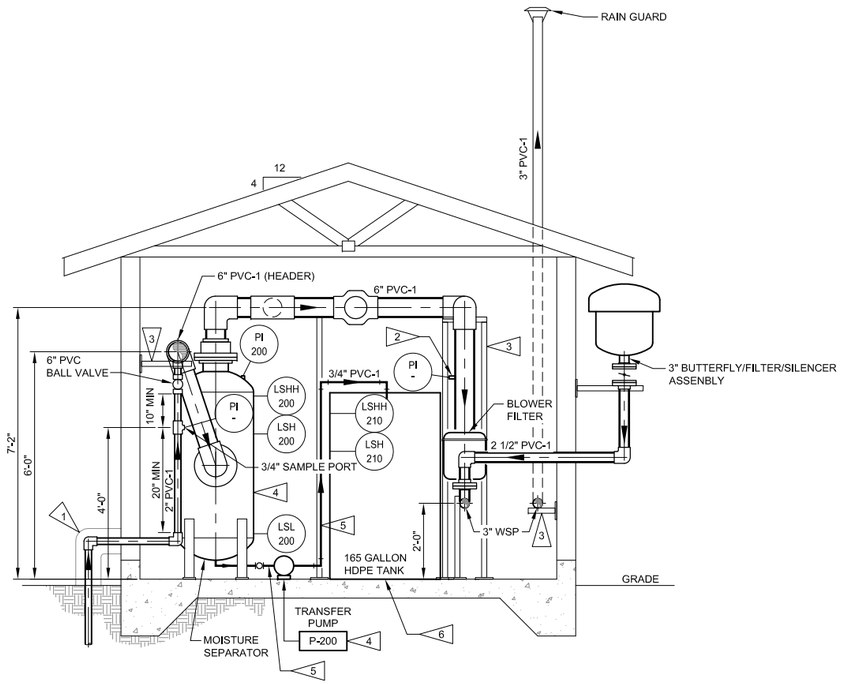
Process Flow Sheets and Equipment Layout Diagrams



PIPING PLAN 1 — C-4

0 1 2 3

1/2"=1'-0"



SECTION A — C-4

0 1 2 3

1/2"=1'-0"

NOTES:

1. 3" INSULATION.
2. INSTALL PRESSURE INDICATOR IN A MANNER TO BE VIEWED FROM STANDING ON THE FLOOR.
3. CONTRACTOR DESIGNED PIPE SUPPORT. USE P1001 DOUBLE UNISTRUT OR EQUIVALENT. SECURE TO WALL OR CONCRETE FLOOR PER SPECIFICATIONS. PROVIDE BLOCKING FOR WALL MOUNTED SUPPORTS.
4. VENDER SUPPLIED INSULATION AND HEAT TRACE.
5. CONTRACTOR SUPPLIED AND INSTALLED 8W/FT HEAT TRACE AND 3" INSULATION JACKET PER SPECIFICATIONS.
6. CONTRACTOR SUPPLIED 165 GALLON HDPE TANK. REDUCE 2" DRAIN TO 3/4" WITH 3/4" DRAIN VALVE AND GARDEN HOSE THREADED CONNECTION.
7. INSTALL 15-FEET ABOVE FINISH GRADE, THROUGH ROOF OVERHANG AND FLASH APPROPRIATELY. SUPPORT OFF WALL APPROXIMATELY 8 FOOT ABOVE ABOVE FINISH GRADE.

NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

RICHARD C. GUGLIOMO — STATE OF WASHINGTON — 18629 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED	JMF
DRAWN	BBH
CHECKED	RCG

WASHINGTON STATE DEPARTMENT OF ECOLOGY

FRANK WEAR SOIL VAPOR EXTRACTION SYSTEM
YAKIMA, WASHINGTON

Kennedy/Jenks Consultants
FEDERAL WAY, WA

EQUIPMENT BUILDING MECHANICAL PLAN AND SECTIONS

FILE NAME	1196016_M01
JOB NO.	1196016*00
DATE	DEC. 2011
SHEET	M-1

SCADA

RTU

1 PROVIDE EXTRA 4" MPT PVC-1 PLUG FOR FUTURE USE NOT INSTALLED.

2 PROVIDE 4" FLEX HOSE WITH LENGTHS TO SWITCH BETWEEN LEAD AND LAG GAC VESSELS WITHOUT MOVING VESSELS. HOSE LENGTH MUST BE ADEQUATE TO AVOID UNDO-STRESS ON CAMLOCK CONNECTIONS.

3 CONTRACTOR PROVIDE AND INSTALL HEAT TRACE AND INSULATION.

CAMLOCK CONNECTIONS (TYP)

4" FLEX HOSE

GAC VESSEL NO.1

PI 310

3/4" PCV-1 SAMPLE PORT

4" WSP

3/4" WELD-O-LET OR TEE

4" FLEX HOSE

GAC VESSEL NO.2

PI 311

3/4" PCV-1 SAMPLE PORT

4" FLEX HOSE

4" WSP

3/4" WELD-O-LET OR TEE

3" BUTTERFLY/FILTER/SILENCER ASSEMBLY

SILENCER

RAIN GUARD

3" PVC-1 (DISCHARGE STACK)

BUILDING ENCLOSURE

6" PVC-1

PI 200

6" PVC-1

6" PVC-1

PI 320

3/4" PCV-1 SAMPLE PORT

VENDOR SUPPLIED

BLOWER FILTER

3" WSP

VACUUM RELIEF VALVE/SWITCH

FE 410

PI 410

3" PVC-1

3" WSP

3" WSP

TI 410

BLOWER E-410

TI 420

VENDOR SUPPLIED

LSHH 200

LSH 200

LSL 200

DRAIN

MOISTURE SEPARATOR

3/4" PVC-1

TRANSFER PUMP P-200

3/4" PVC-1

LSHH 210

LSH 210

165 GALLON HDPE TANK

2"

3/4" GARDEN HOSE CONNECTION

PI 110

PI 120

PI 130

PI 140

PI 150

5 DIA

10 DIA

3/4" PCV-1 SAMPLE PORT (TYP)

PI 111

PI 121

PI 131

PI 141

PI 151

2" PCV-1 TEE AND THREADED PLUG

2" PVC-1 (SCHD 80) (LOWER ZONE)

2" PVC-1 (SCHD 80) (UPPER ZONE)

2" PVC-1 (SCHD 40)

SVE-1

SVE-2

SVE-3

SVE-4

SVE-5

P:\CAD\1111196016.00 Washington DEQ\1196016-P02.dwg

BRYANH 12/23/2011 1:22 PM

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.

NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

RICHARD C. GUGLIOMO — STATE OF WASHINGTON — 17523 — REGISTERED — PROFESSIONAL ENGINEER

DESIGNED JMF

DRAWN BBH

CHECKED RCG

WASHINGTON STATE DEPARTMENT OF ECOLOGY

FRANK WEAR SOIL VAPOR EXTRACTION SYSTEM
YAKIMA, WASHINGTON

Kennedy/Jenks Consultants
FEDERAL WAY, WA

PROCESS AND INSTRUMENTATION DIAGRAM

FILE NAME 1196016_P02

JOB NO. 1196016*00

DATE DEC. 2011

SHEET P-2 OF

Attachment B

Equipment Model Numbers

Environmental / Chemical Processing Blowers

EN 808 & CP 808 Three-Phase

ROTRON®

Sealed Regenerative Blower w/Explosion-proof Motor

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- Maximum flow: 360 SCFM
- Maximum pressure: 85 IWG
- Maximum vacuum: 90 IWG
- Standard motor: 7.5 HP, explosion-proof
- Cast aluminum blower housing, impeller , cover & manifold; cast iron flanges (threaded); teflon® lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

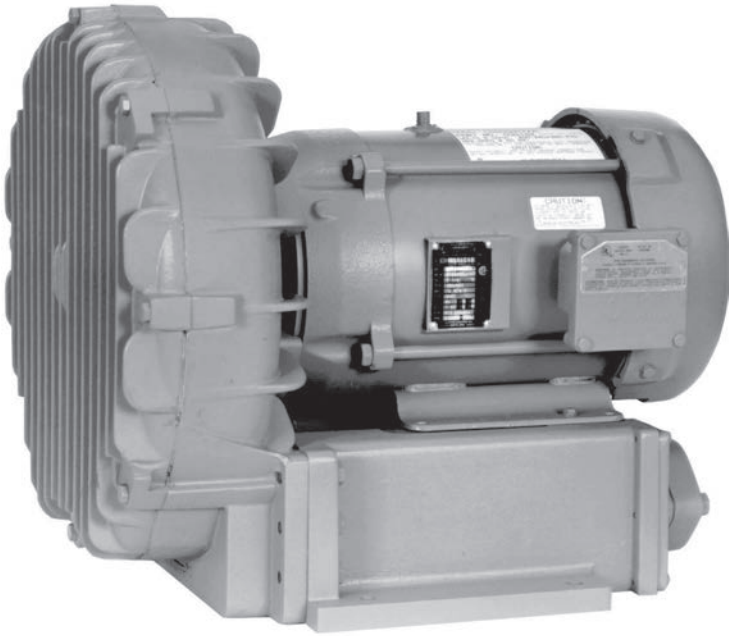
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

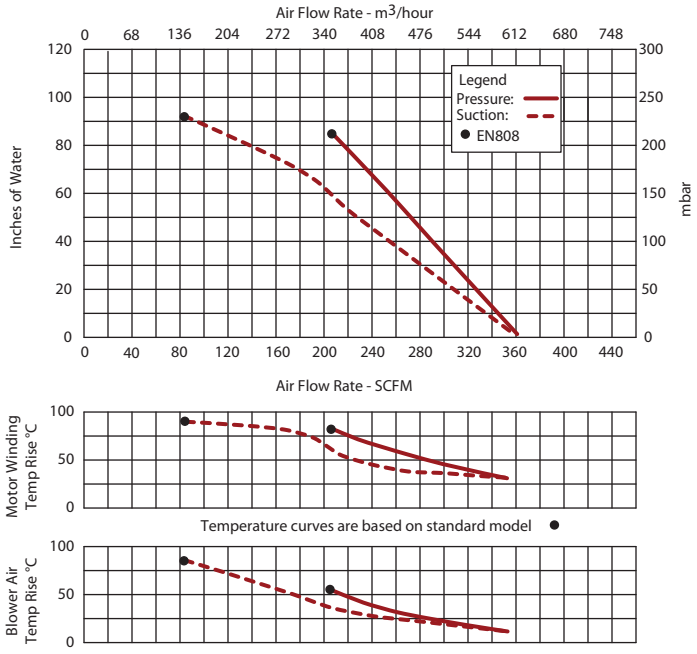
ACCESSORIES

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

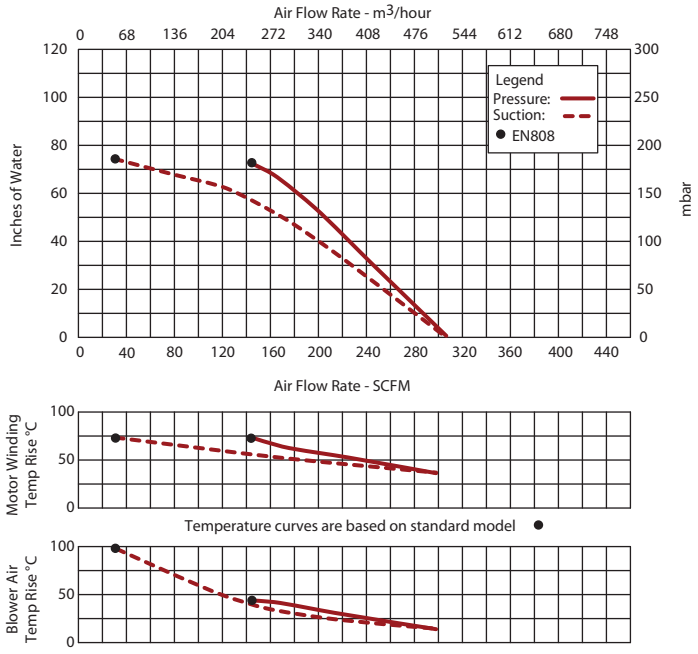


Blower Performance at Standard Conditions

60 Hz



50 Hz



This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

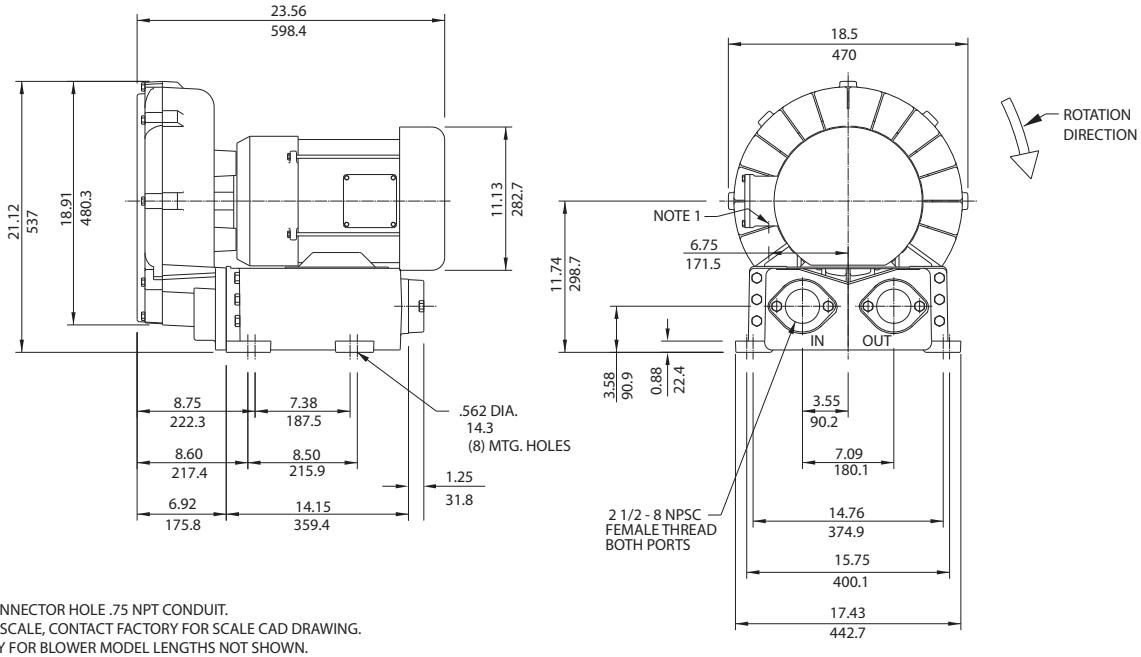
AMETEK TECHNICAL & INDUSTRIAL PRODUCTS
75 North Street, Saugerties, NY 12477
USA: +1 215-256-6601 - Europe: +44 (0) 845 366 9664 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK® TECHNICAL & INDUSTRIAL PRODUCTS

EN 808 & CP 808 Three-Phase

ROTRON®

Sealed Regenerative Blower w/Explosion-proof Motor



IN
MM

NOTES
1. TERMINAL BOX CONNECTOR HOLE .75 NPT CONDUIT.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

		Part/ Model Number		
		EN808BA72MXL	EN808BA86MXL	CP808FY72MXLR
Specification	Units	081229	081230	081234
Motor Enclosure - Shaft Mtl.	-	Explosion-proof-CS	Explosion-proof-CS	Chem XP-SS
Horsepower	-	7.5	7.5	7.5
Phase - Frequency	-	Three-60 hz	Three-60 hz	Three-60 hz
Voltage	AC	230/460	575	230/460
Motor Nameplate Amps	Amps (A)	18.6/9.3	7.4	18.6/9.3
Max. Blower Amps	Amps (A)	22.0/11.0	8.1	22.0/11.0
Inrush Amps	Amps (A)	126/63	56	126/63
Service Factor	-	1.0	1.0	1.0
Starter Size	-	1/1	1	1/1
Thermal Protection	-	Class B - Pilot Duty	Class B - Pilot Duty	Class B - Pilot Duty
XP Motor Class - Group	-	I-D, II-F&G	I-D, II-F&G	I-D, II-F&G
Shipping Weight	Lbs	287	287	287
	Kg	130.2	130.2	130.2

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

XP Motor Class - Group - See Explosive Atmosphere Classification Chart in Section I

