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WCH 11/29/99

November 24, 1999

Wen C. Huang, P.E.
Minnesota/Wisconsin Section,
RCRA Permitting Branch HRP-8J
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

**Subject:** **PPG Industries, Inc.**
**Oak Creek, Wisconsin**
**EPA ID WID 059972935**
**CMS Presumptive Remedy Implementation Report – Revision 1.0**

Dear Mr. Huang:

On behalf of PPG Industries, inc., IT Corporation (IT) is submitting the attached CMS Presumptive Remedy Report (Revision 1.0) for PPG's Oak Creek, Wisconsin facility. This report incorporates your comments as well as our subsequent telephone conversations regarding your comments on the initial September 9, 1999 submittal (Revision 0.0) of the report.

If you have any questions or require additional information the interim, please feel free to call Ted Huyett of PPG at (414) 764-6000 at your convenience.

Sincerely,

**IT CORPORATION**

Dough E. Lay

Douglas E. Laymon, P.G.
Client Program Manager

Cc: Ted Huyett – PPG
Dave Weber – PPG
866930 Project File

Walt Ebersol – WDNR
Mark Gordon – WDNR

Attachments

163

11/29/

**IT CORPORATION**
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# CORRECTIVE MEASURES STUDY (CMS) PRESUMPTIVE REMEDY IMPLEMENTATION REPORT

**Prepared for**

**PPG INDUSTRIES, INC.**
**Oak Creek, Wisconsin**
**EPA ID NO. WID 059972935**

**November 24, 1999**

**Prepared by**
**IT CORPORATION**
**2790 Mosside Boulevard**
**Pittsburgh, Pennsylvania 15146**

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# LIST OF ACRONYMS

| | |
|---|---|
| AOC | Area of Concern |
| AS | Air Sparging |
| AST | Above-Ground Storage Tank |
| CA 725 | RCRA Form CA 725 – Current Human Exposures Under Control |
| CA 750 | RCRA Form CA 750 – Migration of Contaminated Groundwater Under Control |
| CERCLA | Comprehensive Environmental Response Compensation and Liability Act |
| cfm | cubic feet per minute |
| CMI | Corrective Measures Implementation |
| CMS | Corrective Measures Study |
| °C | Degrees Centigrade |
| °F | Degrees Fahrenheit |
| IM | Interim Measure |
| IT | IT Corporation |
| MCL | Maximum Contaminant Level |
| mg/kg | milligrams per kilogram |
| mg/l | milligrams per liter |
| mmHg | millimeters of mercury |
| O&M | Operation and Maintenance |
| PID | Photoionization Detector |
| PPG | PPG Industries, Inc. |
| ppm | parts per million |
| PSI | pounds per square inch |
| RCRA | Resource Conservation and Recovery Action |
| RFI | RCRA Facility Investigation |
| SVE | Soil Vapor Extraction |
| SWMU | Solid Waste Management Unit |
| µl/l | microliters per liter |
| USEPA | United States Environmental Protection Agency |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |
| WAC | Wisconsin Administrative Code |
| WDCOM | Wisconsin Department of Commerce |

# EXECUTIVE SUMMARY

PPG Industries, Inc. (PPG) holds a Resource Conservation and Recovery Act (RCRA) operating permit at the Company's Oak Creek, Wisconsin facility. The corrective action provisions of the permit require PPG to investigate and, if necessary, implement corrective measures at identified solid waste management units (SWMUs) or areas of concern (AOCs). In August 1997, PPG submitted a comprehensive RCRA Facility Investigation (RFI) Report that presented the results of the investigation and assessment of human health and ecological risks related to 10 identified SWMUs. The report concluded that there were no unacceptable risks under current or future land use scenarios for 7 of the 10 SWMUs. One SWMU (SWMU 17), that was part of the Tank Farm Area was removed in 1996 in order to install new above-ground storage tanks. The two remaining SWMUs (SWMUs 8 and 18), within the Tank Farm Area, were only partially addressed in the RFI report risk assessment. While there were no unacceptable risks associated with the current use of these SWMUs, PPG deferred an assessment of risks associated with future land use scenarios in the Tank Farm Area because the tanks were subject to closure regulations, and meeting these regulations would dramatically change site conditions.

In July 1998, the USEPA granted conditional approval of the RFI Report. The condition of the approval was that PPG initiate corrective action by proceeding with the closure of the Tank Farm Area in accordance with applicable Wisconsin underground storage tank (UST) closure guidance. [In February/March 1999, PPG removed 23 of the 40 USTs and closed the remaining 17 USTs in place with Wisconsin Department of Commerce approval.] ?

PPG also implemented a presumptive remedy of soil vapor extraction (SVE) combined with air sparging (AS) of groundwater to reduce the levels of soil and groundwater contamination thereby stabilizing the Tank Farm Area. The constituents of interest in the Tank Farm Area were volatile organic compounds (VOCs), specifically ethylbenzene and xylene. SVE is a widely recognized effective method for the in-situ remediation of VOCs in soil. Target cleanup goals for constituents of interest were based on Wisconsin NR 720 standards and federal Maximum Contaminant Levels (MCLs) for soils and groundwater, respectively. Design calculations show that there are an estimated total of 8,226 pounds of VOCs in the Tank Farm Area soils and 76 pounds of VOCs in groundwater contained within the area. Based on the current operating parameters of the AS/SVE system, it is predicted that 18 months will be required to achieve the target cleanup goals.

The presumptive remedy was initially installed as an interim measure. However, PPG is confident that the implementation of the presumptive remedy will also meet the long term corrective measure goal of abating risks to human health and the environment under future land use scenarios. Thus, the action taken in addition to the information provided herein will meet the corrective action implementation requirements of PPG's permit. PPG will evaluate soil and groundwater conditions at the completion of the presumptive remedy program. If the target cleanup goals have been met, the AS/SVE system and groundwater underdrain system will be removed from service and no further action will be necessary.

In the event that the target cleanup levels are not achieved within the anticipated timeframe, PPG will perform a risk assessment based on the residual concentrations that are present. If the risk assessment concludes the risks are acceptable under future land use scenarios, no further action will be recommended. If the risk assessment concludes future risks are unacceptable, PPG will evaluate several contingency measures, one or more of which will be considered to meet the long term corrective measure goal. PPG will maintain adequate financial assurance for the presumptive remedy and reasonably anticipated contingency measures.

The results of the post-presumptive remedy analyses will be summarized in a final Corrective Measures Implementation Report.

# 1.0 INTRODUCTION

This document presents the Corrective Measures Study (CMS) Presumptive Remedy Implementation Report for the PPG Industries, Inc. (PPG), Oak Creek Facility located in Oak Creek, Wisconsin. This action is being taken under the Corrective Action provisions of the facility's Resource Conservation and Recovery Act (RCRA) permit dated March 31, 1992.

On August 5, 1998 the United States Environmental Protection Agency (USEPA) granted conditional approval to the RCRA Facility Investigation (RFI) Report (ICF Kaiser, 1997) prepared for the Oak Creek Facility. Approval was contingent upon PPG initiating the corrective action process at the Tank Farm Area in accordance with its RCRA Permit.

PPG elected to initiate the corrective action process by: 1) implementing soil vapor extraction (SVE), a USEPA presumptive remedy for soils in the Tank Farm Area; 2) installing and in-situ groundwater remediation system; and 3) preparing this report to describe the relationship of these actions to the Corrective Measures Implementation (CMI) requirements of PPG's permit. PPG and USEPA have agreed that the presumptive remedy SVE and the groundwater treatment (air sparging) currently being implemented will initially be considered interim measures (IM) rather than corrective measures as defined by the USEPA Corrective Action Guidance (USEPA, 1994).

In addition to the presumptive remedy and groundwater treatment, PPG elected to take the underground storage tanks (USTs) in the tank farm out of service in order to comply with Wisconsin Department of Commerce (WDCOM) regulations. These USTs and associated piping were taken out of service prior to the December 22, 1998 deadline. Since that time, PPG has removed 23 of the USTs, and closed the other 17 in place, with state approval.

## 1.1 REPORT PURPOSE

The purpose of this report is to document the selection and implementation of the IM, and provide information on how it will be integrated into the corrective action process. This report defines the IM objectives, describes the selection and implementation of the IM, sets the IM cleanup goals and provides contingencies for corrective action in the event cleanup goals are not met.

## 1.2 REPORT ORGANIZATION

This Report is organized into the following sections.

- Section 1.0 - Introduction
- Section 2.0 - Background
- Section 3.0 - Interim Measures Objectives
- Section 4.0 Presumptive Remedy Implementation
- Section 5.0 - Integration of Interim Measure with Corrective Measures Implementation
- Section 6.0 - Project Schedule
- Section 7.0 - References

# 2.0 BACKGROUND

This section of the report provides a physical description of the Tank Farm Area, a discussion of the applicable regulatory framework, a summary of previous investigations and information regarding the impacted media.

## 2.1 SITE AND TANK FARM AREA DESCRIPTION

The Oak Creek Facility is located at 10800 South 13th Street in Oak Creek, Wisconsin approximately five miles west of Lake Michigan (see Figure 2-1). The facility covers approximately 51 acres. The major components of the PPG Oak Creek Facility include a resin plant, a paint production plant, a Tank Farm Area, and a former impoundment basin. Administrative buildings, laboratories, raw materials and finished goods warehouses are also located at the site. A railroad spur is present in the southeast quadrant of the site and leading to the Raw Material Warehouse.

The Tank Farm Area is located in the southeastern portion of the site. A plan view of the Tank Farm Area is shown on Figure 2-2 (incorporated from the RFI report). The current and historical use of this area is for bulk solvent, organic acid and raw material storage and contains both USTs and above ground storage tanks (ASTs). A railroad spur runs along the north side of the Tank Farm Area and is used for limited resin plant loading operations. Two SWMUs are currently associated with the Tank Farm Area, SWMUs 8 and 18. These SWMUs are summarized below:

- SWMU 8: contains three 15,000-gallon ASTs. Two of these ASTs are used to contain spent paint-related solvents and the third is used to contain spent resin solvent. The ASTs are surrounded by concrete secondary containment, and releases and some staining have been reported in the past.
- SWMU 18: consists of a 3,770-gallon concrete underdrain sump for the Tank Farm Area. The sump collects groundwater and surface water infiltration from the area around the former USTs.

## 2.2 REGULATORY FRAMEWORK

The PPG Oak Creek Facility is subject to the regulations promulgated under RCRA. On March 31, 1992 the USEPA issued a RCRA Permit (EPA ID WID 059972935) to the Oak Creek Facility. This permit contained a requirement for conducting a RFI at 10 solid waste management units (SWMUs). With USEPA's approval of the RFI Report, all corrective action requirements have been met for 8 of the 10 SWMUs. (The two remaining SWMUs, listed above (Nos. 8 and 18), represent the Tank Farm Area and are the focus of this report.)

The Tank Farm Area was also subject to federal and state regulations regarding USTs. In order to meet the UST Regulations, PPG elected to take the USTs out of service and either remove or close them in place. This work was completed in the spring of 1999.

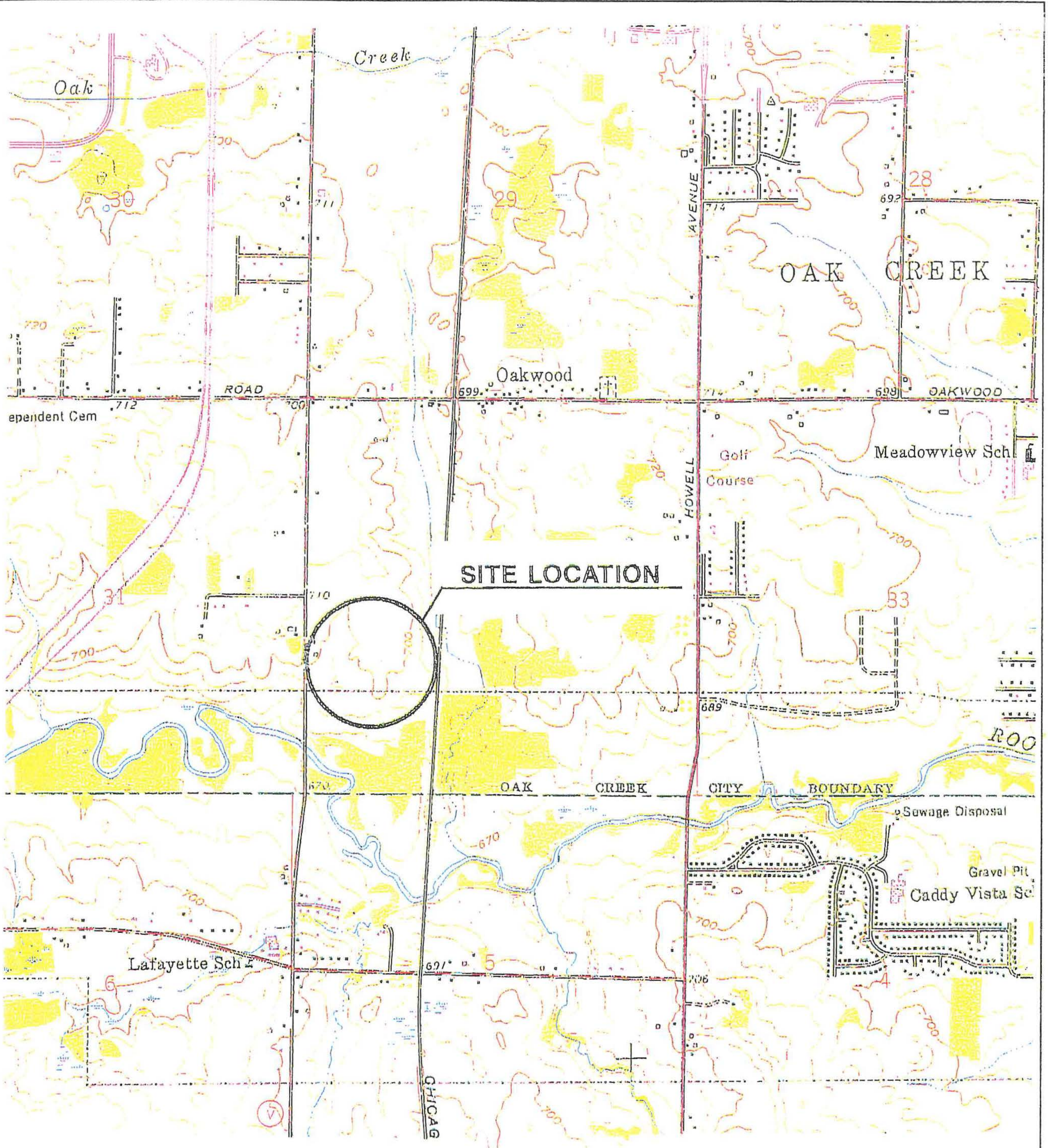
## 2.3 PREVIOUS INVESTIGATIONS AT THE TANK FARM AREA

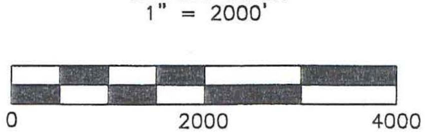
Eleven investigations have been conducted at the Oak Creek Facility. All of these investigations have provided information on the Tank Farm Area. Table 2-1 summarizes each of the previous investigations. A detailed account of each investigation is included in the RFI Report (ICF Kaiser, 1997). These investigations have indicated that former operations impacted soil and groundwater in the Tank Farm Area.

## TABLE 2-1

## SUMMARY OF PREVIOUS INVESTIGATIONS

| Company | Date | Description |
|---|---|---|
| Layne Western Company, Inc. | 1973 | Construction Geotechnical Borings |
| Warzyn Engineering, Inc. | October, 1981 | Soil Borings and Samples |
| Geraghty and Miller | June, 1986 | Soil Vapor Survey |
| OHM | October, 1987 | Soil Boring Study |
| Geraghty and Miller | December, 1987 | Groundwater Study |
| PPG | December, 1988 through December, 1991 | Tank Farm Sump Analysis |
| Geraghty and Miller | August 1998 through December 1991 | Quarterly Groundwater Sampling |
| Warzyn Engineering, Inc. | June, 1992 | Soil and Groundwater Assessment Report |
| PPG | 1992 | UST Leak Detection Program |
| Warzyn Engineering, Inc. | 1995 | Test Borings |
| ICF Kaiser | 1997 | RFI Report |





NOTE:

BASEMAP DEVELOPED FROM THE FRANKSVILLE, WISCONSIN 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAP, DATED 1958, PHOTOREVISED 1971.

FIGURE 2–1

| | |
|---|---|
| PPG INDUSTRIES, INC.<br>OAK CREEK, WISCONSIN | SITE LOCATION MAP<br>RCRA FACILITY INVESTIGATION |

| | | |
|---|---|---|
| *ICF KAISER ENGINEERS* | DATE: 7/31/97 | DR.: T. BLAIR |
| PITTSBURGH, PA | SCALE: AS SHOWN | DWG. NO.: FIG1_1 |

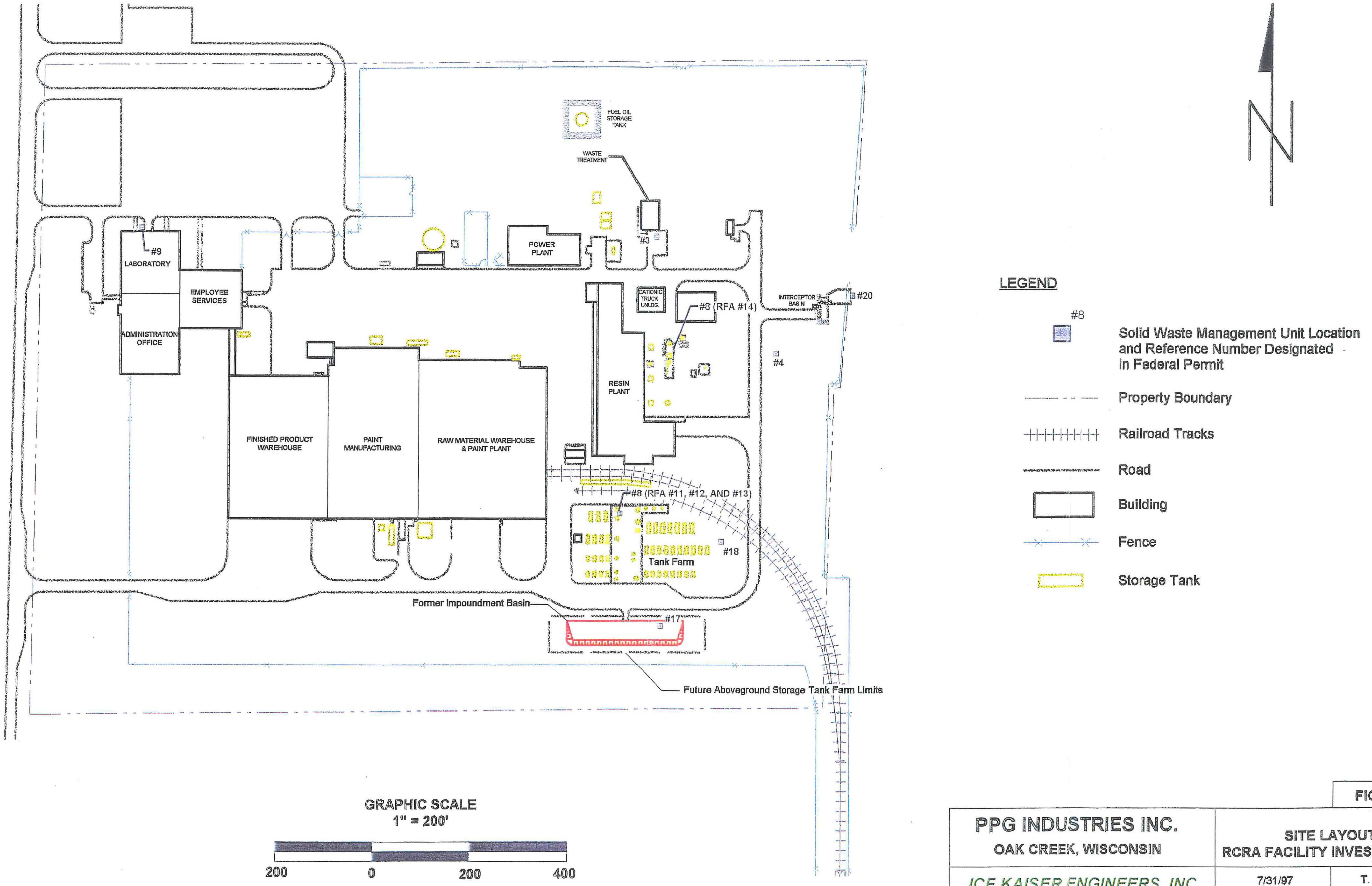
## 2.4 SUMMARY OF SITE CONDITIONS

Localized impacted soil and groundwater in the Tank Farm Area were identified in the RFI. Seven volatile organic compounds (VOCs) were identified in concentrations exceeding risk-based soil to groundwater screening criteria. These included toluene, ethylbenzene, xylene, styrene, methylene chloride, 1,1,2,2-tetrachloroethane, and tetrachloroethylene. No significant migration of constituents was evident due to the hydrogeologic setting and the influence of the Tank Farm underdrain system on groundwater flow.

Two VOCs were identified in concentrations exceeding the risk-based screening criteria for industrial soils. A quantitative risk assessment was performed under the RFI using a standard industrial worker exposure scenario. The industrial worker was evaluated for exposure to the identified constituents through incidental ingestion of soil, dermal contact with soil, and inhalation of VOCs released from soil. Conservatively estimated non-carcinogenic hazards for an industrial worker in the Tank Farm Area are acceptable for both ethylbenzene and xylenes under current conditions. Neither of these constituents are classified as carcinogenic, and consequently, cancer risks were not calculated.

A quantitative risk assessment for groundwater was not performed because there are currently no complete groundwater exposure pathways. This determination was made based on the fact that the aquifer is not currently used for potable water, and the impacted groundwater within the Tank Farm Area is captured by the underdrain system. The RFI concluded that no corrective measures are warranted for the protection of human health under current site exposure scenarios.

The RFI further concluded that performing a risk assessment for human or ecological receptors under potential future exposure scenarios was not appropriate since PPG planned to close the USTs and perform the IM to remediate the VOCs identified in the Tank Farm Area. Subsequent to completion of the RFI, the USTs were removed and the SVE and in-situ air sparging systems were installed.



| | | |
|---|---|---|
| | | **FIGURE 2-2** |
| **PPG INDUSTRIES INC.**<br>OAK CREEK, WISCONSIN | SITE LAYOUT<br>RCRA FACILITY INVESTIGATION | |
| *ICF KAISER ENGINEERS, INC.*<br>PITTSBURGH, PA | 7/31/97<br>1" = 200' | T. BLAIR<br>FIG2-2.WOR |

## 3.0 INTERIM MEASURE OBJECTIVES

In order to fulfill State UST closure requirements and to reduce concerns for VOC migration in the event that the underdrain system is discontinued in the future, PPG initiated an in-situ remedial action for the tank farm area. Specifically, soil vapor extraction enhanced with air sparging of contaminated groundwater was employed to achieve a short term objective of stabilizing the tank farm area. As discussed in Section 5, the federal corrective action environmental indicators CA 725 (Current Human Exposures Under Control) and CA 750 (Migration of Contaminated Groundwater Under Control) have been met for this site. PPG believes that the AS/SVE measure employed will also meet the long-term objective of reducing contaminant concentrations to levels that will be protective of human health and the environment under future use scenarios. Accordingly, it is PPG's desire to justify that the AS/SVE remedial action meets the CMI requirements for the RCRA permit. However, the AS/SVE system is considered an interim measure until a RCRA permit modification is approved by USEPA outlining the steps for determining AS/SVE system performance, the employment of contingency measures and establishing that potential risks under future site use scenarios are acceptable.

### 3.1 SELECTION OF SOIL VAPOR EXTRACTION AS A PRESUMPTIVE REMEDY TO ACHIEVE INTERIM MEASURE OBJECTIVES

The selected IM for soil is justified based on USEPA's criteria for presumptive remedies. As stated previously, the IM alternative proposed for the Tank Farm Area is SVE, which is commonly used as a presumptive remedy. Air sparging will also be conducted concurrently with the SVE to enhance remediation of the groundwater. The presumptive remedy approach was based on USEPA guidance including Presumptive Remedies: Site Characterization and Technology Selection for Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Sites With Volatile Organic Compounds in Soils (USEPA, 1993) and User's Guide to VOCs in Soils: Presumptive Remedy (USEPA, 1996b). The presumptive remedy process is designed to significantly streamline remedy selection by establishing consistently successful technologies for given contamination scenarios (e.g., subsurface soils contaminated with VOCs). This process eliminates the need to identify and compare remedial alternatives when it is highly unlikely that they will be as effective as the presumed remedy. Based on the information presented in the documents, SVE is the primary presumptive remedy for sites similar to the Tank Farm Area. This is based on the vast weight of evidence from similar sites that has proven that this technology effectively treats contaminated soil in place at a relatively low cost. The following paragraph provides an overview of the site-specific conditions that make SVE a reasonable alternative for the presumptive remedy.

The constituents detected in the unsaturated soils in the Tank Farm Area are VOCs. As such, they are amenable to extraction via volatilization into the soil vapor. The soil in the affected area of the Tank Farm is sand and gravel that was placed into an excavated basin to accommodate the tanks. The basin is lined with clay tile; outside of the basin, the natural soil is clay. The purpose of the basin was to construct a high permeability zone to facilitate groundwater extraction and maintain groundwater levels below the base of the tanks. Due to the nature of the constituents present, and the construction of the Tank Farm, SVE and air sparging technologies should be ideal for reducing the constituent concentrations. Section 4.0 of this report details the design and construction of the SVE and air sparging systems.

An SVE pilot test was conducted in the Tank Farm Area during the week of February 1, 1999. The test was conducted to provide information for the design of the full-scale system as well as to determine the need for an impermeable surface cover. The results of the pilot test indicated that SVE is an appropriate remedial technology for the site and installation of a full scale SVE system is reasonable. The SVE pilot test is further discussed in Section 4.0 of this report, and results of the pilot test are provided in Appendix A.

# 4.0 PRESUMPTIVE REMEDY IMPLEMENTATION

## 4.1 PRESUMPTIVE REMEDY DESIGN

This section presents detailed information on the distribution of constituents-of-interest in the Tank Farm Area, the anticipated rates of constituent removal via the presumptive remedy, and specifications for the design and installation of the AS/SVE system constructed.

### 4.1.1 Design Criteria

### 4.1.1.1 Description of Tank Farm Area

The Tank Farm Area was previously used for storage and delivery of various solvents, oils, and other liquids used in plant operations. The area included 40 USTs with a total capacity of approximately 670,000 gallons and associated pumps and piping. The USTs were taken out of service in December 1998 and removed or closed-in-place by March 1999. The Tank Farm Area consists of two sections separated by a concrete secondary containment area for above ground storage tanks.

The Tank Farm Area backfill extends to a uniform depth of approximately 20 feet below ground surface (bgs) and consists primarily of coarse sands. An estimated 4,000 feet of tile drainpipe is present at a depth of approximately 15 feet. The pipe collects water entering the Tank Farm Area; the groundwater flows by gravity to a concrete sump (SWMU No. 18) located at the east end of the area (see Section 4.1.2). The surrounding native soils consist primarily of low permeability glacial tills with discontinuous sand lenses. Based on data obtained during previous investigations and remediation system installation activities, the boundary of the Tank Farm Area backfill was established (Figure 4-1). The Tank Farm Area covers approximately 28,250 square feet; the western section is estimated at 9,750 square feet and the eastern portion is 18,500 square feet.

Twenty-three of the USTs were removed and 17 (with a total volume of 375,000 gallons [1,860 cubic yards]) were closed-in-place with the approval of the WDCOM. Approximately 400 cubic yards of concrete from the South Roadway were placed in the excavation after the USTs were removed. From this information, the total quantity of soil in the Tank Farm Area was calculated to be 18,665 cubic yards (Appendix B).

### 4.1.1.2 VOC Quantity Estimates

Data from previous site investigations were utilized to estimate the quantity of each of the VOCs detected in the Tank Farm Area soils and groundwater. The calculations are presented in Appendix B.

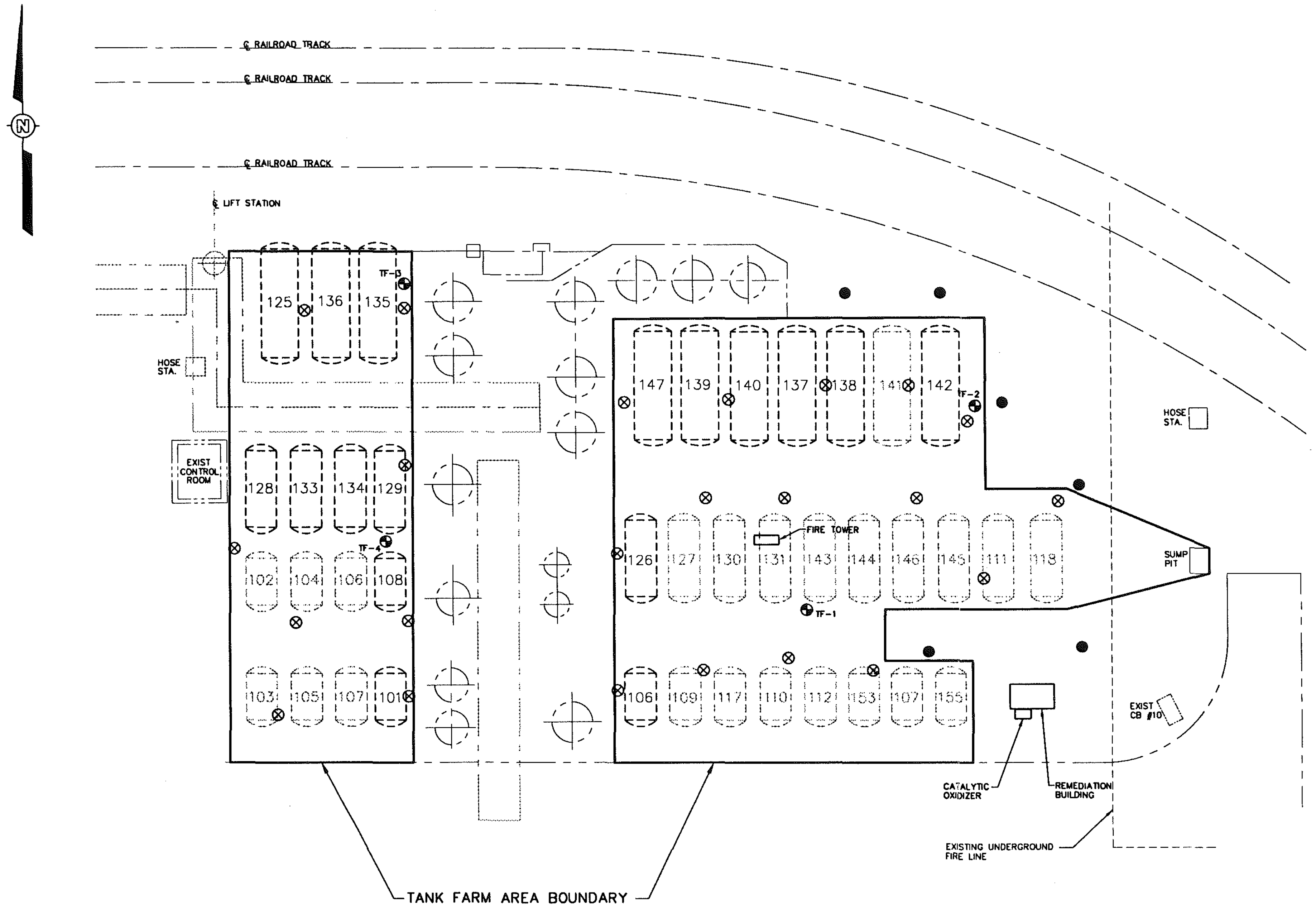
Results from the analysis of 27 soil samples were used to estimate VOC quantities in the soil. These samples were separated into two categories:

- Surface soil – 15 samples collected at depths of less than 4 feet.
- Subsurface soil – 12 samples collected at depths of greater than 4 feet.

The analytical data were then evaluated to determine average concentrations of VOCs for both the surface and subsurface soils. Assuming that the surface samples were representative of soils to a depth of 4 feet and the subsurface samples were representative of soils at depths of 4 to 20 feet, a weighted average concentration of the Tank Farm Area soils was then calculated.

Using these weighted concentrations and the estimated volume of soil in the Tank Farm Area, the total mass of each volatile constituent was calculated. The estimated total mass of the VOCs in the soil is 8,226 pounds.

| IMAGE | X-REF | OFFICE | DRAWING NUMBER |
|---|---|---|---|
| --- | --- | PGH | 778165-E4 |



VERIFY SCALE 0 1"

**NOTE:**

UNDERGROUND TANK LOCATIONS ARE APPROXIMATE.

**LEGEND:**

| | |
|---|---|
| ⊕ TF-1 | MONITORING WELL (APPROXIMATE LOCATION) |
| ⊗ | SPARGE WELL LOCATIONS |
| ● | ATTEMPTED SPARGE WELL LOCATIONS THAT WERE ABANDONED BECAUSE THEY ARE OUTSIDE TANK FARM AREA |
| 106 | UNDERGROUND STORAGE TANK (CLOSED-IN-PLACED) |
| 109 | UNDERGROUND STORAGE TANK (REMOVED) |

SCALE
0 20 40 60 FEET

FIGURE 4-1

| REV | DATE | BY | CHK'D | APR'VD | DESCRIPTION/ISSUE |
|---|---|---|---|---|---|

IT CORPORATION

PPG INDUSTRIES, INC
OAK CREEK, WISCONSIN

## TANK FARM AREA BOUNDARY

TANK FARM AREA REMEDIATION
OAK CREEK, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY | C. PIKE | | CHECKED BY | |
| DRAWN BY | STRITMATTER | | APPROVED BY | |
| SCALE: 1" = 20'-0" | DRAWING NO. 778165-E4 | | SHEET NO. | REVISION NO. |

DATE:3/3/99
TIME: ?:?? AM
FORMAT REVISION 2/26/99

The VOC quantities in the site groundwater were calculated using the analytical results from the baseline groundwater sampling activities conducted on May 18, 1999. The average of the VOC concentrations from the four monitoring wells (TF-1 through TF-4) and the Tank Farm Area sump was utilized as the representative groundwater concentration for the site. Then, the quantity of groundwater in the Tank Farm Area was estimated assuming a 5-foot thick saturated zone (as observed during monitoring well gauging activities) and a porosity of 35 percent. Using an average VOC concentration of 24.67 mg/l and a total groundwater volume of 370,000 gallons, a total of 76 pounds of VOCs was calculated (Appendix B).

A summary of the results of the calculations, including the estimated quantities of each volatile constituent, is presented in Table 4-1.

#### 4.1.1.3 Target Remediation Goals and Future Site Risks

As discussed in Section 3, Corrective Action Indicators CA 725 and CA 750, established as milestones for this site by USEPA, have already been met. PPG's long-term objective is to ensure that constituents in the Tank Farm Area are at levels that are protective of human health and the environment under future, as well as current land use scenarios (i.e., with or without the tank farm under drain system in operation). To optimize the potential to achieve this objective, PPG has established target cleanup goals for the presumptive remedy interim measure. The target goals are conservative and, if met, will ensure that potential future risks are within an acceptable range. In the event that the target goals are not met, PPG will assess the risks based on residual concentrations achieved, and if necessary, evaluate contingency measures to address unacceptable risks. This analysis will form the basis of incorporating the interim measure into the overall corrective measures implementation process which is further discussed in Section 5.0.

The RFI Report (ICF Kaiser, 1997) identified the following seven VOCs for which at least one sample exceeded initial screening levels (USEPA soil screening levels or Region V Data Quality Levels): xylenes, toluene, ethylbenzene, styrene, methylene chloride, 1,1,2,2-tetrachloroethane, and tetrachloroethylene. However, the vast majority of exceedances involved xylenes, toluene, and ethylbenzene, consistent with the storage tank inventory. Accordingly, PPG has set target cleanup goals for these three compounds recognizing that the other more sporadically detected compounds will be reduced along with the three compounds targeted. Table 4-2 presents the target cleanup goals which are based on Wisconsin generic residual soil contaminant levels (Wisconsin Administrative Code (WAC) NR 720.09).

**Table 4-1**
**Summary of VOC Concentrations and Quantities**
**Tank Farm Area**
**PPG Industries, Inc – Oak Creek, WI**

| Compound | Weighted Average Soil concentration (mg/kg) | Average Groundwater Concentration (mg/l) | Quantity in Soil (pounds) | Quantity in Groundwater (pounds) | Total Quantity (pounds) |
|---|---|---|---|---|---|
| 2-Butanone | 0.80 | 0.22 | 42 | 1 | **43** |
| 4-Methyl-2-Pentanone | 7.77 | 9.17 | 406 | 28 | **434** |
| Ethylbenzene | 33.21 | 4.59 | 1,736 | 14 | **1,750** |
| Styrene | 0.87 | 0.00 | 46 | 0 | **46** |
| Toluene | 21.45 | 0.95 | 1,121 | 3 | **1,124** |
| Xylenes | 93.27 | 9.73 | 4,874 | 30 | **4,904** |
| Methylene Chloride | 0.02 | 0.00 | 1 | 0 | **1** |
| **Total** | | | **8,226** | **76** | **8,302** |

## TABLE 4-2

### Soil Target Cleanup Goals
### Tank Farm Area Remediation

| Constituent | mg/kg |
|---|---|
| Xylenes | 4.1 |
| Toluene | 1.5 |
| Ethylbenzene | 2.9 |

**NOTE: Soil Target Cleanup Goals Derived from Table 1 Baseline Concentrations, Dilution Attenuation Factors, and Residual Contaminant Levels based on Protection of Groundwater, WAC, Chapter NR720.09.**

The target cleanup goals for groundwater are conservatively based on Federal maximum contaminant levels (MCLs). Similar to the soil target levels, achieving MCLs will ensure acceptable risks under future land use scenarios and contingency measures will be considered should a post-presumptive remedy risk assessment suggest they are warranted if the target levels are not met. Table 4-3 presents the target cleanup goals for groundwater.