AMETEK TECHNICAL & INDUSTRIAL PRODUCTS
75 North Street, Saugerties, NY 12477
USA: +1 215-256-6601 - Europe: +44 (0) 845 366 9664 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK®
TECHNICAL & INDUSTRIAL PRODUCTS

R3105N-50

R4 - R7 Series

R3-R7 Series - Explosion Proof Motors

MODELS	Maximum Pressure ("H_2O) 60 Hz	50 Hz	Maximum Vacuum ("H_2O) 60 Hz	50 Hz	Maximum Air Flow (CFM) 60 Hz	50 Hz
R3105N-50	43	31	40	28	53	44
R4110N-50 **R4310P-50**	51	38	48	35	92	74
R4P115N-50	65	45	60	40	133	112
R5125Q-50 **R5325R-50**	55 65	- 50	60 65	- 47	160 160	- 133
R6130Q-50 **R6340R-50**	60 100	75 75	70 80	65 65	215 215	180 180
R6P155Q-50 **R6P355R-50**	95 100	80 80	85 85	65 65	280 280	235 232
R7100R-50	100	90	110	85	425	350

PRODUCT FEATURES

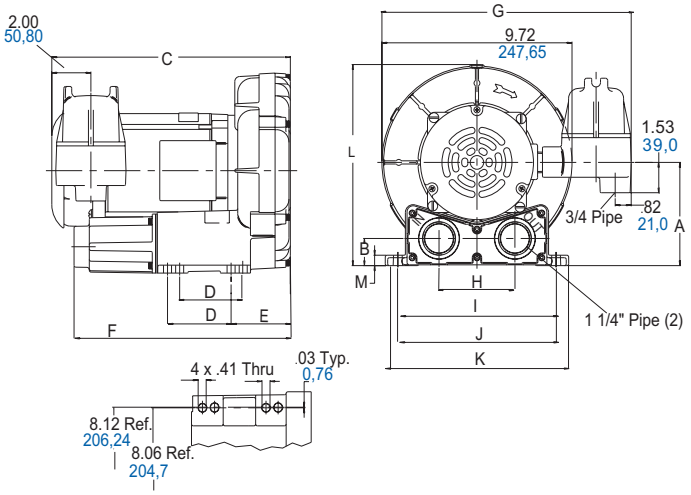
- Rugged design, maintenance free
- Quiet operation within OSHA standards
- Blowers and motors rated for continuous duty
- UL and CSA approved multi-voltage motors, incorporating approved thermal protection
- Motors classified as Explosion Proof Division 1 and 2, for Group D explosive atmospheres
- Motors carry full rated load at temperatures below Class B motor insulation limits
- Class F motor insulation used in motors larger than 1 HP
- Motors conform to NEMA frame sizes; motor enclosures conform to IP54 (suitable for outdoor use)
- Pilot duty thermal overload protection is standard on all 1 HP and larger motors
- Double sealed motor ball bearings with a B10 life exceeding 30,000 hours of continuous operation at the maximum rated continuous blower load
- Sealed air streams
- Aluminum impeller, housing and cover; viton shaft seal.
- Pressurized and leak-tested to less than 5cc/minute

Recommended Accessories	**R3 Series**	**R4 Series**	**R4P Series**	**R5 Series**	**R6 Series**	**R6P Series**	**R7 Series**
Pressure Gauge	AJ496	AJ496	AE133	AE133	AE133	AE133	AE133
Vacuum Gauge	AJ497	AJ497	AE134	AE134	AE134	AE134	AE134
Pressure Filter	AJ126C	AJ126D	AJ126D	AJ126D	AJ126F	AJ126F	AJ126G
Vacuum Filter (Inline)	AJ151C	AJ151D	AJ151D	AJ151E	AJ151G	AJ151G	AJ151H

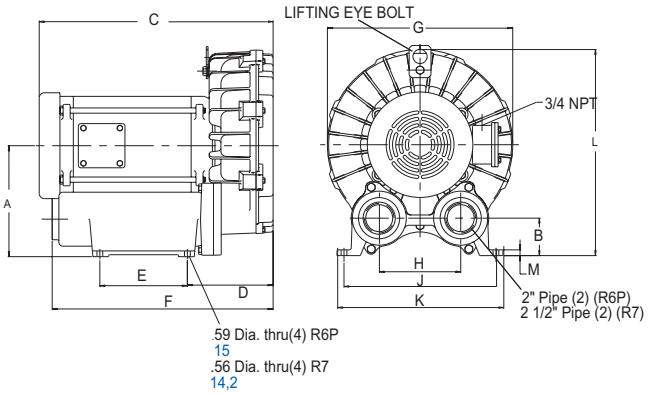
Gast Manufacturing Inc., A Unit of IDEX Corporation, Benton Harbor, MI USA • ph 616-926-6171 • fx 616-925-8288 • www.gastmfg.com

Product Dimensions (in. mm)

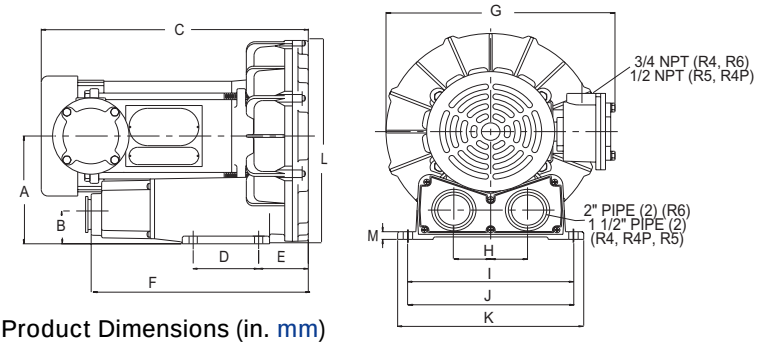
Model R3



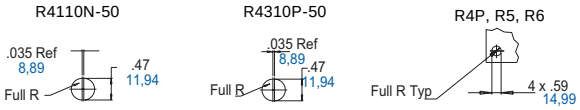
Models R6P, R7



Models R4, R4P, R5, R6



Mounting Hole Detail



Product Dimensions (in. mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M
R3105N-50	5.21	1.37	12.3	3.25	3.06	11.06	12.75	3.88	8.06	8.12	9.38	10.15	.53
	132	35	312	83	78	281	324	99	205	206	238	258	13
R4110N-50	6.18	1.68	15.34	3.75	2.85	12.44	12.34	3.96	8.86	8.93	10.00	11.80	.44
	157	43	390	95	72	316	313	101	225	227	254	300	11
R4310P-50	6.18	1.68	14.09	3.75	2.84	12.44	12.34	3.96	8.86	8.93	10.00	11.80	.44
	157	43	358	95	74	316	313	101	225	227	254	300	11
R4P115N-50	6.98	1.84	17.41	4.50	3.25	13.93	13.75	4.75	10.25	10.31	11.75	13.61	.60
	177	47	442	114	83	354	349	121	260	262	298	346	15
R5125Q-50	7.02	1.82	17.59	4.50	3.55	14.22	13.72	4.75	10.25	10.31	11.75	13.80	.59
	178	46	447	114	90	361	348	121	260	262	298	351	15
R5325R-50	7.02	1.82	16.75	4.50	3.55	14.22	13.56	4.75	10.25	10.31	11.75	13.80	.59
	178	46	1425	114	90	361	344	121	260	262	298	351	15
R6130Q-50	7.75	1.94	18.97	5.50	3.85	16.02	15.17	4.92	11.38	11.42	12.96	15.34	.52
	197	49	482	140	98	407	385	125	289	290	329	390	13
R6340R-50	7.75	1.94	18.82	5.50	3.85	15.89	15.17	4.92	11.38	11.42	12.96	15.34	.52
	197	49	478	140	98	404	385	125	298	290	329	390	13
R6P155Q-50	9.77	3.15	22.81	5.12	5.51	16.85	16.75	5.00	-	11.42	12.80	18.14	.50
	248	80	579	130	140	428	425	127	-	290	325	461	13
R6P355R-50	9.77	3.15	19.92	5.12	5.51	16.85	16.75	5.00	-	11.42	12.80	18.14	.50
	248	80	506	130	140	428	425	127	-	290	325	461	13
R7100R-50	10.79	3.64	22.77	8.36	8.50	21.50	18.00	7.90	-	14.76	16.14	20.03	.56
	274	92	578	212	216	546	457	201	-	375	410	509	14

Notice: Specifications subject to change without notice.

Product Specifications

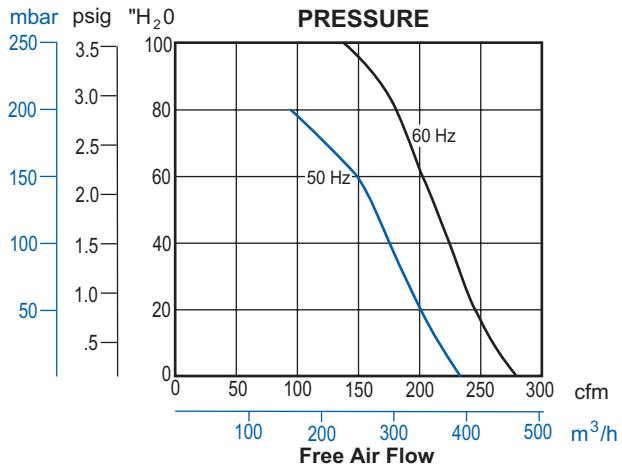
MODEL NUMBER		R3105N-50	R4110N-50	R4310P-50	R4P115N-50
Motor Enclosure		XPFC	XPFC	XPFC	XPFC
HP/kW	60 Hz	.50/0,37	1.0/0,75	1.0/0,75	1.5/1,1
	50 Hz	.33/0,25	.60/0,45	.60/0,45	1.0/0,75
Voltage	60 Hz	115/208-230-1	115/208-230-1	208-230/460-3	115/208-230-1
	50 Hz	110/220-240-1	110/220-240-1	220/380-3	110/220-240-1
Amps	60 Hz	5.2/2.9-2.6	11.4/6.2-5.6	3.4-3.3/1.6	20.3/11.2-10.6
	50 Hz	4.8/2.4-2.2	9.2/5.2-4.6	3.2/1.6	15.2/7.6-8
Starting Amps	60 Hz	12.5 @ 230V	36.5 @ 230V	19.7 @ 230V	60.6 @ 230V
	50 Hz	13 @ 220V	40.6 @ 240V	23.3 @ 220V	Consult Factory
Insulation Class		B	B	B	F
Recommended NEMA Starter Size		00/00	0/00	0/0	1/0
Net Weight (lbs/kg)		52/24	60/28	58/27	79/36

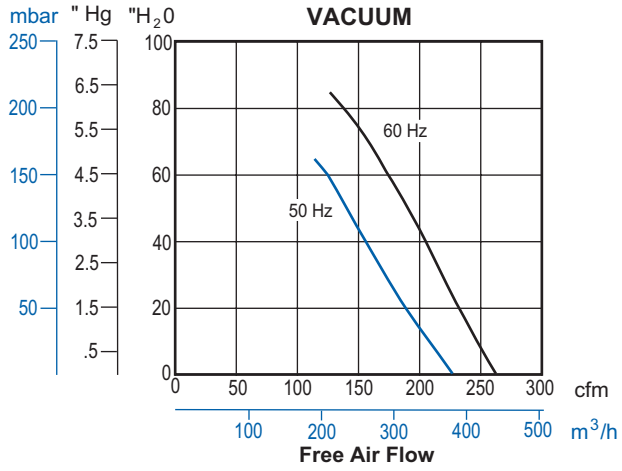
MODEL NUMBER		R5125Q-50	R5325R-50	R6130Q-50	R6340R-50
Motor Enclosure		XPFC	XPFC	XPFC	XPFC
HP/kW	60 Hz	2.0/1,5	2.0/1,5	3.0/2,2	4.0/3,0
	50 Hz	-	1.5/1,1	2.5/1,9	3.0/2,2
Voltage	60 Hz	115/230-1	208-230/460-3	230-1	208-230/460-3
	50 Hz	-	190-220/380-415-3	220-240-1	190-220/380-415-3
Amps	60 Hz	25/12.5	6.6-6.1/3.05	16.3	13-12/6
	50 Hz	-	5.0-4.4/2.5-2.6	14.7-13.5	14.4-13.4/7.2-6.8
Starting Amps	60 Hz	78 @ 230V	48 @ 230V	64 @ 230V	125 @ 230V
	50 Hz	-	Consult Factory	Consult Factory	Consult Factory
Insulation Class		F	F	F	F
Recommended NEMA Starter Size		1/0	0/0	1	1/0
Net Weight (lbs/kg)		77/35	75/34	129/59	112/51

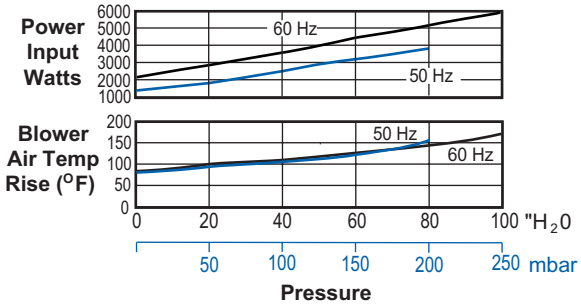
MODEL NUMBER		R6P155Q-50	R6P355R-50	R7100R-50
Motor Enclosure		XPFC	XPFC	XPFC
HP/kW	60 Hz	5.5/4,1	6.0/4,5	10/7,5
	50 Hz	4.0/3,0	4.5/3,4	8.0/6,0
Voltage	60 Hz	230-1	208-230/460-3	208-230/460-3
	50 Hz	220-240-1	190-220/380-415-3	190-220/380-415-3
Amps	60 Hz	29.9	20-18/9	26.5-24/12
	50 Hz	20.8-19.1	14.9-11/7.45-5.8	23.2-21.0/11.6-10.9
Starting Amps	60 Hz	198.4 @ 230V	59 @ 460V	105 @ 460V
	50 Hz	189 @ 240V	Consult Factory	Consult Factory
Insulation Class		F	F	F
Recommended NEMA Starter Size		0/2	1/0	2/1
Net Weight (lbs/kg)		243/110	233/105	297/134

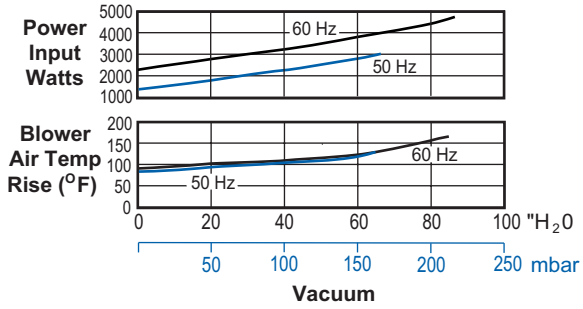
Gast Manufacturing Inc., A Unit of IDEX Corporation, Benton Harbor, MI USA • ph 616-926-6171 • fx 616-925-8288 • www.gastmfg.com

R6P355R-50

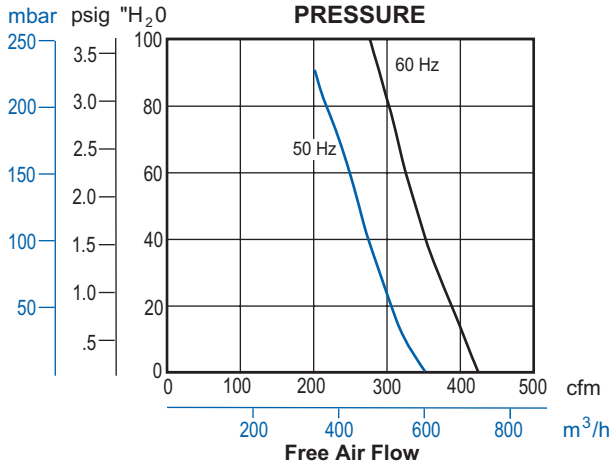


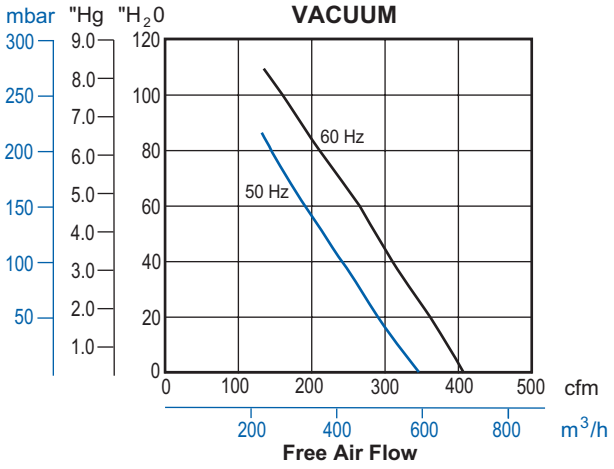


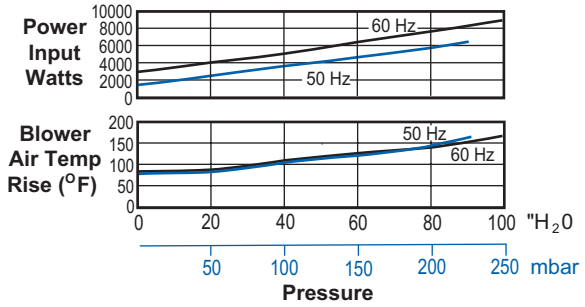


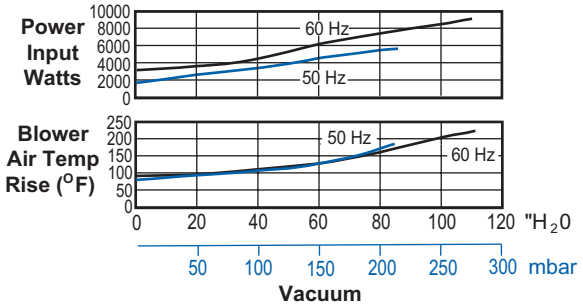


R7100R-50









Q. What happens to the noise when I locate two blowers close together?

A. If the blowers are of the same design they produce sound frequencies that are close together. These may cause a “beating” change in volume of the blower noise. This is because the units are not synchronized. If two small blowers are needed this change in volume can be reduced by moving tham further apart. With larger blowers a dual blower with two blowers on one motor will solve this problem.

Q. What causes the noise relief valves make?

A. Air rush through the valve.

Q. How do I control relief valve or bleed off valve noise?

A. Attach AJ121 series silencer on the port of the relief valve that is open to atmosphere.

Contact Gast at 616-926-6171 or www.gastmfg.com with any further questions you may have on reducing blower noise in your application.

Noise Reduction and Absorption Coefficients for Common and Specialty Noise Reduction Materials

	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	NRC
Brick, unglazed	.03	.03	.03	.04	.05	.07	.04
Carpet 1/4 in pile height	.05	.10	.15	.30	.50	.55	.26
Fabric Heavy Velour 18 oz per sq. yd draped to 1/2 area	.14	.35	.55	.72	.70	.65	.62
Hardwood Plywood Paneling 1/4 in thick wood frame	.58	.22	.07	.04	.03	.07	.09
Tecnifoam* TFP4 Pyramind shape	.39	.60	1.21	1.14	1.16	1.13	1.05
Tecnifoam* TFW4000 Anaechoic Wedge shape	.64	1.10	1.34	1.23	1.24	1.21	1.25

Source: Mechancial Engineering Reference Manual

*TFP4 and TFW4000 are products of Tecnifoam, Inc., 7145 Boone Avenue North, Minneapolis, MN., 55428

Blower Sound Levels of Gast Blowers

Data is highest sound level out of 4 places around the blower at 1 meter.

Data represents average of several units run at nominal voltage.

Lowest to highest maximum dba level throughout performance range is shown.

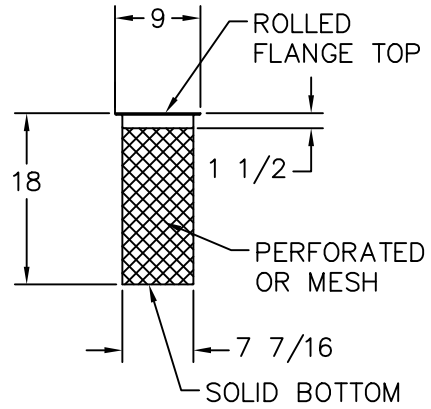
Readings at other than the maximum around the blower at 1 meter may be from 2 to 10 dba less than data shown.

Readings taken in a laboratory sound room that does not reflect much noise.

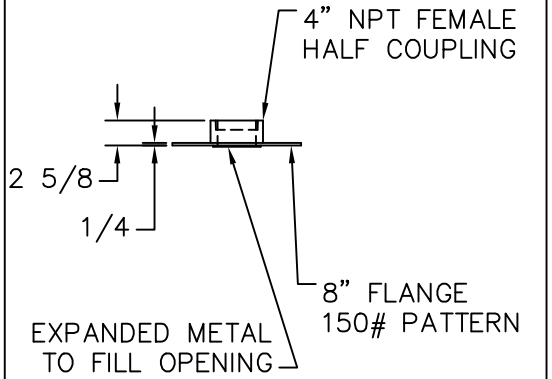
Note: For comparison purposes, some blower manufacturers show sound data from 1–1/2 meters instead of from 1 meter; also, some blower manufacturers show an “average” sound level across performance instead of the full range between minimum and maximum sound levels; either of these methods will provide different and usually lower sound levels compared to Gast’s sound level method.

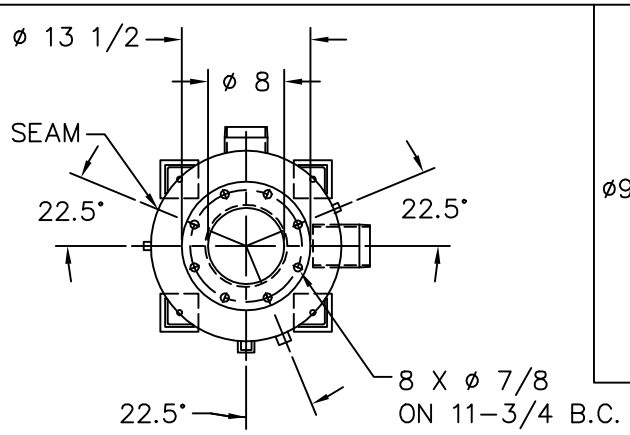
60Hz	dBa at Pressure	50Hz	dBa at Pressure
R1	59-67	R1	59-64
R2	66	R2	61-63
R3	67-70	R3	63-68
R4	69-73	R4	64-69
R4P	69-75	R4P	64-71
R5	73-77	R5	71-77
R6	73-79	R6	70-79
R6P	82-83	R6P	77-80
R6PP	77-79	R6PP	73-76
R6PS	76-77	R6PS	72-75
R7	82-84	R7	77-79
R7P	77-80	R7P	74-79
R7S	75-77	R7S	72-76
R9	82-85	R9	78-85
R9P	81-88	R9P	79-86
R9S	79-81	R9S	77-81
R4H	80-82	R4H	75-81
R4M	82-83	R4M	78-79
R7H	83	R7H	79-81

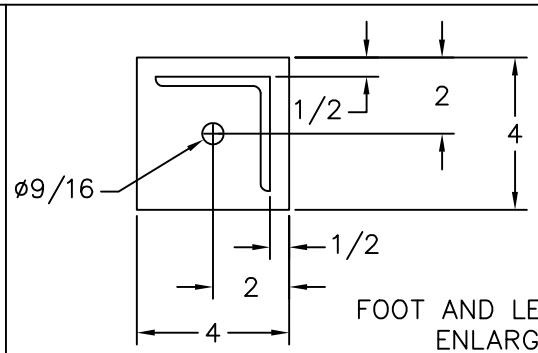
60Hz	dBa at Vacuum	50Hz	dBa at Vacuum
R1	58-63	R1	54-60
R2	67	R2	63-64
R3	67-71	R3	64-69
R4	70-72	R4	66-70
R4P	73-74	R4P	68-71
R5	75-76	R5	71-73
R6	78-80	R6	74-77
R6P	81-85	R6P	79-81
R6PP	81-83	R6PP	78-79
R6PS	79-81	R6PS	76-77
R7	85-87	R7	79-84
R7P	84-86	R7P	80-83
R7S	82-83	R7S	78-80
R9	85-90	R9	83-84
R9P	88-90	R9P	84-87
R9S	87-88	R9S	83-86
R4H	82-89	R4H	79-88
R4M	85-89	R4M	80-85
R7H	82-91	R7H	80-90



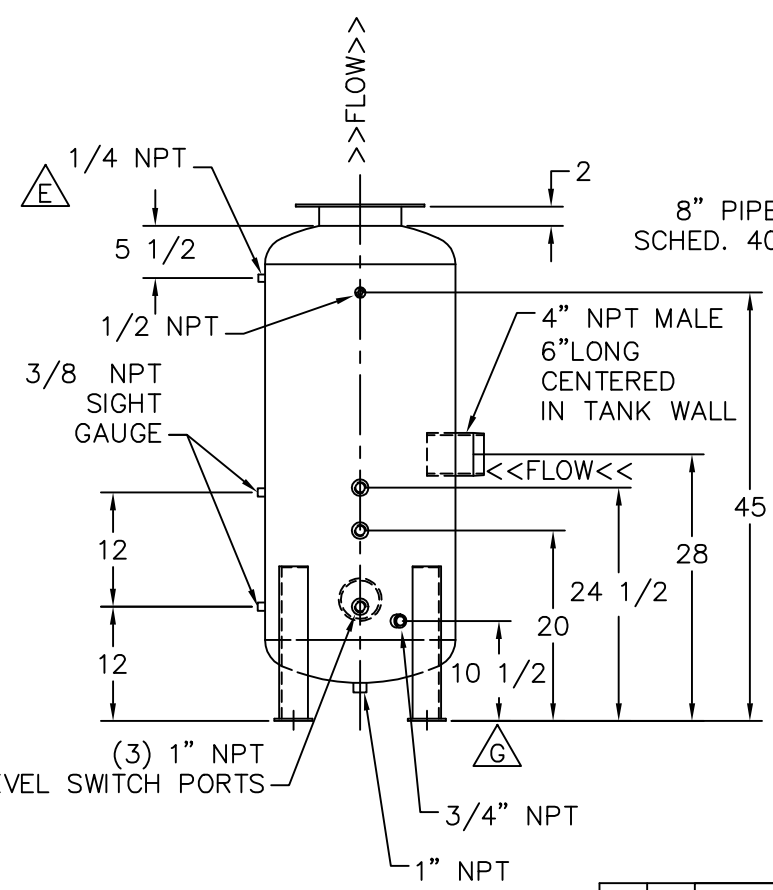
INSERT BASKET DETAIL

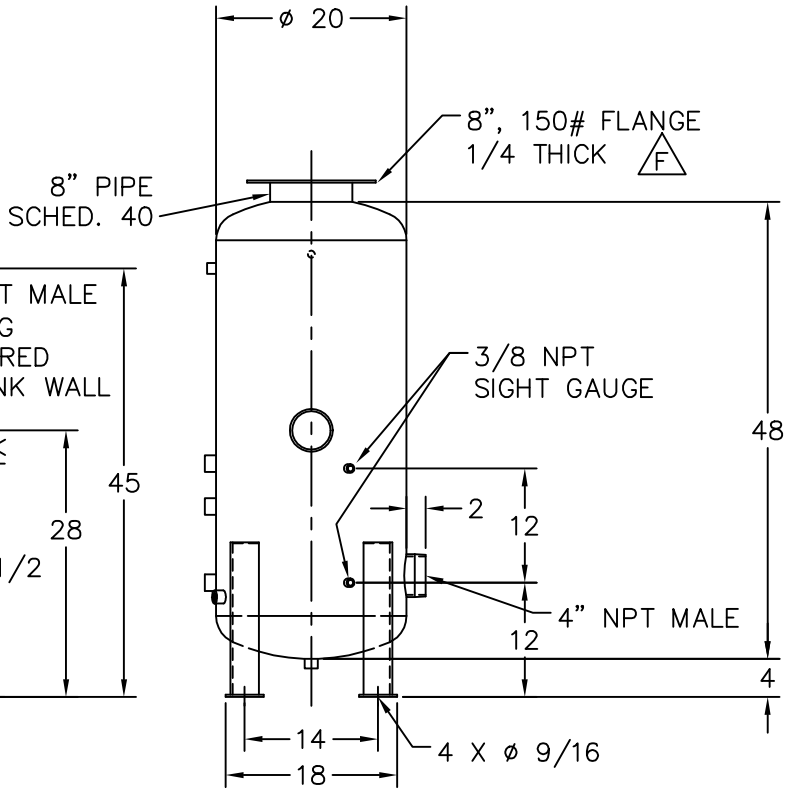






FOOT AND LEG DETAIL ENLARGED





NOTES:
1. MATERIAL:
   SHELL– #12 GA. HRS
   HEADS– #12 GA HRS P & O
   FEET– 4X 4 X 1/4 PLATE
   LEGS– 3 X 3 X 1/4 ANGLE
2. FINISH: GRAY ENAMEL.
3. ALL PORTS ARE FEMALE EXCEPT 4".

ID: 501.DWG 11/09/01 14:12

REV.	DATE	DESCRIPTION
G	9-16 2002	RAISED PUMP PORT
F	11-9 2001	FLANGE THICKNESS 1/4"
E	10-01 2001	MOVED PORT
D	6-1 2001	REDRAWN AND REVISED,MW
C	8-15 1998	ADD SIGHT GAUGE

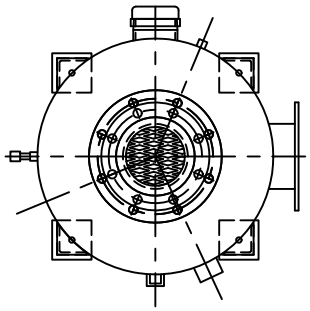
DRAWN BY: ROBINSON DATE: 8-13-98
APPROVED BY: DATE:
DIMENSIONS IN INCHES
SCALE:
TOLERANCE: ANGULAR TOLERANCE:
MATERIAL: STEEL WEIGHT: 100
SHEET 1 OF 1

J.E.GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

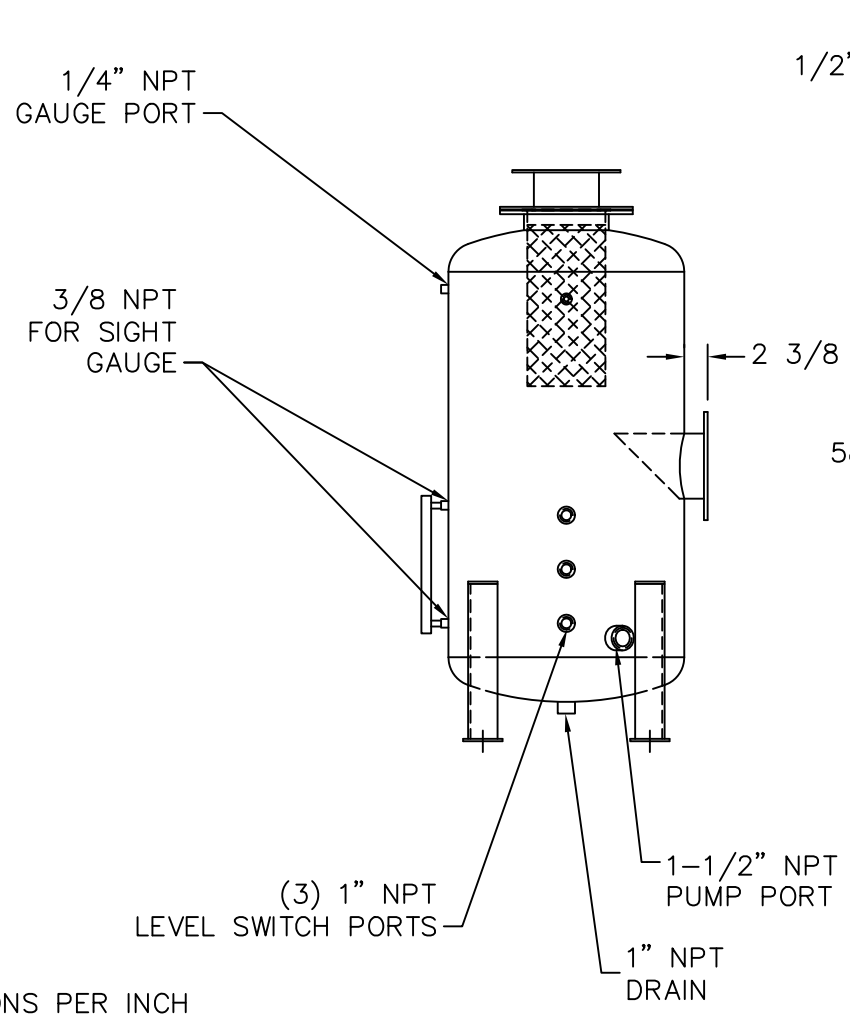
GX-60 SEPARATOR
60 GAL. VESSEL
22 GAL. LIQ CAPACITY