## TABLE 4-3

### Groundwater Target Cleanup Goals
### Tank Farm Area Remediation

| Constituent | mg/l |
|---|---|
| Benzene | 0.005 |
| Ethylbenzene | 0.7 |
| Toluene | 1.0 |
| Xylene | 10.0 |
| Styrene | 0.1 |
| Methylene chloride | 0.005 |
| 1,1,2,2-tetrachloroethane | 0.0005 |
| Tetrachloroethylene | 0.005 |

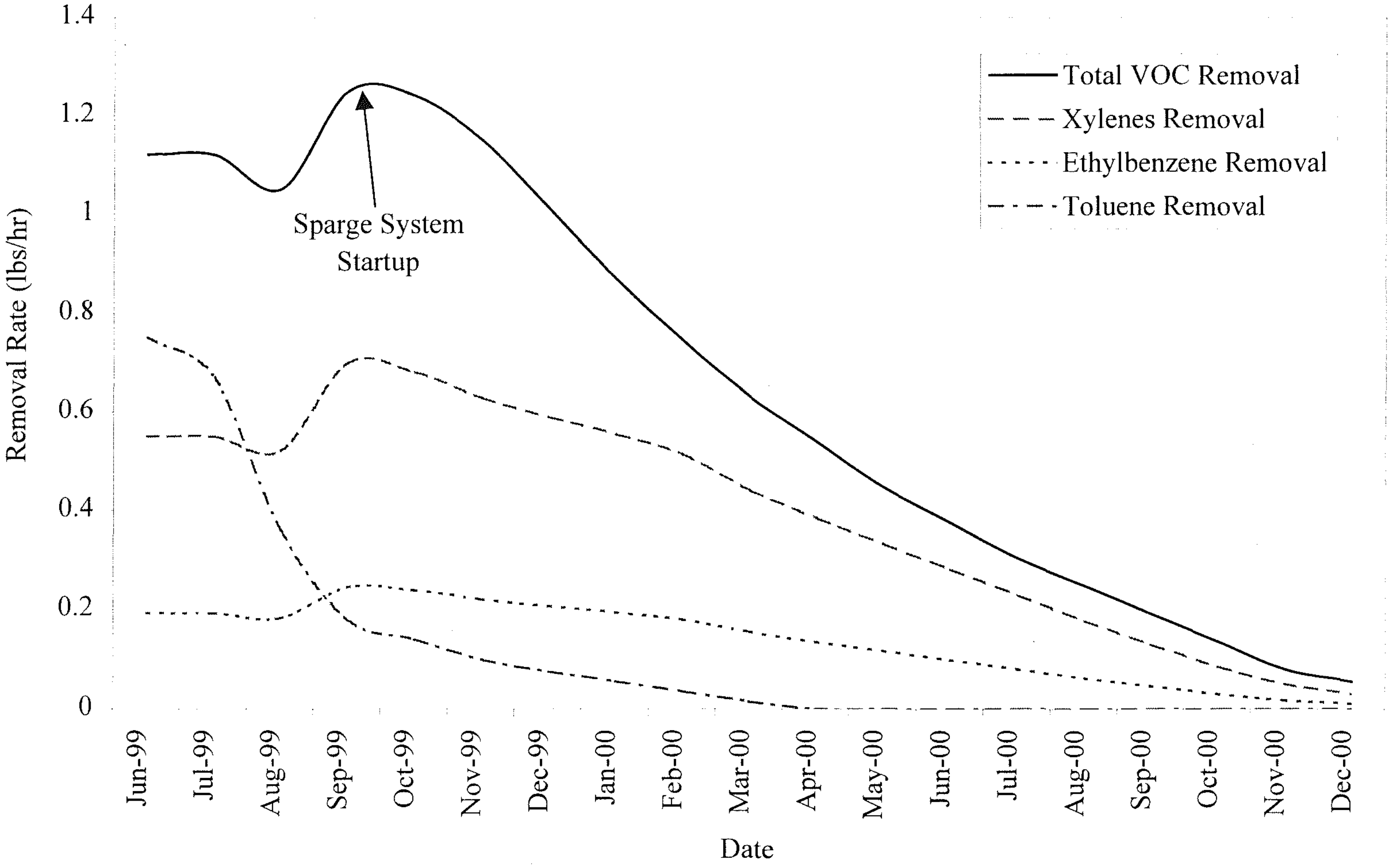
**NOTE: Target Cleanup Goals Based on Federal MCLs.**

### 4.1.1.4 Expected VOC Removal Rates

An estimate of the expected removal rates for total VOCs and the three individual VOCs most prevalent at the site (xylenes, ethylbenzene, and toluene) has been completed. The estimate, presented graphically in Figure 4-2, is based on the following:

- Utilizing recovered vapor stream flowrates and analytical results from start up activities, an initial total VOC removal rate of 1.12 pounds per hour was calculated (Appendix B).

## Figure 4-2
## Estimated VOC Removal



- An estimated total of approximately 8,300 pounds of VOCs are present in the site soil and groundwater. This includes approximately 4,900 pounds of xylenes, 1,750 pounds of ethylbenzene, and 1,125 pounds of toluene (Table 4-1).

- After rapid removal of the most volatile compounds and those VOCs in close proximity to the SVE recovery piping, recovery rates are expected to decrease. The shape of this portion of the curve is primarily based on removal rates observed at other sites at which SVE has been utilized and should be used for qualitative purposes only. The actual removal rates may vary significantly from those shown. The curves will be updated as more operational data is available.

- Toluene, as expected due to its high vapor pressure with respect to the other constituents, was being recovered during initial system operation at a rate disproportionate to its concentration in the site soils. Also because of its vapor pressure, and relative concentrations of the VOCs at the site, the toluene recovery rate is expected to decrease more rapidly than the other VOCs.

- Photoionization detector (PID) readings collected from the recovered vapor stream indicated that VOC recovery rates decreased only slightly during the first month of operation.

- When operation of the air sparging system is initiated, the VOC removal rates are expected to rise rapidly. This is due to volatilization of VOCs in the groundwater as well as increased VOC removal in the soils near the top of the water table.

The total VOC removal curve indicates that the 8,300 pounds of VOCs in the soil and groundwater will be removed in approximately 18 months, with more than 90 percent of the removal occurring in the first 12 months of operation. As stated above, these estimates will be revised as more data is available. Additionally, the graph does not account for the reduction in VOCs due to biodegradation (which will be enhanced via the oxygen delivered to the subsurface by the air sparging system); if biodegradation is significant, the overall remediation time will be reduced.

During system start-up, a sample of the vapor stream after treatment in the catalytic oxidizer was collected. The analytical data for this sample, labeled "Overall Effluent" are summarized in Table 4-4. Using these data and a vapor flow rate of 356 cubic feet per minute, a total rate of VOC discharge was calculated. This rate, approximately 0.004 pounds per hour, is well below state mandated levels of 5.7 pounds per hour (WAC NR 407.03 (sm) (2)) and is protective of the health and safety of site personnel.

### 4.1.2 Detailed Design

Based on the site conditions described above, an AS/SVE system was designed to remove the VOCs from the soil and groundwater. The type of soil in the Tank Farm Area and the constituents of interest are well suited for remediation via these technologies. The Tank Farm Area backfill consists of very high permeability sands; this soil allows substantial vapor flow at relatively low vacuums. Additionally, with this type of soil, a relatively large area of influence can be obtained.

These factors also make the site groundwater conducive to remediation via air sparging. The constituents of interest will be easily volatilized from the groundwater (for recovery via SVE) and will be amenable to biodegradation utilizing oxygen added via sparging. The reduction of VOC concentrations in the groundwater will be accomplished via the following mechanisms:

- The constituents of interest will be volatilized from the groundwater by the injection of pressurized air through the saturated zone. The VOCs will then be recovered via the SVE system.

# Table 4-4
# Summary of Extracted Vapor Analytical Results
# Tank Farm Area - PPG Industries, Inc.
# Oak Creek, WI

(analytical results in ul/l [ppm])

| Sample Location | Description | Date | Toluene | Ethyl-benzene | m-Xylene/ p-Xylene | o-Xylene | Styrene | Methylene Chloride | Chloro-methane | 1,2,4-Tri methylbenzene | 1,3,5-Tri methylbenzene | Dichloro difluoromethane |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SVE -1 | Southeast Portion of Site | 6/23/99 | 320 | 150 | 990 | 170 | 16 | ND 7.9 (a) | ND 20 | ND 7.9 | ND 7.9 | ND 7.9 |
| SVE-2 | East-Central Portion of Site | 6/23/99 | 72 | 39 | 210 | 36 | 2.2 | 2.3 | ND 3.9 | 2.1 | ND 1.6 | ND 1.6 |
| SVE-3 | Northeast Portion of Site | 6/23/99 | 170 | 98 | 380 | 62 | ND 6.6 | ND 6.6 | ND 16 | ND 6.6 | ND 6.6 | ND 6.6 |
| SVE-4 | West Portion of Site | 6/23/99 | 130 | 69 | 140 | 25 | ND 1.7 | ND 1.7 | ND 4.2 | 3.1 | 2.2 | 2.2 |
| Overall Influent | Influent from Entire Site | 6/23/99 | 110 | 22 | 63 | 8.6 | ND 1.7 | ND 1.7 | ND 4.4 | ND 1.7 | ND 1.7 | ND 1.7 |
| Overall Effluent | After Treatment in Oxidizer | 6/23/99 | 0.013 | 0.007 | 0.033 | 0.006 | 0.001 | 0.004 | 0.013 | ND 0.0005 | ND 0.0005 | 0.001 |

Notes:
Locations of SVE-1 through SVE-4 are presented on Figure 4-2.
Only parameters which were detected in at least one sample are reported in this table.
(a) NDXX - Parameter not detected at indicated reporting limit.

- The constituents of interest will be amenable to increased biodegradation due to increased dissolved oxygen concentrations in the site groundwater.

One common disadvantage of air sparging at many sites is the tendency to "push" contaminants outside of the initial plume area. However, this tendency should be minimized at this site due to the naturally occurring low permeability soils that surround the Tank Farm Area.

Based on the high permeability soil type in the Tank Farm Area and the presence of VOCs in the surface soils, there was a recognized possibility that the vacuum induced in the subsurface soils would "short-circuit" to the surface, reducing the area of influence and efficiency of the system. In order to determine the extent of short-circuiting that would occur (to determine if an impermeable surface covering was required) and to obtain data for the system design, a pilot test was designed and conducted.

Two types of SVE recovery piping systems were considered for the pilot test and full-scale system: Vertical well points and horizontal trenches. Horizontal trenches were chosen for the following reasons:

- The surface and subsurface of the Tank Farm Area would be relatively free of obstacles at the time of the installation and the soil would be relatively easy to excavate. Therefore, from a constructability standpoint, the site was ideal for horizontal trenches.

- The horizontal and vertical distribution of the VOCs favored trenches. High VOC concentrations have been observed in the surface soils and would be expected at the top of the water table. In order for vertical SVE well points to effectively recover VOCs from near the surface, the points would be screened to near the surface. This would lead to significant short-circuiting to the surface if an impermeable cover was not in place. Although an impermeable cover was later included, the effectiveness of the horizontal trench in the pilot test was sufficient to recommend use of trenches in the final design.

#### 4.1.2.1 SVE Pilot Test

The pilot test was conducted in February 1999. A 5-horsepower blower was utilized to draw vapor from 40 feet of slotted polyvinyl chloride (PVC) pipe buried to a depth of approximately 6 feet. The recovered vapors were treated in a carbon adsorber. The test was initially conducted without a surface covering. Data collected periodically included: Recovered vapor VOC concentration and flowrate, vacuum readings at the SVE blower and recovery trench, and vacuum readings at piezometers located approximately 10, 20, and 30 feet from the extraction trench.

The area around the recovery trench was then covered with polyethylene sheeting to simulate the use of a non-permeable surface covering. However, various surface structures not yet removed from the area, such as vent pipes and concrete pump blocks, impeded efforts at obtaining an adequate air seal.

The pilot test report was previously submitted and is included in Appendix A. The following conclusions and recommendations were obtained from the pilot test:

- At a depth of approximately 6 feet, the slotted vapor recovery piping was installed in soil observed to contain significant VOC impact. This was observed in the trench excavated for the pilot test as well as soil excavated during UST removal activities.

- The soil on site is very homogenous and permeable from the surface to a depth of at least 12 feet.

- Based on the soil type and nature and location of VOC impact (as well as PID readings recorded during testing), it appears that the SVE system would be very effective in recovering VOCs from the subsurface.

- The placement of a polyethylene liner (which, as explained above, did not provide an adequate seal) increased the vacuum at the blower by 10 percent and doubled the vacuum influence at the piezometer located 20 feet from the recovery trench.

- Significant short-circuiting of air from the surface was expected based on visual inspection of the soil and was observed during the testing. Very high air flowrates and relatively low vacuums at the blower (in conjunction with relatively low vacuums at the vapor monitoring points) indicate that air from the surface was influencing the test. Additionally, the relatively fast decrease in the PID readings indicates that air from the surface may have been diluting the recovered air stream. Another factor indicating that short-circuiting was occurring was the rapid rise in the vacuum at the end of the screen and at the closest piezometer and then the reduction or leveling off of these values during the second phase of the pilot test. This seems to indicate that the surface cover had an effect initially, but that effect was reduced as surface air from around the perimeter of the liner was pulled into the subsurface. Based on the visual observations and test data, an impermeable surface covering was recommended.

#### 4.1.2.2 SVE System

Based on data obtained from the pilot test, the design of the full-scale SVE system was finalized. The system would consist of approximately 600 feet of slotted, 2-inch diameter PVC pipe buried to a depth of 6 feet. The locations of the slotted pipe were based on an area of influence of approximately 30 feet on each side of the pipes and taking into account site surface and underground obstructions. Due to the potential for loss of vacuum along a run of slotted pipe, the maximum length of a run of slotted pipe is 50 feet. Each run of slotted pipe is connected to solid, 2-inch diameter PVC pipe. The solid pipe is manifolded together into four branches which are run to the remediation building as illustrated in Figures 4-3 and 4-4. More details on the construction of the underground piping are presented in Section 4.2.2.

A 10 horsepower, Roots Series 59 positive displacement blower (part of the Carbonair Environmental System, Inc. integrated SVE system) is utilized to draw vapors from the subsurface via the underground piping network. The blower is presently operated to recover approximately 350 cubic feet per minute (cfm) of vapors at a vacuum of 25 inches of water (iw).

From the underground piping, the vapor stream is transferred into a pipe manifold inside the remediation building. The vacuum on each of the 4 legs of the manifold and the header pipe are measured; valves located on each branch control the air flow. From the manifold, the vapor passes through a 100-gallon knockout tank. There, any water that is recovered with the vapor is separated from the vapor stream and stored. The SVE blower will shut down when the water level in the knockout tank reaches a preset high level; however, recovery of a significant amount of water is not expected. A differential pressure indicator measures the drop in the vacuum across the knock out tank. If this value is observed to be increasing it could indicate a block in the mist eliminator installed near the outlet of the tank.

After passing through the knockout tank, the vapor enters the blower and is discharged. A meter at the blower discharge indicates the vapor flow rate. The air then enters a catalytic oxidizer for destruction of the VOCs. This is accomplished by passing the vapors across a heated catalyst. When VOC concentrations are high, the heat created by the destruction of the VOCs is sufficient to maintain the catalyst temperature. As VOC concentrations decrease, an electric heater is utilized to maintain the catalyst temperature. Three thermocouples measure the temperature at various locations in the oxidizer. If the temperatures are below the set point, the heater is automatically started; if the temperatures are above the set point, an automatic

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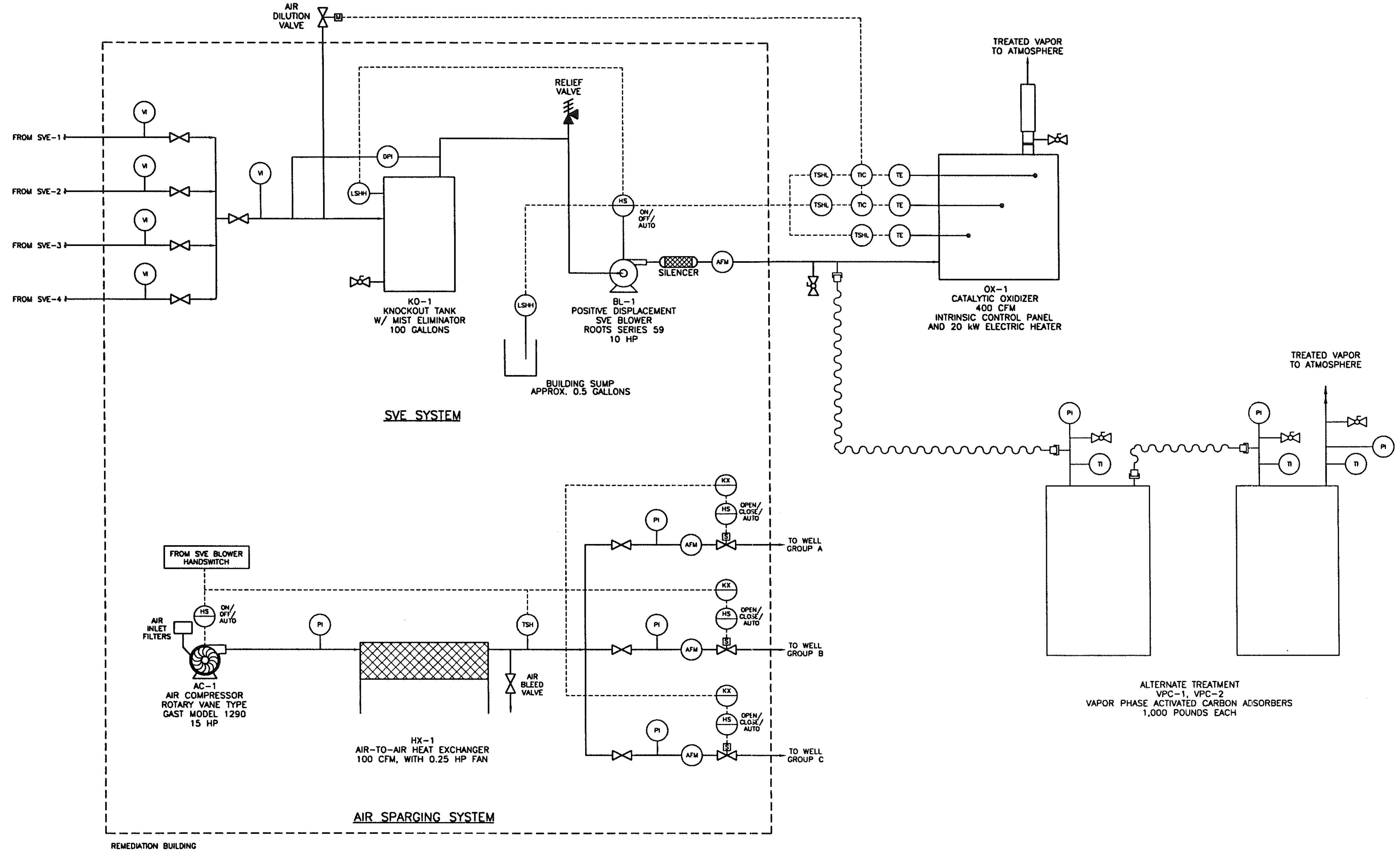
| 778165-E5 | PGH | --- | --- |



NOTES:

1. SVE BLOWER SHUTS DOWN ON:
   - HIGH HIGH LIQUID LEVEL IN KNOCKOUT TANK
   - SHUT DOWN OF CATALYTIC OXIDIZER
   - HIGH HIGH LIQUID LEVEL IN BUILDING SUMP
2. AIR COMPRESSOR SHUTS DOWN ON:
   - HIGH TEMPERATURE AT HEAT EXCHANGER DISCHARGE
   - SHUT DOWN OF THE SVE BLOWER
   - NO SOLENOID VALVES OPEN
3. THE CATALYTIC OXIDIZER WILL BE REPLACED BY THE VAPOR PHASE CARBON ADSORBERS WHEN VOC CONCENTRATIONS ARE REDUCED TO APPROXIMATELY 25 PPM.

LEGEND:

| | |
|---|---|
| ⋈ | GATE VALVE |
| ⋈ | BALL VALVE |
| M ⋈ | MOTORIZED BALL VALVE |
| S ⋈ | SOLENOID VALVE |
| AFM | AIR FLOW METER |
| DPI | DIFFERENTIAL PRESSURE INDICATOR |
| HS | HAND SWITCH (ON CONTROL PANEL) |
| VI | VACUUM INDICATOR |
| VSL | VACUUM SWITCH (LOW) |
| VSH | VACUUM SWITCH (HIGH) |
| LSHH | LEVEL SWITCH (HIGH HIGH) |
| TE | TEMPERATURE ELEMENT |
| TI | TEMPERATURE INDICATOR |
| TIC | TEMPERATURE INDICATING CONTROLLER |
| TSHL | TEMPERATURE SWITCH (HIGH/LOW) |
| KX | ADJUSTABLE TIMER (ON CONTROL PANEL) |
| PI | PRESSURE INDICATOR |
| TSH | TEMPERATURE SWITCH (HIGH) |

VERIFY SCALE 0 1"

FIGURE 4-5

IT CORPORATION

PPG INDUSTRIES, INC.
OAK CREEK, WISCONSIN

SVE AND AIR SPARGING SYSYEM
PROCESS FLOW DIAGRAM
TANK FARM AREA REMEDIATION
OAK CREEK, WISCONSIN

| | | | | |
|---|---|---|---|---|
| DESIGNED BY | C. PIKE | | CHECKED BY | |
| DRAWN BY | STRITMATTER | | APPROVED BY | |
| SCALE: NONE | DRAWING NO. 778165-E5 | | SHEET NO. | REVISION NO. |

| REV | DATE | BY | CHK'D | APR'VD | DESCRIPTION/ISSUE |
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FORMAT REVISION 2/26/99

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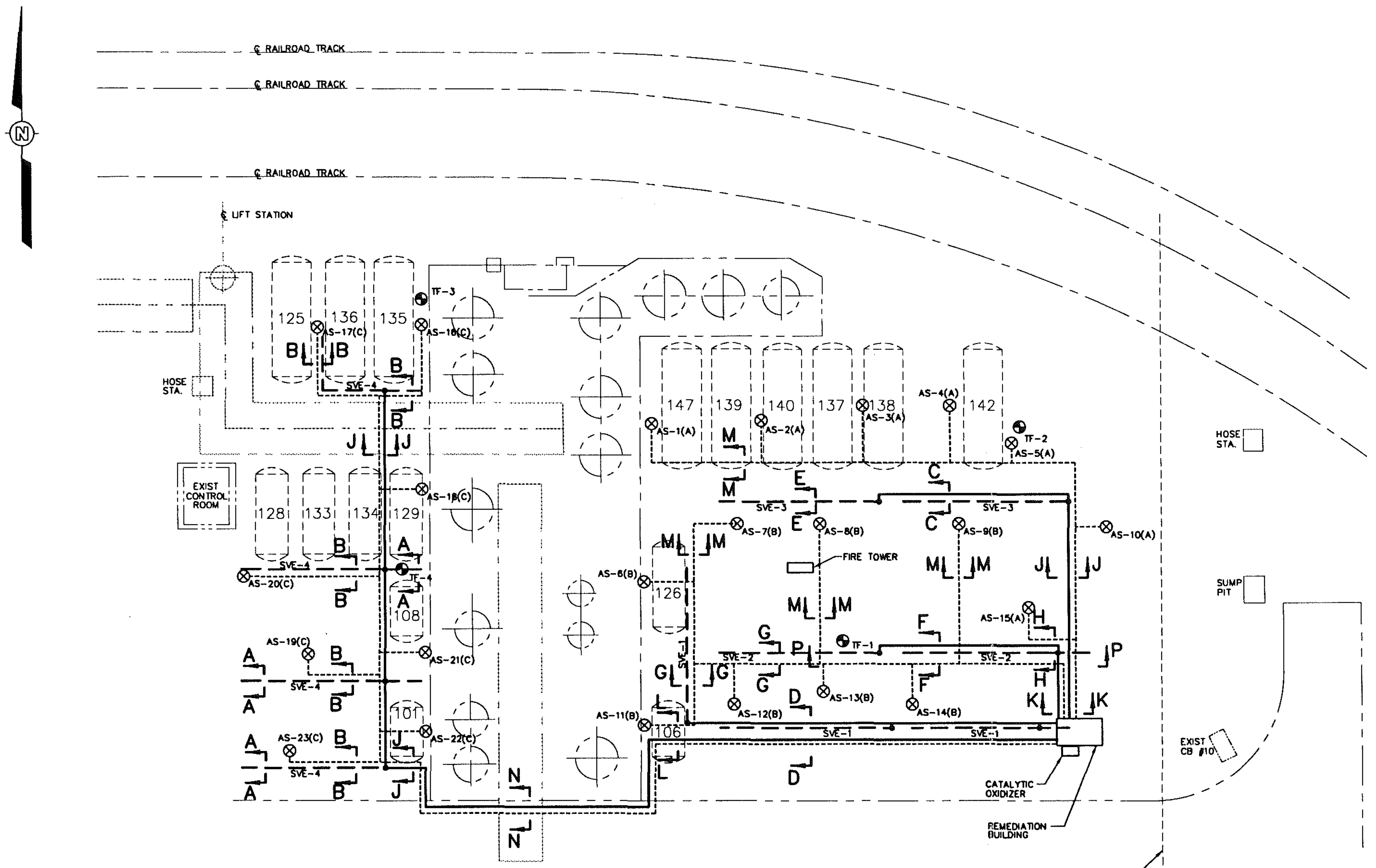
| -- | -- | PGH | 778165-E1 |

**NOTE:**

UNDERGROUND TANK LOCATIONS ARE APPROXIMATE.

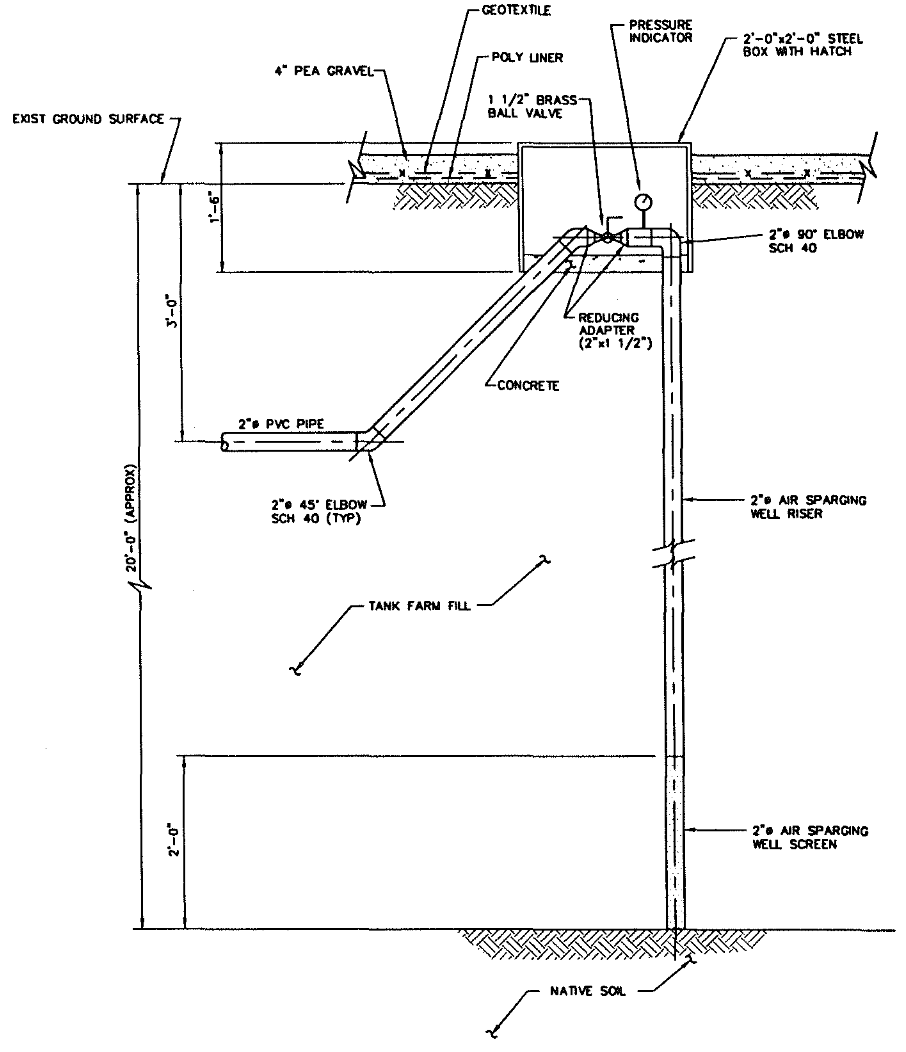
**LEGEND:**

| | |
|---|---|
| ⊕ TF-1 | MONITORING WELL (APPROXIMATE LOCATION) |
| ⊗ AS-7(A) | AIR SPARGING WELL-WELL GROUP A |
| ------------------ | SOLID 2"ø PVC AIR SPARGING PIPE (UNDERGROUND) |
| ———— | SOLID 2"ø PVC SVE SYSTEM PIPE (UNDERGROUND) |
| — — — — | SLOTTED 2"ø PVC SVE SYSTEM PIPE (UNDERGROUND) |



**NOTE:**

TRENCH WIDTHS EXAGGERATED FOR CLARITY.



## TYPICAL AIR SPARGING WELL

SCALE: 1" = 1'-0"

SCALE

0 20 40 60 FEET

FIGURE 4-3

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IT CORPORATION

PPG INDUSTRIES, INC
OAK CREEK, WISCONSIN

SITE PIPING PLAN
SVE AND AIR SPARGING SYSTEM
TANK FARM AREA REMEDIATION
OAK CREEK, WISCONSIN

| | | | | | |
|---|---|---|---|---|---|
| DESIGNED BY | C. PIKE | | CHECKED BY | | |
| DRAWN BY | STRITMATTER | | APPROVED BY | | |

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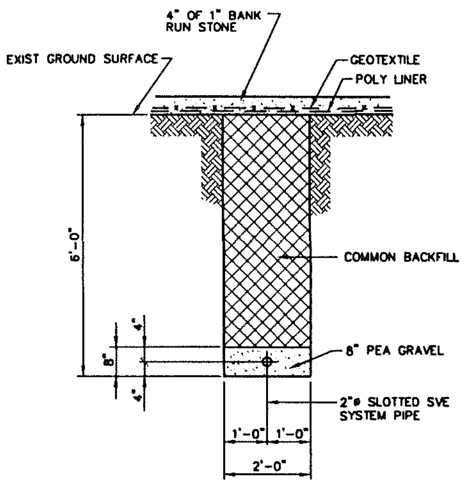

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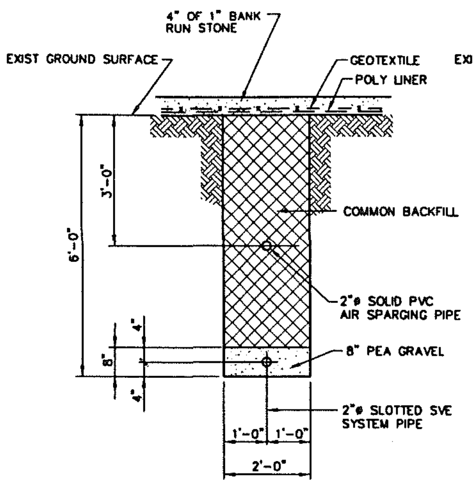

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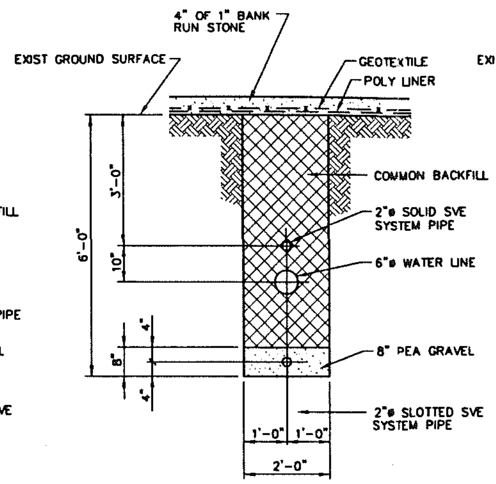
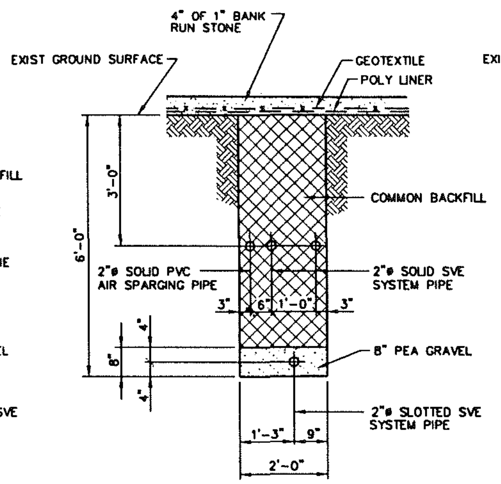
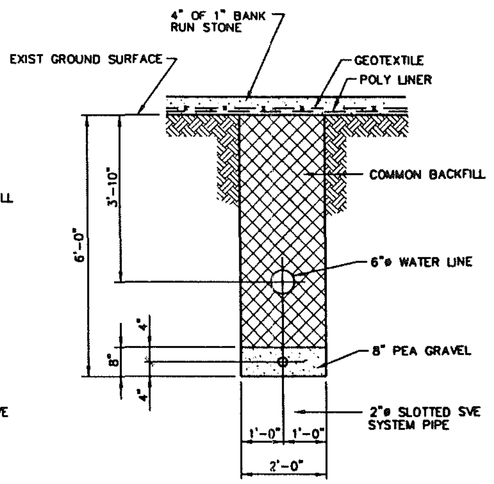


SECTION C – C



SECTION D – D



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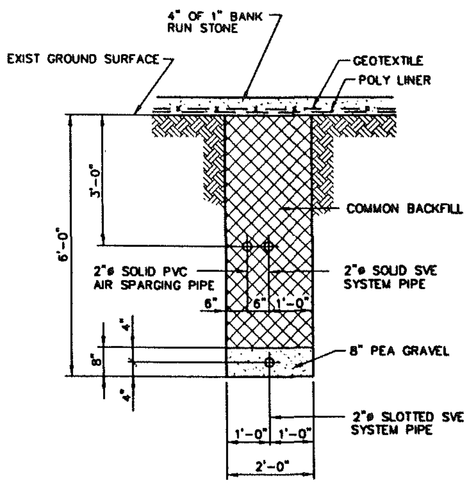

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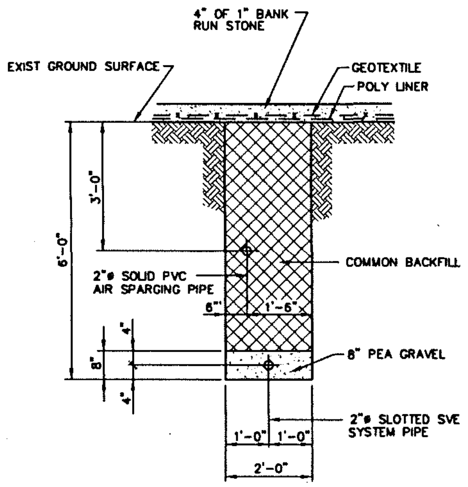
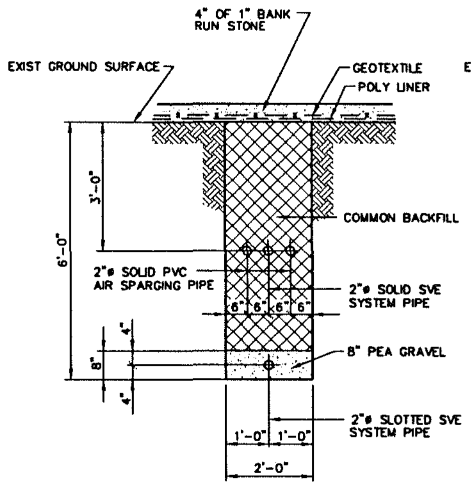


SECTION G – G



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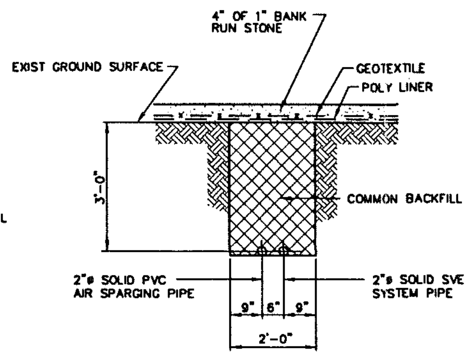
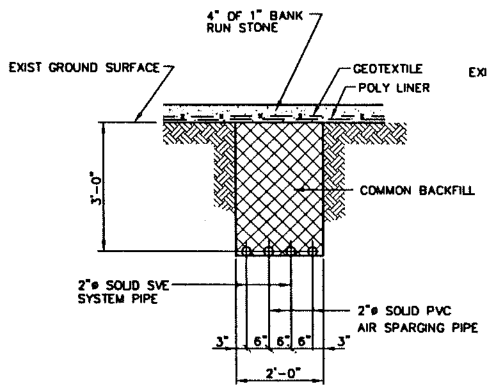


SECTION J – J



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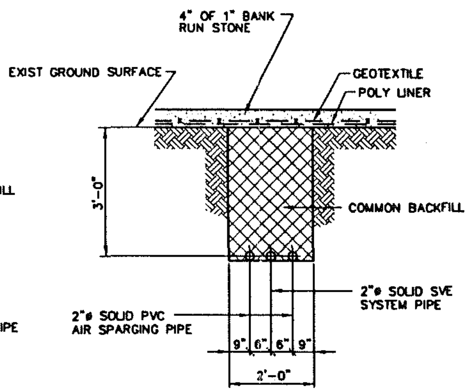

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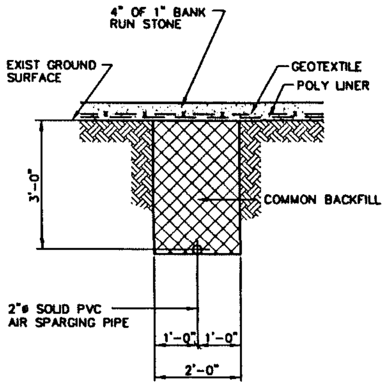

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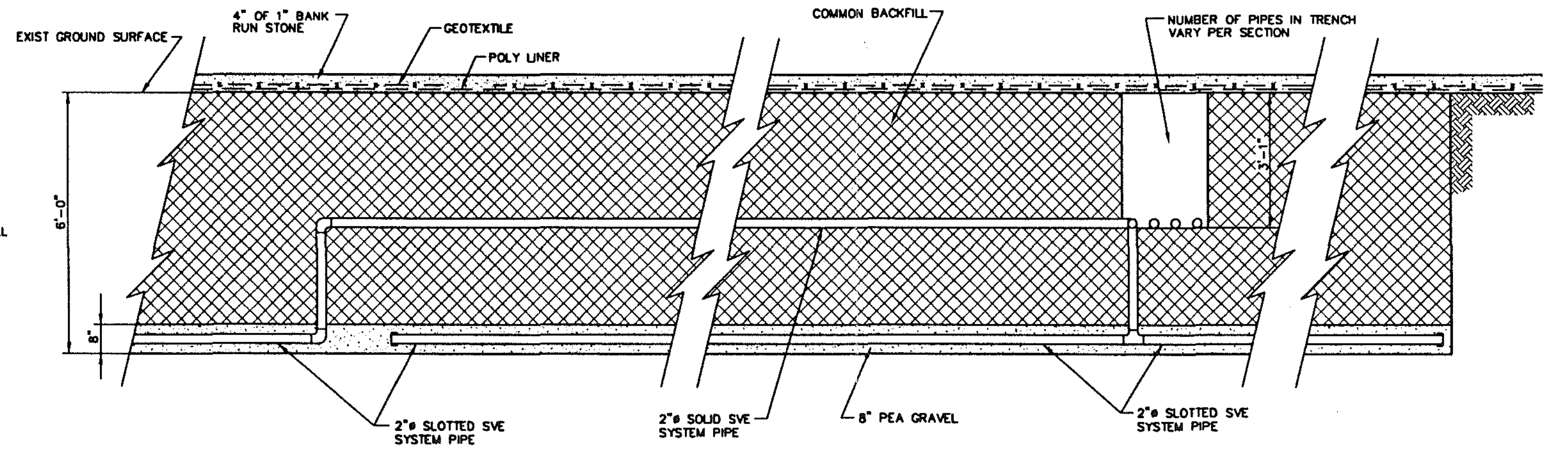

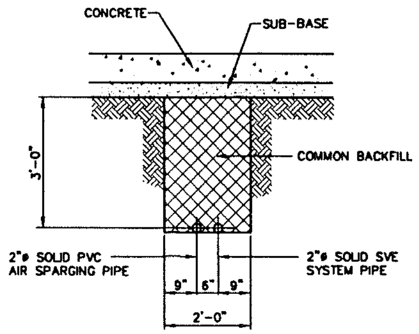

SECTION N – N

SECTION P – P (AS SHOWN)
(3-PLACES)

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| | | | | | |
| | | | | | |

FIGURE 4-4

IT CORPORATION

PPG INDUSTRIES, INC.
OAK CREEK, WISCONSIN

SITE PIPING SECTIONS
SVE AND AIR SPARGING SYSTEM
TANK FARM AREA REMEDIATION
OAK CREEK, WISCONSIN

DESIGNED BY C. PIKE
CHECKED BY
DRAWN BY STRITMATTER
APPROVED BY
SCALE: 1/2"=1'-0"
DRAWING NO. 778165-E2
SHEET NO.
REVISION NO.

dilution valve (installed on the suction side of the SVE blower) is opened. This allows ambient air to be drawn into the oxidizer, reducing the VOC concentration of the inlet stream, thereby cooling the catalyst bed. If temperatures reach a high or low alarm condition, the oxidizer and SVE blower are automatically shut down. The temperature set points on the oxidizer are as follows:

- Vapor temperature entering catalyst: Set point – 330 degrees Centigrade (°C), Low alarm – 270 °C, High alarm – 505
- Vapor temperature exiting catalyst: Set point – 600°C, Low alarm – 305°C , High alarm – 620°C Vapor temperature in catalyst: Set point – 580°C, High alarm - 600°C .

After being treated in the oxidizer, the vapor is discharged to the atmosphere.

As remediation progresses and the VOC concentration of the recovered air stream is reduced, it will become cost effective to treat the recovered vapor with activated carbon adsorbers in lieu of the catalytic oxidizer. The proposed treatment would consist of two adsorbers, piped in series, each with a capacity of 1,000 pounds of carbon. The use of adsorbers would become cost effective when the change-out of one adsorber was required approximately every 4 weeks. Using a rule of thumb of 10 pounds of carbon required for each pound of VOCs treated, this equates to replacement of the oxidizer at a removal rate of approximately 0.15 pounds per hour or a VOC concentration of approximately 25 ppm. Additionally, the concentration of ketones in the vapor stream will be monitored to ensure that the adsorption system can be operated safely without the possibility of excessive heat generation. A process flow diagram of the proposed carbon adsorption system is presented in Figure 4-5.

Carbon adsorbers, if used, will be sized to remove 99 percent of the VOCs in the vapor effluent stream. This will result in a discharge of less than 0.0004 pounds per hour of VOCs to the atmosphere, which is well below state mandated levels and is protective of the health and safety of site personnel.

A process flow diagram of the SVE recovery and treatment system is presented in Figure 4-5. Manufacturer's information on the SVE blower and oxidizer are included in Appendix C.

#### 4.1.2.3 Air Sparging System

Based on the coarse nature of the Tank Farm Area backfill and the aquifer thickness, a radius of influence of approximately 20 feet is estimated for each sparging well; therefore, 23 sparge wells were installed in the locations shown in Figure 4-3 (see Section 4.2.1 for installation details). The wells are 2 inches in diameter and were installed, where possible, to the bottom of the Tank Farm Area backfill. Each well contains a 2-foot length of slotted PVC screen.

The sparging of the site groundwater will be accomplished by injecting pressurized air into the sparging wells. A 15-horsepower rotary vane compressor (Gast Model 1290) will transfer approximately 100 cfm of air at 5 pounds per square inch (psi) through an air-to-air heat exchanger to the sparging wells. The compressor discharge air must be cooled by the heat exchanger because it is too hot for the downstream PVC piping and to allow biodegradation to occur in the subsurface. If this air reaches a preset high temperature (170° F), the air compressor will shut down.

The sparging wells are divided into three groups. Air will be injected into each group of wells for 4 to 6 hours out of every day. Solenoid valves, operated by timers, on the header pipes to each group of wells will control the well group(s) into which air will be injected. The compressor will only operate when at least one of the solenoid valves is open. Pressure and flow indicators are installed on each branch of the piping manifold; these parameters can be controlled by a valve on each branch of the manifold as well as a bypass valve located upstream of the manifold. The wells are grouped as follows:

- Group A – AS-1 through AS-5, AS-10, and AS-15
- Group B – AS-6 through AS-9 and AS-11 through AS-14
- Group C – AS-16 through AS-23.

During periods of air injection to a group of wells, the primary remedial mechanism will be volatilization of VOCs from the groundwater and recovery of these VOCs via the SVE system. During the periods between injection, the primary remedial mechanism will be biodegradation; the oxygen added to the subsurface will enhance the natural biodegradation of the VOCs in the soil and groundwater. As more volatile compounds are removed from the groundwater, the primary purpose of the air sparging system will be to provide oxygen for additional biodegradation. The intermittent injection will also allow new flowpaths to be created when injection to a group of wells is re-started.

Figures 4-3 and 4-4 present the layout and sections of the air sparging wells and piping. A process flow diagram, showing the major equipment and instrumentation, is presented in Figure 4-5. Manufacturer information on the air sparging system equipment is presented in Appendix D.

#### 4.1.2.4 Controls

One control panel will be utilized to operate both the AS and SVE systems. The catalytic oxidizer will be provided with its own control panel. The interior of the building is classified as Class I, Division I, under the National Electric Code; therefore, the panel is mounted on the outside of the building. The control panel contains the following:

- Hand/Off/Auto or Open/Close/Auto switches and run lights for the SVE blower, air compressor, and solenoid valves.
- Timers for operation of the solenoid valves and compressor.
- Relays required for the following functions:
    - Shut down of the air compressor for high temperature at the heat exchanger discharge or shut down of the SVE blower
    - Shut down of the SVE blower for high liquid level in the knock-out tank, shut down of the catalytic oxidizer, or a high liquid level in the building sump
    - Operation of the solenoid valves and compressor based on the timers.
- An autodialer to notify IT office locations of a system shut down.

#### 4.1.2.5 Remediation Building

The remediation system components, with the exception of the underground piping and the catalytic oxidizer, are installed inside a remediation building. The wooden building, on a steel base, is 8 feet wide and 14 feet long. All electrical components inside the building, including lighting, heating and ventilation fans, are suitable for use in a Class 1, Division 1 environment. Schematic drawings of the building are presented in Appendix E. The location of the building is presented in Figure 4-3.

### 4.1.2.6 Tank Farm Area Underdrain System

During the original installation of the USTs in the Tank Farm Area, an underdrain system was constructed. The underdrain system was designed to transport water from all sections of the Tank Farm Area to the sump located at the east end of the area. The underdrain system consists of a network of 6-inch diameter perforated and non-perforated tile pipes. The pipes are located on the north and south ends of each UST foundation pad at the depth of the pads.

On the west side of the Tank Farm Area, the pipes run into a common header located west of Tanks 102, 103, 125, and 128. The water flows north in this header by gravity to the end of Tank 125, then east past the secondary containment area, then south under the secondary containment to the northwest corner of Tank 147. This pipe then runs east just past Tank 142, southeast to Tank 118 and east to the sump.

The water collected along the north and south edges of Tanks 137 through 142 and 147 flows by gravity east to the end of Tank 142 and then follows the same path as the pipe from the west end of the Tank Farm Area. The water collected in the drain pipe south of the Tanks 106, 109, 110, 112, and 117 flows to the east side of Tank 112, then north to Tank 144 where it is manifolded with the water collected from the south end of that row of tanks. The water then flows east to the end of Tank 118, then north and east to the sump. It is unknown whether drainpipes were installed north and south of Tanks 107, 153, and 155.

The water collected in the drain pipe north of the Tanks 106, 109, 110, 112, and 117 flows west to the edge of the secondary containment, flows north to the north end of Tank 126, then east along that row of tanks to the sump.

The sump in which the water is collected is constructed of concrete. Its interior dimensions are 4 feet-by-6 feet and the total depth is approximately 21 feet. The top of the sump is at an elevation approximately equal to the elevation of the ground surface of the Tank Farm Area. The underdrains, which are manifolded into one 6-inch header pipe, enter the sump approximately 16 feet below this level. The sump location is shown in Figure 4-1. Sump construction drawings are presented in Appendix F.

A pump, mounted on the top of the sump, transfers the collected water to the plant's wastewater treatment area where it is discharged to the local sanitary sewer via a forced main. Despite being discharged in the vicinity of the wastewater treatment plant effluent, these two streams are not mixed prior to discharge. The pump is currently set to maintain the water at a level between 15.84 feet and 16.67 feet below the top of the sump. This depth is sufficient to cause a groundwater gradient inward towards the Tank Farm Area, significantly reducing migration of groundwater from the Tank Farm Area to the native soils.

During the first six months of 1999, the pump transferred an average of 5,100 gallons per day of water to the sanitary sewer; from July 1 through August 20, 1999, the pump transferred an average of 1,941 gallons per day of water. This reduction may be due to the installation of the surface liner system which was begun (and 90 percent complete) in April 1999 and completed in May 1999.

## 4.2 PRESUMPTIVE REMEDY CONSTRUCTION

### 4.2.1 Air Sparging Well Installation

During the week of March 8, 1999, the air sparging wells were installed. An attempt was made to install 25 wells to the bottom of the Tank Farm Area backfill; an estimated depth of 20 feet bgs. The wells were installed utilizing 4.25-inch hollow stem augers and consist of 2 feet of 2-inch diameter Schedule 40 PVC screen and 2-inch diameter Schedule 40 riser to the ground surface.

The proposed well locations were presented in the Conceptual Design. As the drilling progressed, it was observed that the Tank Farm Area did not extend as far as initially believed, particularly north of Tanks 138, 141, and 142 and east of Tanks 118, 142, and 155 (Figure 4-1). Therefore, these well locations were either abandoned (north of 138 and 142) or relocated (east of 118, 142, and 155). Other wells were relocated to avoid tanks that had been closed in place and tank pads. As-built well locations are presented in Figure 4-3.

Four of the wells (AS-2, AS-4, AS-18, and AS-22) were set at depths of 16 or less due to auger refusal caused by the concrete pads on which the USTs had been installed.

The sparging wells were marked and left with 3 to 4 feet of riser exposed above the ground surface awaiting installation of the underground piping.

### 4.2.2 Underground Piping Installation

A limited amount of underground piping installation was completed during restoration of the South Roadway surface in early March 1999. At this time, the two pipes used to connect the sparging and SVE systems on the east and west sides of the secondary containment area were installed. The pipes were installed in trenches excavated to 3 feet below the roadway sub-base. The trenches were then backfilled with the excavated material and covered with the roadway sub-base.

The majority of the underground piping installation was completed during the weeks of March 22 and March 29, 1999. The piping layout was altered from the Conceptual Design based on information obtained during the drilling activities. The slotted SVE pipe north of Tanks 138, 141, and 142 was eliminated, and the other SVE lines running east of the USTs were shortened to reflect the dimensions of the Tank Farm Area. Based on this information, piping layout and section drawings were prepared for installation activities.

Based on constructability issues, several minor changes to the piping layout were made during installation activities. None of these changes were expected to have an effect on the operational efficiency of the system. The as-built piping layout and sections are presented in Figures 4-3 and 4-4.

Approximately 600 feet of 2-inch diameter PVC slotted pipe were installed to a depth of 6 feet bgs. First, the trenches were excavated to a depth slightly more than 6 feet. Because the soil was not cohesive and had been previously excavated, the sidewalls of the trench were cut back to prevent cave-ins. Approximately 4 inches of pea gravel were installed in the bottom of the trench. Then, the slotted PVC piping runs, which had been threaded together on the surface, were lowered into the trench. The pipe was fabricated with a solid PVC stick-up to allow connection to the solid PVC pipe which was to be installed above the slotted pipe at a depth of 3 feet bgs. Four additional inches of pea gravel were then placed on top of the pipe. The trench was then backfilled with excavated soil to a depth of 3 feet and solid piping was installed at that depth. The trench was then backfilled to the surface using excavated material. A total of 570 feet of solid 2-inch diameter PVC pipe was installed to connect the slotted SVE pipe to the pipe manifold installed in the remediation building.

Concurrently, solid, 2-inch PVC pipe was installed to a depth of 3 feet to connect the air sparging wells to the pipe manifold in the remediation building. A total of approximately 1,250 feet of air sparging piping was installed. At each wellhead, a pressure indicator and ball valve were installed in a 2-foot-by-2-foot steel manway. A typical air sparging well is shown in Figure 4-3.

The SVE pipes were manifolded into four lines and the air sparging wells were manifolded into three lines. These lines were run to the future location of the remediation building and stubbed up approximately 2 feet above the ground surface awaiting delivery of the remediation building.

After completion of the underground piping and wellhead installation, the soil on the east side of the secondary containment was graded to drain to the catch basin in the southeast corner of the Tank Farm Area. The soil on the west side was graded to drain to the far west end of the Tank Farm Area where the rainwater would percolate into the soil. The impermeable surface liner system was then placed over the Tank Farm Area. The system consists of a 16-mil layer of polyethylene, which is protected from tearing by a layer of geotextile fabric and a layer of 1-inch bank run stone approximately 4 inches thick. The edges of the liner system were not sealed along the secondary containment, the boundaries of the Tank Farm Area, and the sparging well manways. This was done to allow a limited amount of moisture and air to enter the soil to promote air movement in the subsurface and to enhance biodegradation of the VOCs in the soil.

### 4.2.3 Remediation Building Installation and Start-Up

During the week of May 15, 1999, the remediation building and catalytic oxidizer were received on site and set in place near the southeast corner of the Tank Farm Area. Connections from the underground piping to the system inlet manifolds were completed. The catalytic oxidizer was also piped to the SVE blower discharge. During these activities, it was observed that some of the system components in the remediation building were not suitable for use in a Class 1, Division 1 environment.

After the piping was completed, IT personnel demobilized to await upgrading of the entire system to Class 1, Division 1 by the equipment supplier and completion of system wiring by the electrical subcontractor.

During the week of June 22, 1999, IT personnel mobilized to complete start-up activities. The system motors, interlocks, controls, and autodialer were tested. Oxidizer operation was then initiated; ambient air was first passed through the oxidizer until the catalyst temperature was increased by the system heater, then hydrocarbons were gradually introduced. All system equipment was found to be operating properly and the SVE system was allowed to operate continuously. The air sparging system was shut down until the VOC content of the recovered air is reduced. This was done to prevent system shut downs caused by high VOC content vapor (caused by volatilization via sparging) entering the oxidizer.

## 4.3 O&M PROCEDURES

The remediation system will be visited periodically to record system data and perform maintenance on the system components. An operation and maintenance (O&M) data sheet will be completed during each visit. The following readings are to be recorded on the checklist: the overall vacuum created by the SVE system and the vacuum at each leg of the SVE manifold; the PID readings of the overall influent, effluent, and the influent from each SVE branch; the SVE flowrate; the temperature readings in the oxidizer; the pressure, flowrate, temperature and operational hours of the air sparge system; and the pressure at each of the sparge wells. A copy of the O&M data sheet is included in Appendix C.

The data will be analyzed to determine if the system pressures, vacuums, and flows are within expected limits or if the system is not operating properly. The data will also be utilized to optimize system performance; for example, the flow from the streams with the highest VOC concentrations can be increased while the others are decreased.

Routine maintenance will also be performed during the O&M visits. The maintenance required for each piece of equipment is outlined in the manufacturers' data sheets (Appendices C and D). Additionally, the system piping will be inspected for leaks and any debris in the area will be removed.

As stated above, an autodialer is installed in the system control panel. When the system calls out indicating an alarm condition, a site visit will be scheduled at the earliest possible time (within 48 hours, if possible). During these visits, the cause of the shutdown will be determined and any necessary repairs completed. System data will then be recorded.

The reduction of VOC concentrations in the groundwater will be monitored by sampling of the four monitoring wells in the Tank Farm Area (TF-1 through TF-4) and the Tank Farm Area sump. The groundwater samples will be analyzed for the ten VOCs detected using SW-846 Method 8260. In order to establish baseline VOC concentrations, the wells and sump were sampled on May 18, 1999, prior to system start up. The results of the analyses are summarized in Table 4-5. Sampling of the wells and sump will be conducted quarterly; the events will take place in September 1999, December 1999, March 2000, and June 2000. These data will be used to determine the actual amount of time the system should operate for the presumptive remedy.

The VOC removal rate will be monitored using the VOC concentration and flowrate in the vapor discharge stream. The VOC concentration will be measured during each O&M visit using a PID; quarterly, vapor samples will be collected and laboratory-analyzed using USEPA Method TO-14. Vapor samples were collected and analyzed during system start up activities. The results of the analyses are summarized in Table 4-4. The vapor flowrate will be measured using the air flow meter on the system or a handheld manometer. Using the VOC concentrations and vapor flowrate, a VOC removal rate will be calculated. This removal rate will be used to estimate total VOC removal to date and to determine when the catalytic oxidizer should be replaced with vapor phase carbon adsorbers. These data will be used to determine the actual amount of time the SVE system should operate for the presumptive remedy.

## 4.4 PROJECT MANAGEMENT

PPG's project manager for the presumptive remedy implementation for the Tank Farm Area and finalization of the PPG Oak Creek Corrective Action requirements is Mr. David Weber. Mr. Weber is located at PPG's Coatings and Resins Corporate Headquarters located in Pittsburgh, Pennsylvania. Mr. Ted Huyett, PPG's Manager, Environmental Affairs at the Oak Creek facility will be providing on-site support to Mr. Weber. PPG has contracted with the IT Group (IT) to design, install, and operate the presumptive remedy. Mr. Chris Pike of IT will serve as the Lead Design Engineer for the project.

# Table 4-5
# Summary of Groundwater Analytical Results
# Tank Farm Area - PPG Industries, Inc.
# Oak Creek, WI

(analytical results in mg/l)

| Sample Location | Description | Date | Benzene | Ethyl-benzene | Toluene | Total Xylenes | MIBK (a) | Methylene Chloride | MEK (b) | Styrene | 1,1,2,2-Tetra-chloroethane | Tetra-chloroethene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TF-1 | Monitoring Well in Southeast Area of Site | 5/18/99 | 0.0064 | 0.11 | 0.029 | 0.33 | 0.57 | ND 0.005(c) | ND 0.10 | ND 0.10 | ND 0.001 | ND 0.005 |
| TF-2 | Monitoring Well in Northeast Area of Site | 5/18/99 | ND 0.5 | 7.1 | 1.9 | 32 | 5.0 | ND 0.05 | 1.1 | ND 1.0 | ND 0.01 | ND 0.05 |
| TF-3 | Monitoring Well in Northwest Area of Site | 5/18/99 | 0.0058 | 0.34 | 0.73 | 4.6 | 2.3 | ND 0.005 | 0.22 | ND 0.10 | ND 0.001 | ND 0.005 |
| TF-4 | Monitoring Well in Southwest Area of Site | 5/18/99 | ND 0.50 | 9.6 | ND 0.50 | 5.4 | ND 10 | ND 0.50 | ND 10 | ND 10 | ND 0.10 | ND 0.50 |
| Sump | Collection Sump at Eastern Edge of Site | 5/18/99 | ND 0.50 | 5.8 | 2.1 | 6.3 | 38 | ND 0.50 | ND 10 | ND 10 | ND 0.10 | ND 0.50 |

Notes:
Sample locations presented on Figure 4-1.
(a) MIBK - 4-Methyl-2-pentanone.
(b) MEK - Methyl ethyl ketone.
(c) NDXX - Parameter not detected at indicated reporting limit.

# 5.0 INTEGRATION OF INTERIM MEASURE WITH CORRECTIVE MEASURES IMPLEMENTATION

This section presents information on how the IM will be integrated into the overall Corrective Measures Implementation (CMI) process. Specifically, this section presents a determination of meeting identified corrective action milestones, as well as contingency measures, including costs and financial assurances, in the event the IM does not meet the remedial goals.

## 5.1 DETERMINATION OF MEETING CA 725 AND CA 750 MILESTONES

The USEPA identified two corrective action environmental indicators as milestones for the PPG Oak Creek corrective action program. Specifically, the indicators CA 725 (Current Human Health Exposures Under Control) and CA 750 (Migration of Contaminated Groundwater Under Control) were identified. CA 725 is used to evaluate a site relative to current human health exposures to determine if there is the potential for significant exposure and if so, whether the risks are acceptable. The risk assessment in the approved RFI Report (ICF Kaiser, 1997), addressed human health risks to the appropriate receptors and concluded that risks were within acceptable levels. While the UST removal and AS/SVE installation activities disturbed the Tank Farm Area, the concentrations and distribution of VOCs after these events would essentially be the same as those evaluated in the RFI risk assessment. Accordingly, the milestone represented by the indicator CA 725 has been met.

The indicator CA 750 is used to evaluate the site relative to the potential for constituents to migrate off-site in groundwater. In the Tank Farm Area, the underdrain system captures groundwater in the area and thus controls migration. The disturbance created by the UST removal and AS/SVE installation had no significant impact on the operation of the underdrain system. Disturbance to the underdrain system (including the concrete pads and perforated and non-perforated tile pipes) was avoided because excavations completed during the UST removal and remediation system installation did not extend below approximately 8 feet bgs; the components of the underdrain system are a minimum of 12 feet bgs. Therefore, the milestone represented by the indicator CA 750 has been met. To assist USEPA with this determination, completed forms for these indicators are presented in Appendix G.

## 5.2 CONTINGENCY MEASURES

PPG believes that the interim measures will meet the remediation goals for the site and achieve the long-term objectives of the CMI, and consequently the requirements of the permit. The AS/SVE remedial system and the underdrain system will be operated for a period of up to 18 months. As discussed in Section 4.1.1.4, the majority of VOCs will be removed within 12 months. Therefore, PPG will use the routine performance data collected to determine the completion of the initial period of operation. At the appropriate time, the site will be evaluated with respect to soil and groundwater concentrations. At the completion of the initial presumptive remedy period, the Tank Farm soils and groundwater will be sampled to determine if the target clean up goals have been met. A total of 28 soil samples and 10 groundwater samples will be collected and analyzed for VOCs for this effort. The statistical determination of the number of samples is presented in Appendix H. Soil samples will be collected using a Geoprobe® or similar device. Groundwater samples will be collected from existing wells and/or directly from the Geoprobe® boring used for soil sampling. All other sampling and analytical methodology will follow the RFI QAPP.

If the remediation goals are met, the AS/SVE and underdrain systems will be removed from service. If, at the end of the initial period of operation, the remediation goals have not been met, PPG will employ contingency measures as described in the following paragraphs.

PPG will first evaluate the relevance of the residual constituent concentrations by performing a risk assessment. The risk assessment will differ from the RFI risk assessment in that it will consider the potential future exposure scenarios with the underdrain system out of service. If the calculated risks under the potential future use scenarios are acceptable, the AS/SVE and underdrain system will be taken out of service and no further action will be recommended. If the potential future risks are unacceptable, PPG will first back-calculate appropriate remedial targets given the potential future use scenarios, and consider further remedial options as follows:

- Continued operation of the AS/SVE system;
- Continued use of the underdrain system;
- Demonstration of natural attenuation; or
- Long term monitoring.

Each of these options is discussed in the following paragraphs.

The AS/SVE system will be evaluated for effectiveness through collection and analysis of soil vapor and groundwater samples as appropriate. The concentrations will be plotted to determine their change through time. If the concentrations are decreasing and continue to do so through time, additional operation of the AS/SVE system is appropriate in considering continued operation as a contingency measure.

The underdrain system currently controls the groundwater flow in the vicinity of the Tank Farm. In the event that the risk assessment shows potentially unacceptable risks associated with offsite groundwater movement, the underdrain system may remain in operation.

PPG may consider evaluation of natural attenuation in lieu of continued AS/SVE and underdrain system operation. The natural attenuation option would be evaluated by determining if the environmental conditions at the site are conducive to degrading the constituents to levels below the target risk-based levels given the distance and estimated time of travel to the potential exposure point(s). Evaluation of the site for natural attenuation may include collection of site-specific information to supplement existing data. During groundwater sampling events, in-situ dissolved oxygen concentrations would be measured at existing monitoring wells (before and after well purging) to assess for the presence of aerobic conditions. Soil samples would be collected and analyzed for microbial nutrient or biodegradation indicator parameters (pH, alkalinity, biochemical oxygen demand, sulfate, chlorides, iron, TOC, ammonia nitrogen, ortho-phosphate, total phosphate, and total heterotrophic bacterial plate count).

To obtain site-specific data on soil and aquifer conditions to be used as input for natural attenuation modeling, a shelby tube sample would be collected from soil intervals representative of each soil deposit between the source area and the aquifer for geotechnical testing. Geotechnical and chemical testing would include, bulk density, porosity, fraction organic carbon, soil classification, and hydraulic conductivity testing. As an alternative, hydraulic conductivity data could be obtained from in-situ testing of existing monitoring wells. This information can be used in fate and transport analytical models to predict the potential concentrations of chemical of concern migrating to the property boundary. The fate and transport modes could use the ASTM Risk Based Corrective Action (RBCA) at petroleum contaminated sites protocols which consider the effects of biodegradation, dispersion, and diffusion during transport in an aquifer.

Long term monitoring may be evaluated as an O&M option, and could potentially be used alone or coupled with natural attenuation. The purpose of long term monitoring would be to document the environmental fate and transport of constituents through time. This information would be used to ensure that the potential future exposure pathways identified in the risk assessment are not complete. This option would include periodic sample collection at the site perimeter as well as measurement of water levels. The perimeter analytical data would be used to determine if the constituents are moving off-site while the water level measurements would be used to determine the groundwater flow direction and rate.

If necessary, PPG will evaluate each of these options with respect to their ability to meet the risk-based remediation goals, technical practicability and cost. PPG will select and recommend the most appropriate action and present it along with the justification in the final CMI Report.

## 5.3 CORRECTIVE MEASURE COSTS AND FINANCIAL ASSURANCE

This section presents the estimated costs of the remedial alternatives and PPG's financial assurance for implementation. The estimated costs are presented below for each of the tasks that may be necessary to complete the CMI. A summary of costs is presented in Table 5-1.

The first task necessary if the AS/SVE system does not meet the remedial goals is to perform a risk assessment under potential future use scenarios. The risk assessment would use data generated both under the RFI and the remedial system performance evaluation. It is anticipated that the risk assessment would include some hydrogeologic evaluation and fate and transport modeling. The estimated cost of the hydrogeologic evaluation and fate and transport modeling would be approximately $10,000. The estimated cost of the risk assessment is approximately $25,000. The total for this option is not expected to exceed $35,000. The breakdown of these costs are presented in Table 5-2.

The costs associated with continued operation of the AS/SVE system are available from current cost estimates for the first 18-months of operation. The initial operation cost of the 18-month presumptive remedy program is approximately $77,076. In addition to the operation cost, costs will be incurred for progress and post-remediation sampling. The total estimated initial cost of these samples is $35,250. As noted in Section 5.2, the system may be operated for an additional period as a contingency measure. For contingency costing purposes it is assumed the system would be operated for an additional 12 months. The total estimated cost for the system operation as a contingency and sampling is $90,119. The breakdown of these costs are presented in Table 5-3.

PPG currently operates the underdrain system, and no construction or modification costs are anticipated. The costs incurred for operation of this system include operation and maintenance (O&M) and treatment of the collected groundwater. As shown in Table 5-4, the annual O&M costs are estimated at $5,500 and the annual water treatment costs are $2,000. Assuming the system would be operated for 5 years and the inflation rate is 5%, the net present value of operating the system is $32,500.

The cost of the natural attenuation option will be limited to collection of some analytical data and modeling to predict time and distance of constituent travel. The data necessary would include some additional chemical data and soil physical properties. The natural attenuation remediation itself does not require any action, therefore no costs are anticipated. The data collection is expected to cost approximately $10,000. The modeling effort would be roughly the same scope of work as that for the risk assessment and is anticipated to cost $10,000. The total cost for the natural attenuation evaluation is approximately $20,000. A breakdown of these costs is presented in Table 5-5.

The long term monitoring costs assume that groundwater samples would be collected on a semi-annual basis from approximately 5 wells. The samples would be analyzed for VOCs by appropriate analytical methods. The duration of the monitoring program is estimated to be 5 years. The cost of the monitoring is estimated

# TABLE 5-1

## SUMMARY OF PRESUMPTIVE REMEDY AND CONTINGENCY MEASURE COSTS

| REMEDY | | NET PRESENT VALUE (1) |
|---|---|---|
| A. | Presumptive Remedy | |
| A-1 | Presumptive Remedy Implementation (2) | $105,600 |
| A-2 | Post-Presumptive Remedy Soil and Groundwater Sampling | $19,000 |
| B. | Contingency Measures | |
| B-1 | Post-Presumptive Remedy Risk Assessment | $35,000 |
| B-2 | Continued Operation of AS/SVE System | $90,119 |
| B-3 | Continued Operation of the Tank Farm Underdrain System | $32,500 |
| B-4 | Natural Attenuation | $20,000 |
| B-5 | Long-Term Monitoring | $43,300 |

(1) Net present value based on 5-year operation and 5% interest rate for options B-3 and B-5.
(2) Remaining costs for system startup and 18-month operation

# TABLE 5-2

## Estimate Presumptive Remedy Contingency Costs
## (B-1 – Risk Assessment)

| Task | Total Estimated Cost |
|---|---|
| | |
| Data Review | $5,000.00 |
| | |
| Hydrogeologic Evaluation | $5,000.00 |
| | |
| Fate & Transport Modeling | $5,000.00 |
| | |
| Risk Assessment | $15,000.00 |
| | |
| Reporting | $5,000.00 |
| | |
| **TOTAL COST** | $35,000.00 |

# TABLE 5-3

## Estimate of Annual Operation & Maintenance Costs
## (B-2 – Continued Operation of SVE/AS)

| Task | Estimated Annual Cost |
|---|---:|
| | |
| O&M | $54,384.00 |
| | |
| Air Samples | $12,000.00 |
| | |
| GW Samples | $19,000.00 |
| | |
| Post Rem Samples | $5,500.00 |
| | |
| Demob | $2,235.00 |
| | |
| **TOTAL** | $90,119.00 |

## TABLE 5-4

### Estimate of Annual Operation & Maintenance Costs [1]
### (B-3 – Underdrain)

| | Description | Estimated Annual Cost ($) |
|---|---|---|
| | | |
| 1 | Sewerage cost (see Tank Farm Underdrain Sump – Pump Flow Data) | $2,000 |
| | | |
| 2 | Electrical (20 HP pump, 50 GPM, 460V, 14kW annually, 426 hrs of operation annually, $0.45 per kW hr) | $2,700 |
| | | |
| 3 | Replacement parts (LEL head, pump, etc. – estimated only) | $1,000 |
| | | |
| 4 | Maintenance mechanic costs (wage rate $19.54/hour plus 44% benefits = $28.14/hour; estimate 12 hrs/year for level recording; 4 hrs/year for LEL calibration and head replacement; 40 hrs/year for daily inspections & miscellaneous alarms/repairs = 56 hrs x $28.14 hr. | $1,800 |
| | | |
| | **TOTAL ANNUAL COST** | **$7,500** |
| | | |
| | **Net Present Value of 5-Year Operation [2]** | **$32,500** |
| | | |

[1] Source: PPG payment records

[2] Net present value of 5-year operation assumes 5% interest rate.

## TABLE 5-5
## Estimate Natural Attenuation Demonstration Costs
## (B-4 – Natural Attenuation)

| Task | Total Cost |
|---|---|
| | |
| Sample Collection | $6,000.00 |
| | |
| Analysis | $4,000.00 |
| | |
| Fate & Transport Modeling | $6,000.00 |
| | |
| Reporting | $4,000.00 |
| | |
| **TOTAL COST** | $20,000.00 |

to be approximately $5,000 per event including sampling, analysis and reporting for a total annual cost of $10,000. The total present value of the long term monitoring assuming an inflation rate of 5% is estimated to be $43,300. A breakdown of the estimated costs are presented in Table 5-6.

PPG will assure USEPA that funding for the remaining components of the presumptive remedy as well as any contingency measures deemed necessary, are secured. PPG typically uses the financial test or corporate guarantee for the purposes of demonstrating financial assurance for RCRA closure requirements. PPG assumes that a similar mechanism will be sufficient to demonstrate financial assurance for corrective action requirements. PPG recommends that a reasonable maximum cost for financial assurance would consist of the presumptive remedy costs (Items A-1 and A-2 in Table 5-1) and the contingency cost for the post presumptive remedy risk assessment (Item B-1 in Table 5-1) for a total cost of $159,600.

## 5.4 FINAL CMI REPORT

Upon completion of the initial period of operation of the AS/SVE system, analytical data will be collected and the performance of the system will be evaluated. If the data show that the system has met the remediation goals, a final CMI Report will be prepared. The CMI Report will provide documentation of the operation and performance of the AS/SVE system and make recommendations for future work if necessary. In the event that the AS/SVE system does not meet the remediation goals, the CMI Report will be used to present the risk assessment of the potential future exposure scenarios, and the recommendations for further work based on the risk assessment results.