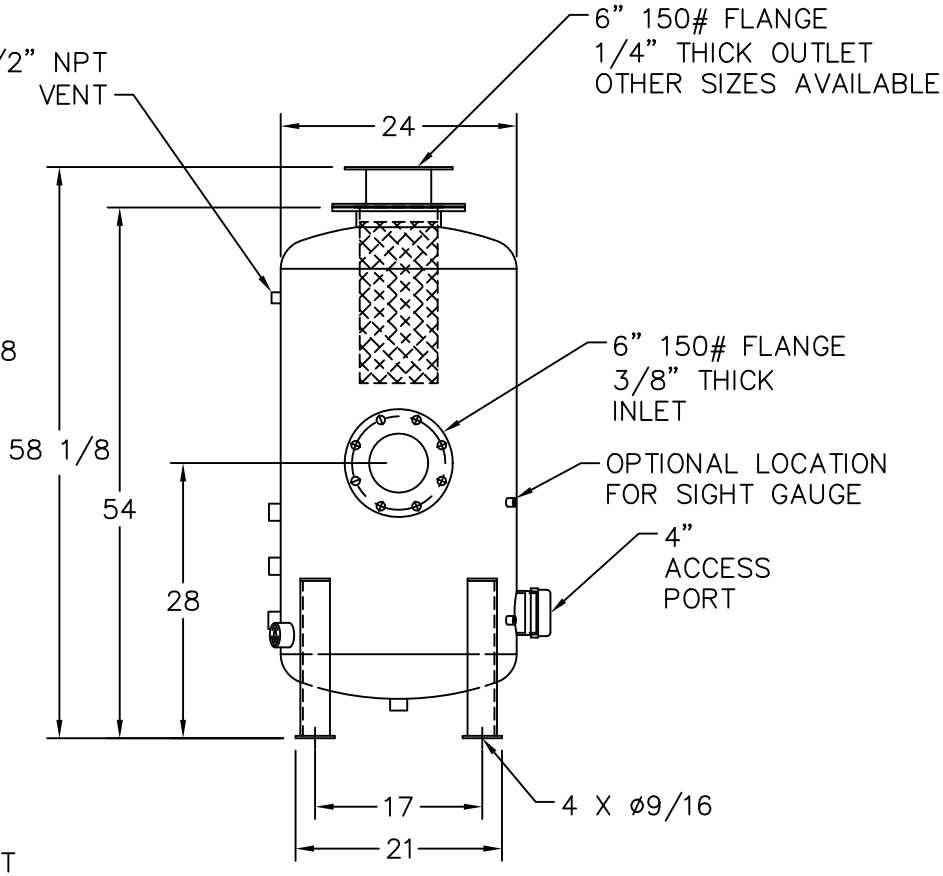
1500-C-0501 | G

501A.dwg 09/16/02 15:13



NOTES:
1. FINISH: GRAY ENAMEL
2. ALL PORTS ARE FEMALE EXCEPT 4"





1.93 GALLONS PER INCH
APPROX. 10.6 GALLONS LOW TO HIGH
APPROX. 10.6 GALLONS HIGH TO HIGH-HIGH

REV.	DATE	DESCRIPTION
F	4-23 2008	MOVED H L SWITCH PORT

DRAWN BY: M. WITTE | DATE: 12-14-01
APPROVED BY: | DATE:
DIMENSIONS IN INCHES
SCALE:
TOLERANCE | ANGULAR TOLERANCE
MATERIAL | WEIGHT: 240
SHEET 1 OF 1

J.E.GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

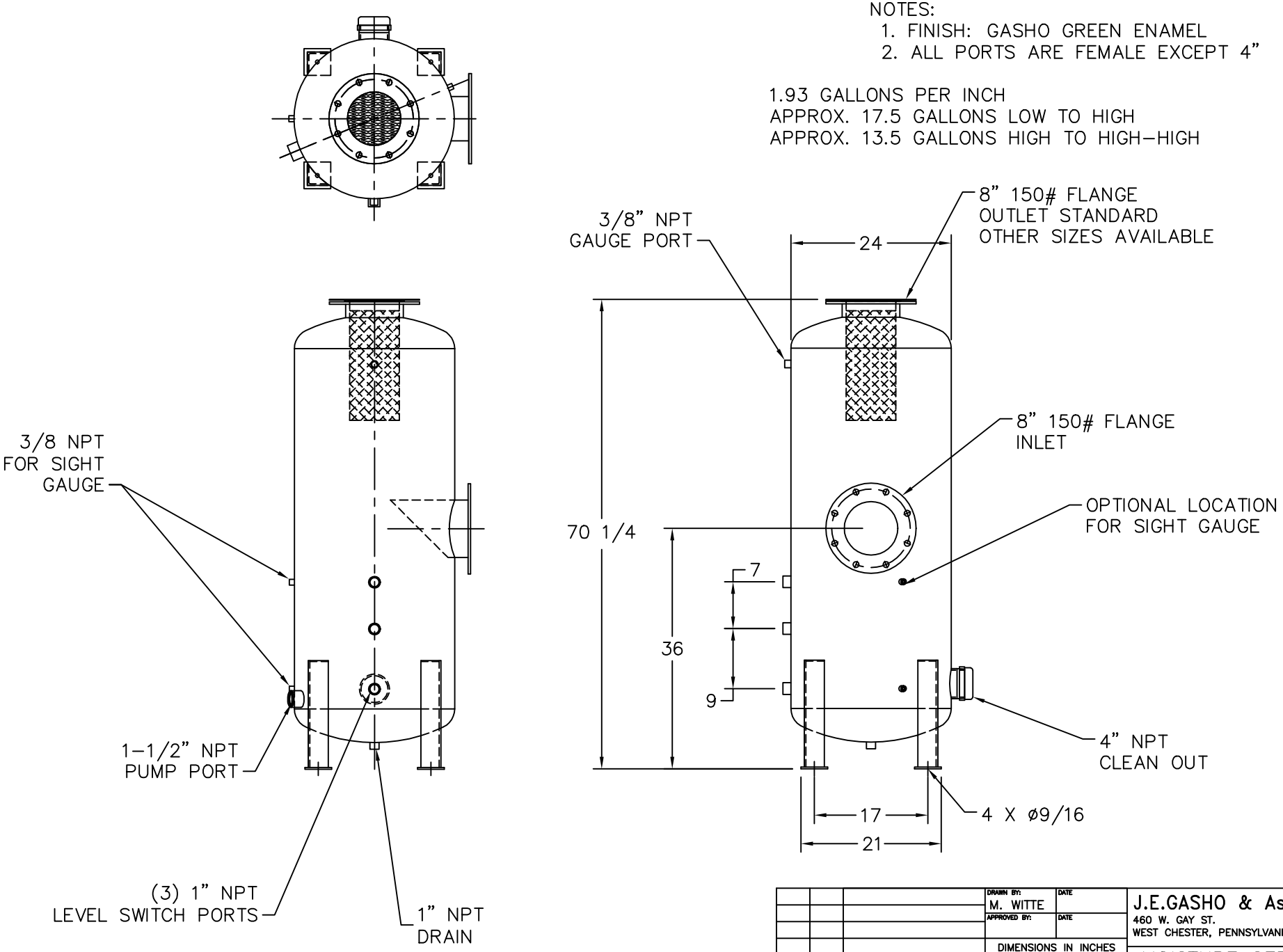
GX-90 SEPARATOR
90 GALLON VESSEL
30 GAL. LIQ. CAPACITY

1500-C-0513 | F

GX90.dwg 01/20/09 09:08

NOTES:
1. FINISH: GASHO GREEN ENAMEL
2. ALL PORTS ARE FEMALE EXCEPT 4"

1.93 GALLONS PER INCH
APPROX. 17.5 GALLONS LOW TO HIGH
APPROX. 13.5 GALLONS HIGH TO HIGH–HIGH



REV.	DATE	DESCRIPTION
C	1-29 2010	MOVED PORT
B	1-15 2003	PORT WAS 3/4"
A	5-9 2002	ADDED DIMS

DRAWN BY: M. WITTE — DATE
APPROVED BY: — DATE
DIMENSIONS IN INCHES
SCALE
TOLERANCE — ANGULAR TOLERANCE
MATERIAL: STEEL — WEIGHT
SHEET 1 OF 1

J.E.GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

MOISTURE SEPARATOR
GX–120

1500–C–0526 | C

526C Customer.dwg 07/18/11 14:04

Gasho SINCE 1982
The Leader in Blower & Vacuum Solutions
460 West Gay Street
West Chester, PA 19380
610-692-5650 Fax 610-692-5837
cs@gasho.org

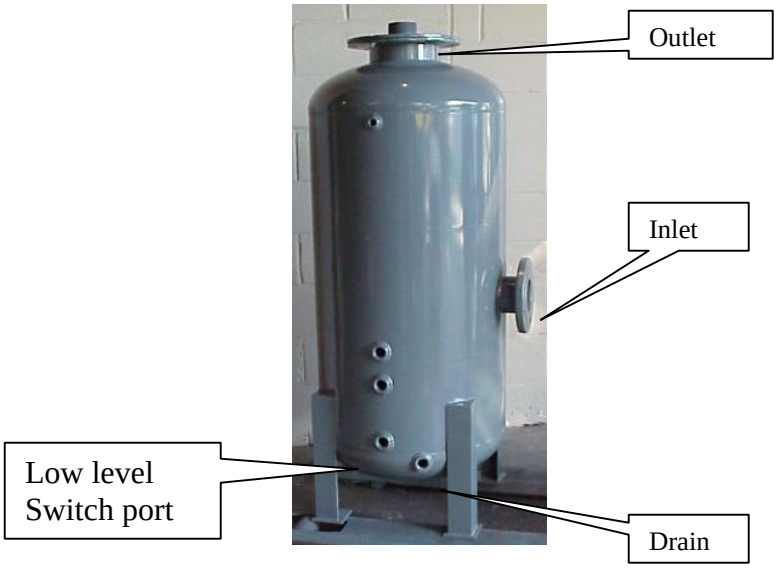
Moisture Separators

Moisture separators are used to remove water and other liquids from air streams. They are typically used on the inlet of vacuum systems to remove water and other contaminants before they enter the vacuum pump. The air volume of the moisture separator reduces the velocity of the air stream to allow liquids to precipitate. Up to 95% water removal is possible. The models GX-30 & GX-60 are rated for full vacuum. Other moisture separators are rated to 18 in. Hg. higher vacuum ratings available.

Standard accessories include a sight gauge, drain valve, and a hand operated sludge pump. Inside the top of the separators is a basket with “tri-packs” demister material to promote condensation of vapors.

Options include: 1 to 3 level switches, automatic pump down systems, heat tracing, vacuum gauges, and thermometers.

Model Number	Nominal Flow Rate	Liquid Capacity	Diameter (inches)	Height (inches)	Inlet Size	Discharge Size	Cleanout Size
GX-30	250	8	16	47	3"	3"	4"
GX-60	500	22	20	57	4"	4"	4"
GX-90	1200	30	24	57	6" Flange	6" Flange	4"
GX-100DL	1200	40	24	72	6” Flange	4” Flange	6” Flange
GX-120	2000	40	24	70	8" Flange	8" Flange	4"
GX-200	2000	95	30	85	8" Flange	8" Flange	4"



Attachment C

Average Throughput Values and Emissions

Emissions (lbs/hr) and (tons/yr)

Assumptions

1. Full time operation; 24 hours per day, 365 days per year.
2. Flow rate = 300 ft^3/min (cfm).
3. Maximum influent volatile organic compound (VOC) concentration = 50,000 ug/m^3. Initial influent concentration at system startup.
4. Mass removal rate decreases during system operation; reach asymptotic conditions; 90% reduction in influent VOC concentration at start of Month 4 operation (50,000 to 5,000 ug/m^3).

	Time (day)	VOC Concentration (ug/m^3)	Emissions (lb/hr)[1]	Emissions (lb/month)[2]	
Month 1	31	50,000	0.056	41.7	
Month 2	28	25,000	0.028	18.8	
Month 3	31	12,500	0.014	10.4	
Month 4	30	5,000	0.006	4.0	
Month 5	31	5,000	0.006	4.2	
Month 6	30	5,000	0.006	4.0	
Month 7	31	5,000	0.006	4.2	
Month 8	31	5,000	0.006	4.2	
Month 9	30	5,000	0.006	4.0	
Month 10	31	5,000	0.006	4.2	
Month 11	30	5,000	0.006	4.0	
Month 12	31	5,000	0.006	4.2	
			Total	108	lbs/year
				0.05	tons/year

Equations

(1) (Concentration [ug/m^3])*(300 ft^3/min)*(mg/1,000 ug)*(1,000mg/g)*(1,000g/kg)*(2.2lb/kg)*(m^3/35.3ft^3)*(60min/hr)

(2) (Concentration [ug/m^3])*(300 ft^3/min)*(mg/1,000 ug)*(1,000mg/g)*(1,000g/kg)*(2.2lb/kg)*(m^3/35.3ft^3)*(60min/hr)*(24hrs/day)*(days/month)

Estimated maximum emission - assume total VOC concentration of 50,000 ug/m^3 is constant through the duration of system operation.
Emission = (0.056 lb/hr)*(24hrs/day)*(365days/year)= 490 lbs/yr = 0.25 tons/yr

(A) - Emission Reduction (tons/yr)
Assumptions

Two, 2,000 carbon units aligned in series
BACT - activated carbon - 99.9 percent removal
Worse case scenario - 90 percent removal based on carbon loading over time; require activated carbon changeout.
Maximum emmission = 490 lbs/yr = 0.25 tons/yr

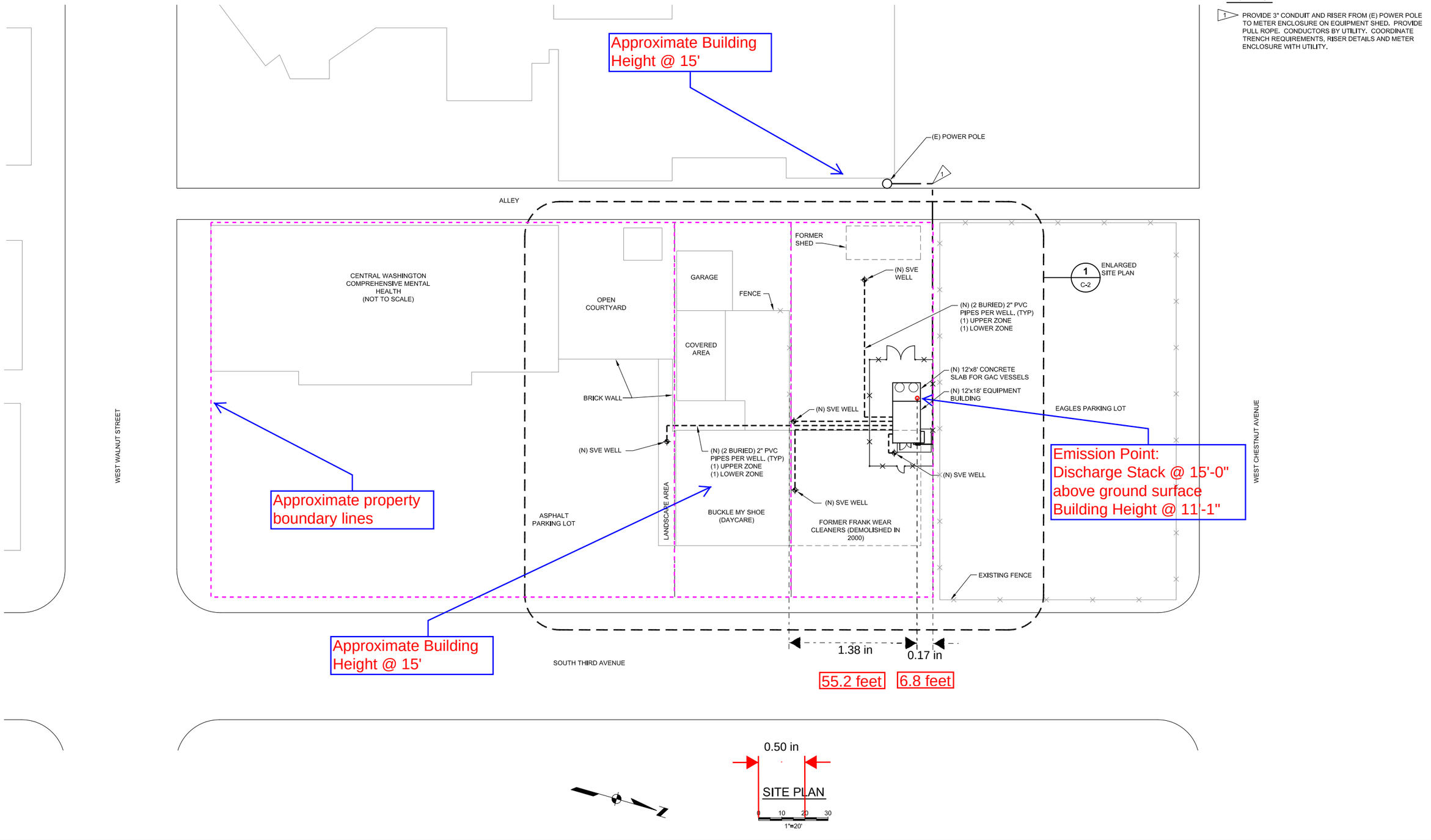
Emission Reduction = (490lbs/yr)*(0.9) = 441 lbs

Attachment D

Plot Plan

NOTES:

1. PROVIDE 3" CONDUIT AND RISER FROM (E) POWER POLE TO METER ENCLOSURE ON EQUIPMENT SHED. PROVIDE PULL ROPE. CONDUCTORS BY UTILITY. COORDINATE TRENCH REQUIREMENTS, RISER DETAILS AND METER ENCLOSURE WITH UTILITY.



USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.

NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

RICHARD C. GUGLIOMO — STATE OF WASHINGTON — 11523 — REGISTERED PROFESSIONAL ENGINEER

DESIGNED #########

DRAWN ####

CHECKED ####

WASHINGTON STATE DEPARTMENT OF ECOLOGY

FRANK WEAR SOIL VAPOR EXTRACTION SYSTEM
YAKIMA, WASHINGTON

Kennedy/Jenks Consultants
FEDERAL WAY, WA

SITE PLAN

FILE NAME 1196016_C01

JOB NO. 1196016*00

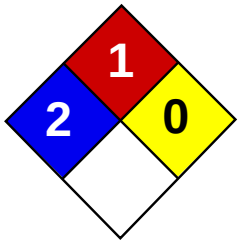
DATE DEC. 2011

SHEET OF **C-1**

P:\CAD\1111196016.00 Washington DEQ\1196016-C01.dwg 12/23/2011 1:11 PM BRYANH

Attachment E

Material Safety Data Sheets



Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet

Vinyl Chloride (Chloroethylene)

Section 1. Chemical product and company identification

Product name : Vinyl Chloride (Chloroethylene)

Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Product use : Synthetic/Analytical chemistry.

Synonym : Ethylene, chloro-; Chloroethene; Chloroethylene; Monochloroethylene; Vinyl chloride; Vinyl chloride monomer; Vinyl C monomer; C2H3Cl; Ethylene monochloride; Monochloroethene; Chlorethene; Chlorethylene; Chlorure de vinyle; Cloruro di vinile; Rcra waste number U043; Trovidur; UN 1086; VC; VCM; Vinile; Vinylchlorid; Vinyl chloride, inhibited; Vinyle(chlorure de); Winylu chlorek; 1-Chloroethylene

MSDS # : 001067

Date of Preparation/Revision : **4/27/2010.**

In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]]

Emergency overview : WARNING!

FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CAN CAUSE CANCER.
CONTENTS UNDER PRESSURE.

Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not ingest. May cause target organ damage, based on animal data. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed.

Contact with rapidly expanding gases can cause frostbite.

Target organs : May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).

Routes of entry : Inhalation

Potential acute health effects

Eyes : Irritating to eyes.

Skin : Irritating to skin.

Inhalation : Acts as a simple asphyxiant.

Ingestion : Ingestion is not a normal route of exposure for gases

Potential chronic health effects : **CARCINOGENIC EFFECTS**: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Vinyl Chloride (Chloroethylene)	75-01-4	100	**ACGIH TLV (United States, 1/2009).** TWA: 1 ppm 8 hour(s). **OSHA PEL (United States, 11/2006).** STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). **OSHA PEL 1989 (United States, 3/1989).** STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Flammable.

Auto-ignition temperature : 471.85°C (881.3°F)

Flash point : Open cup: -79.15°C (-110.5°F).

Flammable limits : Lower: 4% Upper: 22%

Products of combustion : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds

Fire-fighting media and instructions : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not ingest. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Storage : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

vinyl chloride

ACGIH TLV (United States, 1/2009).
TWA: 1 ppm 8 hour(s).
OSHA PEL (United States, 11/2006).
STEL: 5 ppm 15 minute(s).
TWA: 1 ppm 8 hour(s).
OSHA PEL 1989 (United States, 3/1989).
STEL: 5 ppm 15 minute(s).
TWA: 1 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight : 62.5 g/mole

Molecular formula : C2-H3-Cl

Boiling/condensation point : -13.8°C (7.2°F)

Melting/freezing point : -160°C (-256°F)

Critical temperature : 158.5°C (317.3°F)

Vapor density : 2.21 (Air = 1)

Specific Volume (ft^3/lb) : 6.25

Gas Density (lb/ft^3) : 0.16

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
vinyl chloride	LD50 Oral	Rat	500 mg/kg	-
	LC50 Inhalation Gas.	Rat	18 pph	15 minutes
	LC50 Inhalation Gas.	Rat	5000 ppm	1 hours

Chronic effects on humans : **CARCINOGENIC EFFECTS**: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : Can cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation : Products of degradation: carbon oxides (CO, CO_2) and water, halogenated compounds.

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		**Reportable quantity** 1 lb. (0.454 kg) **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: 150 kg **Special provisions** 21, B44, T50
TDG Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Road or Rail Index** Forbidden
Mexico Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations :

United States inventory (TSCA 8b): This material is listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: vinyl chloride
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: vinyl chloride: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: vinyl chloride

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: vinyl chloride

Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

		Product name	CAS number	Concentration
Form R - Reporting requirements	:	Vinyl Chloride (Chloroethylene)	75-01-4	100
Supplier notification	:	Vinyl Chloride (Chloroethylene)	75-01-4	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations :

Connecticut Carcinogen Reporting: This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.
Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

California Prop. 65 :

WARNING: This product contains a chemical known to the State of California to cause cancer.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Vinyl Chloride (Chloroethylene)	Yes.	No.	Yes.	No.

Canada

WHMIS (Canada) :

Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

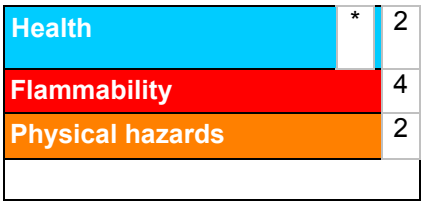
United States

Label requirements : FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CAN CAUSE CANCER.
CONTENTS UNDER PRESSURE.

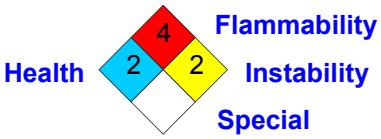
Canada

Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

Hazardous Material Information System (U.S.A.) :

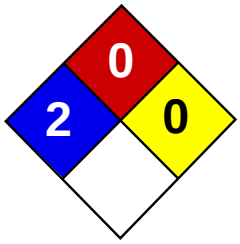


National Fire Protection Association (U.S.A.) :



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: TRANS-1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:
MTG MSDS 196; TRANS-ACETYLENE DICHLORIDE; TRANS-DICHLOROETHYLENE; TRANS-1,2-DICHLOROETHENE; 1,2-DICHLOROETHYLENE; RCRA U079; C2H2CL2; MAT23670; RTECS KV9400000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: TRANS-1,2-DICHLOROETHYLENE
CAS NUMBER: 156-60-5
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2

EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: liquid
ODOR: pleasant odor
MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression
PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire. May react on contact with air, heat, light or water.

POTENTIAL HEALTH EFFECTS:

INHALATION:
SHORT TERM EXPOSURE: irritation, nausea, vomiting, drowsiness, symptoms of drunkenness
LONG TERM EXPOSURE: no information on significant adverse effects
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: same as effects reported in short term exposure
EYE CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: same as effects reported in short term exposure
INGESTION:
SHORT TERM EXPOSURE: symptoms of drunkenness
LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any

discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

FLASH POINT: 36 F (2 C) (CC)
LOWER FLAMMABLE LIMIT: 9.7%
UPPER FLAMMABLE LIMIT: 12.8%
AUTOIGNITION: 860 F (460 C)
FLAMMABILITY CLASS (OSHA): IB

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
TRANS-1,2-DICHLOROETHYLENE:
1,2-DICHLOROETHYLENE (ALL ISOMERS):
200 ppm (790 mg/m3) OSHA TWA
200 ppm ACGIH TWA
200 ppm (790 mg/m3) NIOSH recommended TWA 10 hour(s)

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye

wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
2000 ppm
Any supplied-air respirator operated in a continuous-flow mode.
Any powered, air-purifying respirator with organic vapor cartridge(s).
Any air-purifying respirator with a full facepiece and an organic vapor canister.
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
Emergency or planned entry into unknown concentrations or IDLH conditions -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
COLOR: colorless
ODOR: pleasant odor
MOLECULAR WEIGHT: 96.94
MOLECULAR FORMULA: C2-H2-CL2
BOILING POINT: 118 F (48 C)
FREEZING POINT: -58 F (-50 C)
VAPOR PRESSURE: 400 mmHg @ 31 C
VAPOR DENSITY (air=1): 3.34
SPECIFIC GRAVITY (water=1): 1.2565
WATER SOLUBILITY: slightly soluble

PH: Not available
VOLATILITY: Not available
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: ethanol, ether

10. STABILITY AND REACTIVITY

REACTIVITY: May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic, corrosive, flammable or explosive gases.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES: bases, metals, combustible materials, oxidizing materials, acids

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: May polymerize. Avoid contact with incompatible materials.

11. TOXICOLOGICAL INFORMATION

TRANS-1,2-DICHLOROETHYLENE:
IRRITATION DATA: 500 mg/24 hour(s) skin-rabbit moderate; 10 mg eyes-rabbit moderate
TOXICITY DATA: 24100 ppm inhalation-rat LC50; >5 gm/kg skin-rabbit LD50; 1235 mg/kg oral-rat LD50
LOCAL EFFECTS:
Irritant: inhalation, skin, eye
ACUTE TOXICITY LEVEL:
Moderately Toxic: ingestion
Slightly Toxic: inhalation
TARGET ORGANS: central nervous system
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: respiratory disorders
MUTAGENIC DATA: Available.
REPRODUCTIVE EFFECTS DATA: Available.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
INVERTEBRATE TOXICITY: <110000 ug/L 48 hour(s) (Mortality) Water flea (Daphnia magna)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U079.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Trichlorobenzenes, liquid
ID NUMBER: UN2321
HAZARD CLASS OR DIVISION: 6.1
PACKING GROUP: III
LABELING REQUIREMENTS: 6.1

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Trichlorobenzenes, liquid
UN NUMBER: UN2321
CLASS: 6.1
PACKING GROUP/CATEGORY: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):
ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
1,2-DICHLOROETHYLENE (ALL ISOMERS)

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

MATHESON TRI-GAS, INC. MAKES NO EXPRESS OR IMPLIED WARRANTIES, GUARANTEES OR REPRESENTATIONS REGARDING THE PRODUCT OR THE INFORMATION HEREIN, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE. MATHESON TRI-GAS, INC. SHALL NOT BE LIABLE FOR ANY PERSONAL INJURY, PROPERTY OR OTHER DAMAGES OF ANY NATURE, WHETHER COMPENSATORY, CONSEQUENTIAL, EXEMPLARY, OR OTHERWISE, RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.

Attachment F

Prevention/Control Methods and Equipment

Protect™ V Series
Modular Vapor Adsorbers

CALGON
CALGON CARBON CORPORATION

Description
The PROTECT™ V Series are a line of low cost, vapor adsorber that can easily be put into service. Designed for a maximum pressure of 15-psi, a vacuum of 5" of mercury, a maximum operating temperature of 150°F, the PROTECT™ V Series adsorbers hold from 500 to 2,000 lbs. of activated carbon.

Specifications

Model #	GAC ft³/lbs	Recommended Maximum Flow Rate	Estimated Weight (Empty/Shipping)
V-1M	36/1,000	675-cfm	1,005/2,005
V-1.5M	54/1,500	750-cfm	1,150/2,650
V-2M	72/2,000	750-cfm	1,150/3,150

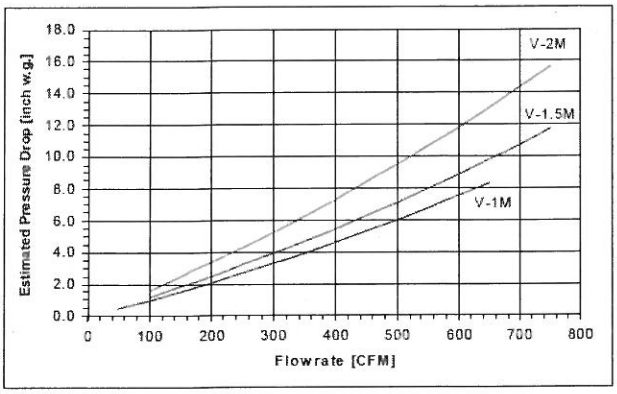
Features
- Durable carbon steel construction.
- Lifting lugs and forklift guides to facilitate moving.
- Upper and lower open-air plenum area designed for maximum carbon utilization.
- Designed for either upflow or downflow operation.
- Fitting for PROTECT™ Saturation Indicator or effluent sample port.
- 6" threaded influent/effluent connections.
- Condensate drain plug.
- 16" drum type manway for easy access.
- Exterior protected with a rust-inhibitive epoxy urethane for a durable finish.
- Can be filled with any of Calgon Carbon's virgin or reactivated granular or extruded activated carbons.
- Dished top and bottom heads allow higher operating pressures and light vacuum.
- Shipped with carbon and ready for service.
- All models available for rent.

Safety Message
Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all applicable Federal and State regulations.

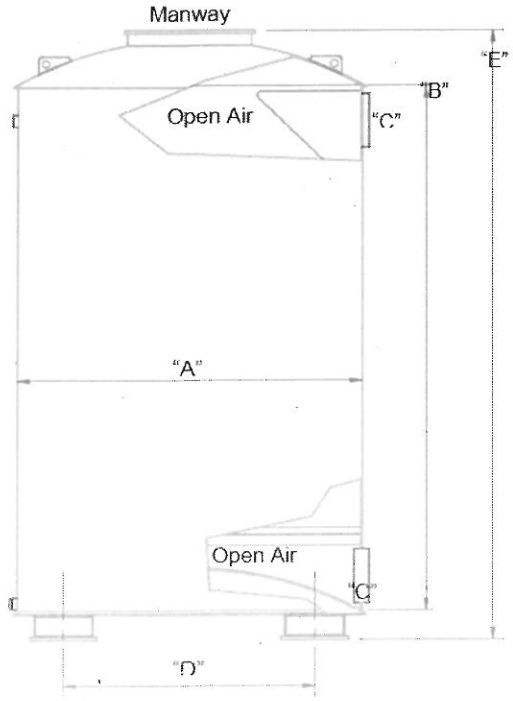
Model #	Diameter "A"	Can Length "B"	Inlet/ Outlet "C"	Forklift Guides "D"	Overall Hgt. "E"
V-1M	45½"	72"	6" fpt	33"	84"±
V-1.5M	48"	84"	6" fpt	33"	96"±
V-2M	48"	84"	6" fpt	33"	96"±

Pressure Drop Curve
- Volume and weight based on vapor phase bituminous carbon at 30lbs/ft³.
- Estimated pressure drop based on virgin 4x10 carbon.
- Designs and specifications subject to change without notice.