# TABLE 5-6

## Estimate of Annual Operation & Maintenance Costs
## (B-5 – Long-Term Monitoring)

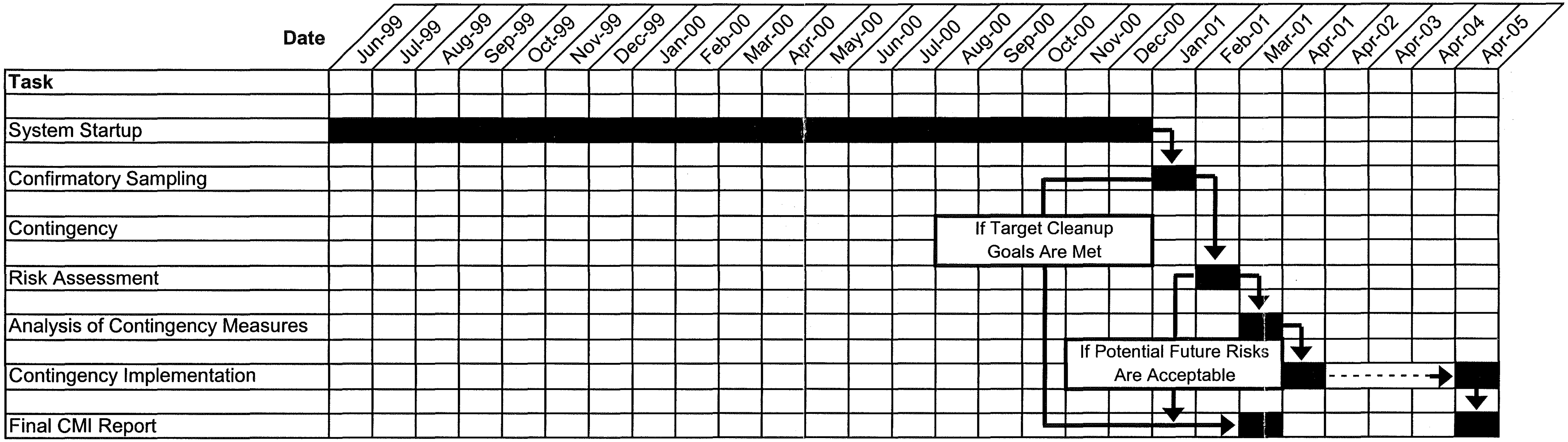
| Task | Cost Each | Number per Event | Total Cost per Event | Total Cost per Year (Two Events) |
|---|---|---|---|---|
| | | | | |
| Sample Collection | $2,300.00 | 1 | $2,300.00 | $4,600.00 |
| | | | | |
| Analysis | $100.00 | 7 | $700.00 | $1,400.00 |
| | | | | |
| Reporting | $2,000.00 | 1 | $2,000.00 | $4,000.00 |
| | | | | |
| **TOTAL ANNUAL COST** | | | | **$10,000.00** |
| | | | | |
| **Net present value of 5-year monitoring** [1] | | | | **$43,300.00** |

[1] Net present value assumes 5% interest rate.

# 6.0 CORRECTIVE MEASURES SCHEDULE

This section presents a tentative schedule of the activities presented in Sections 4 and 5. Figure 6-1 illustrates the anticipated timeline for completion of the presumptive remedy and, if necessary contingency measures leading up to the completion of the final CMI Report.

## Figure 6-1
## Anticipated Presumptive Remedy Implementation Schedule(1)



(1) Based on PPG's recommended process.

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United States Environmental Protection Agency (USEPA). 1993. Presumptive Remedies: Site Characterization and Technology Selection For CERCLA Sites With Volatile Organic Compounds In Soils. Office of Solid Waste and Emergency Response. EPA 540-F-93-048. OSWER Directive 9355.0-48FS. September 1993.

# APPENDIX A

# SVE PILOT TEST REPORT

February 9, 1999

Ms. Patricia Kacsuta
Senior Environmental Specialist
PPG Industries, Inc.
4325 Rosanna Drive
Allison Park, PA 15101

Project No. 778165

SVE Pilot Test
Tank Farm Area Remediation
PPG - Oak Creek, WI

Dear Ms. Kacsuta:

During the week of February 1, 1999, IT Corporation (IT) personnel conducted an SVE pilot test at the above-referenced facility. The test was conducted to provide information for the design of the full-scale system as well as to determine the need for an impermeable surface cover. This letter is being submitted to summarize pilot test activities and results, and to provide recommendations based on the results of the test.

## Equipment Installation

On February 2, 1999, the pilot test equipment was installed. A trench, 35 feet long and 6 feet deep was excavated. During excavation of the trench, the soil type was noted; below the surface covering of gravel (less than two inches), the soil consisted of slightly moist, medium to coarse brown sand to a depth of approximately 5 feet. At that depth, grey staining was present and an odor (thought to be solvent) was observed. After excavation was completed, approximately 6 inches of pea gravel were installed in the bottom of the trench upon which 30 feet of 0.020 slotted polyvinyl chloride (PVC) piping was installed. At each end of the screen, solid PVC riser was run to the surface. The screen was then covered with approximately 6 inches of pea gravel and the trench was backfilled.

On one riser, a cap with a quick-disconnect fitting was installed to allow vacuum measurement. The other riser was piped to the pilot test skid. The skid consisted of a 5-horsepower vacuum blower, water knock-out, air filters, air bypass valve, temperature and vacuum gauges, and an air sampling port. The vacuum blower was utilized to draw vapors from the underground slotted PVC screen; the recovered vapor was then passed through a vapor phase carbon adsorber for removal of volatile organic compounds (VOC) prior to discharge to the atmosphere.

In order to determine the area of influence of the vacuum blower on the subsurface soils, three vapor monitoring points (VP-1 through VP-3) were installed at distances of 10 feet, 18 feet, and 31 feet from the trench. The piezometers consisted of 3/4-inch PVC pipe installed to a depth of approximately 4 feet. At the top of each vapor point, a cap with a quick-disconnect (for vacuum measurement) was installed.

The locations of the pilot test equipment are presented in Figure 1.

**Pilot Test Activities and Results**

On February 3, 1999, pilot test activities were initiated. The vacuum blower was started and extraction of soil vapor began at approximately 10 am. The following parameters were measured immediately after the blower was started and periodically until the test was discontinued after 8 hours:

- Air flow rate
- Temperature at blower inlet and outlet
- Vacuum at the blower, at the far end of the PVC screen (at the riser), and at the three vapor monitoring points
- The VOC content of the recovered vapor (as measured with a photoionization detector [PID]).

Additionally, an air sample was collected after approximately 50 minutes of operation and was submitted for laboratory analysis for VOCs by EPA Method TO-14.

At the initial sampling, the vacuum at the blower was approximately 20 inches of water (iw), the air flow rate was 195 cubic feet per minute (cfm), the vacuum at the end of the screen was 4.20 iw, and the air inlet temperature was 38 degrees F. These parameters changed only slightly during system operation. The vacuum reading at VP-1 increased steadily from 0.0 iw to a high of 0.27 iw, the vacuum at VP-2 increased steadily from 0.0 iw to a high of 0.07 iw, and the vacuum at VP-3 remained at 0.0 iw. The PID reading increased from 100 parts per million (ppm) to 144 ppm over the first two hours of the test and then decreased to 65 ppm. Data from this phase of the test is presented in Table 1.

On February 4, 1999, the area of the test was covered with polyethylene liner to simulate the installation of an impermeable cover (such as asphalt) in the Tank Farm Area. An area approximately 40 feet-by-50 feet was covered. An attempt was made to obtain the best possible seal; two layers of liner were used and the outer edges of the liner were covered with pea gravel and soil. However, the presence of many surface obstructions (tank vent pipes and manholes, pipe rack footers, etc.) Limited the effectiveness of the seal.

With the liner in place, the second phase of the SVE pilot test was begun at approximately 8:15 am. The parameters listed above were also measured periodically during this phase of the test. An air sample was collected after 25 minutes of testing for laboratory analysis (VOCs by EPA Method TO-14). The vacuum at the blower (22 iw), the air flow rate (185 cfm), and the air inlet temperature (32 degrees F) also remained steady throughout this test. The vacuum at the end of the screen decreased from 4.42 iw at the start of the test to 4.29 iw at the end of the test. The vacuum at VP-1 remained steady throughout the test, ranging from 0.24 iw to 0.28 iw, the vacuum at VP-2 increased steadily from 0.07 iw to 0.12 iw, and the vacuum at VP-3 remained at 0.0 iw. The PID readings decreased steadily from 170 ppm to 60 ppm. Due to the relatively insignificant changes in test data, the test was discontinued after approximately 5.25 hours. Data from this phase of the test is presented in Table 2.

**Conclusions and Recommendations**

The following conclusions were drawn from the pilot test operations:

- At a depth of approximately 6 feet, the slotted vapor recovery piping was installed in soil observed to contain significant VOC impact. This was observed in the trench excavated for the pilot test as well as soil excavated for underground storage tank (UST) removal.

- The soil on site is very homogenous and permeable from the surface to a depth of at least 12 feet.

- Based on the soil type and nature and location of VOC impact (as well as PID readings recorded during testing), it appears that the proposed remediation system will be very effective in recovering VOCs from the subsurface.

- The placement of a polyethylene liner (which, as explained above, provided an inadequate seal) increased the vacuum at the blower by 10 percent and doubled the vacuum influence at VP-2.

- Significant short-circuiting of air from the surface was expected based on visual inspection of the soil and was observed during the testing. Very high air flowrates and relatively low vacuums at the blower (in conjunction with relatively low vacuums at the vapor monitoring points) indicate that air from the surface was influencing the test. Additionally, the relatively fast decrease in the PID readings indicate that air from the surface may have been diluting the recovered air stream. Another factor indicating that short-circuiting was occurring was the rapid rise in the vacuum at the end of the screen and at VP-1 and then the reduction or leveling off of these values during the second phase of the pilot test. This seems to indicate that the surface cover had an effect initially, but that effect was reduced as surface air from around the perimeter of the liner was pulled into the subsurface.

Based on the observed soil type (homogenous, permeable sand covered only by surface gravel) and the data obtained during pilot testing, IT recommends that an impermeable surface covering be placed over the entire Tank Farm Area. The primary purposes of this cover will be to increase VOC recovery and decrease remediation time by significantly enhancing the efficiency of the vapor recovery system and to ensure that all VOCs volatilized during air sparging activities are recovered by the system and do not enter the atmosphere, potentially causing odors.

If you have any questions regarding this submittal, or require additional information, please contact me at (412)858-3963.

Respectfully submitted,
IT Corporation

Christopher Pike
Project Engineer

cc: D. Bonk - Baker Environmental, Inc.
L. Gackowski - IT Corporation

Date 2/3/99

Page 1 of 1

# Table 1
# SVE Pilot Test
# PPG Industries, Inc.
# Oak Creek, WI

**Without Polyethylene Cover**

| Time from Start of Test | Air Flow Rate (cfm) (a) | Temp at Blower In (F) | Temp at Blower Out (F) | Vacuum at Blower (iw) (b) | Vacuum at end of screen (iw) | Vacuum at VP-1 (iw) | Vacuum at VP-2 (iw) | Vacuum at VP-3 (iw) | PID Influent (ppm) (c) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 195 (d) | 38 | 70 | 20 | 4.20 | 0.00 | 0.00 | 0.00 | 100 | Bypass is closed |
| 20 | 195 | 36 | 96 | 20 | 4.40 | 0.10 | 0.00 | 0.00 | 110 | |
| 35 | 195 | 38 | 96 | 20 | 4.14 | 0.11 | 0.02 | 0.00 | 80 | |
| 50 | 195 | 39 | 96 | 20 | 4.14 | 0.09 | 0.02 | 0.00 | 120 | Collect first air sample |
| 60 | 195 | 39 | 98 | 20 | 4.14 | 0.09 | 0.01 | 0.00 | 90 | |
| 90 | 195 | 39 | 99 | 20 | 4.18 | 0.12 | 0.03 | 0.00 | 135 | |
| 120 | 195 | 39 | 100 | 20 | 4.12 | 0.11 | 0.03 | 0.00 | 144 | |
| 150 | 195 | 39 | 100 | 20 | 4.21 | 0.13 | 0.05 | 0.00 | 100 | |
| 180 | 195 | 39 | 100 | 20 | 4.21 | 0.13 | 0.03 | 0.00 | 100 | |
| 210 | 195 | 39 | 100 | 20 | 4.22 | 0.14 | 0.04 | 0.00 | 92 | |
| 240 | 195 | 39 | 99 | 20 | 4.20 | 0.13 | 0.04 | 0.00 | 100 | |
| 270 | 195 | 39 | 100 | 20 | 4.23 | 0.20 | 0.06 | 0.00 | 90 | |
| 300 | 195 | 39 | 100 | 20 | 4.20 | 0.17 | 0.04 | 0.00 | 70 | |
| 330 | 195 | 39 | 98 | 20 | 4.20 | 0.20 | 0.05 | 0.00 | 86 | |
| 360 | 195 | 39 | 98 | 20 | 4.21 | 0.22 | 0.06 | 0.00 | 90 | |
| 390 | 195 | 39 | 99 | 20 | 4.23 | 0.25 | 0.07 | 0.00 | 65 | |
| 420 | 195 | 39 | 98 | 20 | 4.21 | 0.25 | 0.06 | 0.00 | 62 | |
| 450 | 195 | 39 | 98 | 20 | 4.21 | 0.27 | 0.06 | 0.00 | 68 | |
| 480 | 195 | 39 | 98 | 20 | 4.22 | 0.26 | 0.06 | 0.00 | 65 | End Test |

Notes:

(a) cfm - cubic feet per minute

(b) iw - inches of water

(c) ppm - parts per million

(d) Flow is estimated based on vacuum/flowrate curve for the SVE blower

Date 2/4/99

Page 1 of 1

# Table 2
## SVE Pilot Test
## PPG Industries, Inc.
## Oak Creek, WI

**With Polyethylene Cover**

| Time from Start of Test | Air Flow Rate (cfm) (a) | Temp at Blower In (F) | Temp at Blower Out (F) | Vacuum at Blower (iw) (b) | Vacuum at end of screen (iw) | Vacuum at VP-1 (iw) | Vacuum at VP-2 (iw) | Vacuum at VP-3 (iw) | PID Influent (ppm) (c) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 185 (d) | 32 | 65 | 22 | 4.42 | 0.26 | 0.07 | 0.00 | 170 | Bypass is closed |
| 10 | 185 | 32 | 84 | 22 | 4.34 | 0.27 | 0.08 | 0.00 | 150 | |
| 25 | 185 | 32 | 90 | 22 | 4.29 | 0.26 | 0.08 | 0.00 | 140 | Collect second air sample |
| 45 | 185 | 32 | 92 | 22 | 4.30 | 0.26 | 0.08 | 0.00 | 100 | |
| 75 | 185 | 32 | 92 | 22 | 4.29 | 0.27 | 0.09 | 0.00 | 90 | |
| 105 | 185 | 32 | 90 | 22 | 4.27 | 0.26 | 0.09 | 0.00 | 80 | |
| 135 | 185 | 33 | 92 | 22 | 4.27 | 0.24 | 0.07 | 0.00 | 70 | |
| 165 | 185 | 33 | 92 | 22 | 4.30 | 0.24 | 0.10 | 0.00 | 80 | |
| 195 | 185 | 33 | 92 | 22 | 4.29 | 0.27 | 0.10 | 0.00 | 70 | |
| 225 | 185 | 33 | 92 | 22 | 4.27 | 0.26 | 0.10 | 0.00 | 70 | |
| 255 | 185 | 33 | 94 | 22 | 4.29 | 0.28 | 0.11 | 0.00 | 75 | |
| 315 | 185 | 33 | 96 | 22 | 4.29 | 0.27 | 0.12 | 0.00 | 60 | End Test |

Notes:

(a) cfm - cubic feet per minute

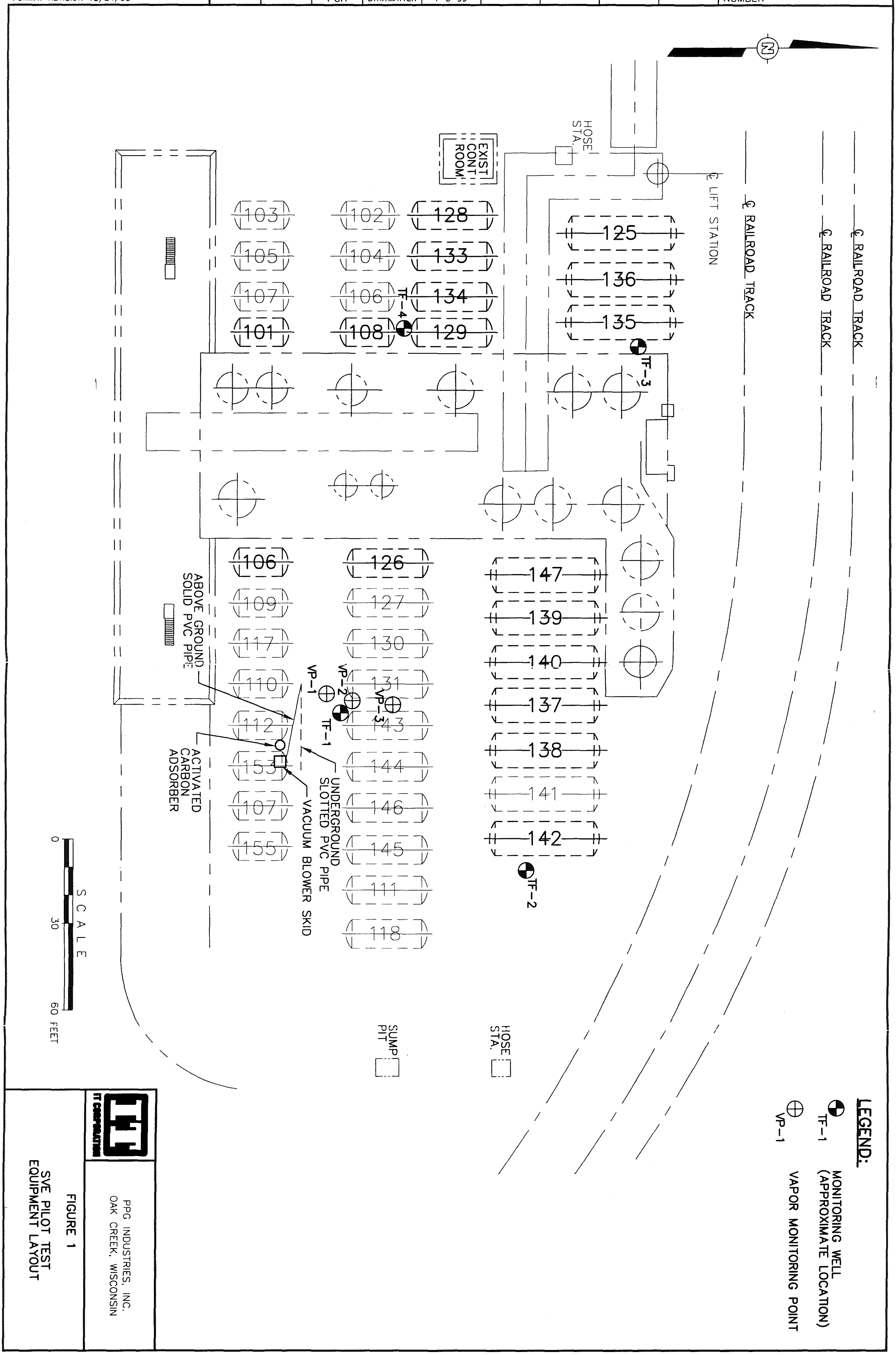
(b) iw - inches of water

(c) ppm - parts per million

(d) Flow is estimated based on vacuum/flowrate curve for the SVE blower

DATE: 2/9/99
TIME: 11:00 AM
FORMAT REVISION 12/24/98

| IMAGE | X-REF | OFFICE | DRAWN BY | | CHECKED BY | | APPROVED BY | | DRAWING NUMBER 778165-B6 |
|---|---|---|---|---|---|---|---|---|---|
| --- | --- | PGH | STRITMATTER | 1-6-99 | | | | | |



PPG INDUSTRIES, INC.
OAK CREEK, WISCONSIN

FIGURE 1
SVE PILOT TEST
EQUIPMENT LAYOUT

# APPENDIX B

# VOC QUANTITY AND ANTICIPATED REMOVAL RATE ESTIMATION

# Estimate of VOC Quantities and Removal
# Tank Farm Area Soil and Groundwater
# PPG Industries, Inc.
# Oak Creek, Wisconsin

PURPOSE: The purpose of this calculation is to estimate the total quantity of VOC constituents in the soil and groundwater at this site and the removal rate of the SVE system.

## VOC Quantity Calculations

### Quantity of VOC constituents in Soil

The data used for the purpose of these calculations is obtained from samples collected directly from the Tank Farm Area and includes these samples:

Subsurface samples: B - 1, 5, 6, 7, 8 (1.5' - 20.5'), 9 (13.5' - 15.5'), 10, and 11
Surface samples: B-8 (1' - 3'), B-9 (1' - 3'), GS - 6, 12, 14, 15, 16, 23, 24, 38, 39, and 40, HA-3, HA-5, and HA-8

The locations of these samples are presented in the attached figure.

The attached tables summarize available analytical data from these surface and subsurface samples. The average concentrations are summarized below. It was estimated that the surface samples were representative of the top four feet of soil in the Tank Farm Area. The total depth of the Tank Farm Area is approximately 20 feet; therefore, the weighted average soil concentration was calculated using a ratio of 80:20 subsurface soils to surface soils. The following is an example of the calculation for the weighted average:

Weighted average soil conc. for xylenes = (Surface soil conc.) * (4 feet/20 feet) + (Subsurf. Conc.) * ( 16 feet/20 feet)

= (407.13 mg/L) * (0.20) + (14.80 mg/L) * (0.80)

= **93.27 mg/L**

The Tank Farm Area has two sections (west side - 9,750 square feet; east side - 18,500 square feet) for a total area of 28,250 square feet. The depth of the Tank Farm is approximately 20 feet; therefore, the total volume of the area is 565,000 cubic feet or 20,925 cubic yards. However, this includes approximately 400 cubic yards of concrete which have been placed in the area and 17 underground storage tanks which have been closed in place (total volume 375,000 gallons) which occupy approximately 1,860 cubic yards. Therefore, the total volume of soil in the Tank Farm Area is 18,665 cubic yards. The weight of the soil is estimated at 2,800 pounds per cubic yard (from WDNR air permit calculation).

Sample Calculation:
Total VOCs (lbs) = (18,665 cu.yds. soil) * (2,800 lbs./cubic yard) * (157.40 mg/kg) * (1 kg/1,000,000mg)

**Total VOCs in soil = 8,226 pounds**

# Estimate of VOC Quantities and Removal
# Tank Farm Area Soil and Groundwater
# PPG Industries, Inc.
# Oak Creek, Wisconsin

Based on the analytical data and the calculations detailed above, the constituent breakdown is estimated as follows:

| Constituent | Avg. Conc. Subsurface Soils (mg/kg) | Avg. Conc. Surface Soils (mg/kg) | Weighted Avg. Conc. (mg/kg) | Total Weight (pounds) |
|---|---|---|---|---|
| MEK | 0.79 | 0.85 | 0.80 | **42** |
| MIBK | 0.01 | 38.83 | 7.77 | **406** |
| Ethylbenzene | 17.45 | 96.25 | 33.21 | **1,736** |
| Styrene | 0.00 | 4.37 | 0.87 | **46** |
| Toluene | 1.19 | 102.51 | 21.45 | **1,121** |
| Xylenes | 14.80 | 407.13 | 93.27 | **4,874** |
| Methylene Chloride | 0.02 | 0.00 | 0.02 | **1** |
| **Total VOCs** | **34.26** | **649.94** | **157.40** | **8,226** |

**Quantity of VOC constituents in Groundwater**

Attached is a table summarizing laboratory data for five groundwater samples collected from the Tank Farm Area wells and the Tank Farm Area sump. As above, the average and total concentration for each constituent and the total VOC concentration, in milligrams per liter (mg/L), was calculated.

The total Tank Farm Area (28,250 square feet) was also used in this calculation. Groundwater gauging data was utilized to estimate the thickness of the groundwater in the Tank Farm Area (5 feet). A porosity of 35% was assumed.

Quantity of groundwater in Tank Farm Area = (28,250 sq.ft.) * (5 feet) * (0.35) * (28.32 L/cu.ft.) = 1,400,070 L

Total VOCs in groundwater (lbs) = (1,400,070 L) * (24.7 mg/L) * (1 lb/454,000 mg)

**Total VOCs in groundwater = 76 pounds**

# Estimate of VOC Quantities and Removal
# Tank Farm Area Soil and Groundwater
# PPG Industries, Inc.
# Oak Creek, Wisconsin

Based on the analytical data and the calculations detailed above, the constituent breakdown is estimated as follows:

| Constituent | Average Concentration (mg/L) | Total Weight (pounds) |
|---|---|---|
| Benzene | 0.006 | **0.0** |
| Ethylbenzene | 4.59 | **14.1** |
| MIBK | 9.17 | **28.2** |
| Methylene Chloride | ND | **0.0** |
| MEK | 0.22 | **0.7** |
| Styrene | ND | **0.0** |
| 1,1,2,2-Tetrachloroethane | ND | **0.0** |
| Tetrachloroethene | ND | **0.0** |
| Toluene | 0.95 | **2.9** |
| Total Xylenes | 9.73 | **30.0** |
| **Total** | **24.67** | **76** |

**Summary of VOC Quantity Calculations**

The total VOCs in the Tank Farm Area is the sum of the VOCs in the soil and in the groundwater.

Total VOCs in Tank Farm Area = 8,226 pounds + 76 pounds

**Total VOCs in Tank Farm Area = 8,301 pounds**

## VOC Removal Calculations

During system start-up, a sample of the recovered vapor stream was collected and analyzed for VOCs by USEPA Method TO-14. Additional samples of the recovered vapor, one sample from each "leg" of the SVE manifold, were also collected. A summary of the analytical data is attached.

For the overall influent stream, the analytical results were as follows. The molecular weight of each constituent is included for use in the removal calculations.

# Estimate of VOC Quantities and Removal
# Tank Farm Area Soil and Groundwater
# PPG Industries, Inc.
# Oak Creek, Wisconsin

| Constituent | Average Concentration (uL/L) | Molecular Weight (g/mole) |
|---|---|---|
| Toluene | 110 | 92 |
| Ethylbenzene | 22 | 106 |
| Total Xylenes | 72 | 106 |
| Styrene | ND | |
| Total VOCs | 204 | -- |
| Avg. MW (weighted) | -- | 98.5 |

To calculate the removal in pounds per hour, the concentration in uL/L must be converted to milligrams per cubic meter (mg/m3) using the following:

$$C\ (\text{mg/m3})\quad \frac{C\ (\text{uL/L}) \times \text{Avg MW of constituents}}{(RT/P)}\ (1\ \text{L}/1{,}000{,}000\ \text{uL})(1{,}000\ \text{mg/g})$$

$$= \frac{(204\ \text{uL/L})(98.5\ \text{g/gmole})(1\ \text{L}/1{,}000{,}000\ \text{uL})(1{,}000\ \text{mg/g})}{0.024\ \text{m3/mol at operating conditions}}$$

$$= 837\ \text{mg/m3}$$

Using the vapor flowrate measured at the time of sample collection (356 cfm), the removal rate can be calculated.

$$\text{Removal Rate (lb/hr)} = (837\ \text{mg/m3}) * (356\ \text{ft3/min}) * (1\ \text{lb}/454{,}000\ \text{mg}) * (1\ \text{m3}/35.3\ \text{ft3}) * (60\ \text{min/hr})$$

$$= \mathbf{1.12\ lb/hr}$$

## Subsurface Analytical Data
## Tank Farm Area
## PPG Industries, Inc - Oak Creek, WI
(all analytical data in mg/kg)

| Sample Location | Date | Depth (feet) | 1,1,2,2 - PCA(a) | MEK (b) | MIBK (c) | Ethyl-benzene | Styrene | Toluene | Total Xylenes | Tetrachloro-ethene | Methylene Chloride | Total VOCs (d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 8/8/91 | 13.5 - 15.5 | ND (e) | ND | ND | ND | ND | ND | ND | ND | ND | 0.00 |
| B-5 | 8/14/91 | 8.5 - 10.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.00 |
| B-6 | 8/12/91 | 6 - 7 | ND | ND | ND | 15.00 | ND | 4.50 | 110.00 | ND | ND | 129.50 |
| B-6 | 8/12/91 | 18.5 - 20.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.00 |
| B-7 | 8/13/91 | 8.5 - 10.5 | ND | ND | ND | 0.64 | ND | 0.33 | 0.53 | ND | ND | 1.50 |
| B-7 | 8/13/91 | 18.5 - 20.5 | ND | ND | ND | ND | ND | ND | 0.01 | ND | ND | 0.01 |
| B-8 | 8/14/91 | 18.5 - 20.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.00 |
| B-9 | 8/15/91 | 13.5 - 15.5 | ND | ND | ND | 8.70 | ND | 0.82 | 27.00 | ND | ND | 36.52 |
| B-10 | 8/6/91 | 6 - 8 | ND | 9.40 | ND | 11.00 | ND | 1.20 | 14.00 | ND | ND | 35.60 |
| B-10 | 8/14/91 | 13.5 - 15.5 | ND | ND | ND | 170.00 | ND | 7.40 | 18.00 | ND | ND | 195.40 |
| B-11 | 8/14/91 | 3.5 - 5.5 | ND | 0.05 | 0.12 | ND | ND | 0.01 | 1.10 | ND | 0.19 | 1.47 |
| B-11 | 8/16/91 | 11 - 13 | ND | ND | ND | 4.00 | ND | ND | 7.00 | ND | ND | 11.00 |
| Average | | | 0.00 | 0.79 | 0.01 | 17.45 | 0.00 | 1.19 | 14.80 | 0.00 | 0.02 | 34.25 |

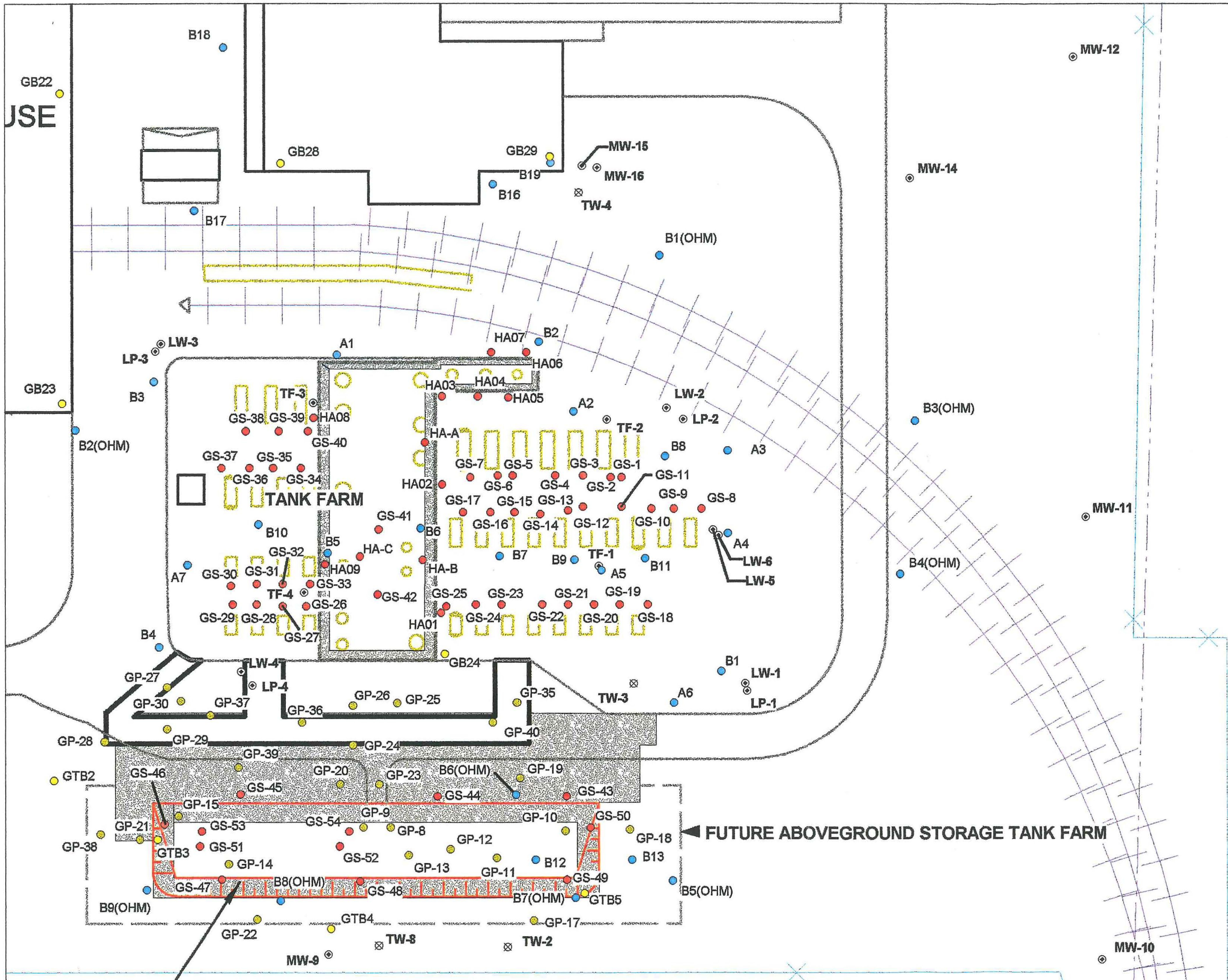
Notes:
(a) 1,1,2,2 - PCA - 1,1,2,2 - Tetrachloroethene
(b) MEK - Methyl ethyl ketone (2-butanone)
(c) MIBK - Methyl isobutylketone (4-methyl-2-pentanone)
(d) Total VOCs - Total concentration of all compounds on this table.
(e) ND - Non detect

**Surface Sc[illegible]lytical Data**
**Tan[illegible]m Area**
**PPG Industries, Inc. - Oak Creek, WI**
(all analytical data in mg/kg)

| Sample Location | Date | Depth (feet) | 1,1,2,2 - PCA(a) | MEK (b) | MIBK (c) | Ethyl-benzene | Styrene | Toluene | Total Xylenes | Tetrachloro-ethene | Methylene Chloride | Total VOCs (d) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-8 | 8/15/91 | 1 - 3 | ND | ND | ND | 3.90 | ND | ND | 51.00 | ND | ND | 54.90 |
| B-9 | 8/15/91 | 1 - 3 | 0.01 | ND | ND | ND | ND | ND | ND | ND | ND | 0.01 |
| GS-6 | 8/7/91 | 0 - 2 | ND | 9.80 | ND | ND | 52.00 | ND | ND | ND | ND | 61.80 |
| GS-12 | 8/14/91 | 0 - 2 | 0.01 | 0.36 | 9.50 | 4.30 | 0.40 | 3.30 | 140.00 | 0.02 | ND | 157.89 |
| GS-14 | 8/12/91 | 0 - 2 | ND | ND | ND | 11.00 | ND | 14.00 | 28.00 | ND | ND | 53.00 |
| GS-15 | 8/12/91 | 0 - 2 | 0.01 | 0.08 | 120.00 | 200.00 | 0.09 | 120.00 | 580.00 | 0.002 | ND | 1020.18 |
| GS-16 | 8/13/91 | 0 - 2 | ND | ND | 390.00 | 810.00 | ND | 570.00 | 2100.00 | ND | ND | 3870.00 |
| GS-23 | 8/13/91 | 0 - 2 | ND | ND | ND | 17.00 | ND | 12.00 | 140.00 | 0.02 | ND | 169.02 |
| GS-24 | 8/14/91 | 0 - 2 | ND | ND | ND | 5.50 | ND | 2.30 | 26.00 | ND | ND | 33.80 |
| GS-38 | 8/15/91 | 0 - 2 | ND | ND | ND | 34.00 | ND | 69.00 | 280.00 | ND | ND | 383.00 |
| GS-39 | 8/6/91 | 0 - 2 | ND | ND | ND | 100.00 | ND | 630.00 | 490.00 | ND | ND | 1220.00 |
| GS-40 | 8/14/91 | 0 - 2 | ND | ND | 9.90 | ND | ND | ND | 390.00 | ND | ND | 399.90 |
| HA-3 | 8/14/91 | 0 - 2 | NA | NA | 53.00 | 62.00 | NA | 17.00 | 230.00 | NA | NA | 362.00 |
| HA-5 | 8/16/91 | 0 - 2 | NA | NA | ND | 50.00 | NA | ND | 2.90 | NA | NA | 52.90 |
| HA-8 | 8/16/91 | 0 - 2 | NA | NA | ND | 150.00 | NA | 100.00 | 1700.00 | NA | NA | 1950.00 |
| Average | | | 0.00 | 0.85 | 38.83 | 96.25 | 4.37 | 102.51 | 407.13 | 0.00 | 0.00 | 649.95 |

Notes:

(a) 1,1,2,2 - PCA - 1,1,2,2 - Tetrachloroethene
(b) MEK - Methyl ethyl ketone (2-butanone)
(c) MIBK - Methyl isobutylketone (4-methyl-2-pentanone)
(d) Total VOCs - Total concentration of all compounds on this table.
(e) ND - Non detect
(f) NA - Not analyzed



## LEGEND:

MW-15
◉ Monitoring Well (Active)

TW-2
⊠ Monitoring Well (abandoned)

B2
● Soil Boring Location (Warzyn, 1992)

A4
● Soil Boring Location (OHM, 1987)

B4(OHM)
● Soil Boring Location (OHM, 1987)

GP-40
● Geoprobe Location (Montgomery Watson, 1995)

GTB1
○ Geotechnical Boring (Warzyn, 1992)

GB17
○ Geotechnical Boring (Layne-Western, 1973)

GS-49
● Ground Surface Soil Sample (Warzyn, 1992)

HA-09
● Hand Auger Location (Montgomery Watson, 1995)

▨ Area of Excavated Soil

GRAPHIC SCALE
1" = 60'

60 0 60 120

**Notes:**

ICF Kaiser, 1996 - LW-5, LW-6 installed; LP-2, LP-4 and MW-9 replaced
Warzyn, 1994 - TF-1 thru TF-4 installed
Warzyn, 1992 - LW-1, LW-2 and LW-4; LP-2 thru LP-4 installed
LW = water table wells LP = deep wells
Geraghty & Miller, 1987 - MW-14 thru MW-16 installed
Warzyn, 1981 - TW-2, TW-3, TW-4 and TW-8 installed (abandoned, 1992)

FIGURE 8-1

| PPG INDUSTRIES INC.<br>OAK CREEK, WISCONSIN | RFI AND HISTORICAL SOIL BORING LOCATIONS - TANK FARM AREA RCRA FACILITY INVESTIGATION | |
|---|---|---|
| *ICF KAISER ENGINEERS, INC.*<br>PITTSBURGH, PA | 7/31/97<br>1" = 60' | T. BLAIR<br>FIG8-1.WOR |

# APPENDIX C

# SVE SYSTEM MANUFACTURER DATA

# O&M Checklist

Date________________

Name_______________

# Operation and Maintenance Checklist
## SVE and Air Sparging System
## PPG Industries, Inc.
## Oak Creek, WI

### SVE System

**Vacuum Readings (in H2O)**

Overall __________

SVE-1 __________

SVE-2 __________

SVE-3 __________

SVE-4 __________

Diff. Pressure (in H2O) __________

**PID Readings (ppm)**

Influent __________

Effluent __________

SVE-1 __________

SVE-2 __________

SVE-3 __________

SVE-4 __________

Flowrate (cfm) __________

**Oxidizer Temperatures (C)**

| | Arrival | Departure |
|---|---|---|
| T1 | | |
| T2 | | |
| T3 | | |

Dilution Valve (% Open) __________

### Air Sparge System

| | Pressure (psi) | Flow (cfm) | Hours/Day |
|---|---|---|---|
| Overall | | | |
| Sparge 1 | | | |
| Sparge 2 | | | |
| Sparge 3 | | | |

Outlet Temperature (F) __________

**Pressure (psi)**

AS-1 __________

AS-2 __________

AS-3 __________

AS-4 __________

AS-5 __________

AS-6 __________

AS-7 __________

AS-8 __________

AS-9 __________

AS-10 __________

AS-11 __________

AS-12 __________

AS-13 __________

AS-14 __________

AS-15 __________

AS-16 __________

AS-17 __________

AS-18 __________

AS-19 __________

AS-20 __________

AS-21 __________

AS-22 __________

AS-23 __________

Adjustments to SVE/Sparge Systems:

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

# SVE Equipment

CARBONAIR®

# Operation & Maintenance Manual

## PD Blower- SVE System

CE 2004, CE 3003, CE 3006,
CE 4007, CE 5009, CE 6015

*CONTENTS*

## 1.0 SAFETY PRECAUTIONS

*Failure to observe these precautions could result in serious bodily injury and/or property damage.*

- Be sure you thoroughly read & understand this O & M Manual before beginning operation. If you have any questions, please call Carbonair Environmental Systems, Inc. at (800) 526-4999.
- Be sure all electrical disconnects are "OFF" and locked out before servicing.
- Be sure belt guard is in place and secure before operating.
- Take time to review your specific operating parameters on page 8.