Warning: Some compounds and/or high concentrations can lead to heat buildup in granular activated carbon and potential bed fire. Contact Calgon Carbon for information.



Available Options
- Internal Lining
- Custom Colors
- Flanged Inlet/Outlet
- Higher operating pressures/vacuums
- PROTECT™ Carbon Saturation Indicators
- Call for Your Custom Configuration



Protect™ V Series
Modular Vapor Adsorbers

CALGON CARBON CORPORATION

Making Water and Air Safer and Cleaner

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA USA 15230-0717
1-800-422-7266
Tel: 1-412-787-6700
Fx: 1-412-787-6713

Chemviron Carbon
European Operations of
Calgon Carbon Corporation
Zoning Industriel C de Feluy
B-7181 Feluy, Belgium
Tel: + 32 (0) 64 51 18 11
Fx: + 32 (0) 64 54 15 91

Calgon Carbon Asia PTE LTD
9 Temasek Boulevard
#08-01A Suntec Tower Two
Singapore 038989
Tel: + 65 6 221 3500
Fx: + 65 6 221 3554

Your local representative

VPR 4x10

Granular Activated Carbon

CALGON CARBON CORPORATION

Specification

Test	Min	Max	Calgon Carbon Test Method
BUTANE ACTIVITY, wt%	21.4	-	TM-36 or ASTM D 5742
MOISTURE, wt%, as packed	-	2	TM-1 or ASTM D 2867
US SIEVE SERIES			TM-8
- 10	-	5	

Typical Properties:

Ash, wt%	8	TM-5
A.D. (g/cc)	0.5	TM-7 or ASTM D 2854

This activated carbon product is not for use in potable water or food grade applications

Safety Message

Wet activated carbon preferentially removes oxygen from air. In closed or partially closed containers and vessels, oxygen depletion may reach hazardous levels. If workers are to enter a vessel containing carbon, appropriate sampling and work procedures for potentially low oxygen spaces should be followed, including all applicable Federal and State requirements.

CALGON CARBON CORPORATION

Making Water and Air Safer and Cleaner

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA USA 15230-0717
1-800-422-7266
Tel: 1-412-787-6700
Fx: 1-412-787-6713

Chemviron Carbon
European Operations of
Calgon Carbon Corporation
Zoning Industriel C de Feluy
B-7181 Feluy, Belgium
Tel: + 32 (0) 64 51 18 11
Fx: + 32 (0) 64 54 15 91

Calgon Carbon Asia PTE LTD
9 Temasek Boulevard
#08-01A Suntec Tower Two
Singapore 038989
Tel: + 65 6 221 3500
Fx: + 65 6 221 3554

Your local representative

Attachment G

BACT Supporting Information

Yakima Regional Clean Air Agency

PERMIT APPLICATION / NEW SOURCE REVIEW

BACT IMPACT ANALYSIS WORKSHEET

Facility Name: Former Frank Wear Site, Soil Vapor Extraction System **Date:** January 5, 2012

CONTROL ALTERNATIVE	EMISSIONS [lbs/hr] & [tons/yr]	EMISSIONS REDUCTION (a) [tons/yr]	INSTALLED CAPITAL COST (b) [$]	TOTAL ANNUALIZED COST (c,g) [$]	AVERAGE COST EFFECTIVENESS OVER BASELINE (d) [$/ton]	INCREMENTAL COST EFFECTIVENESS (e) [$/ton]	ENERGY INCREASE OVER BASELINE (f) [mmBtu/yr]	TOXICS IMPACT [Yes/No]	ADVERSE ENVIRONMENTAL IMPACT [Yes/No]
1) Activated Carbon	0.006 lb/hr VOCs 0.025 tons/yr VOCs	0.225 tons/yr VOCs	$38,750	$76,350	$173/lb $346,000/ton	Not applicable	12.3 mmBTU/yr	No	No
2)									
3)									
4)									
5) Uncontrolled Baseline (worst case - no controls)	0.056 lb/hr VOCs 0.25 tons/yr VOCs								

(a) Emissions reduction over baseline control level.
(b) Installed capital cost relative to baseline.
(c) Total annualized cost (capital, direct, and indirect) of purchasing, installing, and operating the proposed control alternative. A capital recovery factor approach using a real interest rate (i.e., absent inflation) is used to express capital costs in present-day annual costs.
(d) Average cost effectiveness over baseline is equal to total annualized cost for the control option divided by the emissions reductions resulting from the uncontrolled baseline.
(e) The optional incremental cost effectiveness criterion is the same as the average cost effectiveness criteria except that the control alternative is considered relative to the next most stringent alternative rather than the baseline control alternative.
(f) Energy impacts are the difference in total project energy requirements with the control alternative uncontrolled baseline expressed in equivalent millions of Btus per year.
(g) Assumptions made on catalyst life may have a substantial affect upon cost effectiveness.

Notes:

The number of alternatives to be evaluated will vary depending on application.
Values for each variable should be provided as they are applicable. Use N/A if not applicable.
Emission rates are the expected or predicted emission rates.
Calculations should provide for a range of alternatives.
Emissions reduction should use estimated efficiency if actual efficiency is unknown - should so state.
Attach worksheets as necessary to substantiate above values.

(A) - Installed Capital Cost ($) - relative to baseline

Includes installation of two, 2,000 lb activated carbon vessels on concrete foundation within perimeter security fencing.

Item	Cost
Design	$4,650
Concrete Pad with Fencing (12 feet by 8 feet)	$2,000
Activated Carbon Vessels	$11,000
Activated Carbon	$6,000
Hose/Fittings	$4,000
Insulation/Heat Trace for Vessels	$3,000
System Constuction	$5,000
Construction Management	$3,100
Total Cost	$38,750

(B) - Total Annualized Cost ($)

Assumes removal and replacement of 2,000 lbs of activated carbon on an annual basis.

Item	Cost
Capital Cost	$38,750
Long-Term Costs	
Carbon Remove/Replace	$5,000
Waste Characterization/Profiling	$1,000
Carbon Transport/Disposal	$500
Activated Carbon (material and transport)	$3,500
Analytical (vapor samples)	$9,600
Consultant Labor	$18,000
Total Cost	$76,350

(C) - Average Cost Effectiveness over Baseline ($/ton)

$$\frac{\text{Total Annualized Cost - (C)}}{\text{Emission Reduction - (A)}}$$

$76,350/441 lbs = $173/lb

(D) - Incremental Cost Effectiveness ($/ton)

Not applicable - one treatment alternative evaluated.
Activated Carbon - BACT

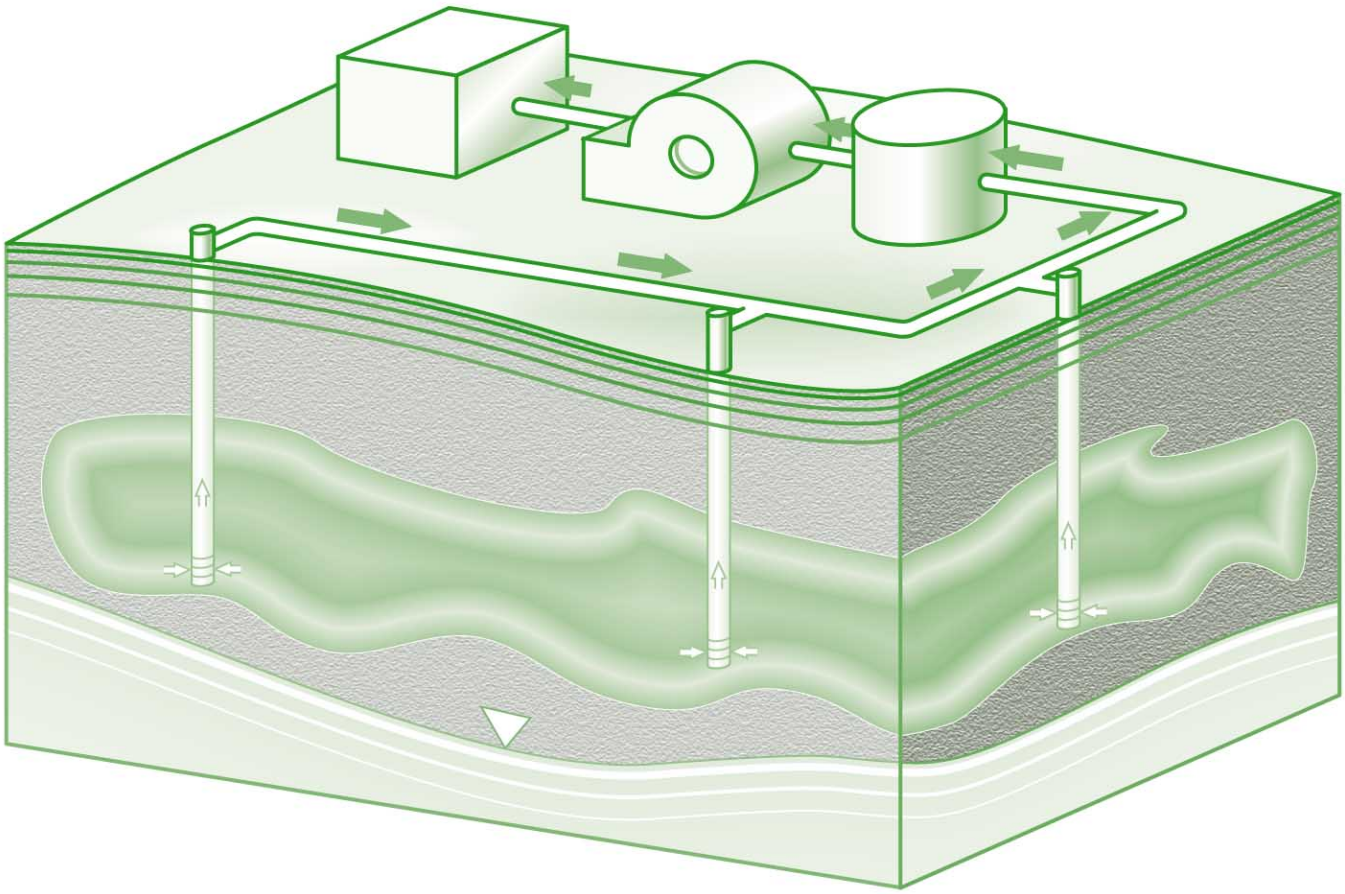
(E) - Energy Increase Over Baseline (mmBtu/yr)

Assumptions

Heat trace for two carbon vessels during winter months (November to March; 5 months)
8 Watts/foot

Assumes 5 helical wraps around 4 foot diameter carbon vessels = 125 feet of 8 W/ft heat trace.
Total = 125 ft x 8 W/ft = 1,000 W
Duration is assumed 5 months x 30 days x 24 hr/day = 3,600 hours
Energy = 1,000 W x 3,600 hr = 3,600,000 Watt hours, 1 BTU = .293071 Watt hours, Energy = 12,283,712 BTU for 5 months
Energy Increase Over Baseline = 12.3 mmBTU/yr

Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice



Evaluation Factors for Thermal Oxidation and Carbon Adsorption Technology Selection

Factor	Thermal Oxidation	Carbon Adsorption
Concentration	More commonly used for higher contaminant concentrations (> 500 ppmv); treatment costs per pound of contaminant decrease as VOC concentrations increase because less supplemental energy is required per pound removed	More frequently used for dilute vapor concentrations (< 1,000 ppmv); treatment costs per pound of contaminant tend to stay same or increase as concentration of vapors increase because carbon replacement frequency increases
O&M requirements	Tends to require more labor and more skilled labor to operate because of safety considerations	Tends to be simpler and less labor-intensive to operate and maintain unless vapor-phase concentrations are high and "breakthrough" occurs frequently
Safety	More safeguards necessary if it is possible for off-gases to reach high concentrations (significant fractions of the lower explosive limits of the contaminants in the vapor); formation of dioxins and furans is possible if not properly operated	Tends to be very safe under most conditions; however, high levels of ketones or similar compounds may pose a fire hazard
Chlorinated vs. non-chlorinated VOCs	Less commonly used for chlorinated VOCs because of formation of hydrochloric acid during vapor combustion, which requires special acid-resistant materials for piping and equipment after combustion chamber	Equally applicable to chlorinated and non-chlorinated VOCs; acid formation not typically an issue
Variety of compounds that can be treated	Except for acid formation during combustion of chlorinated VOCs, wide variety of compounds can be treated	Not all compounds adsorb well to activated carbon (depends on sorptive capacity); some common compounds (such as vinyl chloride) not readily treated; therefore, each compound in off-gas must be considered
Capital vs. O&M costs	Equipment significantly more expensive to purchase than carbon units; however, at high VOC concentrations, O&M costs lower than carbon units	Capital costs fairly low; O&M costs proportional to off-gas flow rates and vapor concentrations

Notes:

O&M = Operation and maintenance
ppmv = Part per million by volume
VOC = Volatile organic compound

Attachment H

Estimates of Proposed Project Ambient Impact

Table 1: Summary of SCREEN3 Model Estimates

Month of Operation	Stack Effluent VOC Concentration ($\mu g/m^3$)			Modeled VOC Annual Average Concentration ($\mu g/m^3$)		
	No Treatment	GAC Treatment (90% Removal)	GAC Treatment (99.9% Removal)	No Treatment	GAC Treatment (90% Removal)	GAC Treatment (99.9% Removal)
Month 1	50,000	5000	50	4.02	0.402	0.00402
Month 2	25,000	2500	25	2.01	0.201	0.00201
Month 3	12,500	1250	12.5	1.01	0.101	0.00101
Month 4	5,000	500	5	0.40	0.0402	0.000402
Month 5	5,000	500	5	0.40	0.0402	0.000402
Month 6	5,000	500	5	0.40	0.0402	0.000402
Month 7	5,000	500	5	0.40	0.0402	0.000402
Month 8	5,000	500	5	0.40	0.0402	0.000402
Month 9	5,000	500	5	0.40	0.0402	0.000402
Month 10	5,000	500	5	0.40	0.0402	0.000402
Month 11	5,000	500	5	0.40	0.0402	0.000402
Month 12	5,000	500	5	0.40	0.0402	0.000402

Notes:

GAC = Granulated activated carbon.

$\mu g/m^3$ = micrograms per cubic meter of air.

VOC = volatile organic compound.

12/22/11
16:59:36

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

C:\Lakes\Screen View\3InchDIA_ModelRun_#1.scr

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =       4.5720
   STK INSIDE DIAM (M)    =       0.0762
   STK EXIT VELOCITY (M/S)=      31.0466
   STK GAS EXIT TEMP (K)  =     311.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       1.7000
   URBAN/RURAL OPTION     =        URBAN
   BUILDING HEIGHT (M)    =       4.5720
   MIN HORIZ BLDG DIM (M) =      15.2400
   MAX HORIZ BLDG DIM (M) =      15.2400

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =  0.14158410     (M**3/S)

BUOY. FLUX =    0.026 M**4/S**3;  MOM. FLUX =    1.318 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
     1.   0.000        0     0.0    0.0     0.0    0.00    0.00    0.00    NA
   100.   1856.        6     1.0    1.0 10000.0    9.26   10.79    7.46    SS

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    14.   7181.        5     2.5    2.5 10000.0    4.83    1.65    2.27    SS

 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

**********************************
*** SCREEN DISCRETE DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----  -----  ------  ------  ------  ------  -----
     1.   0.000        0     0.0    0.0     0.0    0.00    0.00    0.00    NA
```

```
 DWASH=   MEANS NO CALC MADE (CONC = 0.0)
 DWASH=NO MEANS NO BUILDING DOWNWASH USED
 DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
 DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
 DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

**************************************
     *** REGULATORY (Default) ***
    PERFORMING CAVITY CALCULATIONS
  WITH ORIGINAL SCREEN CAVITY MODEL
          (BRODE, 1988)
**************************************


 *** CAVITY CALCULATION - 1 ***       *** CAVITY CALCULATION - 2 ***
  CONC (UG/M**3)     =    0.000        CONC (UG/M**3)     =    0.000
  CRIT WS @10M (M/S) =    99.99        CRIT WS @10M (M/S) =    99.99
  CRIT WS @ HS (M/S) =    99.99        CRIT WS @ HS (M/S) =    99.99
  DILUTION WS (M/S)  =    99.99        DILUTION WS (M/S)  =    99.99
  CAVITY HT (M)      =     4.67        CAVITY HT (M)      =     4.67
  CAVITY LENGTH (M)  =    14.55        CAVITY LENGTH (M)  =    14.55
  ALONGWIND DIM (M)  =    15.24        ALONGWIND DIM (M)  =    15.24

CAVITY CONC NOT CALCULATED FOR CRIT WS > 20.0 M/S.  CONC SET = 0.0

**************************************
      END OF CAVITY CALCULATIONS
**************************************


     **************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     **************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      7181.           14.        0.