## 2.0 EQUIPMENT DESCRIPTION

Carbonair's skid mounted soil vapor extraction (SVE) system is an integrated equipment and control package designed for high performance, and ease of use. Carbonair's skid mounted design provides unit mobility and easy installation.

The skid mounted SVE system has the following standard features:

- ✔ appropriately sized PD blower with explosion proof motor,
- ✔ coated carbon steel frame,

✓ vacuum gauges,
✓ washable demister with replaceable air filter element,
✓ 100 gallon, centrifugal moisture separator,
✓ fluid & sludge drain.

Optional features include:

✓ NEMA 7 enclosed manual starter w/thermal overload,
✓ NEMA 3R or NEMA 4 enclosed manual starter switch,
✓ custom control panel with appropriate NEMA enclosure,
✓ UL-listed control panel,
✓ additional vacuum gauges,
✓ high level switch,
✓ temperature gauges,
✓ discharge pump for moisture separator with explosion proof level controls,
✓ trailer mounted or custom enclosure,
✓ calibrated flow monitoring assemblies,

| CES Model # | CE 2004 | CE 3003 | CE 3006 | CE 4007 | CE 5009 | CE 6015 |
|---|---|---|---|---|---|---|
| scfm @ 3" Hg | 95 | 125 | 210 | 340 | 555 | 1015 |
| scfm @ 14" Hg | 40 | 50 | 95 | 160 | 270 | 560 |
| Max. Vacuum ("Hg) | 14 | 14 | 14 | 14 | 14 | 12 |
| Motor Enclosure | EP | EP | EP | EP | EP | EP |
| Motor HP | 2-7.5 | 3-10 | 5-15 | 7.5-20 | 7.5-25 | 15-50 |
| Voltage Options | 115/230/460 | 115/230/460 | 230/460 | 230/460 | 230/460 | 230/460 |
| Phase Options | 1 & 3 | 1 & 3 | 3 | 3 | 3 | 3 |
| Discharge Size | 2" NPT | 2" NPT | 2.5" NPT | 3" NPT | 4" NPT | 6" Flng |
| Dimensions (LxWxH) | 62x30x68 | 62x30x68 | 62x30x68 | 80x30x68 | 80x30x68 | 98x34x68 |
| Unit Weight (lbs) | 769 | 832 | 950.5 | 1169 | 1368 | 2153 |

## 3.0 PROCESS DESCRIPTION

Carbonair's skid mounted SVE system is designed to provide an efficient and economical means in which to extract vapors from contaminated soils.

Contaminated vapors are drawn into the side of the moisture separator tank where excessive moisture is removed from the air flow stream via a centrifugal separator and demisting media. Controlled amounts of dilution or make-up air can be introduced into the influent air flow stream through a control/isolation valve to optimize blower performance and minimize excessive blower discharge temperatures. The moisture separator is equipped with a drain valve at the bottom of the tank to remove condensate as required.

After the moisture has been separated from the air flow stream, particulates are removed by an in-line air filter. Filtering the air to remove particulates is an essential part of the process because it helps to protect the blower from excessive wear.

From the filter, the air is drawn into the blower and is then discharged directly into the atmosphere or may be directed to an off-gas treatment system like vapor phase carbon for further treatment.

## 4.0 INSTALLATION

*Be sure to carefully read all installation instructions before beginning the installation of the skid mounted SVE system.*

### 4.1 Inspection

Upon receipt of the skid mounted SVE unit, and before the unit is removed from the truck, be sure to perform a complete inspection for damage.

DO NOT operate the unit if it has been damaged since this could result in personal injury and/or damage to other equipment. If the skid mounted SVE system sustains damage during transit, notify the carrier and call Carbonair immediately at (800) 526-4999.

### 4.2 Loading & Unloading

When handling the skid mounted SVE system, be careful not to damage any of the system components, fittings, and inlet/outlet ports.

The SVE unit is compact and mounted on a skid which makes it easy to load and unload using a forklift. The unit should be strapped in place during transport as an added safety precaution.

*Be sure to use the proper equipment and follow proper safety procedures when loading & unloading the unit.*

### 4.3 Connections

After the skid mounted SVE system has been properly inspected and positioned on site, process connections can be made.

The SVE unit is shipped with all nozzles and ports covered. This is done as a safety precaution and also to prevent equipment damage. The covers must be removed prior to making the necessary piping connections.

Once the system is in place and the connections are ready, make the necessary connections as outlined below. If there are any special connection requirements, assistance is available by calling Carbonair at (800) 526-4999.

1. Connect the outlet piping to vent the unit as required.

   ▣ Note: ***Be sure to install the discharge piping so as to prevent water from entering the discharge silencer.***

2. Connect the inlet air piping to the moisture separator influent coupling.

3. Connect the drain pipe or hose to the drain fitting at the bottom of the moisture separator.

4. Install sample ports on the inlet and outlet piping to monitor system performance. Since turbulence and other unique operating conditions may adversely affect the accuracy of sampling results, it is recommended that an emissions expert be consulted to specify the best locations for air sampling and air flow measurements.

5. Make the necessary electrical connections as specified on the Marathon Motor face plate.

### 4.4 Lubrication

The blower of the unit is shipped with oil. However prior to operation the level should be checked. If low, the blower must be filled with a good grade industrial type anti-rust, oxidation and foam inhibited, non-detergent oil. Filling instructions and oil selection table can be found in the blower manual provided.

## 5.0 START-UP

After all the necessary connections are made, proceed with the following start-up procedures:

1. Verify that the drain valve is closed at the bottom of the moisture separator.

2. Verify that the bolts on the moisture separator lid are secure.

3. Open the dilution air valve on the inlet pipe.

4. Open the process air inlet valve to the SVE skid.

5. Bump the motor to confirm proper blower rotation.

6. Start the SVE blower.

7. Record the vacuum gauge and filter pressure readings.

8. Measure the blower motor current draw and the flow rate through the unit.

9. Adjust the dilution valve position until the current draw and the air flow rate falls within the recommended blower operating range.

10. To achieve optimum performance of the SVE unit during initial start-up, check:

    ✓ motor current draw
    ✓ air flow rate
    ✓ filter pressure differential
    ✓ air leaks
    ✓ inlet & outlet air temperatures

Refer to the Specific Operating Parameters Section 12 for project specific information.

## 6.0 OPERATION

After initial start-up & successful checkout of the SVE unit, long term continuous operation can be initiated.

Performance of the unit should be checked periodically by measuring the pressure drop across the filter, blower motor current draw, air flows, temperatures and vacuum levels. Measurement & sampling frequencies will be dictated by process air flows, inlet air characteristics and unique operating conditions.
Belt tension should be checked after approximately 24 hrs. of continuous use.

## 7.0 TROUBLE SHOOTING

There are a few situations which may arise while operating the skid mounted SVE system which can adversely effect the performance of the unit and/or result in abnormally high maintenance costs. Most of these situations can be resolved by following the directions which are outlined in the blower manual provided..

If any situations cannot be corrected using the blower manual provided, contact Carbonair at (800) 526-4999 for additional help.

## 8.0 MAINTENANCE

There are several maintenance tasks which must be performed periodically to ensure continued, trouble free operation. These tasks are discussed in subsequent sections.

### 8.1 Filter Replacement

Periodically, the in-line air filter and demisting material will have to be serviced. As the filter and demister become plugged, the air flow through the is restricted and the differential pressure increases. Eventually, the blower will begin to overheat resulting in equipment damage.

Carbonair recommends that the filter and demister differential pressure NOT exceed 15" of $H_2O$. At this point the unit should be stopped and the top of the moisture separator opened. The filter can then be replaced. The demister should be inspected for excessive amounts of dirt and washed if necessary. At this time the bottom of the unit should be inspected for excessive sludge.

### 8.2 Sludge Removal

In order to remove sludge from the unit, the cover of the moisture separator must be removed. Next, the filter assembly is removed at the male connection to the side of the tank. The demister and baffle plate can then be removed. This leaves direct access to the bottom of the tank for cleaning.

### 8.3 Condensate Drainage

Drainage of condensate from the bottom of the moisture separator may be required periodically depending on the inlet gas stream moisture content. This is done by opening the condensate drain valve at the bottom of the tank. The blower must be shut down before the drain valve is opened and then restarted when the valve is closed.

### 8.4 Waste Disposal

Proper disposal of the contaminated condensate and sludge is essential. Be sure to follow all local, state and federal regulations for handling, storing, transporting, and disposal of the condensate.

### 8.5 Lubrication

Be sure to follow the lubrication schedule found on page 2 of the M-D Pneumatics COMPETITOR O&M manual. This includes an oil change after the first 100 hours of operation and thereafter every 1,000 hours. In addition the blower bearings should be greased every week for units that are run continuously.

### 8.6 Belt Tension

Belt tension should be checked after initial operation and inspected periodically. Belts showing excessive wear should be replaced.

## 9.0 SYSTEM STORAGE

In order to prevent the blower from rusting during extended downtime or storage the unit must be shut down in the following manner.
The moisture separator must be emptied of liquid and cleaned of sludge. Next the blower should be operated with the process valve fully closed and the bleed air valve throttled to provide a system vacuum near design maximum. The unit should be run in this manner for period of about 30 minutes to allow the blower to be purged of any condensate. The unit should now be ready for storage.

## 10.0 SPARE PARTS

When ordering spare parts, refer to the drawings at the end of this manual. Be sure to provide the SVE system model number and the complete description of the part.

## 11.0 DESIGN CRITERIA SUMMARY

For project specific design parameters and standard specifications for the skid mounted SVE system, refer to the specific operating parameters section on page 8.

## 12.0 DRAWINGS

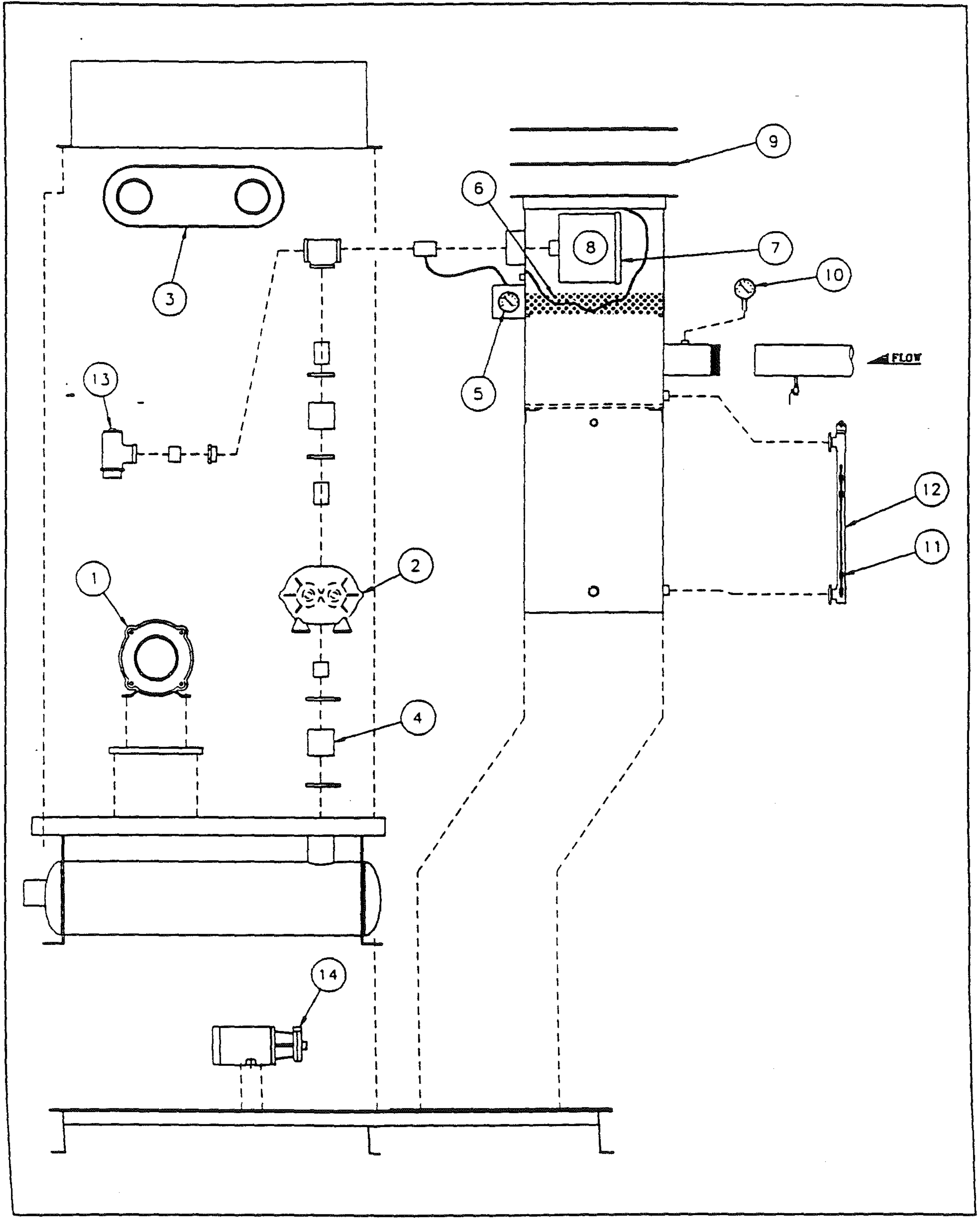
An assembly drawing has been included on page 6 to simplify the part identification and ordering process. A parts list is included along with the corresponding order number.

## Table No. 1
## Skid mounted SVE system Assembly Drawing Parts List & Order Numbers

| # | PART DESCRIPTION | CE 2004 | CE 3003 | CE 3006 | CE 4007 | CE 5009 | CE 6015 |
|---|---|---|---|---|---|---|---|
| 1 | Motor | | | | | | |
| 2 | Blower | BL 139586 | BL 139594 | BL 139601 | BL 139626 | BL 142825 | BL 141453 |
| 3 | Belts | | | | | | |
| 4 | Flex Connector | HO 140924 | HO 140924 | HO 140932 | HO 140940 | HO 140957 | HO 146181 |
| 5 | Pressure Gauge, Dwyer 0-15" | GA 142006 | GA 142006 | GA 142006 | GA 142006 | GA 142006 | GA 142006 |
| 6 | Demisting Material | FI 141372 | FI 141372 | FI 141372 | FI 141372 | FI 141372 | FI 141372 |
| 7 | Filter Assembly | FI 141972 | FI 141972 | FI 141972 | FI 141980 | FI 141980 | FI 141997 |
| 8 | Replacement Filter Element | FI 142436 | FI 142436 | FI 142436 | FI 142444 | FI 142444 | FI 142452 |
| 9 | Gasket - 22x25x ⅛ Buna N | GA 142014 | GA 142014 | GA 142014 | GA 142014 | GA 142014 | GA 142014 |
| 10 | Vacuum Gauge | GA 128191 | GA 128191 | GA 128191 | GA 128191 | GA 128191 | GA 128191 |
| 11 | Level Control Assembly | SW 135768 | SW 135768 | SW 135768 | SW 135768 | SW 135768 | SW 135768 |
| 12 | Sight Glass Assembly | AS 142177 | AS142177 | AS 142177 | AS 142177 | AS 142177 | AS 142177 |
| 13 | Vacuum Relief Valve | VA 140365 | VA 140365 | VA 140365 | VA 140365 | VA 140373 | VA 140381 |
| 14 | Pump (Optional) | PU 128986 | PU 128986 | PU 128986 | PU 128986 | PU 128986 | PU 128986 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Figure No. 1**

Skid mounted SVE system Assembly Drawing No. 1



# 13.0 SPECIFIC OPERATING PARAMETERS

Job ________________________________________

Carbonair's Serial Number ____________________________

Design Air Flow Rate ____________________________

System Vacuum (" Hg) ____________________________

Inlet Temperature (°F) ____________________________

Outlet Temperature (°F) ____________________________

Blower Speed (RPM) ____________________________

Belt Size/Tension ____________________________

Blower Motor Size (HP) ____________________________

Blower Motor Enclosure XP ☐ TEFC ☐

Blower Motor Phase Single ☐ Three Phase ☐

Voltage 110 ☐ 208 ☐ 230/460 ☐

Current Draw Range (amps) ____________________________

Blower Current Draw (amps) ____________________________

Pressure Relief Setting ____________________________

Discharge Pipe Size ____________________________

**OPTIONAL FEATURES INCLUDED:**

NEMA 7 Enclosure ☐
NEMA 3R Enclosure ☐
NEMA 4 Enclosure ☐
Custom Control Panel ☐
UL-Listed Control Panel ☐
Additional Vacuum Gauges ☐
High Level Switch ☐
Discharge Pump w/ Controls ☐
Trailer Mounted ☐
Custom Enclosure ☐
Flow Monitoring Assemblies ☐
Bleed Valve ☐

# EPT EDGE - Browning Drive Specifications

## Drive #1, Selection #3

LAW ENGINEERING
209849

## Bill of Materials

| Qty | Part Number | Net Each |
|---|---|---|
| 1 | 2B5V56 | 36.52 |
| 1 | B 1 3/8 5/16 | 7.48 |
| 1 | 2B5V46 | 30.89 |
| 1 | B 1 1/8 | 7.48 |
| 2 | BX53 | 13.74 |
| | Total: | 96.11 |

## Technical Specifications

| | Required | Actual |
|---|---|---|
| Driver Speed: | 1750 | 1750 |
| Driven Speed: | 2054 | 2107 |
| Center Distance: | 19-21 | 19.39 |
| Horsepower: | 10.00 | 10.00 |
| Service Factor: | 1.50 | 1.51 |

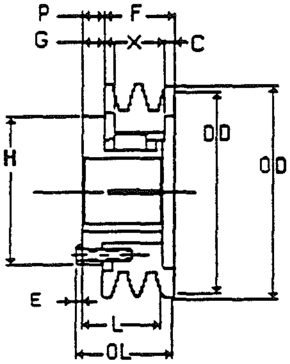
Options Invoked: Yes -- Save Solutions Sheet

Tension: 4.46 Lb. should deflect belt 0.30 In.

Hub Load: 217 Lb. "running" Hub Load

**Driver Sheave: 2B5V56**

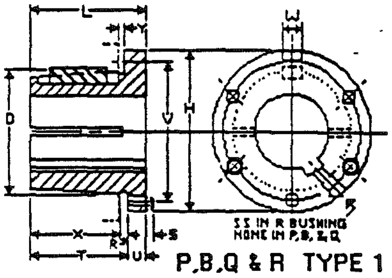
Page=A-39
DD=5.6
PD=5.9
F=1 23/32
OD=5.88
TYPE=3
OL=2 31/64
P=33/64
C=11/64
X=1 5/16
WT=6.7



TYPE 3

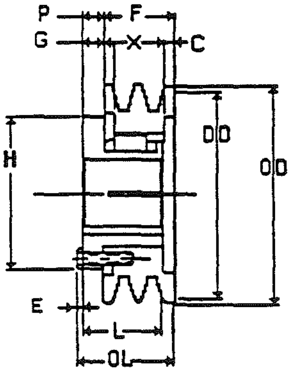
**Driver Bushing: B 1 3/8 5/16**

Page=A-1
L=1 15/16
U=1/2
T=1 7/16
Lrg D=2.625
Sml D=2.5567
H=3 11/16
V=3 1/8
W=1/2
X=1 3/16
Y=7/32
R=1/4
S=1/4
Cap Screws=3
WT=1.8



**Driven Sheave: 2B5V46**

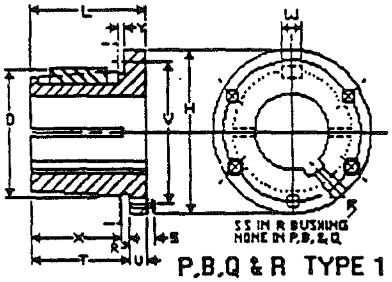
Page=A-39
DD=4.6
PD=4.9
F=1 23/32
OD=4.88
TYPE=3
OL=2 31/64
P=33/64
C=0
X=1 31/64
WT=3.3



TYPE 3

**Driven Bushing: B 1 1/8**

Page=A-1
L=1 15/16
U=1/2
T=1 7/16
Lrg D=2.625
Sml D=2.5567
H=3 11/16
V=3 1/8
W=1/2
X=1 3/16
Y=7/32
R=1/4
S=1/4
Cap Screws=3
WT=1.8



CARBONAIR®

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MINNESOTA 55427
PHONE: 612-544-2154 1-800-526-4999 FAX: 612-544-2151

## Installation:

The Carbonair Sparge Flow Meter may be installed vertically or horizontally. The flow meter is directional and must be installed so that the flow direction is the same as the arrow on the high-pressure port. A typical installation is shown in FIGURE 1 for a total flow meter and branch flow meters.

The gauge may be rotated 180° to allow better readability of the scale.

To accurately measure flow, it is recommended that a pressure gauge and a temperature gauge are mounted on the inlet side of the lfow meter. The flow meter is provided with an appropriate inlet run of pipe. A throttle valve should not be installed on the inlet of the flow meter. It is recommended that there be 4 pipe diameters on the discharge side of the meter.

## Operation

The Carbonair Sparge Air Flow Meter is calibrated in SCFM for different pressures. To read air flow, find where the needle crosses the line for your operating pressure. (See Figure 2) Follow the nearest curved vertical line to the top of the scale. Read the flow in SCFM. If the needle falls between lines, your flow is the average of flow lines that are marked. To balance flows in a header, use the included throttle valve on the flow meter body.

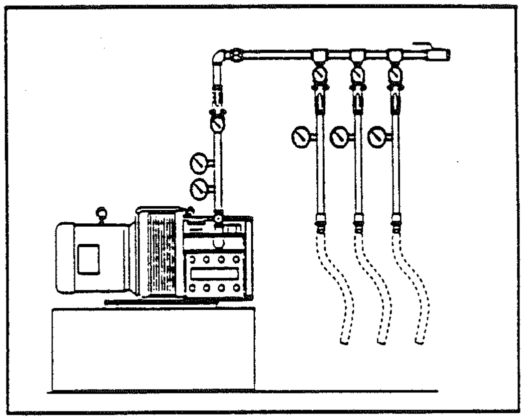


FIGURE 1

## Maintenance

The meter is designed for clean dry air service. Condensation and debris should be kept out of the pipe and tubes leading to the gauge. If the meter is mounted horizontally, the gauge should be mounted facing up, to prevent any condensation from getting into the gauge.

This valve includes a locking mechanism on the handle stem to set an allowable range of motion for the handle.

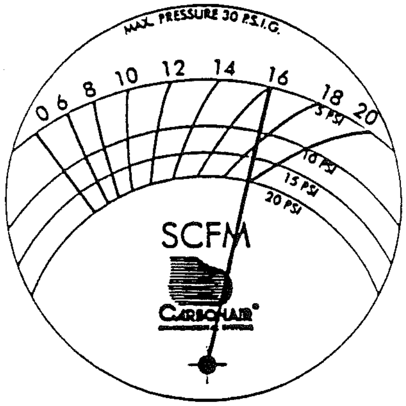


FIGURE 2

At 5 psig, gauge reads 16 SCFM
At 15 psig, gauge reads 19 SCFM

## Correction for Temperature and Pressure

The flow meter is calibrated for typical sparging temperature/ressure combinations. If your pressure is off-scale or your temperature is significantly different than the temperature listed in Table 1, you can correct for this using the following equation:

$$SCFM_2 = \frac{SCFM_1}{\sqrt{\left(\frac{14.7 + P_1}{14.7 + P_2}\right)\left(\frac{T_2 + 460}{T_1 + 460}\right)}}$$

CALIBRATION TEMPERATURE

| | | FULL SCALE FLOW SCFM | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 20 | 30 | 40 | 50 | 100 |
| $P_1$ (psig) | 5 | 130 | 155 | 190 | 190 | 190 | 190 | 190 |
| | 10 | 140 | 170 | 215 | 215 | 215 | 215 | 215 |
| | 15 | 150 | 185 | 250 | 250 | 250 | 250 | 250 |

TABLE 1

$SCFM_2$ = Corrected SCFM
$SCFM_1$ = SCFM read from uppermost scale of gauge
$P_1$ = Pressure from uppermost scale of gauge (psig)
$P_2$ = Operating pressure (psig)
$T_1$ = Calibration temperature (°F) from Table 1
$T_2$ = Operating temperature (°F)

## Specifications:

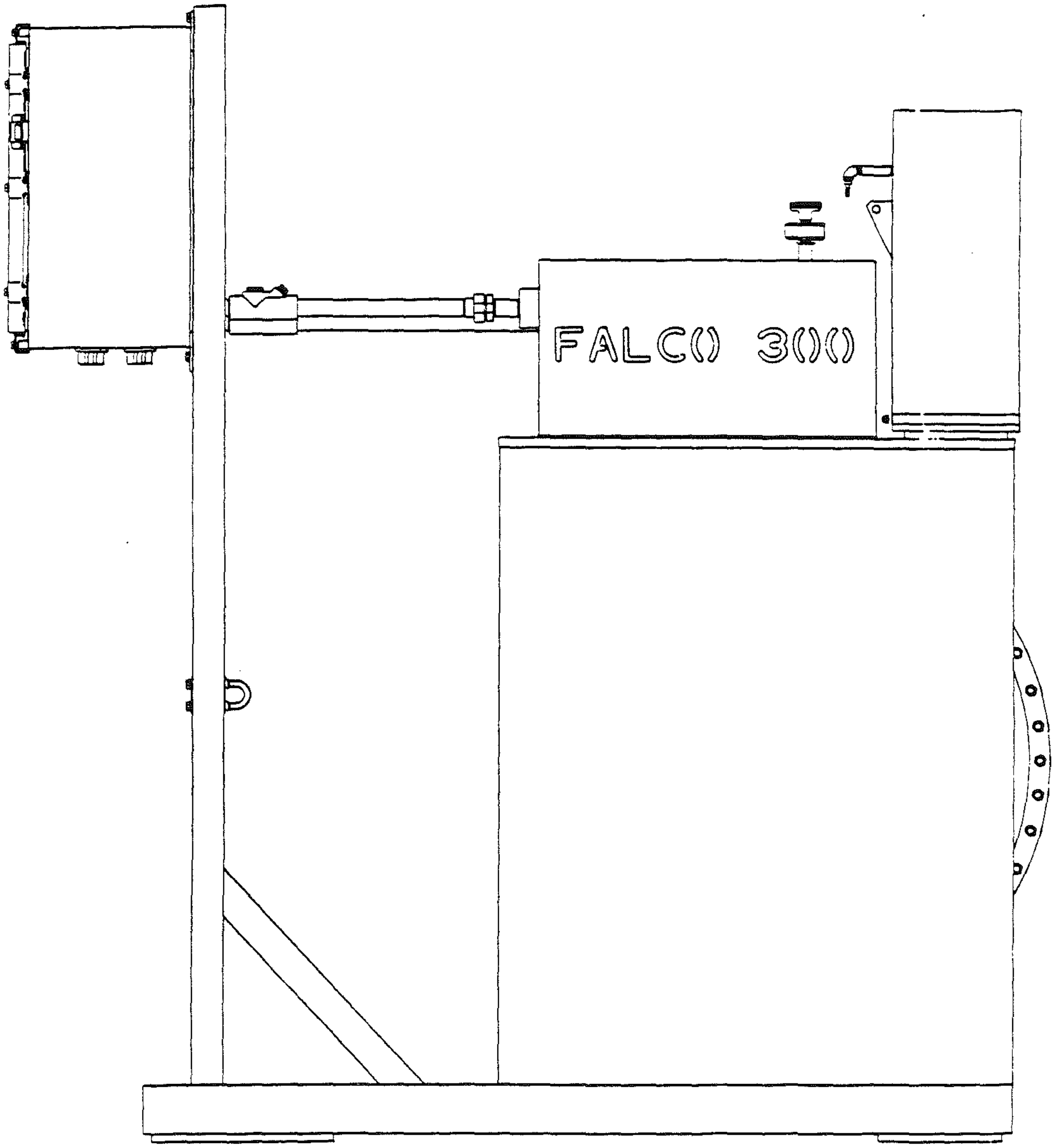
1. Flow element accurate to ±5% full scale
2. Brass/bronze integral valve body with teflon seals rate to 250°F and 30 psig
3. Low pressure drop (less than 10" $H_2O$)

| Standard Flow Ranges | Connections | Length | Width | Depth |
|---|---|---|---|---|
| 6-20 SCFM | 1" mpt x 1" fpt | 12" | 5" | 3.5" |
| 3-10 SCFM | 3/4" mpt x 3/4" fpt | 12" | 5" | 3.5" |

# Catalytic Oxidizer

# FALMOUTH PRODUCTS CATALYTIC OXIDIZER
# FALCO 300
# INSTALLATION AND OPERATIONS MANUAL

MANUAL 1997.300.01 LAST REVISION 10-10-97
TECHNICAL ASSISTANCE: 1-800-340-8125



$10.00

# NOTICE

To: FALCO 300 owner

From: Falmouth Products

RE: Mercury Relay lifespan

The FALCO 300 Catalytic Oxidizer uses electric heat as a supplementary form of energy. The heaters are switched on and off by mercury relays.

Mercury relays have a finite life span (apx. 3 million cycles) and should be replaced after two years of use. Failure to replace these relays every two years may result in heater damage, which is expensive.

These mercury relays (3 used) are single pole, 100 Amp, normally open relays with 120 volt coils. They are mounted on the rear panel inside the FALCO 300 control box, and are easily replaced. Replacements may be purchased from Falmouth Products.

FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA. 02541 PHONE 508 548 6686 FAX 508 548 8144

# FALCO 300 CATALYTIC OXIDIZER INSTALLATION AND OPERATIONS MANUAL
## TABLE OF CONTENTS

Rev 10-10-97

# FALMOUTH PRODUCTS CATALYTIC OXIDIZER FALCO 300
# INSTALLATION AND OPERATIONS MANUAL

FALMOUTH PRODUCTS CATALYTIC OXIDIZER (FALCO) converts hydrocarbon contaminates in an air stream to carbon dioxide and water vapor. Combustion occurs in the temperature range of 300°C-620°C. Heat is transferred from the hot exhaust stream to the incoming contaminated air, heating it to the catalytic oxidation temperature.

FALCO is equipped with three programmable temperature controllers. One controller (T1) monitors and responds to a thermocouple sensing the temperature at the upstream end of the catalyst. The second controller (T2) monitors and responds to a thermocouple sensing temperature downstream from the catalyst. The third controller (T3) senses the temperature at an intermediate position inside the catalyst. The T3 controller provides a rapid response to increasing vapor concentration by increasing dilution air and shutting the system off if necessary.

The T1 controller shuts down the system if the T1 thermocouple temperature moves above or below its set point by selected amounts. The T2 and T3 controllers will also shut down the system if corresponding thermocouple temperatures deviate from their set points by selected amounts. If the automatic dilution valve control (DVC) does not respond rapidly enough to an increase in vapor line concentration, T2 and T3 will increase to their HI alarm settings and turn off the system.

FALCO is also equipped with a pressure switch which interrupts the heater circuit if flow is interrupted, for example, due to a thermal protection cut out of the blower or frozen vapor line. This prevents overheating the electric heaters if the flow rate becomes too low.

If a short power interruption should occur, 1 minute for example, the unit will restart itself and resume normal operation. If the interruption persists long enough, T1 or T2 will fall below the selected shutdown limits, and the system will remain off until restarted by the operator.

The three controllers regulate the temperature of vapor entering the catalyst. The T1 controller regulates a bank of electric heaters, which add heat to the incoming flow when required. The three controllers cooperate in the regulation of dilution valves that control input vapor concentration to the catalytic unit. The controllers are programmed to automatically shut down the system if selected temperature limits are exceeded.

Heat recovery is adjustable. FALCO has a tunable heat exchanger, allowing the operator to adjust the amount of heat recovery desired. When vapor concentration is low, heat recovery should be maximized to save electric power costs. At high concentration sites, heat recovery should be reduced to maximize input concentrations and recovery rate.

Figures 1, 2, and 3 show the basic components of the FALCO 300 and a flow schematic.

## TRANSPORTATION & STORAGE

FALCO-300 weighs approximately 850 pounds. Forklift pockets are provided for lifting. The unit should be transported and moved around on site carefully.

FALCO-300 is supplied with tires mounted on steel axles. These steel axles may be inserted into holes in the frame to ease in **manual** transportation around the site. (See figure 11)

**CAUTION! UNDER NO CIRCUMSTANCES SHOULD THE UNIT BE TOWED BY A MOTORIZED VEHICLE.**

FALCO is weather proof while in operation. When FALCO is in storage, however, it should be kept clean and dry.

**CAUTION! WHEN FALCO IS NOT OPERATING, ALL OPENINGS MUST BE COVERED TO PREVENT RAIN, DIRT AND RODENTS FROM ENTERING.**

## INSTALLATION

Place FALCO on a level surface in a **secure** area. Figure 4 illustrates a plan view of a typical installation. Buried lines from the vapor recovery wells should emerge at the surface within a fenced area. In cold climates all vapor lines should be protected from freezing by heat tape and insulation.

### PIPING FROM VAPOR WELLS TO VACUUM SIDE OF BLOWER

Beginning at the vapor lines, the **PVC** piping should be installed as follows:

1. Install valves on each separate vapor line. These lines should each be equipped with sample and vacuum ports.

2. Combine the vapor lines together into a single line, and if available, install a piece of clear PVC so water can be seen when it is being produced.

3. Run this main vapor line into and out of a large capacity water knockout (40 gallons minimum). On the discharge side of the water knockout install a 3 inch **gate** valve. This valve will control the combined vapor flow from the wells.

4. Install a 3 inch T downstream from the **gate** valve installed in step #3. Install the automatic dilution control valve with filter (DVC) into this T using 3" pipe. The connection into the bottom of the DVC should not be glued so this assembly may be easily disconnected and used again. (See figure 4 & 5)

5. Pipe into the vacuum side of the blower with 3 " PVC. Install a vacuum gauge between the DVC system and the blower. For operation in cold climates all piping on the vacuum side of the blower, including the water knockout, should be insulated and heat taped.

## PIPING FROM PRESSURE SIDE OF BLOWER TO THE FALCO 300

Note: **Please do not use galvanized pipe or Teflon/silicone based pipe thread sealants, as they may damage the catalyst.**

Note: **Falmouth Products recommends using Rectorseal # 5 pipe thread sealant on all pipe threads.**

Recognizing that 3" steel pipe is difficult to work with and expensive, please adhere to the following guidelines in using PVC when installing the piping between the discharge of the blower and the inlet of the oxidizer.

Beginning at the blower, the piping should be installed as follows:

When the oxidizer is to be mounted close to the blower use steel 3" **non-galvanized** piping.

If the oxidizer is to be mounted more then 10'(total pipe length) away from the blower, use at least 5' of steel pipe for blower heat dissipation. Next install a steel coupling and a 3" schedule 80 PVC male adapter into this coupling. The piping may be finished off with schedule 80 PVC pipe to the oxidizer.

1. Adapt the discharge piping from the blower up to 3 inch pipe. For ease of installation and reduced time it is advantageous to locate the blower parallel to and next to the catalytic unit. (See figure 4).

2. Install a 3 " pipe nipple on the discharge side of the blower.
   Install a 3 " union so that the blower may be removed for service.
   Install a 3 " nipple into this union and a 3 " 90° elbow onto the nipple.

3. Screw the flame arrester onto the 4 " inlet pipe on the oxidizer.
   Screw a 4 " x 3 " reducer bushing into the flame arrester inlet.
   Install a 3 " nipple into the 4 " X 3 " reducer bushing. Screw a 3 " 45° elbow onto the 3 " nipple.

4. Install a short 3 " nipple onto the 45° elbow, and then install a 90° elbow onto the other end of the 3" nipple.

5. If the blower has been mounted parallel to the catalytic unit, the discharge piping from the blower will be able to swing up to the intake piping of the oxidizer.

6. Install 3 " steel pipe between the elbow on the flame arrester inlet to the elbow on the blower. Include in this steel piping (schedule 80 PVC piping in some cases as mentioned earlier) an influent sample port, a pressure gauge and another union if needed.

## WATER

Most vapor recovery operations produce some water. While water vapor is not a problem, **take care not to allow liquid water to reach the catalytic unit.** Recognizing that conditions vary widely from site to site, the following strategies should be considered to minimize the transportation of water to the catalytic unit:

1. Slant vapor lines downhill toward the vapor wells.
2. Avoid low points that might accumulate slugs of water. If low points can't be avoided, provide a means for draining accumulations.
3. In cold climates, heat tape and insulate all pipe that is not buried.
4. Install a water knockout upstream from the blower. Install a vacuum gauge. A bouncing vacuum gauge often means that there is a slug of water in a vapor line.
5. Make sure that site check intervals do not exceed the time for water to fill the knockout.

## ELECTRICAL POWER CONNECTIONS

### CONTROL BOX TO BREAKER BOX.

FALCO control box is connected by rigid metal conduit to the breaker box (not supplied).
Two 1" holes are supplied with hubs on the bottom of the control box. Explosion proof seal fittings should be installed in line with the conduit just below the control box and the breaker box.

**Three circuits feed power to FALCO through the rigid conduit.**
**All wires used should be stranded copper wire.**

1. A 70 amp. three pole (208 volts three phase) breaker supplies power to the electric heaters (20,300 watts) through three #6 wires. (Optionally the heater can be wired for operation at lower power levels).
2. A second three pole breaker (size depends on blower horsepower) supplies power to the blower.
3. A third 15 amp single pole 120 volt breaker supplies power to the controllers and relays through two #12 wires.
   A #6 grounding wire is run from the FALCO control box grounding bar through the conduit and attached to the grounding rod at the base of the breaker box.

## FEED CONDUIT

1. Remove the control panel retaining nuts and carefully lower the top of the control panel out of the box until it is horizontal. Take care not to pull on the wires. Slide the panel four inches inward so it is bearing on the bottom two studs and is face down on the foam pad.

**Note: Do not allow controllers or inside of box to get wet !**

2. Run rigid conduit with seals from the breaker box to the control box.

   Pull the following nine wires through the conduit:
   Three # 6 wires for the heaters.
   Three wires appropriately sized for the blower (usually three #8's).
   One pair of # 12 wires for the controls.
   One # 6 ground wire.

## CONTROL CIRCUIT

The (120 volt) control circuit is wired as follows:
Neutral lead (white) is attached to terminal block #30 on the rear control panel.
Hot lead (colored) is attached to terminal block #31 on the rear control panel.

## GROUND

FALCO is grounded as follows:
Locate the grounding bar inside the control box.
Run a grounding wire (Green#6) from the bar, through the 1" conduit and the breaker box to the grounding rod.

## HEATER

Wire the heater as follows:
Locate terminal blocks # 21, 22, 23 on the rear control panel and install the three #6 feed wires to these terminals.

## BLOWER

Wire the blower feed wires as follows:
Locate terminal blocks # 24, 25, 26 on the rear control panel and install the three blower feed wires to these terminals.

## WIRE THE BLOWER AS FOLLOWS:

Run a 3/4" rigid metal conduit with explosion proof seal fittings between the blower and the FALCO control box. Install a 3/4" union at the blower end so that the blower may be removed for service. Pull the three load wires through the 3/4 conduit. Install the three blower load wires to terminal blocks # 27, 28, 29 on the rear control panel of FALCO.

## GROUND THE BLOWER AS FOLLOWS:

Run a grounding wire (green) from the case of the blower through the 3/4" conduit and attach it to the grounding bar inside the control box.

## DILUTION VALVE CONTROL SYSTEM (DVC)

The automatic dilution control (DVC) has two major components: a motor driven gate valve and a solenoid valve. These valves work together to regulate inlet vapor concentrations. The valves get their power from the FALCO 300 control box. The DVC adjusts a flow of atmospheric air into the source vapor stream. For FALCO 300 units supplied with the 10 horsepower blower package, the DVC is pre-mounted and wired on the blower package mounting frame.

For FALCO 300 units supplied **without** the blower package, the DVC is field wired as follows:

1. Install a 1/2" rigid conduit with a seal at the oxidizer control box end. This conduit should be run along the ground to below the DVC box. Next, extend the conduit upward at least 18" off the ground below the base of the plastic DVC box. A seal fitting should be installed at the end of the rigid conduit. Liquid tight conduit should be installed between the seal and the DVC box. The liquid tight will provide enough flexibility to adjust the box for drive belt tension.

2. Pull 4 #14 wires (white, yellow, brown and green) through the 1/2" rigid and liquid tight that is installed between the FALCO control box and the DVC. Starting at the control box make the following terminations:
   Connect the white wire to terminal block #30 (neutral side) on the rear control panel.
   Connect the two colored wires (yellow and brown) to the two wires secured to the right hand side of the FALCO control box (yellow and brown) marked DVC wires.
   Connect the green wire to the grounding bar inside the FALCO control box.
   At the DVC box end of the conduit, connect the four DVC wires to the corresponding colored wires inside the DVC box. (see figure #5)

**Note: The solenoid dilution valve comes mounted and piped to the aluminum box that encloses the motorized gate valve. There is a piece of liquid tight conduit that connects the solenoid dilution valve to the DVC box located inside the aluminum enclosure. If this conduit gets disconnected, terminate the solenoid wires to the lead wires in the plastic DVC box as follows. (See figure # 5 )**

1. Connect the brown wire to the brown wire in the box (this is the opening circuit).

2. Connect the green wire to the green wire in the box (ground).

3. Connect the white wire to the white wire in the box (neutral).

**Verify correct DVC operation as follows when you reach the INITIAL START UP section in this manual.**

- Turn the FALCO power switch on.
- With the blower now running, and airflow through the system, turn on the heater switch.
- Adjust the T1 setpoint so that the L1 light is lit on the T1 controller. (See initial startup section in the manual).
- Turn on the DVC switch.
- Verify that the DVC sprocket on the side of the DVC box turns clockwise as you face it when the L1 light is lit on the T1 controller. The solenoid valve will not operate under this condition as it only responds to the opening circuit.
- Lower the T3 setpoint to 10° below the actual temperature.
- Verify that the DVC sprocket on the side of the DVC box turns counterclockwise as you face it when the L1 light is lit on the T3 controller. When L1 lights on the T3 controller a snap will be heard as the solenoid valve opens.

The DVC valve moves toward open (Counterclockwise rotation) and the solenoid valve opens, when L1 is lit on either the T2 or T3 temperature controllers. The controller setpoints may need to be adjusted downward to observe this. Once proper rotation, solenoid valve operation, and switch control have been verified, make final connections with crimp connectors.

## Optional sparge compressor output

The FALCO 300 has a fused output (terminal block # 0) to control the coil on a contactor for an additional treatment system such as a sparge compressor. This output is only energized when the extraction blower is operating.

Secure control panel with 3/8 nuts.

## CONTROLLER OPERATION

The control parameters have been set by FALMOUTH PRODUCTS before delivery. With the exception of temperature setpoints, control settings will normally not be changed by the operator. If circumstances indicate a need to change controller programming, please consult with Falmouth Products before changing any programming. The setpoints are adjusted on the controllers by pressing the up or down buttons. Holding down either button produces a continuous, **accelerating** change. Pressing either button momentarily produces a 1° change (see figure 9).

There are alarms that turn off the sysfem (blower and heater) if the catalyst temperatures exceed the setpoints by set limits:

The T1 controller alarm settings are +175°C and -60°C. (Deviation alarm)
The T2 controller alarm settings are +20° C and -300°C. (Deviation alarm)
The T3 controller alarm setting is 600°C. (Process alarm).

The AUTO/MAN button, the middle button on the right side of the controller, is used to reset the alarm after it has tripped. To reset an alarm, the temperature must be within the alarm limit.

## DILUTION VALVE CONTROL

Some vapor recovery systems supply stable input concentrations which decrease slowly over time. Other systems yield concentrations which fluctuate up and down. The DVC is designed to respond to **gradual** increases or decreases in vapor line concentrations, to maintain nearly constant input concentration. When vapor line concentrations are high or fluctuating, the automatic dilution valve (DVC) maintains the selected input concentration by adjusting dilution air.

A sprocket on the DVC drives a belt, which in turn drives a sheave on the gate valve.
The DVC is assembled with the dilution valve on an aluminum plate. (See figure 5).
The assembly includes an L bracket that is mounted inside an aluminum box that protects the DVC from the elements. The DVC assembly should be fastened to a post, wall or fence using the four holes in the back of the L bracket and box. Mount the DVC at shoulder level so that it can be easily seen and adjusted. In cases where the blower package is supplied with the oxidizer, the DVC is factory mounted on the blower package frame.

Grease the sheave and the belt on the DVC so the belt may slip when the DVC valve is fully closed or fully open.

The solenoid valve works with the DVC by increasing dilution air rapidly in the event of a sudden increase in vapor concentration.

## DILUTION CONTROL OPERATION

The automatic dilution control (DVC) is a motor driven valve controlled by the three temperature controllers. The DVC regulates a flow of atmospheric air into the source vapor stream, thus bringing the concentrations to the proper level.
The DVC valve controls the inlet vapor concentration to the oxidizer to minimize heater load. Heater load will be minimal until the DVC valve is closed.

The T1 controller responds to a thermocouple, T1, at the upstream end of the catalyst.
The T1 controller cycles the heaters and adjusts the dilution valve toward closed when the temperature at the T1 thermocouple falls close to its set point.
The T1 set point is typically 330°C.

The T2 controller responds to a thermocouple, T2, measuring the temperature at the downstream end of the catalyst. The T2 controller makes incremental adjustments in the dilution valve toward open when the temperature at the T2 thermocouple rises close to its set point. The T2 set point is normally 600°C.

The T3 controller responds to a thermocouple, T3, embedded in the catalyst about one quarter of the catalyst depth from the inlet end. The T3 controller has a rapid response to changes in vapor concentration. If the vapor line concentration increases rapidly, it is the T3 controller that responds by adjusting the dilution valve toward open, and by opening the solenoid valve. The T3 set point is 580°C.

The solenoid valve responds to either the T2 or T3 controllers by cycling open, increasing dilution air when the vapor concentration increases.

## MANUAL BYPASS

The purpose of the heat exchanger bypass is to allow the operator to manually adjust inlet vapor concentration when the FALCO 300 is operating with dilution control.

The heat exchanger bypass is an adjustable valve in the passage connecting the discharge side of the catalyst to the exhaust stack. Flow of hot exhaust gas through the bypass provides a corresponding reduction in flow through the heat exchanger. In this way, the heat exchanger bypass regulates heating of the inlet vapor stream.

As the heat exchanger bypass is adjusted toward open, the flow of hot exhaust gas through the heat exchanger is reduced, thus reducing heat recovery. During operation with low vapor line concentration, when electric heat is needed to help preheat the vapor being treated, the heat exchanger bypass should be kept closed to minimize energy use. The heat exchanger bypass is also kept closed during warm-up.

**For adjustment refer to Figures 6, 7, and 8.**
The top portion of the bypass valve assembly projects through the top of the heat shield.
In figure 6 the bypass valve is in the **closed** position. The ballast nut has been run upward so that several threads are visible above the ballast nut.

In figure 7 the bypass valve is adjusted to a partially **open** position. The ballast nut supports the valve off its seat. The bypass knob is now approximately one inch higher than the top of the bypass weight. The distance between the bypass knob and the ballast nut represents the amount of heat exchanger bypass.

CAUTION: **If the oxidizer has been running with the bypass open, it will be hot; wear gloves to make adjustments.**

The closing force on the bypass valve is the weight of the valve assembly. Therefore, the bypass valve also serves as a pressure relief valve limiting pressure in the catalyst chamber.

## EXAMPLES OF BYPASS ADJUSTMENT AND CONTROL RESPONSE

**Case 1.**
Initial conditions: DVC partially open, and vapor concentration is relatively high.
The objective is to increase input concentrations.

Heat recovery is **reduced** by adjusting the bypass valve toward **open.**
Control system responds by **increasing** inlet vapor concentration.
The control mechanism is as follows:

1. Reduction in heat recovery results in a drop in the temperature of vapors entering the catalyst. The T1 thermocouple senses the new temperature, at or below the T1 set point.

2. The T1 controller responds to the drop in temperature by signaling the dilution control to start making small adjustments of the dilution valve toward close.
   As a result, the inlet vapor concentration is increased.

3. The increased inlet vapor concentration makes more heat available. In this way, the temperature of the inlet vapor is raised to or above the T1 set point, despite the lower heat recovery efficiency.

Further adjustments of the bypass valve toward open result in a repetition of the above control cycle, with further increases in concentration.

Increases in inlet vapor concentration result in temperature increases at T3 and T2. The maximum allowable inlet vapor concentration is reached when the temperature rise through the catalyst results in T2 approaching its setpoint temperature of 600°C.

**Case 2 .**

| | |
|---|---|
| Initial conditions: | Concentrations have dropped over time and the heater has started to cycle. Objective is to increase heat recovery (reducing heater load). |

Heat recovery is **increased** by adjusting the bypass valve toward **close.**
The control mechanism is as follows:

1. The increase in heat recovery results in an increase in the temperature of vapors entering the catalyst. This temperature increase propagates through the catalyst as a temperature wave, increasing the temperatures at T2 and T3.

2. After approximately five minutes the T1 temperature will increase and the heater load will be reduced. The T1 temperature may drift above its setpoint.

3. If the effect of the adjustment is great enough, all three temperatures will drift upward after about ten minutes. The T2 or T3 controller may respond by signaling the dilution control to start making small adjustments of the dilution valve toward open. The solenoid valve also cycles during these DVC opening adjustments.

## DISCUSSION OF COLD STARTUP

The FALCO 300 is first heated up (using the electric heaters) to the reaction temperature for hydrocarbons within the catalyst. Once the unit has achieved reactive temperatures, vapors are slowly fed in. The oxidation of vapors results in a temperature rise across the catalyst. The temperature entering the catalyst (untreated vapors) is lower then the temperature exiting the catalyst (treated vapors). The greater the concentration of hydrocarbon vapor entering the unit, the greater the temperature rise ($\Delta T$) across the catalyst. To achieve proper start up of the oxidizer, the temperature rise across the catalyst must be carefully controlled. If the concentrations entering the oxidizer are too high, the control systems will not be able to regulate the resulting temperature increase. The alarms on the temperature controllers will shut down the system if set temperature limits are exceeded.

The following start-up procedure must be followed to avoid the danger of costly damage to the system. Vapors initially recovered may be very high in concentration. Keep in mind that a substantial period of time is required to reach new equilibrium temperatures after a valve adjustment has been made. About four minutes are required after an adjustment in the dilution valve or the vapor line valve to see an effect on T2. T3 responds much more quickly, and provides an early indication of increased concentration. During a relatively rapid rise in vapor line concentration, T3 responds early by opening the DVC valve.

Note: References to hydrocarbon concentration in this manual refer to total hydrocarbon concentrations in the air stream, excluding methane.

## ALARM SETTINGS

Note: The process temperature (which is the temperature the thermocouple is reading) appears in the upper display on the controller, and the setpoint appears in the lower display (see figure 9).

It is helpful during the startup to be familiar with the alarm settings:

**T1** alarms are **+175°** and **-60° C**, relative to the setpoint.

**T2** alarms are **+20°** and **-300°C**, relative to the setpoint.

**T3** alarm is tripped if the **T3** process temperature reaches **600°C.**

If the process temperatures exceed these limits the system will shut down:

| | |
|---|---|
| T1 setpoint = 330°C, | alarm +175 (shutdown at 505°C) alarm - 60 (shutdown at 270°C) |
| T2 setpoint = 600°C, | alarm + 20 (shutdown at 620°C) alarm - 300 (shutdown at 300°C) |
| T3 setpoint = 580°C, | alarm 600 (shutdown at 600°C) this is a process alarm |

For example:

If the T2 setpoint is 600° and the temperature drops to 299° or lower, the system will shut down and the alarm will flash 600°/LO. To clear the alarm, lower the setpoint to within the alarm limit, and push the AUTO/MAN key.

## INITIAL WARM-UP

**NOTE: The concentration from the vapor source may not be known at the time of start up. Actual concentrations will become more evident as the start up progresses through the steps below.**

**NOTE: FALCO must be warmed up to the reaction temperature (200° C) before hydrocarbons are introduced.**

### VALVE AND SWITCH POSITIONS.

1. **CLOSE** the main vapor line valve.
   This main vapor line **gate** valve should have been installed for collective control of the vapor wells.

2. Loosen the DVC belt by pushing the bottom of the plastic DVC box to the right.
   Remove the belt from the sprocket.
   Open the DVC valve completely.
   Turn **ON** the DVC switch.

3. Adjust the heat exchanger bypass to the **closed** position (wear gloves and see figure 6).
   If the bypass is open, warm-up time will be excessive.

4. Turn **OFF** the heater switch.

5. Turn **ON** the power switch.
   The controller displays should light and, depending on the initial temperatures and temperature settings, the blower may or may not start. The initial temperatures will frequently deviate from the setpoint enough to cause an alarm condition. If this is the case, the lower display will alternately flash the nature of the alarm HI (high) or LO (low), and back to the setpoint. If the blower does not come on because an alarm limit has been exceeded, change the setpoint to be within the alarm limit and press the AUTO/MAN button to reset the alarm. ( See figure 9).

**CAUTION !** **VERIFY THAT THE BLOWER IS TURNING IN THE CORRECT DIRECTION, AND THERE IS FLOW THROUGH THE OXIDIZER. CHECK FOR FLOW BY OPENING THE INFLUENT SAMPLE PORT.**

6. Adjust the T1 controller setpoint to 330° C.
   This may trip a LO alarm.
   The T1 controller has a ramping feature: if the Auto/Man key is pushed, the low alarm is bypassed during startup. The alarm condition will still display, but the blower will start. Push the Auto/Man key if the alarm tripped. The alarm can also be cleared by cycling the power switch, in this case the alarm condition does not display.

7. To stay within the alarm limit, adjust the T2 setpoint 250° C greater than the current temperature displayed in the upper window, but not more than 600°C.
   Keep the T2 setpoint 100° or more above the T1 setpoint.

8. Set the T3 set point to 580°.

   The blower should now be running and there should be airflow through the unit.
   If the blower does not start, it may be necessary to push the auto/man key.

9. Turn **ON** the heater switch. The T1 temperature will begin to rise.

Bringing FALCO up to temperature involves adjusting setpoints to stay within alarm limits.
It may take more than 25 minutes before FALCO warms up to **200° on T1, T2, and T3**
(The T2 temperature will lag behind the T3 temperature on warm up).
This is the minimum temperature (**200°C**) required before introducing hydrocarbons.

After T1, T2 and T3 exceed 200 °C, proceed cautiously with the next step in the operation, which is to gradually begin feeding hydrocarbon vapors to FALCO. At the startup (or early in a recovery operation after wells have been shut for an extended period), vapors from a recovery well may be at very high concentrations.

The belt should still be removed from the DVC sprocket with the DVC switch ON.
Confirm that the bypass is in the closed position. (See figure 6).

## DISPLAY KEY

Push the display key on the T1 temperature controller to familiarize yourself with its operation. Observe the effect on the lower window of the temperature controller where the setpoint appears. (See figure 9) The display window will scroll through the following:

- Setpoint

- Deviation from setpoint.
  The light (DEV) will be lit. This lets the operator know how much the process temperature is deviating from the setpoint.

- Percent of relay load.
  The light ( % OUT ) will be lit. This lets the operator know what percentage of the time the output relay is closed. On the T1 controller, for example, this lets the operator know what percent of time the heater is on.

- Units used (°C) Note: If °F is shown then the controller has deprogrammed -Contact Falmouth Products for reprogramming instruction.

## LOW CONCENTRATION STARTUP

After the preceding initial warm-up, T1, T2, and T3 are now above 200°C.

Begin opening the gate valve on the vapor line in quarter turn adjustments, waiting a full minute between each adjustment, and observe the rate of rise of T3.
Roughly 45 seconds after an adjustment, T3 will start increasing more rapidly.

**Limit the rate of temperature rise of T3 to about 3 seconds per degree by spacing the intervals between valve adjustments.**

After a delay of roughly 4 minutes, T2 will also begin increasing. The catalyst weighs over 100 lb., giving it a large thermal inertia. Consequently, substantial time is required for T2 to respond to changes in vapor line concentration.

When making valve adjustments, always move in small increments and take time to observe the effect. If temperatures rise too rapidly, restrict the vapor line, and wait for the temperatures to become more stable.

**CAUTION!** **IF THE VAPOR LINE IS OPENED TOO QUICKLY THE AUTOMATIC CONTROLS MAY NOT RESPOND FAST ENOUGH TO PREVENT OVERHEATING, AND COSTLY DAMAGE TO THE CATALYST. DO NOT SUDDENLY SHUT DOWN LEAN WELLS.**

**CAUTION !** **IF THE T3 OR T2 TEMPERATURES BEGIN TO RISE VERY RAPIDLY, OR APPEAR TO BE OUT OF CONTROL, TURN SYSTEM OFF IMMEDIATELY USING THE POWER SWITCH. CLOSE ALL VAPOR WELLS AND OPEN THE DILUTION VALVE FULLY. START AGAIN USING SMALLER INCREMENTS. HOWEVER, DO NOT RESTART UNTIL THE T3 TEMPERATURE DROPS BELOW 575° OR TO ITS SETPOINT, WHICHEVER IS LOWER. UPON RESTART, OBSERVE THE TEMPERATURES CLOSELY: IF T3 IS INCREASING INSTEAD OF DECREASING SHUT DOWN AGAIN AND WAIT LONGER TO RESTART THE SYSTEM.**

The vapor line valve is opened in small adjustments, observe the temperatures on T1, T2, and T3.
The T1 setpoint should be 330°C
r T2 reaches 310°C, increase the T2 setpoint to 600°C.
e T3 set point should already be 580°C.

To adjust the bypass, grasp the bypass knob and lift the bypass assembly. Rotate the ballast nut downward on the threaded rod about 3/4". When the assembly is lowered, there will be about 3/4" of exposed thread showing between the bypass nut and the bypass knob at the top.

Observe that the upward drift of T1 has been reversed. If the T1 temperature does not begin decreasing toward its setpoint after five minutes, make an additional opening adjustment in the bypass valve, and again observe T1.

The slow downward movement of T1 will, after a substantial delay, be accompanied by a slowing in the rise of T3. After further delay, the advance of T2 will also slow. Continue opening the bypass to the degree necessary to keep T1 moving downward slowly toward its setpoint.

Adjust the DVC manually in small adjustments toward close (belt disconnected).
If T1 drifts above its setpoint, adjust the heat exchanger bypass to the 1.5" open position.

During these adjustments, the T2 and T3 temperatures may be increasing toward their setpoints. If they increase to a point where the solenoid valve begins to cycle, stop adjusting the DVC valve toward close. Open the DVC valve a turn if the temperatures seem to be rising too rapidly. Reconnect the belt to the DVC and allow time for equilibrium to be reached.

If the concentration is around 1800 ppmv, as we assumed, it should be possible to completely close the DVC valve after adjusting the heat exchanger bypass. Startup will now be completed by putting the DVC belt on. The T1 temperature should be close to or above its setpoint before putting the DVC belt on.

**A substantial period of time (perhaps 15 minutes) may be required before temperatures stabilize due to the large thermal mass of the system.**

If the DVC valve can not be closed without exceeding 550°C on the T3 controller, proceed to the HIGH CONCENTRATION STARTUP section below.

## HIGH CONCENTRATION STARTUP

In the case where the vapor line concentration is very high the same procedures will be followed as with the INTERMEDIATE CONCENTRATION STARTUP discussed previously. However in the present high concentration case T1 temperature will begin to drift above set point much earlier in the procedure.

At sites with very high vapor source concentration and low flow resistance in the vapor system, the catalytic unit may reach full operating temperature and maximum input concentration without fully opening the vapor line. The gate valve on the vapor line may then be restricted to provide sufficient flow through the DVC valve. The DVC valve will still be partly if not fully open when the maximum input concentration adjustment is reached.

As before, the heat exchanger bypass is adjusted open to reverse the upward drift of T1. If the solenoid valve begins to cycle before the vapor line valve is fully open, adjust the vapor line valve toward close just enough to stop the solenoid valve from cycling. In some cases, it will be necessary to leave the vapor line valve slightly restricted when the heat exchanger bypass is adjusted.

If the vapor line valve can be opened completely, proceed with closing adjustments of the DVC valve. The heat exchanger bypass may be opened until the maximum allowable input concentration is reached. Do not open the heat exchanger bypass more than 2 inches.

The startup is completed by putting the belt on the DVC and observing that the adjustments have achieved an equilibrium condition with the solenoid valve **not** cycling. The T1 temperature should be close to or above its setpoint before putting the DVC belt on.

The maximum input concentration adjustment is defined in terms of the set points.
For maximum input concentrations a 310°C minimum setpoint for T1 and a 620°C maximum setpoint for T2 may be used. This allows the maximum spread between the T1 and T2 temperatures.

Note: If the heat exchanger bypass valve is opened too much, the heater (L1 lit on the T1 controller) will turn on at the same time as the DVC and solenoid valves open (L1 lit on the T2 or T3 controllers). This condition should be avoided because it may cause temperature oscillations.

If the heat exchanger bypass has been opened too far, the spread between T1 and T2 must be reduced.
This may be done as follows:

1. Open the dilution valve 1/2 a turn.
2. Close the heat exchanger bypass 1/2".
3. Wait for the DVC to automatically adjust the oxidizer to a new equilibrium.

## EXAMPLE OF CONTROL RESPONSE:

Initial conditions: Concentrations are increasing and the oxidizer responds automatically.

1. The increased inlet vapor concentration makes more combustion heat available increasing the temperatures at T3 and T2. With sufficient increase in inlet concentration, the temperature at either T2 or T3 will approach the setpoints. If the increase in concentration of the supply vapor is very gradual, the T2 set point will normally be reached first and the T2 controller will respond. If the increase in concentration is relatively rapid, the T3 controller will respond to the rising T3 temperature, and start control action well before the temperature reaches the T3 set point. The main purpose of the T3 controller is to provide a rapid response to rapid increases in vapor concentration.

2. Either the T2 or T3 controllers respond by signaling the dilution control to begin adjusting the dilution valve toward open. The solenoid valve also cycles in response to

Possible solution: An alarm limit has been exceeded, interrupting the blower relay. The controllers flash the alarm condition. Bring unit to within alarm limits and clear alarms. When unit starts a snap will be heard. This is the blower relay closing.

2. Problem: FALCO controls turn on, with no alarms present, but blower will not start.

Possible cause: The thermal protection on blower or on blower motor starter has stopped blower, or a float switch on water knockout, if present, may have interrupted the blower motor relay. Thermal cutout on the motor starter may trip due to the high vacuum when the dilution valve closes. As the dilution valve closes, the amperage draw on the blower motor increases. If the blower trips its thermal overload, flow is stopped to FALCO and the heater turns off. Temperatures then drop until a low alarm is shown on the T1 and T2 controllers. Make sure the blower is not exceeding its maximum vacuum and pressure ratings. Check that air is allowed to circulate freely across the blower motor.

Check amperage draw on the blower motor.

If a motor starter has been used, check the adjustment of the overload relay on the starter and adjust or size appropriately for motor horsepower (check trip out current for motor starter). The FALCO-300 uses an adjustable Allen Bradley motor starter located on the rear control panel of the control box. The cut out amperage for the starter may need to be adjusted for blower size.

Make sure the line voltage to the blower is within manufactures specifications. Low line voltage may cause the blower to overheat.

3. Problem: FALCO controls turn on, no alarms present, blower will not start and blower circuit breaker has tripped.

Possible cause: Confirm that the blower will spin over freely by hand. Blowers that have been outside for long periods without operating may freeze up. Ice or corrosion may have accumulated preventing a restart, and tripping the circuit breaker.

4. Problem: Blower starts but no flow gets to FALCO.

Possible causes: Vapor line and dilution valve closed
Very tight soil conditions.
Improper blower rotation.
Piping from blower discharge to FALCO is broken or plugged.
Broken drive belt or couplings on blower.

## HEATER PROBLEMS:

1. Problem: FALCO starts but will not warm up.

Possible causes: Heater switch in off position.

Breaker for heater in off position.

Improperly adjusted controller setpoints. If controller setpoints are not adjusted properly FALCO will not warm up. Confirm that the T2 setpoint is at least 100°C greater than the T1 set point.

No or low air flow to unit. Check for air flow at sample port . FALCO is equipped with a pressure switch that disables the heater circuit, protecting the heater from no or low flow conditions.

Remove the stainless steel pressure switch tube (see figure 1) that runs from the intake manifold to the pressure switch. This tube should be free of obstructions.

High and low pressure ports on the pressure switch should be unobstructed.

2. Problem: FALCO warms up but not all the way to 200° C. System needs to be up to this temperature before feeding in hydrocarbon vapors.

Possible causes: Heat exchanger bypass open. Be sure the bypass is closed

Improper adjustment of controller setpoints. Setpoints need to be gradually increased during the warm-up period.

High flow rate entering FALCO. Flows exceeding 300 CFM may make warm up difficult. It may be necessary to **partially** restrict the DVC valve to achieve 200° C. If 200°C still cannot be achieved, start-up may proceed from 180° C. However, adjustments should be made more **slowly** to the vapor line valve allowing **two** minutes between adjustments until temperatures are up to 230°C. Do not introduce hydrocarbon vapors into FALCO if input temperatures are less then 180°C

## CONTROLLER PROBLEMS

The controllers may exhibit unusual behavior if they are too cold. The control box has a thermostat controlled electric heater inside that will keep the controllers at the appropriate temperatures for proper operation (above 30° F). **In very cold conditions (outside temperatures of less then 25° F) the outside of the control box must be insulated.**

1. Problem: Alarm can not be cleared with the Auto/Man key.

Possible cause: Process temperatures are not within alarm limits.

2. Controllers will not turn on.

Possible cause: Circuit breakers are not turned on at the breaker box. If the controllers still will not turn on, turn off the main circuit breaker and check the 2 fuses (1.5 Amp.) on the rear control panel (tip - out fuse holders # 1and #2.) If the fuses have blown and the breakers are on, small lights will light up on these terminal blocks.

3. Controller is reading in °F rather than °C

Possible cause: Controller has deprogrammed. This can be verified by pushing the display key. This key will show the following in succession:

- Setpoint
- Deviation from setpoint
- Percent of relay load
- Units used (this should read °C)

If units used reads in °F the controller has deprogrammed and FALCO should not be run until the controller has been reprogrammed. Contact Falmouth Products for a programming sheet and technical assistance.

## PROBLEMS WITH CONVERSION EFFICIENCY

FALCO does not destroy methane completely at its normal operating temperatures. Therefore, when using a Flame Ionization Detector methane may show up in the output emissions. Methane tends to be present at older gasoline spills. By taking two output samples, one with an activated carbon tip, and one without, the true emissions may be determined. If conversion efficiency is being determined based on input and output concentrations, it will be necessary to subtract the methane from concentrations entering FALCO as well as exiting.

At low input concentrations the percentage destruction efficiency is generally lower then the destruction at high input concentrations. This is due to the lower average treatment temperature at low input concentration. However the absolute emission while operating at low input concentration is generally lower then while operating at high input concentrations.

For example: assume the input concentrations are 2000 PPM and emissions are 10 PPM. Then conversion is 10/2000=.005 or 99.5% conversion. However, if the input concentration is 100 PPM and the emissions are 10 PPM, then the conversion is 10/100= .1 or 90% conversion. The conversion efficiency may then be lower, but the overall emissions are the same.

## HIGH OUTPUT EMISSIONS

Possible causes:

1. High methane concentrations in the influent stream.
   Check for methane with a carbon tip if using an FID.
   Check calibration of your test instrument.

2. Low influent temperature.
   Check T1 setpoint if you are operating at low concentrations with the heater on. Normal setpoint is 310°. This setpoint may be increased in increments of 5°C to a maximum of 370°C. Check emissions after FALCO has reached equilibrium after each increase in setpoint. Increasing input temperatures generally will increase conversion.

3. High influent flow rate.
   Check flow rate in CFM going into FALCO. The FALCO - 300 is designed for flow rates up to 300 CFM. High input flow rates decrease hydrocarbon residence time within the catalyst, making complete conversion more difficult. At high input concentrations, slightly higher flow rates may yield acceptable conversion because of higher operating temperatures. At low input concentrations and high flow rate, the electric heater may have trouble maintaining high enough input temperatures for good conversion.

4. Catalyst settling.
   The catalyst in the FALCO 300 is comprised of 1/8" ceramic spheres with a platinum catalyst deposited on them. This catalyst is contained in a chamber which is screened on two sides to allow the vapors to flow through horizontally. Excessive catalyst bed settling may reduce conversion efficiency. The fill level may be checked and topped off through the fill plugs (see figures 1 and 2 for component locations).
   **Caution: Before opening these fill plugs make sure that all flow through the unit has stopped. Use lockout on breaker box. The catalyst will be hot. Wear gloves, protective clothing, and safety glasses.**
   Remove the rectangular heat guard on the top of the unit.
   Remove fill plugs on the top of the catalyst chamber. The plugs are under the pressure switch and thermocouple conduit body.
   Pour new catalyst into the catalyst chamber. A **clean** flathead screwdriver may be used to gently distribute catalyst toward the ends of the chamber.

5. Catalyst poisoning, masking, and overheating.
   The FALCO 300 catalyst can be deactivated by certain poisons and contaminants. Vapor streams should be analyzed before operation. If poisoning is suspected, a catalyst sample may be removed from the fill tubes discussed in section 4 for analysis. Avoid running water into the oxidizer. Water can transport solids and mineral salts that may mask or poison the catalyst. Always install a filter on the vapor line prior to the blower to capture particulate. The platinum catalyst used on the FALCO 300 can be poisoned by certain compounds. Poisons such as phosphorus and silicone coat the catalyst. Halogens such as chlorine will attack the platinum deposited on the catalyst converting it to an inactive form. Sulfur may mask the catalyst. Operation of the unit at temperatures lower than 300°C may cause incomplete combustion. Deposits of carbon on the catalyst may result in reduced efficiency. Overheating must be prevented. Temperatures exceeding 640°C will reduce catalyst activity by reduction of active surface area. If necessary, the catalyst may be changed by vacuuming the old catalyst out through the fill tubes, and pouring in new catalyst.

FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA. 02541 PHONE 508 548 6686 FAX 508 548 8144

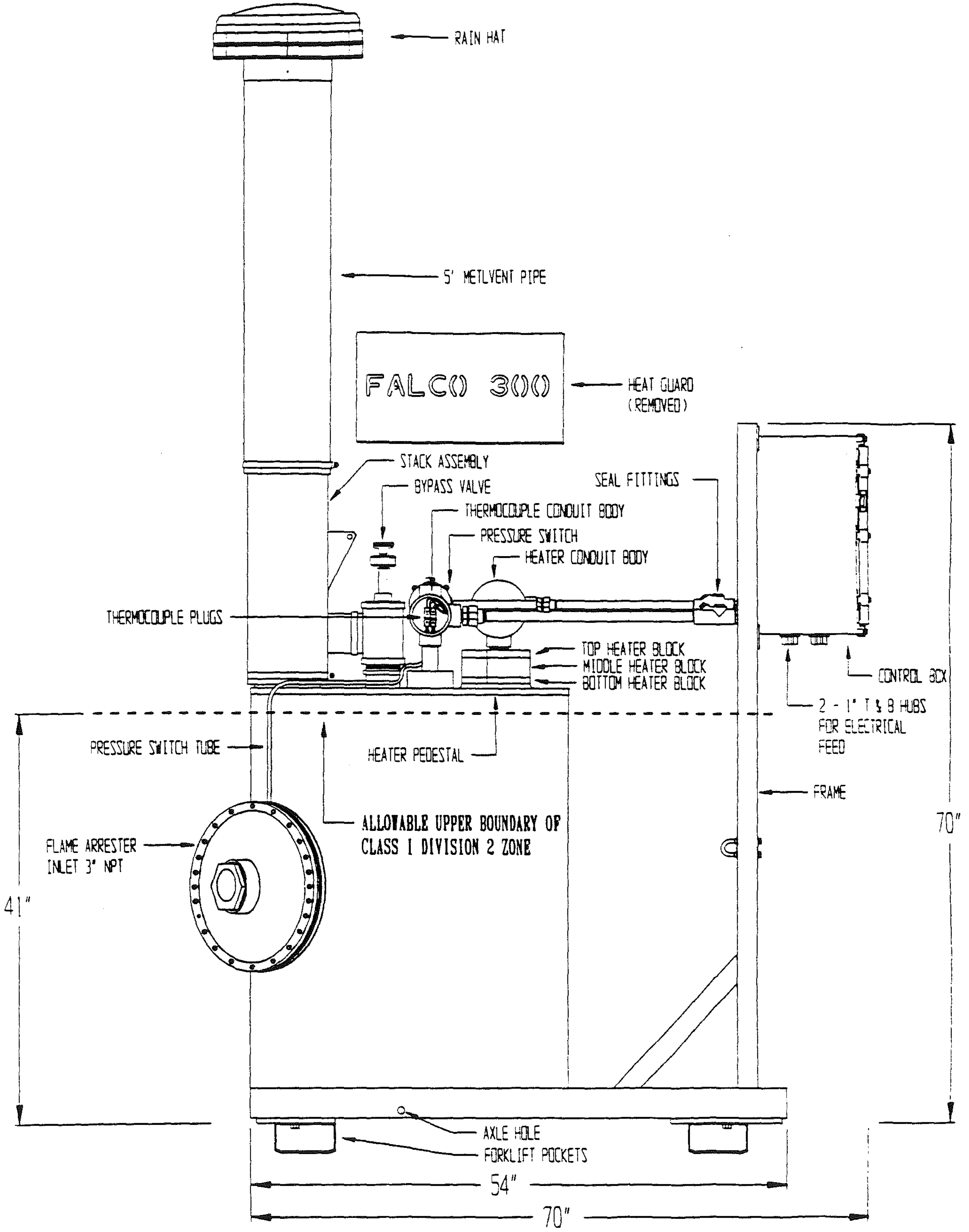


FIGURE 1
FALCO 300 MAJOR COMPONENTS - SIDE VIEW

LAST REVISON 10-13-97

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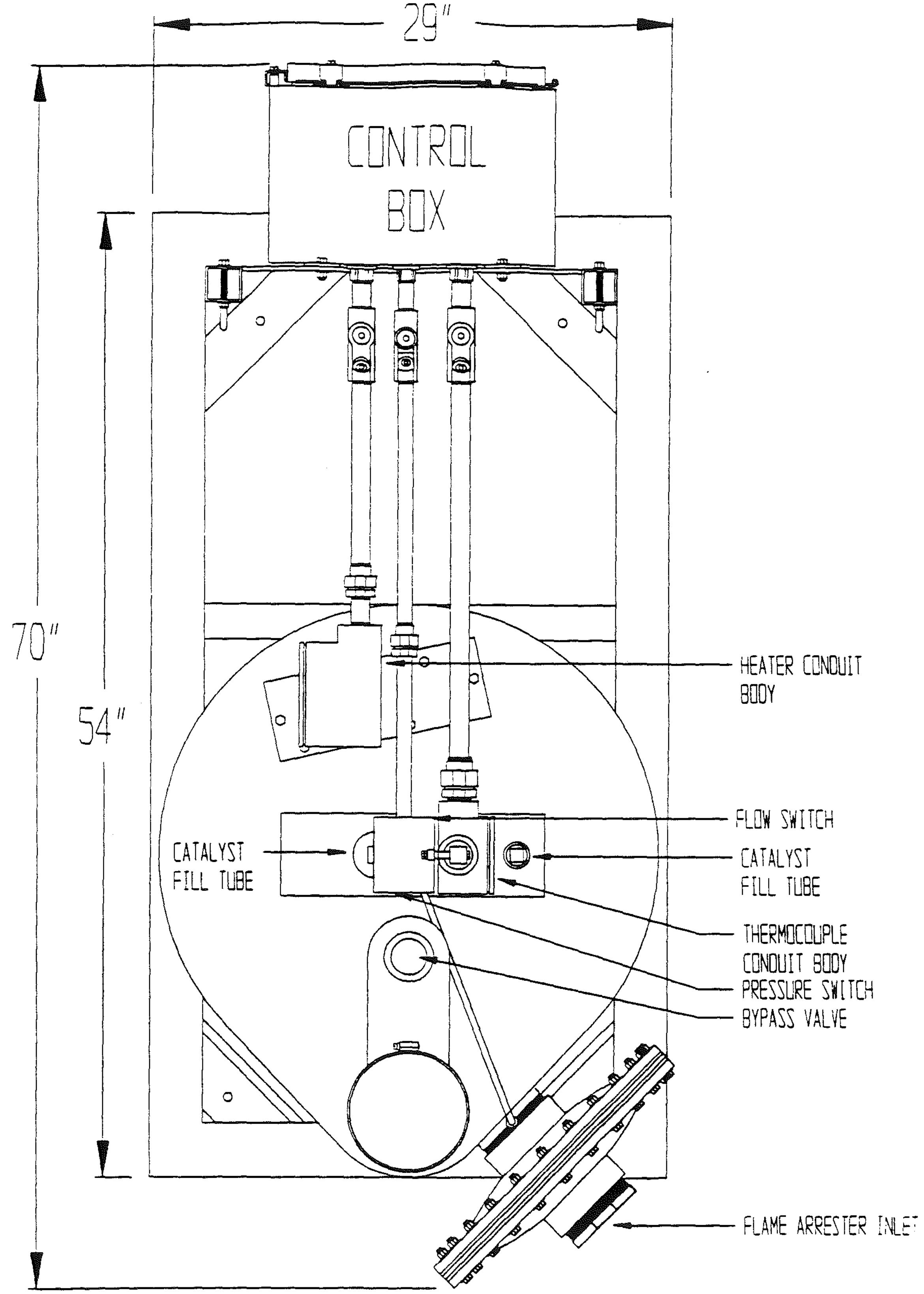

FIGURE 2
FALCO 300 MAJOR COMPONENTS - TOP VIEW

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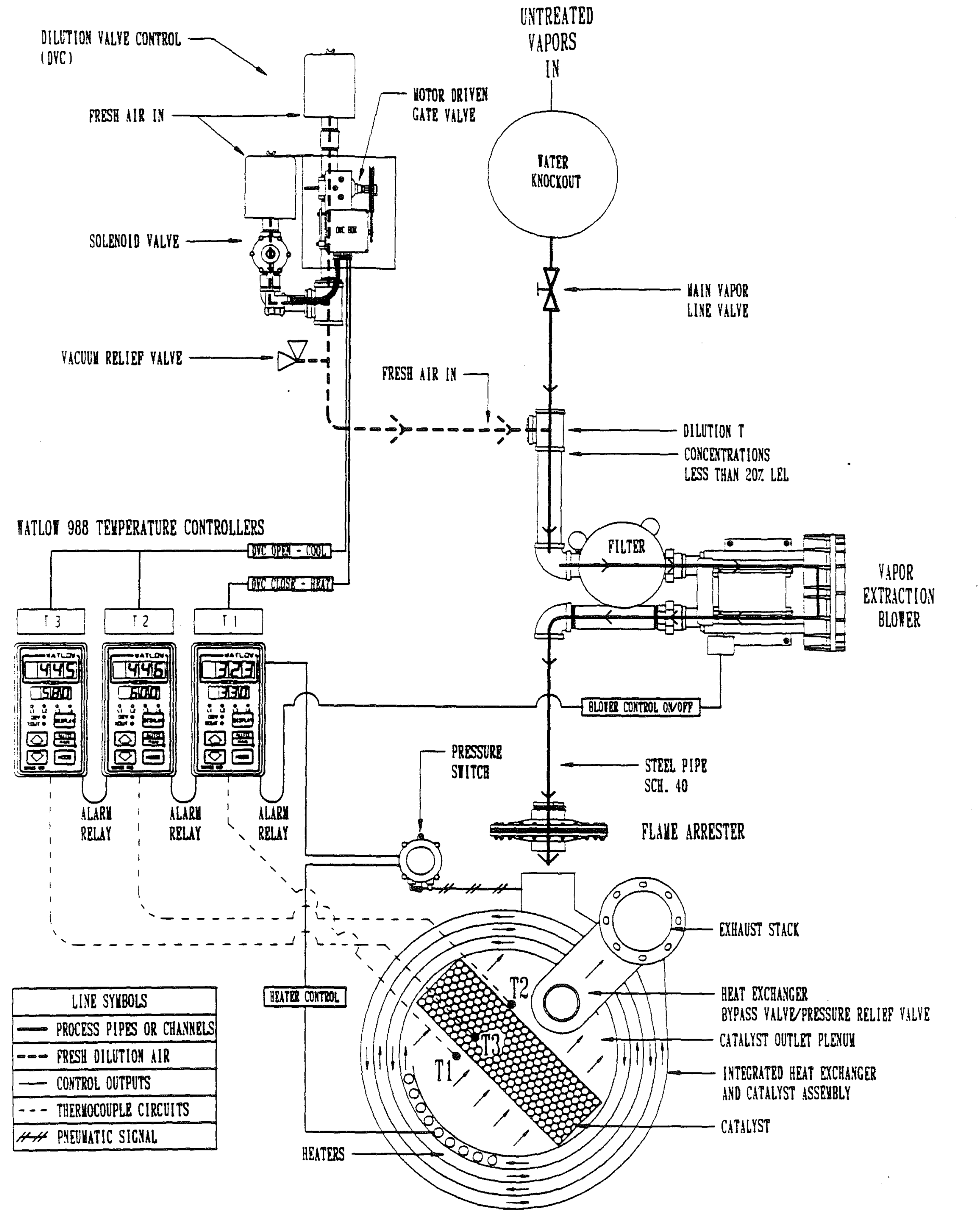

FIGURE 3 FALCO 300 FLOW AND CONTROL

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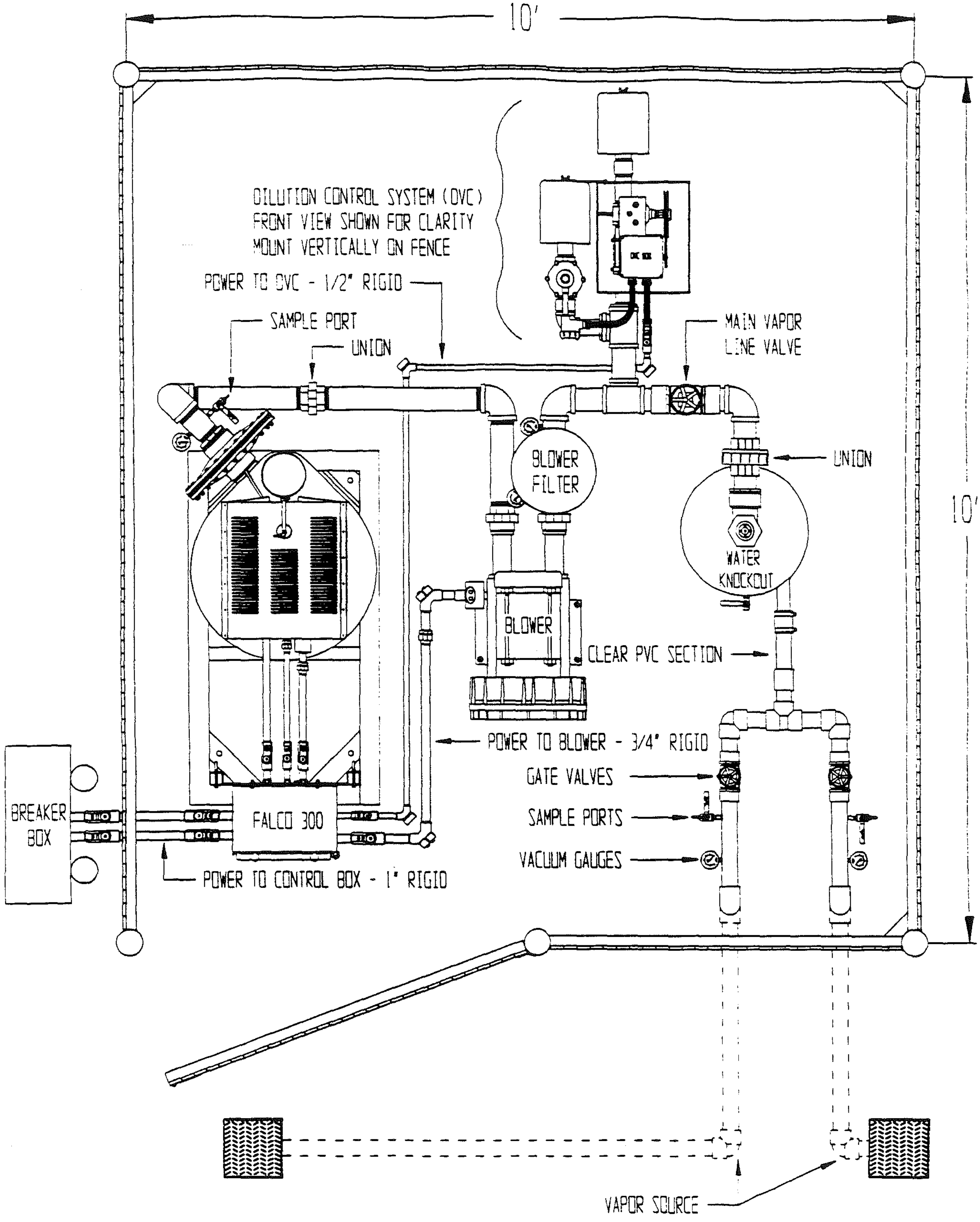

FIGURE 4
PLAN VIEW OF INSTALLATION

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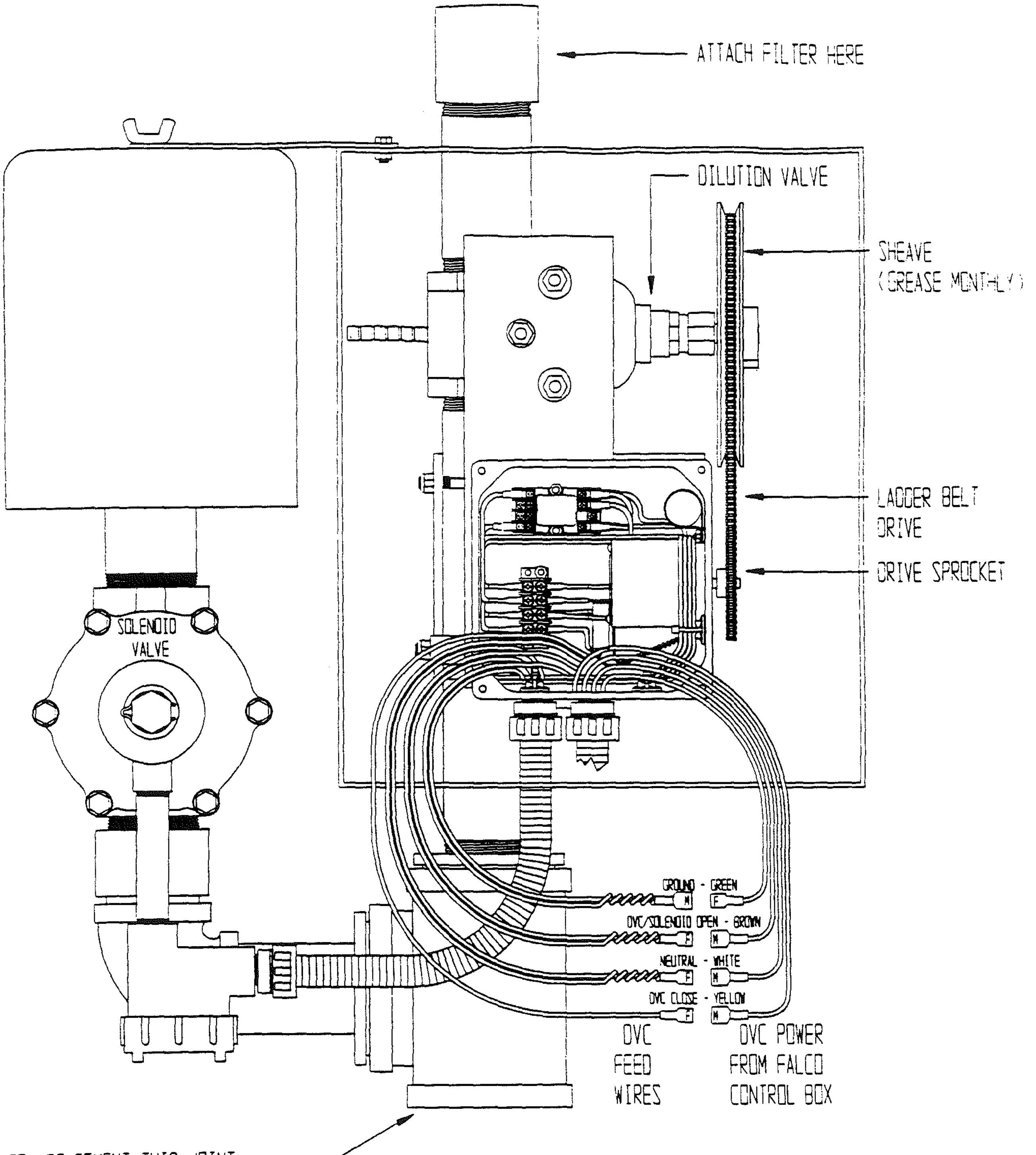

DO NOT CEMENT THIS JOINT
SO IT MAY BE USED AGAIN.
PIPE TO VACUUM SIDE OF BLOWER
AFTER WATER KNOCKOUT

FIGURE 5
DILUTION VALVE CONTROL

LAST REVISION 10-06-97

*FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA. 02541 PHONE 508 548 6686 FAX 508 548 8144*

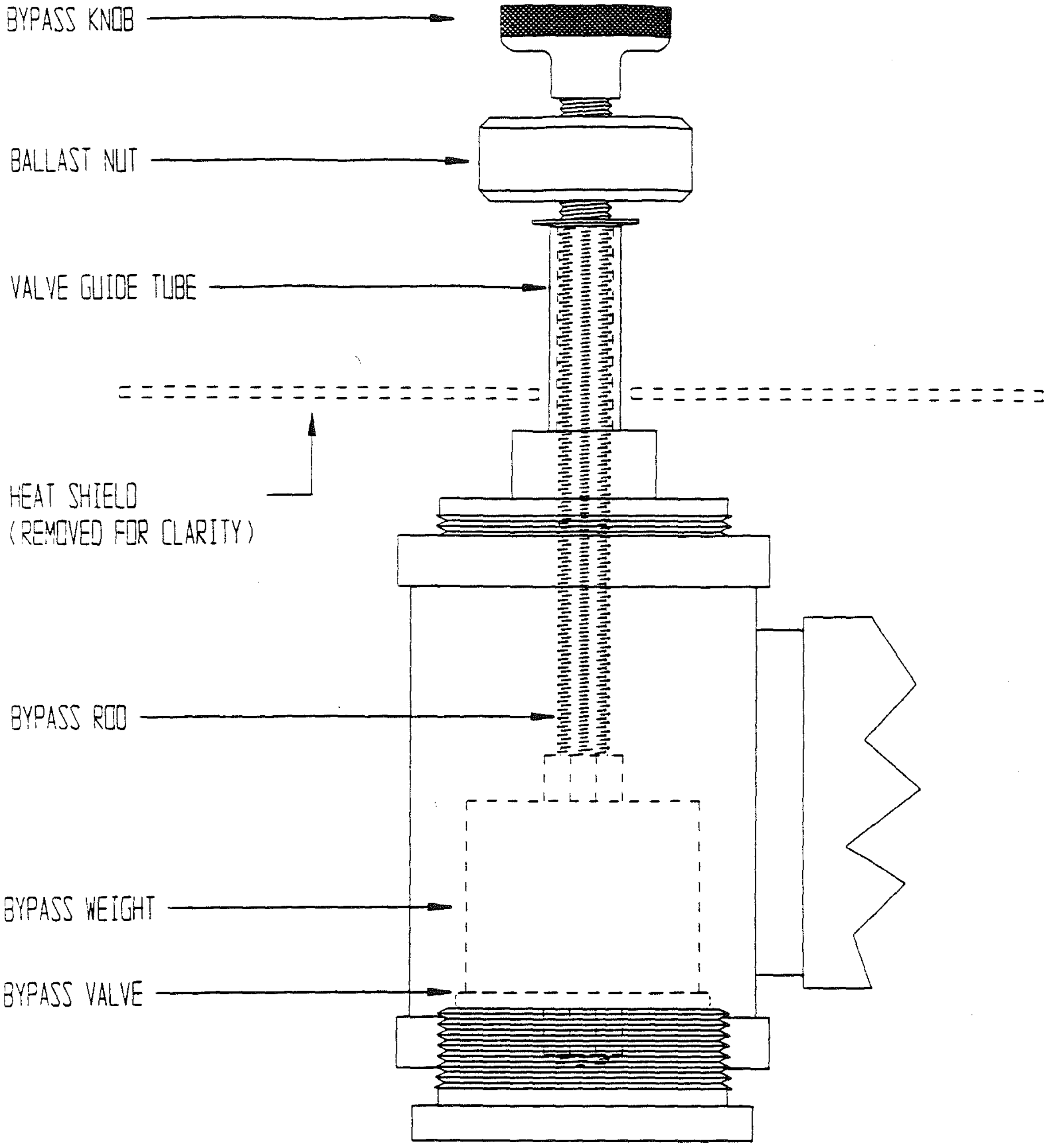

FIGURE 6
BYPASS VALVE - CLOSED POSITION

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# ADJUSTMENT:

1. PUT ON GLOVES, COMPONENTS SHOULD BE ADJUSTED BY HAND AND MAY BE HOT.
2. GRASP BYPASS KNOB AND LIFT ASSEMBLY UPWARD
3. TURN BALLAST NUT CLOCKWISE BY HAND TO INCREASE BYPASS, COUNTERCLOCKWISE BY HAND TO DECREASE BYPASS. (MUST HOLD BYPASS KNOB BY HAND WHILE TURNING BALLAST NUT)
4. LOWER VALVE ASSEMBLY AND OBSERVE EFFECT OF ADJUSTMENT ON CATALYST TEMPERATURES.

# IMPORTANT:

ADJUSTMENTS, EITHER OPEN OR CLOSED, SHOULD NOT EXCEED 1/2" VALVE MOVEMENT AT A TIME. WAIT AT LEAST 15 MINUTES BETWEEN ADJUSTMENTS.

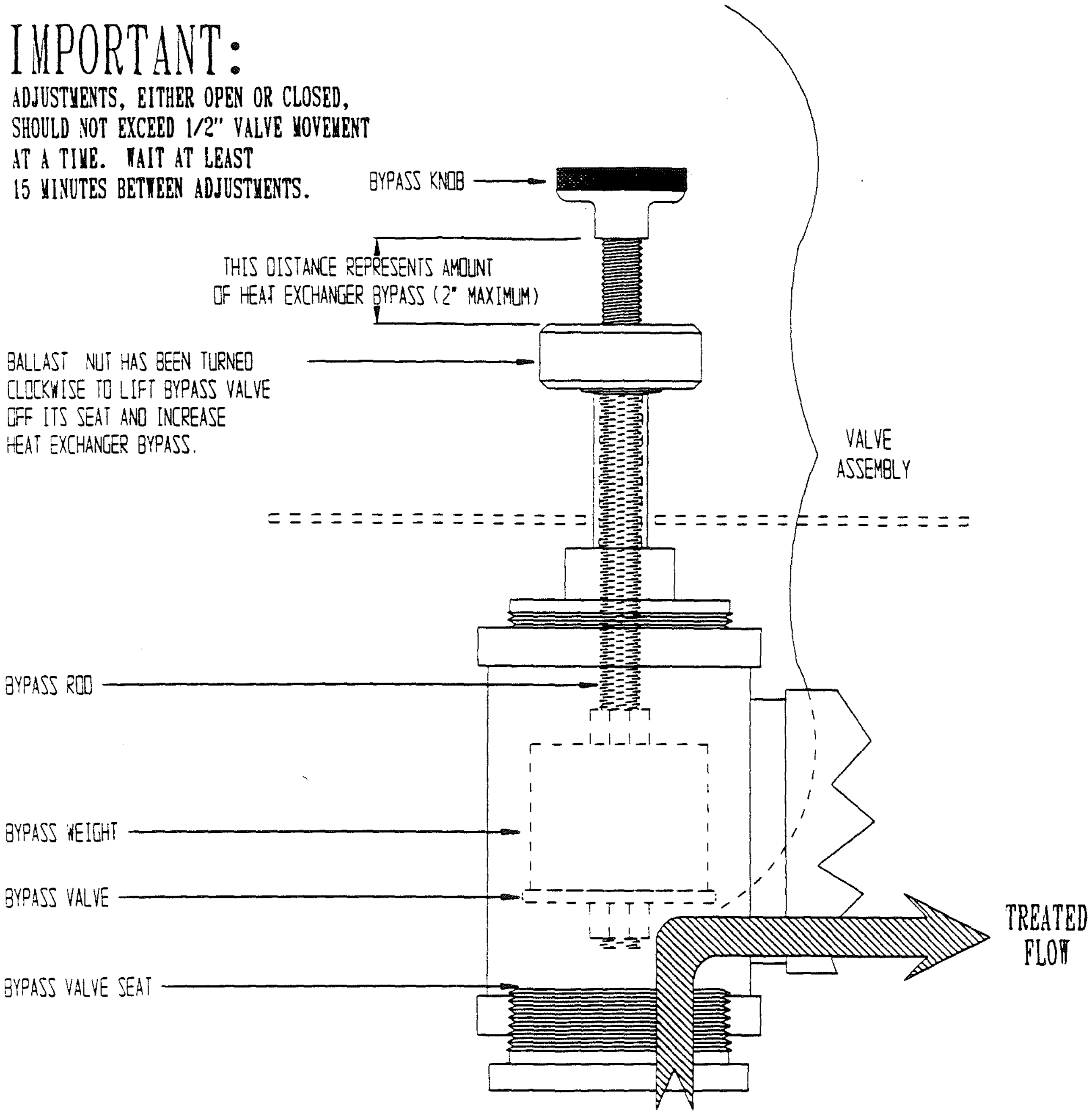

FIGURE 7
BYPASS VALVE - PARTIALLY OPEN POSITION

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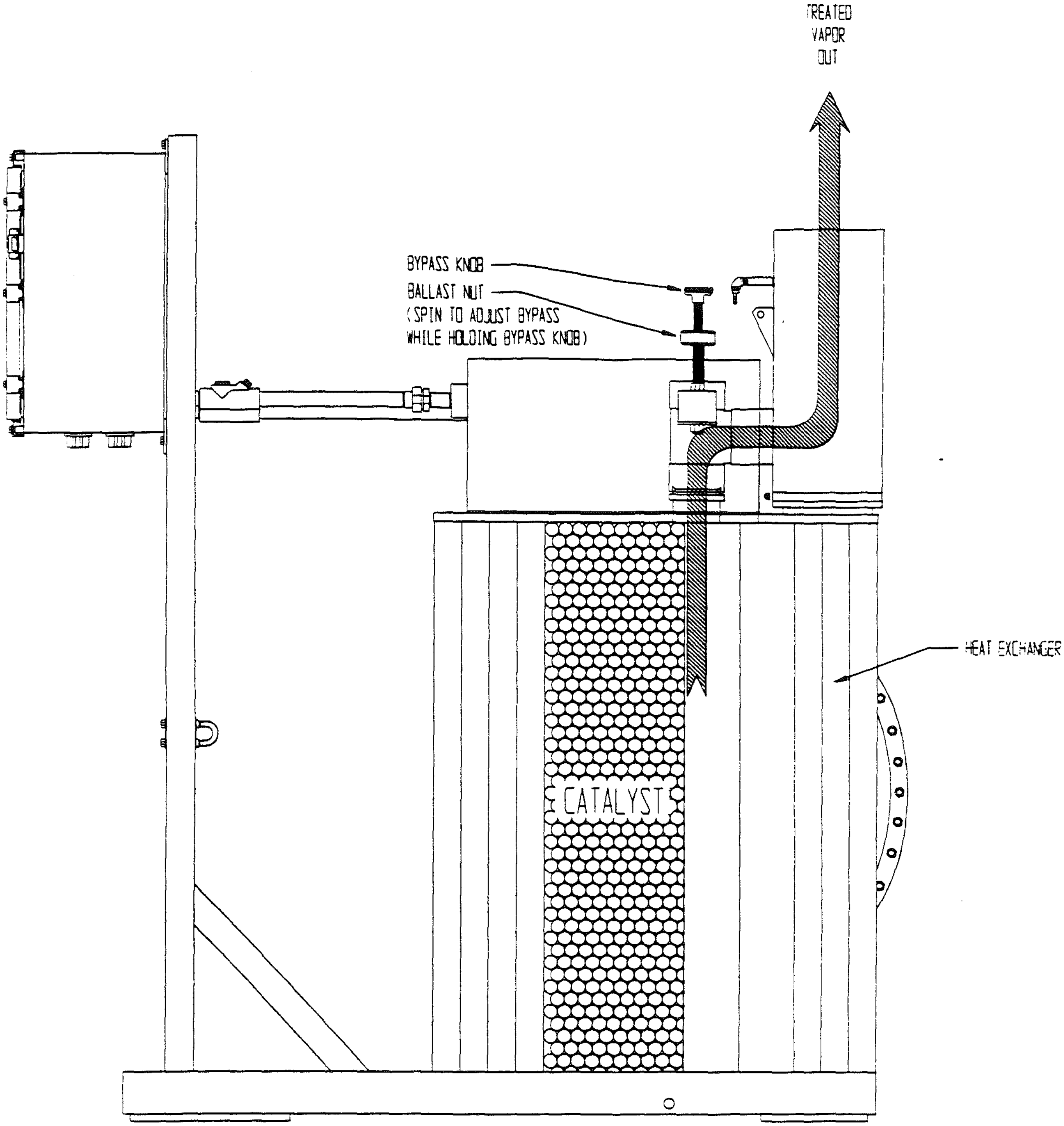

FIGURE 8
MANUAL BYPASS VALVE - OPEN POSITION

LAST REVISION 10-06-97

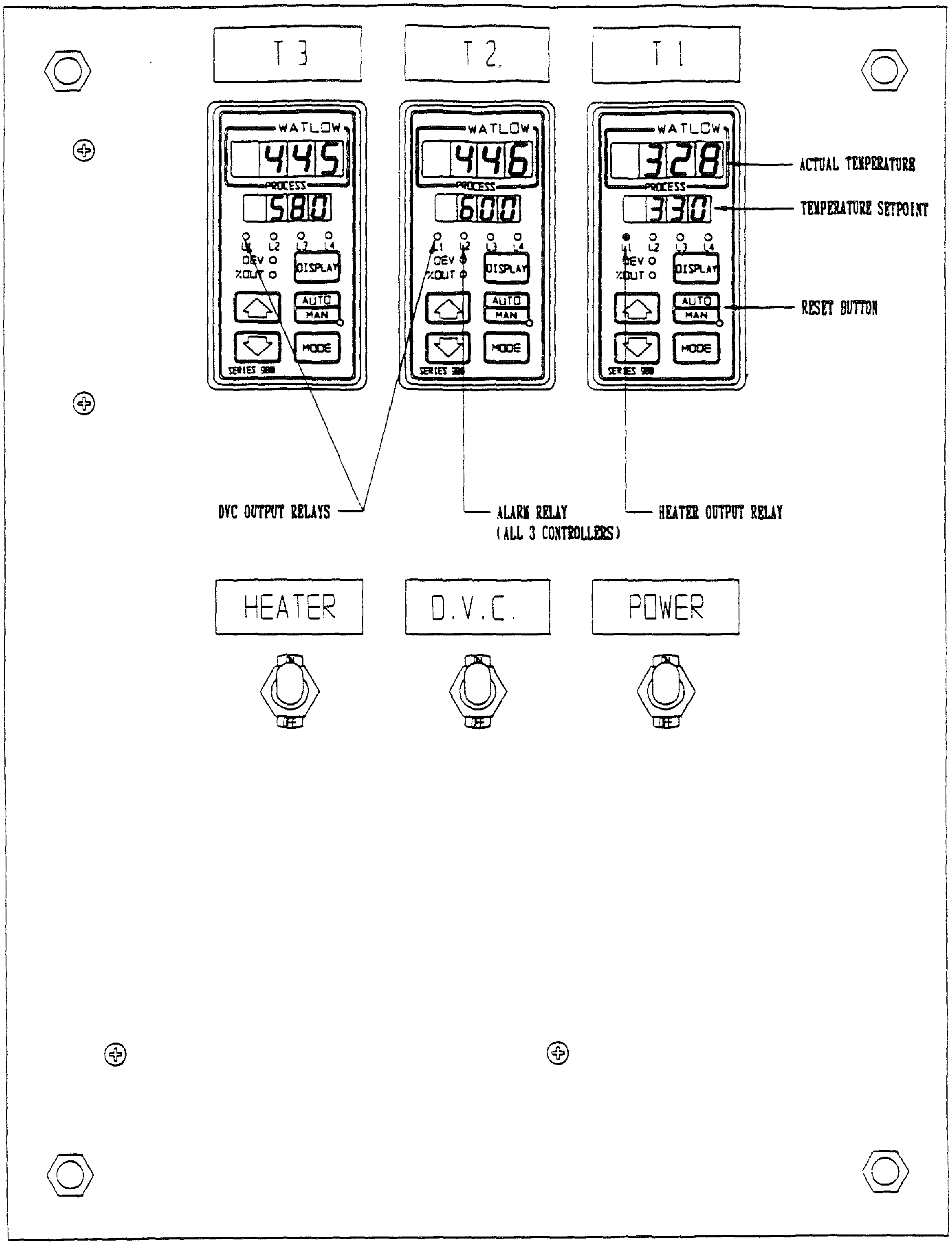

FIGURE 9
CONTROL PANEL

LAST REVISION 10-13-97

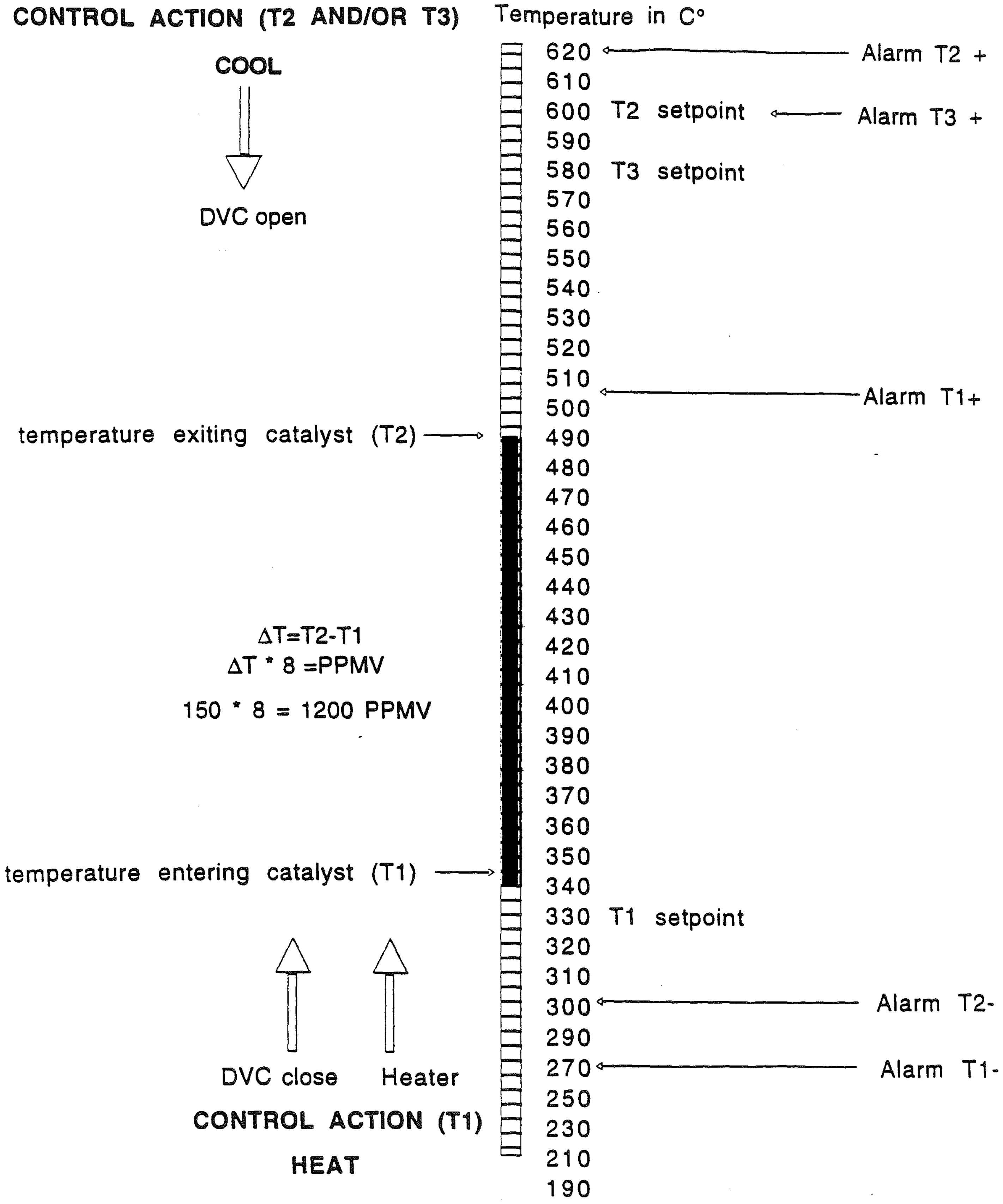

**FIGURE 10 OPERATING LIMITS** REV. 10-10-97

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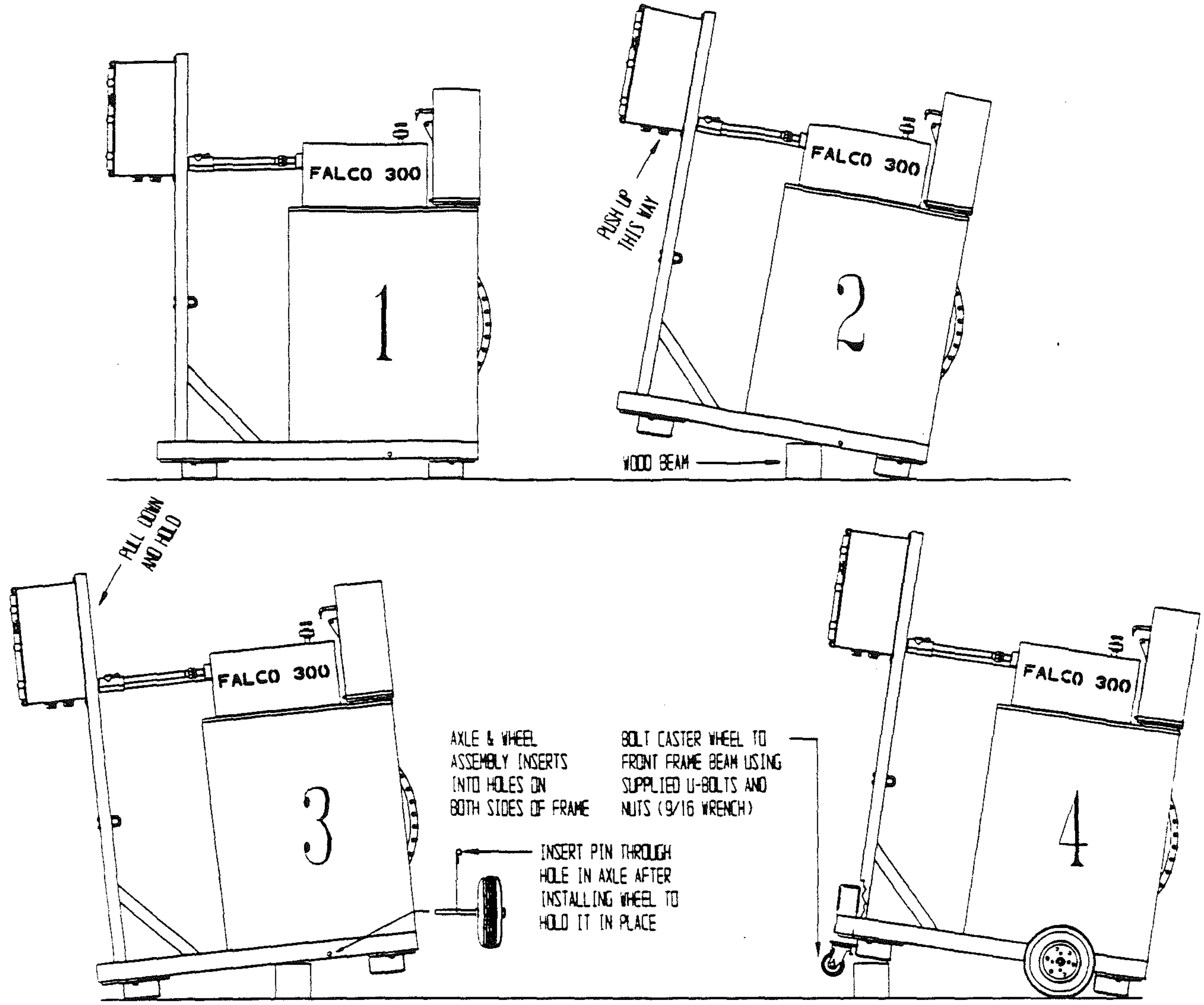
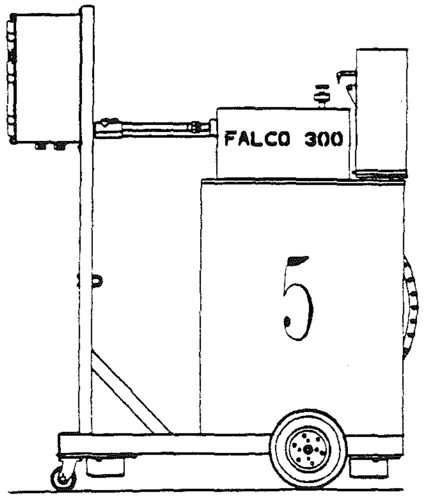