************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
************************************************
```

Attachment I

SEPA Determination

WASHINGTON STATE DEPARTMENT OF ECOLOGY

DETERMINATION OF NONSIGNIFICANCE

Description of proposal: Installation and operation of a Soil Vapor Extraction system to remove and capture PCE vapors and in-situ bioremediation at the Frank Wear Cleaners Site.

Proponents: Washington State Department of Ecology

Location of proposal, including street address if any: 106 S 3rd Avenue, Yakima, Washington

Lead agency: Washington Department of Ecology

The lead agency for this proposal has determined that it does not have a probable significant impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ **There is no comment period for this DNS.**

☒ **This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 30 days from the date below. Comments must be submitted by** 1/16/12 .

Responsible official: Valerie Bound

Position/title: Section Manager, Toxics Cleanup Program, Central Regional Office

Phone: (509) 454 -7886

Address: 15 W Yakima Avenue, Ste 200, Yakima WA 98902

Date 12/7/11 **Signature** Valerie Bound

Please send comments to:

Gwen Clear
Department of Ecology
15 W. Yakima Avenue, Suite 200
Yakima, WA 98902

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL CHECKLIST

Purpose of Checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants:

The environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the works "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic are," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable: **Former Frank Wear site, Soil Vapor Extraction (SVE) System and In-situ Bioremediation**
2. Name of applicant: **Washington State Department of Ecology**
3. Address and phone number of applicant and contact person:

   Jason Shira

   Washington State Department of Ecology

   15 W. Yakima Avenue, Suite 200

   Yakima, WA 98902

   (509) 454-7834
4. Date checklist prepared: **November 16, 2011**
5. Agency requesting checklist: **Washington State Department of Ecology**
6. Proposed time or schedule (including phasing, if applicable): **January 2012 SVE construction; August 2012 Draft Cleanup Action Plan; February 2013 In-situ remediation system construction**

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? **Not at this time**

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. **There are several environmental reports that have been prepared for the former Frank Wear Dry Cleaning Site and surrounding area.**

   1989. SAIC. Preliminary Assessment Report Frank Wear Cleaners.

   1995. AGRA, Inc. Soil Vapor Study 106 South 3rd Avenue Yakima, Washington.

   1996. Maxim Technologies, Inc. Remedial Investigation and Interim Action Frank Wear Cleaners.

   2001. Fulcrum, Inc. Voluntary Cleanup Report Frank Wear Cleaners.

   2007. Hart Crowser, Inc. Feasibility Study Frank Wear.

   2011. Kennedy/Jenks, Inc. Vapor Intrusion Study Report Former Frank Wear Cleaners Site.

9. Do you know whether applications are pending for governmental approvals or other proposals directly affecting the property covered by your proposal? If yes, explain. **No.**

10. List any government approvals or permits that will be needed for your proposal, if known. **An air discharge permit from the Yakima Clean Air Agency may be required for discharge of treated soil vapors to the atmosphere. Underground Injection Control Permit from Department of Ecology maybe required for addition of amendments to groundwater during recirculation. Yakima City approval for installation of wells in right-of-ways; and possible temporary discharge of purge water to POTW (<500-gallons/event).**

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.) **The project includes design and construction of a soil vapor extraction system (SVE) to remove solvents from unsaturated soils and create a negative vacuum below the adjacent daycare building (Buckle My Shoes Early Learning Center located at 108 South Third Street in Yakima, Washington). Soil vapor will be removed from four vertical SVE wells completed in the vadose zone. The SVE system will include a vapor phase treatment system to remove chlorinated solvents for the discharged air. An additional phase includes design and construction of an in-situ remediation system to treat contaminated groundwater. The key component for the in-situ remediation approach is a groundwater recirculation system. We will install of up to eight new groundwater wells, and using five of the existing monitoring wells for extraction and injection. Contaminants in the saturated phase would be destroyed through reductive dechlorination and captured by activated carbon. Based on subsurface conditions following completion of the dechlorination process, the recirculation system may be used to accelerate returning the aquifer to natural, oxidative conditions conducive to rapid degradation of any remaining vinyl chloride (a PCE daughter product).**

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist. **The SVE project will be completed at the at the former Frank Wear Dry Cleaners property located at 106 South Third Avenue in Yakima, Washington. One of the SVE wells will be located on the adjacent property to the south (Buckle My Shoes Early Learning Center). The nearest intersection is West Chestnut Avenue and South 3rd Avenue in Yakima, Washington. The groundwater in-situ remediation project will occur across the entire Site (within the block bounded north/south by Chestnut and Walnut and east/west by 3rd Avenue and 4th Avenue).**

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one) **Flat**, rolling, hilly, steep slopes, mountainous, other _____.

b. What is the steepest slope on the site (approximate percent slope)? The **site is flat (no slope).**

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, mulch)? If you know the classification of agricultural soils, specify them and note any prime farmland. **Surface and subsurface soils consist of sand and gravel.**

d. Are there any surface indications or history of unstable soils in the immediate vicinity? If so, describe. **No.**

e. Describer the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill. **A small area (approximately 20 feet by 30 feet) will require grading for a concrete pad.**

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe. **No.**

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? **Approximately 15 to 20 percent.**

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: **Standard stormwater construction procedures, as needed.**

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if know. **Emission from the SVE system will be treated in an onsite treatment unit consisting of granular activated carbon. The volume of airflow in unknown at this time.**

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe. **No**

c. Proposed measure to reduce or control emissions or other impacts to air, if any: **Installation and operation of soil vapor treatment unit for the SVE system using granular activated carbon.**

3. Water

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river if flows into. **No.**

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans. **No.**

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material. **NA, there will be no significant onsite filling.**

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known. **No, surface water withdrawal or diversion will not be performed.**

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan. **No.**

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge. **No.**

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known. **Groundwater will be extracted, amended, and injected to create a groundwater recirculation cell for the purposes of containing treating contaminated groundwater. Quantities of groundwater are unknown at this time. Purge water generated from characterization of the site will be managed according to local, state and federal regulations.**

2) Describe the waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve. **No wastes will be discharged to the ground.**

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe. **Only a small concrete pad (approximately 20 feet by 30 feet) will be constructed with the SVE system. Stormwater will runoff to the surrounding soils adjacent to the concrete pad.**

2) Could waste materials enter ground or surface waters? If so, generally describe. **No.**

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any: **Condensate (if any) from the SVE may contain volatile organic compounds (VOCs) and will be contained in a knock-out can. Purge water generated during**

characterization of the site will be managed according to local, state and federal regulations.

4. Plants

a. Check or circle types of vegetation found on the site:

_x_ deciduous tree: alder, maple, aspen, other
_x_ evergreen tree: fir, cedar, pine, other
_x_ shrubs
_x_ grass
___ pasture
___ crop or grain
___ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
___ water plants: water lily, eelgrass, milfoil, other
___ other types of vegetation

b. What kind and amount of vegetation will be removed or altered? **No vegetation will be removed.**

c. List threatened or endangered species known to be on or near the site. **None.**

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: **None.**

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other: .....

mammals: deer, bear, elk, beaver, other: .....

fish: bass, salmon, trout, herring, shellfish, other: .....

b. List any threatened or endangered species known to be on or near the site. **None.**

c. Is the site part of a migration route? If so, explain. **No.**

d. Proposed measures to preserve or enhance wildlife, if any: **None needed.**

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether if will be used for heating, manufacturing, etc. **Electrical power will be required to run the SVE system and groundwater recirculation equipment.**

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe. **No.**

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any: **Possible energy conservation measures will be determined in the design stage.**

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of

fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe. **None anticipated. Any possible environmental health hazards that may be identified will be mitigated during the design.**

1) Describe special emergency services that might be required. **No emergency services are anticipated.**
2) Proposed measures to reduce or control environmental health hazards, if any: **The electrical equipment associated with the SVE and groundwater recirculation system will be contained within an onsite building (wood shed) and surrounded by a 6-foot tall fence topped with razor wire.**

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)? **Surrounding noise will not impact this project.**

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site. **The blower associated with the SVE and recirculation system may generate a background noise. Noise from the equipment will be mitigated using a combination of mechanical silencer and a small wood structure over the noise generating equipment. The SVE system will operate 24-hours per day, 7 days per week.**

3) Proposed measures to reduce or control noise impacts, if any: **Noise from the equipment will be mitigated using a combination of mechanical silencer and a small wood structure over the noise generating equipment.**

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? **Industrial/commercial.**

b. Has the site been used for agriculture? If so, describe. **Possibly over 50 years ago.**

c. Describe any structures on the site. **The site is located in a city setting and is surrounded by commercial and industrial buildings. Buckle My Shoes Early Learning Center (located to the south) is used as daycare facility.**

d. Will any structures be demolished? If so, what? **No.**

e. What is the current zoning classification of the site? **CBD (Central Business District)**

f. What is the current comprehensive plan designation of the site **CBD (Central Business District) Core Commercial**

g. If applicable, what is the current shoreline master program designation of the site? **NA**

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify. **No.**

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

i. Approximately how many people would reside or work in the completed project? **None.**

j. Approximately how many people would the completed project displace? **None.**

k. Proposed measures to avoid or reduce displacement impacts, if any? **NA**

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: **Consult with the City of Yakima during design process.**

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing. **NA**

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing. **None**

c. Proposed measures to reduce or control housing impacts, if any: **NA**

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed? **A small wood shed will be constructed. The estimated height is approximately 12 feet or less.**

b. What views in the immediate vicinity would be altered or obstructed? **None**

c. Proposed measures to reduce or control aesthetic impacts, if any: **NA**

11. Light and Glare

a. What type of light or glare will the proposal produce? **None.** What time of day would it mainly occur? **NA.**

b. Could light or glare from the finished project be a safety hazard or interfere with views? **NA.**

c. What existing off-site sources of light or glare may affect your proposal? **None.**

d. Proposed measures to reduce or control light and glare impacts, if any? **NA.**

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity? **None.**

b. Would the proposed project displace any existing recreational uses? If so, describe. **No.**

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: **NA.**

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe. **None we are aware of.**

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site. **None.**

c. Proposed measures to reduce or control impacts, if any: **NA.**

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any. **The nearest intersection is West Chestnut Avenue and South 3rd Avenue in Yakima, Washington. Access to the property will be from either from South 3rd Street or an alley located west of the property.**

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop? **Yes.**

c. How many parking spaces would the completed project have? How many would the project eliminate? **None.**

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private). **No new roads will be required.**

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe. **No.**

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur. **Approximately one site visit per month.**

g. Proposed measures to reduce or control transportation impacts, if any: **NA.**

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? **No.** If so, generally describe. **NA.**

b. Proposed measures to reduce or control direct impacts on public services, if any. **NA.**

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

16. Utilities

a. Circle utilities currently available at the site: **electricity, natural gas, water, refuse** service, **telephone, sanitary sewer**, septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed. **To operate the SVE and recirculation system, electrical power will be needed from the local provider. Purge water generated during characterization might be temporary discharged to the City of Yakima POTW, which will require a local discharge permit.**

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision

Signature: Valerie Bound

Date Submitted: 11-29-11

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS – **THIS IS A PROJECT**
(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   Proposed measures to avoid or reduce such increases are:

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

3. How would the proposal be likely to deplete energy or natural resources?

   Proposed measures to protect or conserve energy and natural resources are:

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   Proposed measures to protect such resources or to avoid or reduce impacts are:

5. How would the proposal be likely to affect land and shoreline use, including whether it

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

would allow or encourage land or shoreline uses incompatible with existing plans?

Proposed measures to avoid or reduce shoreline and land use impacts are:

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   Proposed measures to reduce or respond to such demand(s) are:

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

17 February 2012

Technical Memorandum

To: Hasan Tahat, Yakima Regional Clean Air Agency

From: Sherri Peterson, P.E.

Subject: AERSCREEN Air Dispersion Modeling for SVE System
Frank Wear Site, Yakima, Washington
K/J 1196016*00

On behalf of the Washington State Department of Ecology (Ecology), Kennedy/Jenks Consultants (Kennedy/Jenks) submitted a New Source Review permit application package to the Yakima Regional Clean Air Agency (YRCAA) for a new air contaminant source (dated 27 January 2012). The permit is required for stack discharges of a soil vapor extraction (SVE) system for the Frank Wear site in Yakima, Washington. This technical memorandum was prepared in response to the YRCCA's comment, provided during our 10 February 2012 phone conference, requesting that the United States Environmental Protection Agency's (USEPA's) AERSCREEN model be used as the dispersion model rather than the USEPA's SCREEN3 model. This technical memorandum provides the supporting information for dispersion model estimates of ambient air concentration and replaces Section 6, Section 7, and Appendix H of the Supporting Information of the permit package submitted on 27 January 2012.

The SVE system is designed to remove soil vapor containing tetrachloroethylene (PCE) and its breakdown products that are present in unsaturated zone soils and groundwater and discharge the treated vapor to the atmosphere. Dispersion modeling of the stack discharge of the SVE system was performed to evaluate requirements for treatment (e.g., carbon filtration) of the effluent prior to stack discharge to the atmosphere. The dispersion modeling provides supporting data for estimates of the proposed project ambient impacts, as required by the YRCAA permit application for a new air contaminant source.

Washington Administrative Code (WAC) 173-460 provides the toxic air pollutants acceptable source impact level (ASIL) requirements for new air contaminant sources. Table 1 lists the ASILs for PCE and its breakdown products trichloroethylene (TCE) and vinyl chloride (VC), which are all based on an averaging period of one year. Dispersion model estimates for stack discharges are compared to the ASILs to provide supporting data on estimates of the proposed project ambient air impacts for the permit application. Also listed in Table 1 are the WAC 173-460 requirements for small quantity emissions rates (SQERs) and de minimis emissions[1].

[1] SQER means a level of emissions below which dispersion modeling is not required to demonstrate compliance with ASIL. De minimis emission means trivial levels of emissions that do not pose a threat to human health or the environment.

Table 1: WAC 173-460-150 Table of ASIL, SQER, and De Minimis Emission Values

Chemical	ASIL (µg/m^3- annual average)	SQER (lb/averaging period)	De Minimis Emissions (lb/averaging period)
Tetrachloroethylene	0.169	32.4	1.62
Trichloroethylene	0.5	95.9	4.8
Vinyl chloride	0.0128	2.46	0.123

Notes:

µg/m^3 = micrograms per cubic meter
lb = pound

AERSCREEN is a screening-level air quality model that has been recognized by USEPA as suitable for a screening air dispersion model. The AERSCREEN model produces estimates of "worst-case" 1-hour concentrations for a single source, without the need for hourly meteorological data[2]. The AERSCREEN point source option was used to model the stack discharge. The following lists the project specific parameters used in the model. If project specific parameter information is not noted below, AERSCREEN model default options were used.

- **Emission rate (grams/second [g/s])**: A unit emission rate of 1 g/s was used. See notes on model output summary Table 1 for discussion of stack effluent concentrations and scaled results for modeled annual average concentrations.
- **Stack Height:** 4.572 meters, based on design height of 15 feet.
- **Stack Inside Diameter:** 0.076 meters, based on design diameter of 3 inches.
- **Stack exit velocity:** 31.047 meters/second, based on design volumetric airflow of 300 cubic feet per minute.
- **Stack gas temperature:** 311 degrees Kelvin, based on design effluent temperature of 100 degrees Fahrenheit.
- **Flagpole Receptor Height Above Ground:** 1.7 meters, based on a receptor height of approximately 5.5 feet. 1.7 meters is commonly used by Ecology as receptor height in SCREEN3 model applications.
- **Model Mode:** Urban.
- **Population:** 92,000. 2010 census for Yakima, Washington was 91,067[3].

[2] USEPA. 2011. AERSCREEN User's Guide. EPA-454/B-11-001.
[3] 2010 Census data: http://quickfacts.census.gov/qfd/states/53/5380010.html.

- **Meteorology data:** Min/max temperature of 267/304 degrees Kelvin (equivalent to 21/88 degrees Fahrenheit[4])
- **Dominant surface profile:** Urban.
- **Dominant climate type:** Dry.
- **Terrain.** No terrain elevations.

Attachment 1 to this memorandum provides the AERSCREEN model input and output. AERSCREEN provides model estimates for maximum 1-hour concentration at distances beyond the stack. To compare AERSCREEN model outputs to ASILs based on annual average concentrations, maximum 1-hour concentrations were converted to annual average concentrations using a conversion factor of 0.1.

Modeled annual average concentration (241 µg/m^3) =
Modeled hourly maximum concentration (2,407 µg/m^3) x 0.1

Table 2 provides a summary of AERSCREEN model estimates for annual average concentrations under the following three SVE off-gas treatment scenarios:

- No treatment of SVE system effluent (baseline)
- Treatment of SVE system effluent using carbon vessels with 90 percent removal efficiency (worst-case scenario before carbon vessel change out)
- Treatment of SVE system effluent using carbon vessels with 99.9 percent removal efficiency (initial removal efficiency at system startup).

The anticipated reduction of PCE and its daughter products as a result of vadose zone source removal using SVE and groundwater remediation over the 12-month duration of the system operation will change both the chlorinated volatile organic compound (VOC) total concentration (i.e., decrease) and composition in the stack effluent over the 12-month duration. PCE can sequentially convert to TCE, 1,2-dichloroethylene, and VC during future groundwater remediation processes. The soil vapor VOC mass reduction over a 12-month period resulting from this sequential reductive dechlorination of PCE and its breakdown products was modeled using standard modeling assumptions and site-specific information on the groundwater remediation treatment conditions favorable to reductive dechlorination. While the SVE system itself does not affect the dechlorination of PCE, future groundwater remedial activities and natural processes may result in conditions where reductive dechlorination is possible.

[4] Temperature data: http://www.weather.com/weather/wxclimatology/monthly/graph/USWA0502.

Table 2: Summary of AERSCREEN Model Estimates

	Influent VOC Concentration ($\mu g/m^3$)			Stack VOC Emission Rate (grams/second)			Modeled VOC Annual Average Concentration ($\mu g/m^3$)		
Month of Operation	No Treatment	GAC Treatment (90% Removal)	GAC Treatment (99.9% Removal)	No Treatment	GAC Treatment (90% Removal)	GAC Treatment (99.9% Removal)	No Treatment	GAC Treatment (90% Removal)	GAC Treatment (99.9% Removal)
Month 1	50,000	5,000	50	7.00E-03	7.00E-04	7.00E-06	1.68	0.168	0.00168
Month 2	25,000	2,500	25	3.50E-03	3.50E-04	3.50E-06	0.842	0.0842	0.00084
Month 3	12,500	1,250	12.5	1.75E-03	1.75E-04	1.75E-06	0.421	0.0421	0.000421
Month 4	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 5	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 6	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 7	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 8	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 9	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 10	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 11	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168
Month 12	5,000	500	5	7.00E-04	7.00E-05	7.00E-07	0.168	0.0168	0.000168

Notes:

GAC = granulated activated carbon
µg/m3 = micrograms per cubic meter (of air)
VOC = volatile organic compound

At system start-up the mass of chlorinated VOCs in the influent stream of the carbon vessels is anticipated to be comprised of mostly PCE at a maximum concentration of 50,000 µg/m^3, based on the soil vapor data. The value of 50,000 µg/m^3 at SVE system start-up represents the maximum concentration for recent monitoring soil vapor data collected as subslab vapor from underneath a building slab. In September 2011, subslab vapor data was collected from beneath the concrete slab of the childcare center building that is located adjacent to the Frank Wear site. PCE was detected in subslab vapor samples at concentrations ranging from 3,600 to 50,000 µg/m^3. Trichloroethylene was not detected in the samples. During SVE system operation, influent concentrations typically decline to asymptotic conditions. The time to reach asymptotic conditions is site specific and depend on the amount of residual PCE mass available at beneath the site. For this application, asymptotic conditions were assumed to be reached in approximately 4 months (based on past experience). Even if this takes a little longer than 4 months, asymptotic conditions are expected to be reached fairly quickly, so the maximum concentrations are only present for a short amount of time. (Note: The maximum PCE value of 50,000 µg/m^3 at system start-up used for modeling purposes is expected to be the highest possible, and most conservative, concentration that could be detected. Actual influent PCE concentrations to the SVE treatment system are expected to be significantly less, possibly by two orders of magnitude or more).

The AESCREEN model output is based on a unit emission rate of 1 g/s. For the SVE system scenarios evaluated, the stack VOC emission rate ranged from 7 x 10^{-7} g/s to 7 x 10^{-4} g/s. The stack VOC emission rates listed in Table 2 are based a stack flow rate of 300 cubic feet per minute (0.14 cubic meters per second) and the following equation:

> *VOC stack emission rate (grams per second) = Influent VOC concentration (micrograms per cubic meter) x 0.14 cubic meters per second x 0.000001 grams per microgram*

The stack emission rates were multiplied by the modeled hourly maximum concentration adjusted to an annual concentration. These values are shown in Table 2. At the SVE system start-up the carbon vessel treatment efficiency is anticipated to be 99.9 percent mass removal; over time that efficiency will decrease to levels closer to 90 percent efficiency before the carbon vessels are changed out. The VOC concentration in the soil vapors will also decrease over that period due to sequential dechlorination of PCE and its breakdown products. At system start-up (99.9 percent efficiency and 50,000 µg/m^3 VOC concentration in soil vapor), the AERSCREEN model estimate for a resultant PCE annual average concentration of 0.0017 µg/m^3, which is well below the ASIL for PCE of 0.169 µg/m^3. Although the efficiency of the carbon treatment decreases, because the influent VOC concentrations are also decreasing, the actual annual ambient air concentrations are not expected to be above the ASILs. Daughter products may be present as some portion of the total concentrations, and these will be monitored as described in the monitoring section below. Based on the AERSCREEN model results (Table 2) it is anticipated that the SVE system will not produce emissions that will result in ambient air impacts above ASILs.

Monitoring

Samples of the effluent from the SVE system will be collected at least one time per month (once at the midpoint between the first and second carbon vessels, and once after the second vessel) for the first 6 months, and at a frequency of at least once annually thereafter. The samples will be analyzed for VOCs, and will include analysis for PCE, trichloroethene, and vinyl chloride. Sample analytical results will be compared to the values provided in Table 3 to evaluate the necessity for carbon vessel changeout.

Table 3: Summary Table of Effluent Concentrations to Meet ASILs

Chemical	ASIL ($\mu g/m^3$ - annual average)	Effluent Concentration ($\mu g/m^3$) to Meet ASIL
Tetrachloroethylene	0.169	5,016
Trichloroethylene	0.5	14,840
Vinyl chloride	0.0128	380

Attachment

Attachment 1

Summary of AERSCREEN Model Estimates

```
Start date and time  02/13/12 13:22:51
                          AERSCREEN 11126

            FRANK WEAR


         -----------------  DATA ENTRY VALIDATION  -----------------
                          METRIC              ENGLISH
 ** STACKDATA **  ---------------     ----------------

 Emission Rate:       1.0000 g/s             7.937 lb/hr
 Stack Height:          4.57 meters          15.00 feet
 Stack Diameter:       0.076 meters           3.00 inches
 Stack Temperature:    311.0 K               100.1 Deg F
 Exit Velocity:       31.047 m/s            101.86 ft/s
 Stack Flow Rate:        300 ACFM
 Model Mode:           URBAN
 Population:           92000
 Dist to Ambient Air:           1.0 meters             3. feet


 ** BUILDING DATA **

 No Building Downwash Parameters


 ** TERRAIN DATA **

 No Terrain Elevations
 Source Base Elevation:   0.0 meters        0.0  feet

 Probe distance:   5000. meters       16404. feet
 Flagpole Receptor Height:      1.7 meters             6. feet

 No discrete receptors used


 ** METEOROLOGY DATA **

 Min/Max Temperature:  267.0 / 304.0 K   20.9 /  87.5 Deg F

 Minimum Wind Speed:     0.5 m/s

 Anemometer Height:   10.000 meters

 Dominant Surface Profile: Urban
 Dominant Climate Type:    Dry Conditions


 AERSCREEN output file:
 AERSCREEN.OUT


 *** AERSCREEN Run is Ready to Begin



 No terrain used, AERMAP will not be run
************************************************

SURFACE CHARACTERISTICS & MAKEMET
Obtaining surface characteristics...
```

```
Using AERMET seasonal surface characteristics for Urban with Dry Conditions
Season             Albedo     Bo       zo
Winter              0.35     2.00     1.000
Spring              0.14     2.00     1.000
Summer              0.16     4.00     1.000
Autumn              0.18     4.00     1.000

Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl

Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl

Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl

Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl

PROBE        started 02/13/12 13:23:11

Running probe for Winter sector  1

 AERMOD Finishes Successfully for PROBE stage 1 Winter sector   1

    ********   WARNING MESSAGES   ********

               ***  NONE  ***


Running probe for Spring sector  1

 AERMOD Finishes Successfully for PROBE stage 1 Spring sector   1

    ********   WARNING MESSAGES   ********

               ***  NONE  ***


Running probe for Summer sector  1

 AERMOD Finishes Successfully for PROBE stage 1 Summer sector   1

    ********   WARNING MESSAGES   ********

               ***  NONE  ***


Running probe for Autumn sector  1

 AERMOD Finishes Successfully for PROBE stage 1 Autumn sector   1

    ********   WARNING MESSAGES   ********

               ***  NONE  ***


PROBE        ended 02/13/12 13:23:16

REFINE       started 02/13/12 13:23:16

 AERMOD Finishes Successfully for REFINE stage 3 Winter sector   1

    ********   WARNING MESSAGES   ********

               ***  NONE  ***
```

```
REFINE       ended 02/13/12 13:23:17

 ********************************************
 AERSCREEN Finished Successfully
 With no errors or warnings
 Check log file for details
 ********************************************

 Ending date and time  02/13/12 13:23:20
```

	Concentration	Distance	Elevation	Season/Month	Zo sector	Date	H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS	HT	REF TA	HT
	0.12730E-02	1.00	0.00	Winter	0-360	10011901	-0.85	0.043	-9.000	0.020	-999.	21.	7.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
*	0.24066E+04	23.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.23942E+04	25.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.15377E+04	50.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.97550E+03	75.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.67854E+03	100.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.50535E+03	125.00	0.00	Winter	0-360	10011601	-0.40	0.043	-9.000	0.020	-999.	21.	19.1	1.000	2.00	0.35	0.50	10.0	304.0	2.0
	0.40672E+03	150.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.34255E+03	175.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.29312E+03	200.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.25435E+03	225.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.22337E+03	250.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.19821E+03	275.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.17746E+03	300.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.16011E+03	325.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.14545E+03	350.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.13292E+03	375.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.12212E+03	400.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.11273E+03	425.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.10450E+03	450.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.97244E+02	475.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.90804E+02	500.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.85058E+02	525.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.79905E+02	550.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.75262E+02	575.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.71061E+02	600.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.67244E+02	625.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.63763E+02	650.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.60579E+02	675.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.57657E+02	700.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.54968E+02	725.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.52485E+02	750.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.50188E+02	775.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.48056E+02	800.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.46075E+02	825.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.44229E+02	850.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.42506E+02	875.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.40894E+02	900.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.39383E+02	925.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.37965E+02	950.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.36632E+02	975.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.35376E+02	1000.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.34193E+02	1025.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.33075E+02	1050.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.32018E+02	1075.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.31017E+02	1100.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.30068E+02	1125.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.29167E+02	1150.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.28312E+02	1175.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.27498E+02	1200.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.26723E+02	1225.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.25985E+02	1250.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.25280E+02	1275.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.24608E+02	1300.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.23965E+02	1325.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.23351E+02	1350.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
	0.22762E+02	1375.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0

0.22198E+02	1400.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.21658E+02	1425.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.21140E+02	1450.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.20642E+02	1475.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.20164E+02	1500.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.19705E+02	1525.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.19263E+02	1550.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.18837E+02	1575.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.18428E+02	1600.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.18033E+02	1625.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.17653E+02	1650.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.17286E+02	1675.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.16932E+02	1700.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.16590E+02	1725.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.16260E+02	1750.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.15941E+02	1775.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.15632E+02	1800.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.15334E+02	1825.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.15045E+02	1850.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.14766E+02	1875.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.14495E+02	1900.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.14233E+02	1925.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.13979E+02	1950.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.13733E+02	1975.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.13495E+02	2000.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.13263E+02	2025.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.13038E+02	2050.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.12821E+02	2075.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.12609E+02	2100.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.12404E+02	2125.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.12204E+02	2150.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.12010E+02	2175.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.11822E+02	2200.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.11639E+02	2225.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.11461E+02	2250.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.11288E+02	2275.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.11119E+02	2300.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10955E+02	2325.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10796E+02	2350.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10641E+02	2375.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10490E+02	2400.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10343E+02	2425.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10199E+02	2450.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.10060E+02	2475.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.99239E+01	2500.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.97914E+01	2525.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.96623E+01	2550.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.95365E+01	2575.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.94137E+01	2600.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.92941E+01	2625.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.91774E+01	2650.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.90636E+01	2675.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.89526E+01	2700.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.88442E+01	2725.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.87385E+01	2750.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.86353E+01	2775.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.85345E+01	2800.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.84362E+01	2825.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0

0.83401E+01	2850.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.82463E+01	2875.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.81547E+01	2900.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.80651E+01	2925.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.79777E+01	2950.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.78922E+01	2975.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.78086E+01	3000.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.77270E+01	3025.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.76471E+01	3050.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.75691E+01	3075.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.74927E+01	3100.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.74181E+01	3125.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.73450E+01	3150.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.72736E+01	3175.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.72036E+01	3200.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.71352E+01	3225.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.70682E+01	3250.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.70027E+01	3275.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.69385E+01	3300.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.68756E+01	3325.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.68141E+01	3350.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.67538E+01	3375.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.66947E+01	3400.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.66368E+01	3425.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.65802E+01	3450.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.65246E+01	3475.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.64701E+01	3500.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.64167E+01	3525.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.63644E+01	3550.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.63131E+01	3575.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.62627E+01	3600.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.62134E+01	3625.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.61649E+01	3650.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.61174E+01	3675.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.60708E+01	3700.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.60251E+01	3725.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.59801E+01	3750.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.59360E+01	3775.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.58928E+01	3800.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.58503E+01	3825.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.58085E+01	3850.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.57675E+01	3875.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.57272E+01	3900.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.56877E+01	3925.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.56488E+01	3950.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.56106E+01	3975.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.55730E+01	4000.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.55361E+01	4025.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.54998E+01	4050.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.54641E+01	4075.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.54290E+01	4100.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.53945E+01	4125.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.53605E+01	4150.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.53271E+01	4175.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.52942E+01	4200.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.52618E+01	4225.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.52300E+01	4250.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.51986E+01	4275.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0

0.51677E+01	4300.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.51374E+01	4325.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.51074E+01	4350.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.50780E+01	4375.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.50489E+01	4400.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.50203E+01	4425.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.49921E+01	4450.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.49643E+01	4475.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.49370E+01	4500.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.49100E+01	4525.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.48834E+01	4550.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.48572E+01	4575.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.48313E+01	4600.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.48058E+01	4625.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.47806E+01	4650.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.47558E+01	4675.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.47313E+01	4700.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.47072E+01	4725.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.46834E+01	4750.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.46598E+01	4775.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.46366E+01	4800.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.46137E+01	4825.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.45911E+01	4850.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.45687E+01	4875.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.45467E+01	4900.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.45249E+01	4925.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.45034E+01	4950.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.44821E+01	4975.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0
0.44611E+01	5000.00	0.00	Winter	0-360	10010701	-0.38	0.043	-9.000	0.020	-999.	21.	17.9	1.000	2.00	0.35	0.50	10.0	267.0	2.0