AXLE & WHEEL ASSEMBLY INSERTS INTO HOLES ON BOTH SIDES OF FRAME

BOLT CASTER WHEEL TO FRONT FRAME BEAM USING SUPPLIED U-BOLTS AND NUTS (9/16 WRENCH)

INSERT PIN THROUGH HOLE IN AXLE AFTER INSTALLING WHEEL TO HOLD IT IN PLACE

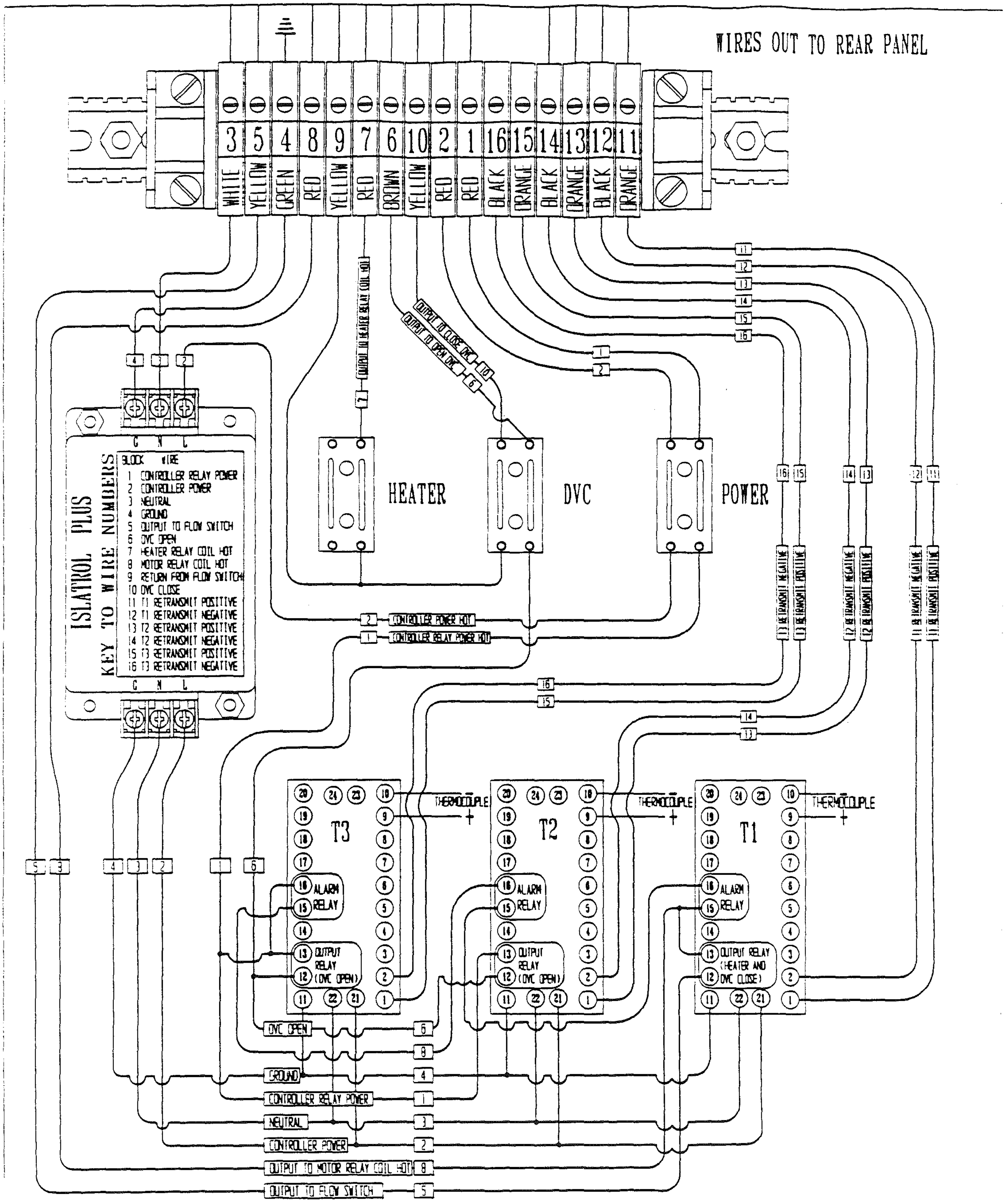


1. FALCO ON GROUND
2. PICK UP FRONT OF FALCO, AND HAVE HELPER PLACE WOODEN BEAM AS FAR BACK AS POSSIBLE UNDER FRAME.
3. PULL FRONT OF FALCO DOWN, AND HOLD. HAVE HELPER INSERT AXLES INTO HOLES IN FRAME, AND PIN IN PLACE.
4. REMOVE WOODEN BEAM, AND PLACE UNDER FRONT FORKLIFT POCKET. FASTEN CASTER WHEEL ON FRONT BEAM OF FRAME.
5. FALCO READY FOR MOVING.

FIGURE 11

FALCO 300 WHEELS FOR MOVING SHORT DISTANCES BY HAND

LAST REVISION 10-13-97



ISLATROL PLUS

KEY TO WIRE NUMBERS

| BLOCK | WIRE |
|---|---|
| 1 | CONTROLLER RELAY POWER |
| 2 | CONTROLLER POWER |
| 3 | NEUTRAL |
| 4 | GROUND |
| 5 | OUTPUT TO FLOW SWITCH |
| 6 | DVC OPEN |
| 7 | HEATER RELAY COIL HOT |
| 8 | MOTOR RELAY COIL HOT |
| 9 | RETURN FROM FLOW SWITCH |
| 10 | DVC CLOSE |
| 11 | T1 RETRANSMIT POSITIVE |
| 12 | T1 RETRANSMIT NEGATIVE |
| 13 | T2 RETRANSMIT POSITIVE |
| 14 | T2 RETRANSMIT NEGATIVE |
| 15 | T3 RETRANSMIT POSITIVE |
| 16 | T3 RETRANSMIT NEGATIVE |

FIGURE 12 WIRING FALCO 300 FRONT PANEL

LAST REVISION 09-30-97

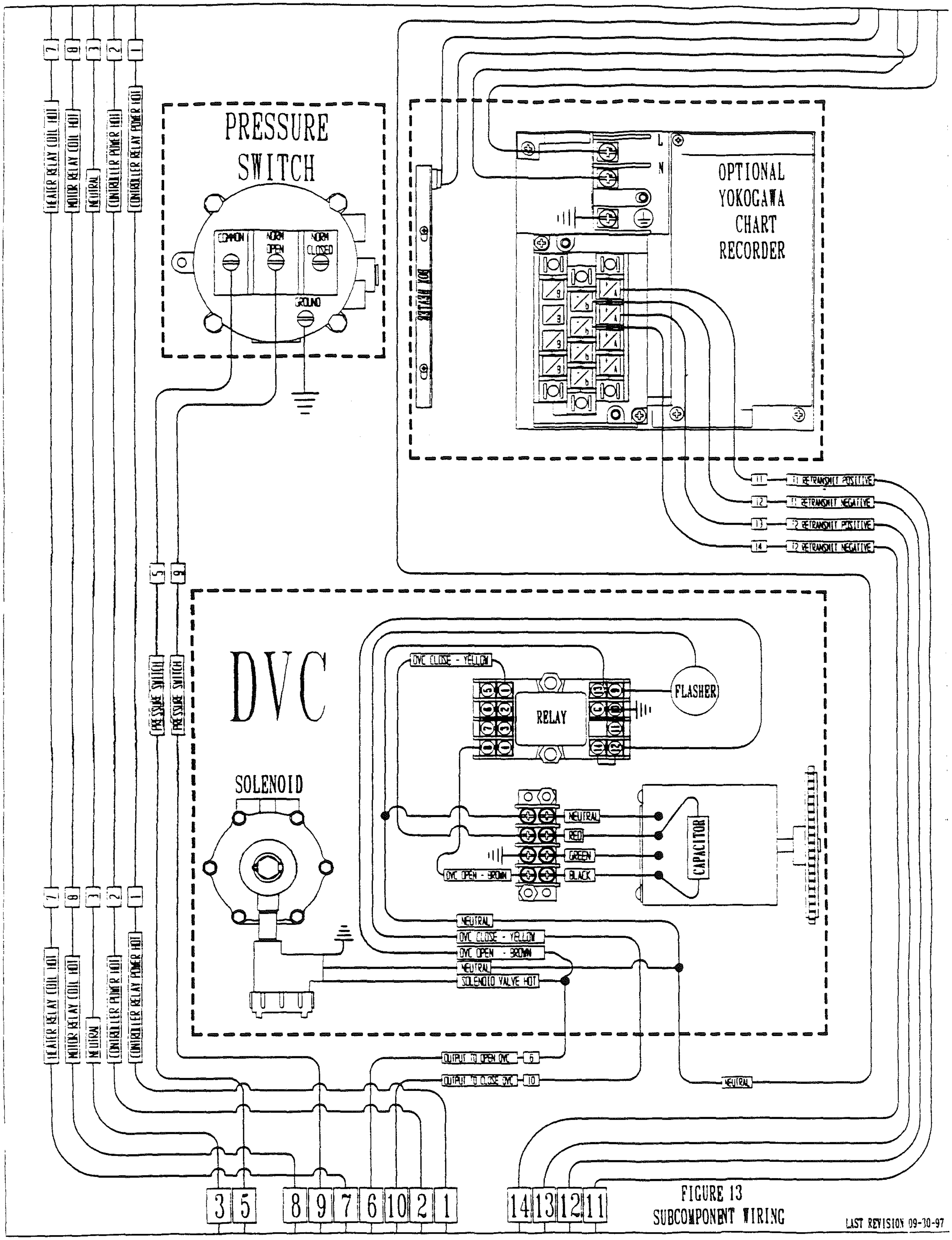


FIGURE 13
SUBCOMPONENT WIRING

LAST REVISION 09-30-97

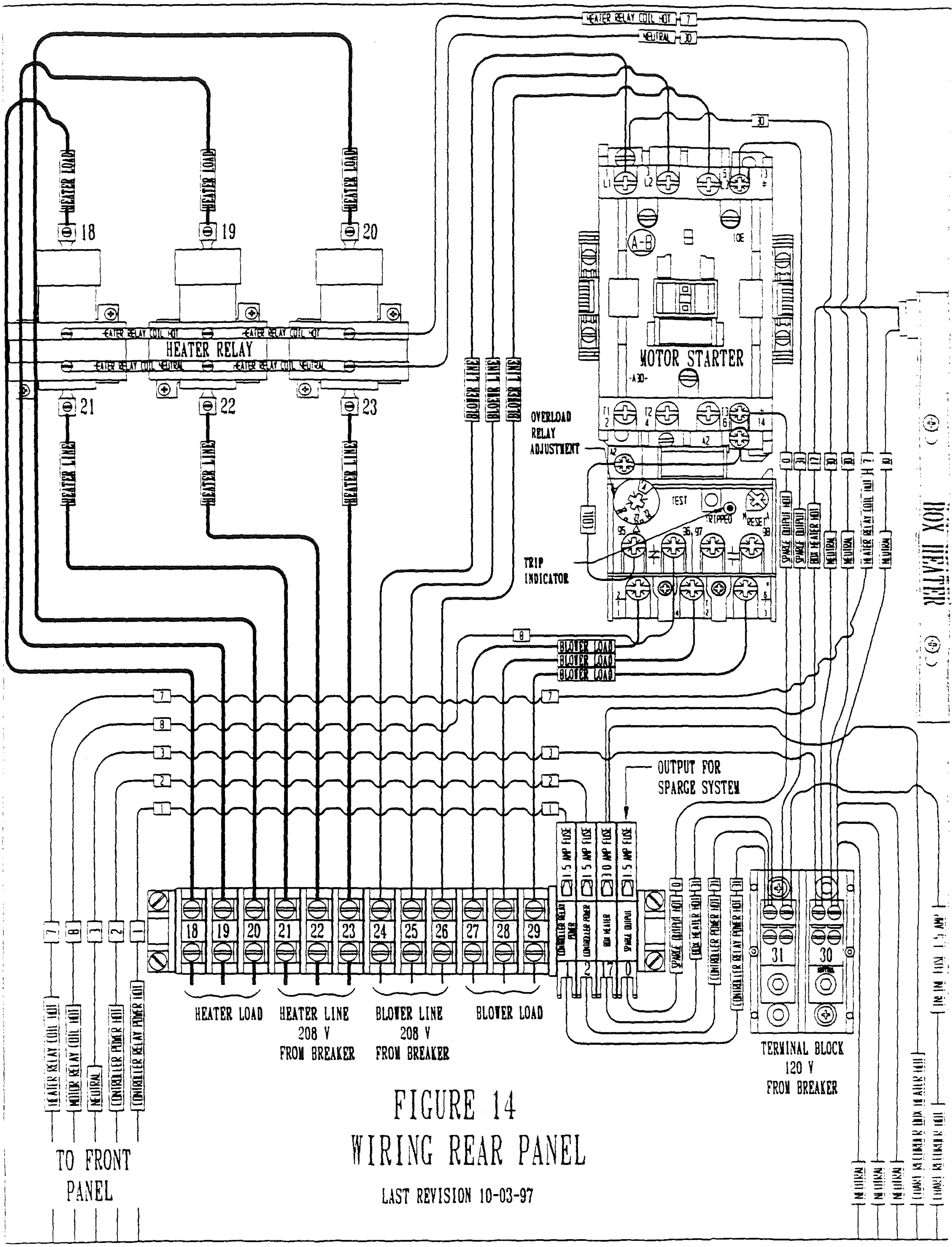


FIGURE 14
WIRING REAR PANEL

LAST REVISION 10-03-97

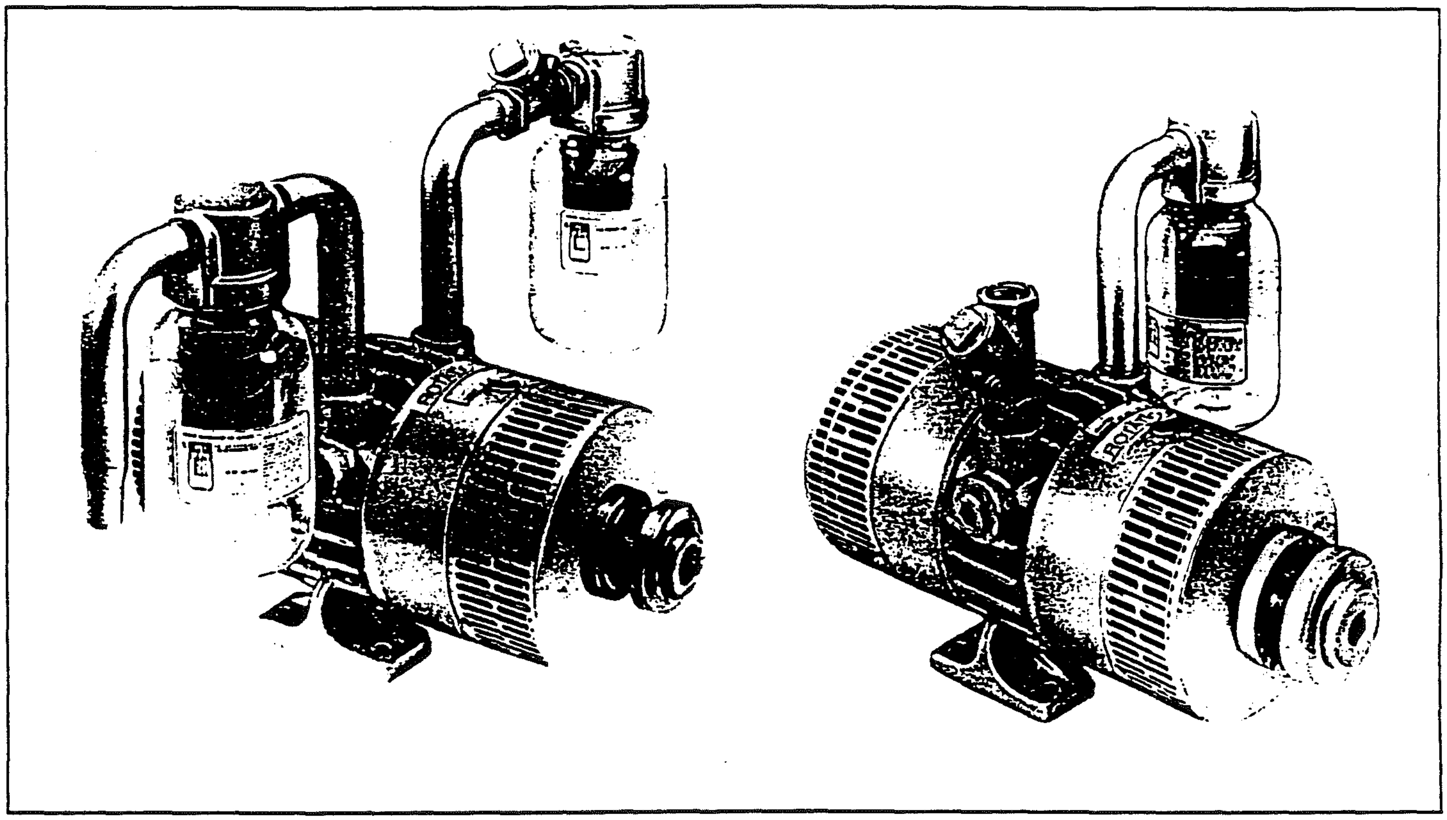
# APPENDIX D

# AIR SPARGING SYSTEM MANUFACTURER DATA

# Air Sparging Equipment

70-700 G425PL (Rev. B)

# 6066 OILLESS VACUUM PUMPS AND COMPRESSORS OPERATION & MAINTENANCE TECHNICAL MANUAL



## CONTENTS:

KEEP THIS DOCUMENT FOR FUTURE REFERENCE

This is the hazard alert symbol: ⚠ When you see this symbol, be aware that personal injury or property damage is possible. The hazard is explained in the text following the symbol. Read the information carefully before proceeding.

The following is an explanation of the three different types of hazards:

| | |
|---|---|
| ⚠ **DANGER** | Severe personal injury or death will occur if hazard is ignored. |
| ⚠ **WARNING** | Severe personal injury or death can occur if hazard is ignored. |
| ⚠ **CAUTION** | Minor injury or property damage can occur if hazard is ignored. |

## GENERAL INFORMATION

This pump is only to be used for the purpose of pumping air and under no circumstances be used with any other gases. The pump must not be used for the pumping of fluids, particles, solids or any substance mixed with air, particularly combustible substances likely to cause explosions.

⚠ **DANGER** Do not pump flammable or explosive gases or operate the unit in an atmosphere containing them.

⚠ **CAUTION** The exhaust air of this pump can become very hot. Do not direct exhaust air towards property that is temperature sensitive.

⚠ **CAUTION** The pump is designed for air only. Do not allow corrosive gases or particulate material to enter the pump. Water vapor, oil-based contaminants, or other liquids must be filtered out.

Ambient temperature should not exceed 40C (104°F). For operation at high temperatures, consult the factory.

Performance is reduced by low atmospheric pressure found at high altitudes. Consult a Gast distributor for details.

Never lubricate this oil-less rotary vane pump. The sealed bearings are grease-packed. The service life of the carbon vanes will be reduced by petroleum or hydrocarbon products.

## INSTALLATION

⚠ **CAUTION** Do not lift the unit by the fan shrouds. The unit should be lifted by means of the eye bolt.

⚠**WARNING** To avoid risk of electrocution do not use this product in an area where it could come in contact with water or other liquids. If exposed to the elements it must be weather protected.

⚠ **CAUTION** Do not block the flow of cooling air over the pump in any way.

⚠**WARNING** Some models are equipped with glass jars. Proper measures should be taken to guard against the fragmenting or braking of glass if an alternative material is not used. If hazard is ignored severe personal injury or death can occur.

### MOUNTING THE PUMP

The pump may be installed in any orientation as long as the flow of cool, ambient air over the pump is not blocked. To reduce noise and vibration, mount to a stable, rigid operating surface.

### PLUMBING

To prevent air flow restriction, use pipe and fittings that are the same size or larger than the threaded ports of the pump. The ports are marked "IN" and "OUT".

### ACCESSORIES

Intake and exhaust filters are external to the pump and will provide adequate filtration for most applications. Check filters periodically and replace when necessary. Consult a Gast Representative for additional filter recommendations. Install relief valves and gauges at the inlet or outlet, or both, to monitor performance. Check valves may be required to prevent backstreaming through the pump.

## WIRING

⚠**WARNING** Incorrect wiring can result in electric shock. Wiring must conform to all required safety codes and be installed by a qualified person. Grounding is required. All power to the motor must be de-energized and disconnected when servicing.

### ELECTRIC MOTOR CONTROL

The motor must be protected against short circuit, overload and excessive temperature rise. Fuses, motor protective switches and thermal protective switches provide the necessary protection in these circumstances. Fuses only serve as a short circuit protection of the motor (wiring fault). Fuses in the incoming line should be chosen so as to be able to withstand the starting current of the motor, not as a protection against overload. Motor starters, incorporating thermal magnetic overload or circuit breakers protect the motor from overload or reduced voltage conditions. Selection of the correct overload setting is required to provide the best possible protection. Refer to the motor starter manufacturer's recommendations.

### ELECTRIC MOTOR CONNECTION

Refer to the motor nameplate for wiring diagram. If the motor fails to start or slows down under load, shut the pump off and unplug. Check that the supply voltage agrees with the motor nameplate. Be sure the three phase motor turns in the proper direction of rotation after installation. Turning in the wrong direction will drastically reduce vane life.

## OPERATION

**⚠WARNING** Solid or liquid material exiting the unit can cause eye or skin damage. Keep away from air stream.

**⚠WARNING** Always disconnect the power before servicing. The motor may be thermally protected and will restart automatically when it cools if the thermal protection switch is tripped.

**⚠WARNING** Do not operate without both the coupling guard and shroud in place. Failure to do so could result in severe personal injury.

**⚠ CAUTION** Do not operate units above recommended pressures or vacuum duties. To do so will damage the unit.

**⚠WARNING** Beware of any exposed and/or movable part. Proper guards should be in place to prevent personal and/or property damage.

### STARTING

If the pump is extremely cold, let it warm up to room temperature before starting. If the pump does not operate properly, see the troubleshooting guide.

**⚠WARNING** Some of these models may exceed 85 dB(A). When in close proximity to these models hearing protection is required. See Technical Data Sheet (if provided), for specific model(s).

## MAINTENANCE AND INSPECTION

Regular inspection can prevent unnecessary damage and repairs. The intake and exhaust filters require periodic inspection and replacement. Initial inspection is suggested at 500 hours, then the user should determine the frequency. Most problems can be prevented by keeping filters clean. Dirty filters decrease pump performance and can decrease pump service life.

### FILTER INSPECTION AND REPLACEMENT

**⚠WARNING** The pump surfaces may become very hot during operation. Do not touch these parts until the pump has been turned off and allowed to cool.

Refer to the proper exploded view during the following procedure.

With the pump turned off and isolated from power supply, and all pressure and vacuum is released from the pump, remove the felts from the intake and exhaust filters and wash them in a solvent. When clean and dry, replace them.

### FLUSHING

Flushing of the pump is accomplished by removing the filter assemblies and while the pump is running, add several tablespoons or spray solvent directly into the intake port. Recommeded is Gast flushing solvent part number AH255B.

**⚠WARNING** Do not use kerosene, gasoline or any flammable liquid.

**⚠WARNING** Flush unit in a well ventilated area. Eye protection is recommended. Keep face away from exhaust port.

After solvent has passed through the pump, replace the filter assemblies.

Before putting tthe pump back into service, ensure that any external accessories such as relief valves and gauges have not been damaged.

## SHUTDOWN PROCEDURES

Proper shutdown procedures must be followed to prevent pump damage. Failure to do so may result in premature pump failure. The Gast Manufacturing rotary vane non-lubricated vacuum pumps and compressors are constructed of ferrous metals or aluminum which are subject to rust and corrosion when pumping condensable vapors such as water.

Follow the steps below to assure correct storage and shutdown between use:

1. NEVER oil this non-lubricated pump.
2. After using the pump, disconnect plumbing and allow the pump to run "open" for at least 5 minutes before shutdown.
3. Be sure to plug open ports so dirt and other contaminants do not enter the unit. It is now ready for shutdown or storage.

## SERVICE KIT INSTALLATION

NOTE: Gast will not guarantee the performance of a field rebuilt pump. You can return the pump to a Gast authorized service facility, or perform the rebuild procedures described below.

Each service kit contains most or all of the following: bearings, vanes, gaskets, and filter elements.

## SERVICE KIT INSTALLATION

Follow these general steps to install the kit:

### PUMP DISASSEMBLY:

1. Disconnect the pump from the electrical power.

⚠ **WARNING** You must disconnect the pump from electrical power before servicing it. Failure to do so can result in severe personal injury or death.

2. Vent all air lines to the pump to remove pressure.

⚠ **WARNING** You must vent all air lines to the pump to remove pressure before servicing it. Failure to do so can result in severe personal injury.

3. Remove the dead end shroud, fan & fan spacer.

4. Use a wheel puller to remove the dead-end plate and bearing from the pump body; note the direction of the bevel edge on the vane. Do not damge the dowel pins between the end plate and the body. Save the bearing spacer on the dead-end of the shaft for reassembly. Remove the snap ring from the end plate. Save the snap ring, belleville springs, and washer for reassembly.

5. Remove the bearing from the dead-end plate.

6. Check the exposed surfaces of the rotor, body, and end plate for scoring. If you find no scoring, you can perform a Minor Rebuild to replace only the vanes and the dead-end bearing. If you find severe damage, perform the Major Rebuild:

### MINOR REBUILD:

7. Install the new vanes supplied with the kit. Be careful to face the vane bevels in the proper direction (as noted in step 4).

8. Place end plate over the shaft with dowel pins aligned. Place bearing spacer on dead end of shaft. Place the new bearing in its bore in the dead end plate. Be careful to press only on the inner bearing race.

9. Install and tighten the pump body bolts. Install the belleville springs with the washer between them, and the snap ring.

### MAJOR REBUILD:

7. Remove the drive end cap. Use a wheel puller to remove the drive end plate and bearing from the body. Do not remove or damage the dowel pins in the body. Save the bearing spacer and endplate gasket for reassembly.

8. Place one of the new bearings in its seat in the drive-end plate, then place one of the shoulder rings on the drive-end of the shaft. Using an arbor press, press the bearing onto the shaft. Be careful to press only on the inner bearing race. Tighten the pump body bolts.

9. Install the new vanes supplied with the kit. Be careful to face the vane bevels in the proper direction (as noted in step 4).

10. Perform step #8 from Minor Rebuild.

11. Install the belleville springs with the washer between them, and the snap ring. Install and tighten the pump body bolts.

12. Apply a thread-lock adhesive and start the drive end cap into its thread in the drive end plate, but do not tighten it.

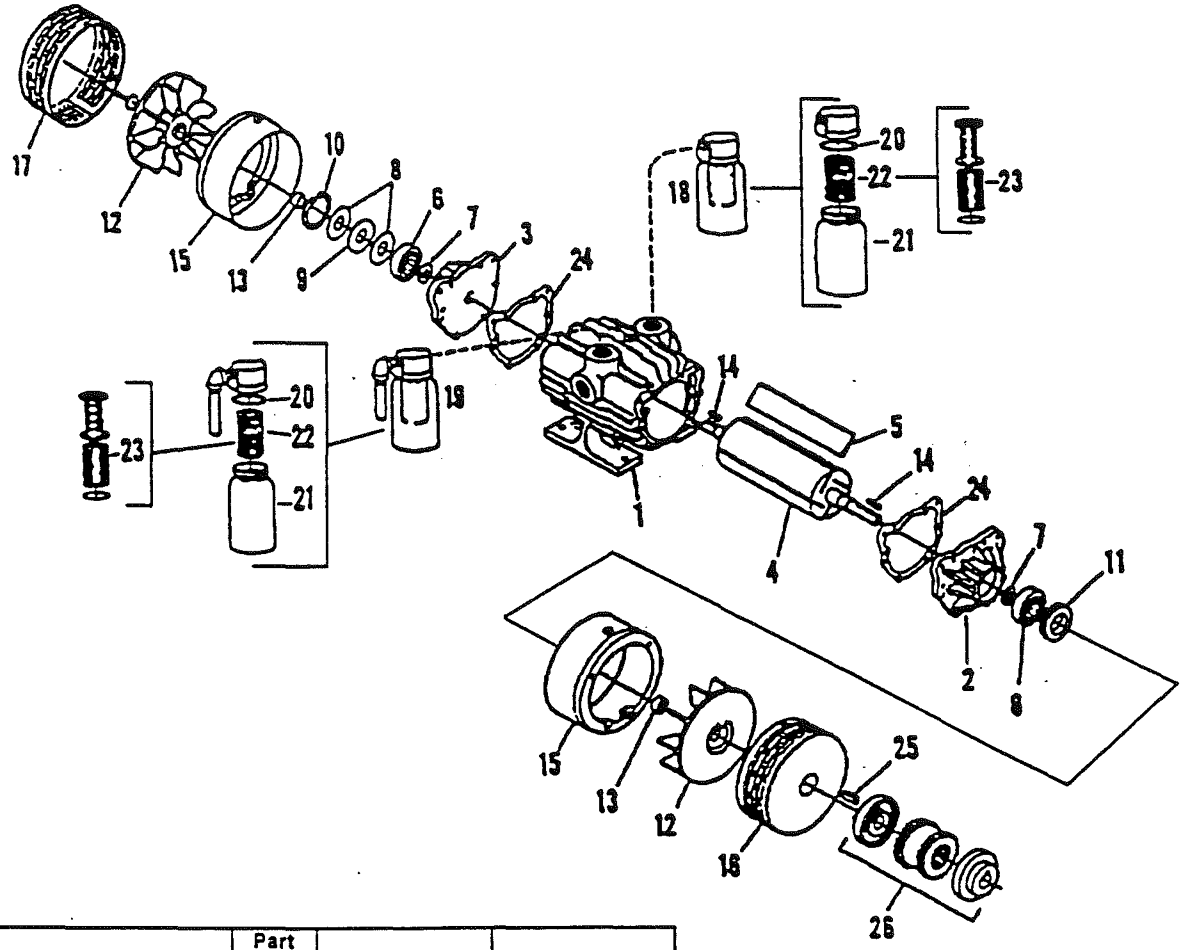
13. Place a dial indicator against the dead-end of the shaft to measure axial movement. Tighten the drive end cap until the indicator show .002" to .003" of the shaft movement against the belleville springs.

14. Replace the filter elements.

## TROUBLE SHOOTING GUIDE

| Reason for Problem | Low Vacuum | Low Pressure | High Vacuum | High Pressure | Pump Overheating | Motor Overload |
|---|---|---|---|---|---|---|
| Filter dirty | X | X | at pump | | X | X |
| Muffler dirty | | X | | at pump | X | X |
| Vacuum line collasped | X | | at pump | | X | X |
| Relief valve set too high | | | X | X | X | X |
| Relief valves set too low | X | X | | | | |
| Plugged vacuum/pressure line | X | X | at pump | at pump | X | X |
| Vanes sticking | X | X | | | | |
| Running at too high RPM | | | X | X | X | X |
| Vanes worn (replace) | X | X | | | | |
| Shaft seal worn (replace) | X | X | | | | |
| Dust or offset powder in pump | X | X | | | X | X |
| Motor not wired correctly | X | X | | | X | |

# 6066 PARTS ORDERING INFORMATION



| Ref. No. | Description | Part Qty | 6066-P102 | 6066-V103 |
|---|---|---|---|---|
| 1 | Body | 1 | AC309 | AC309 |
| 2 | End Plate, Drive | 1 | AE293 | AE293 |
| 3 | End Plate, Dead | 1 | AE294 | AE294 |
| 4 | Rotor Assembly | 1 | AE295A | AE295A |
| ◊5 | Vane | 4 | AK738 | AK738 |
| ◊6 | Bearing | 2 | AB964B | AB964B |
| 7 | Bearing Shoulder Ring | 2 | AB926T | AB926T |
| 8 | Belleville Spring | 2 | AB791 | AB791 |
| 9 | Shim Washer | 1 | AB792 | AB792 |
| 10 | Retaining Ring | 1 | AB793 | AB793 |
| 11 | End Cap | 1 | AB790 | AB790 |
| 12 | Fan | 2 | AK735 | AK735 |
| 13 | Fan Spacer | 2 | AE299 | AE299 |
| 14 | Square Key | 2 | AB136A | AB136A |
| 15 | Shroud | 2 | AE300A | AE300A |
| 16 | Fan Guard Asmb., Drive | 1 | AK736 | AK736 |
| 17 | Fan Guard Asmb., Dead | 1 | AK737 | AK737 |
| 18 | Intake Filter Assembly | 1 | AD560 | AD560 |
| 19 | Muffler Assembly | 1 | | AD560B |
| ◊20 | Cover Gasket | 1<br>2 | AD562 | <br>AD562 |
| 21 | Jar | 1<br>2 | AD563A | <br>AD563A |
| 22 | Filter Element Assembly | 1<br>2 | AD750 | <br>AD750 |
| ◊23 | Filter Felt | 1<br>2 | AD752 | <br>AD752 |
| 24 | Body Spacer | 1<br>2 | AE315B | AE315B |
| 25 | Key, Coupling | 1 | AB136D | AB136D |
| 26 | Coupling Assembly | 1 | AE765 | AE765 |
| 27 | Check Valve (not shown) | 1 | AH326B | AH326B |
| | Service Kit | 1 | K503 | K503 |

◊ Denotes parts included in the service kit.
Parts listed are for stock models. For specific OEM models, consult the fact
When corresponding or ordering parts, please give model and serial numbe

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## AUTHORIZED SERVICE FACILITIES

Gast Manufacturing Corp
2300 Highway M-139
Benton Harbor, MI 49023
TEL: 616-926-6171
FAX: 616-927-0808

Gast Manufacturing Corp
505 Washington Ave
Carlstadt, NJ 07072
TEL: 201-933-8484
FAX: 201-933-5545

Brenner Fiedler & Assoc.
13824 Bentley Place
Cerritos, CA 90701
TEL: 800-843-5558
TEL: 310-404-2721
FAX: 310-404-7975

Gast Manufacturing Co., Ltd
Beech House, Knaves Beech
Business Centre, Loudwater
High Wycombe, Bucks HP 10 9SD
England
TEL: 44 628 532600
FAX: 44 628 532470

Wainbee Limited
215 Brunswick Blvd.
Pointe Claire, Quebec
Canada H9R 4R7
TEL: 514-697-8810
FAX: 514-697-3070

Wainbee Limited
5789 Coopers Avenue
Mississauga, Ontario
Canada L4Z 3S6
TEL: 416-213-7202
FAX: 416-213-7207

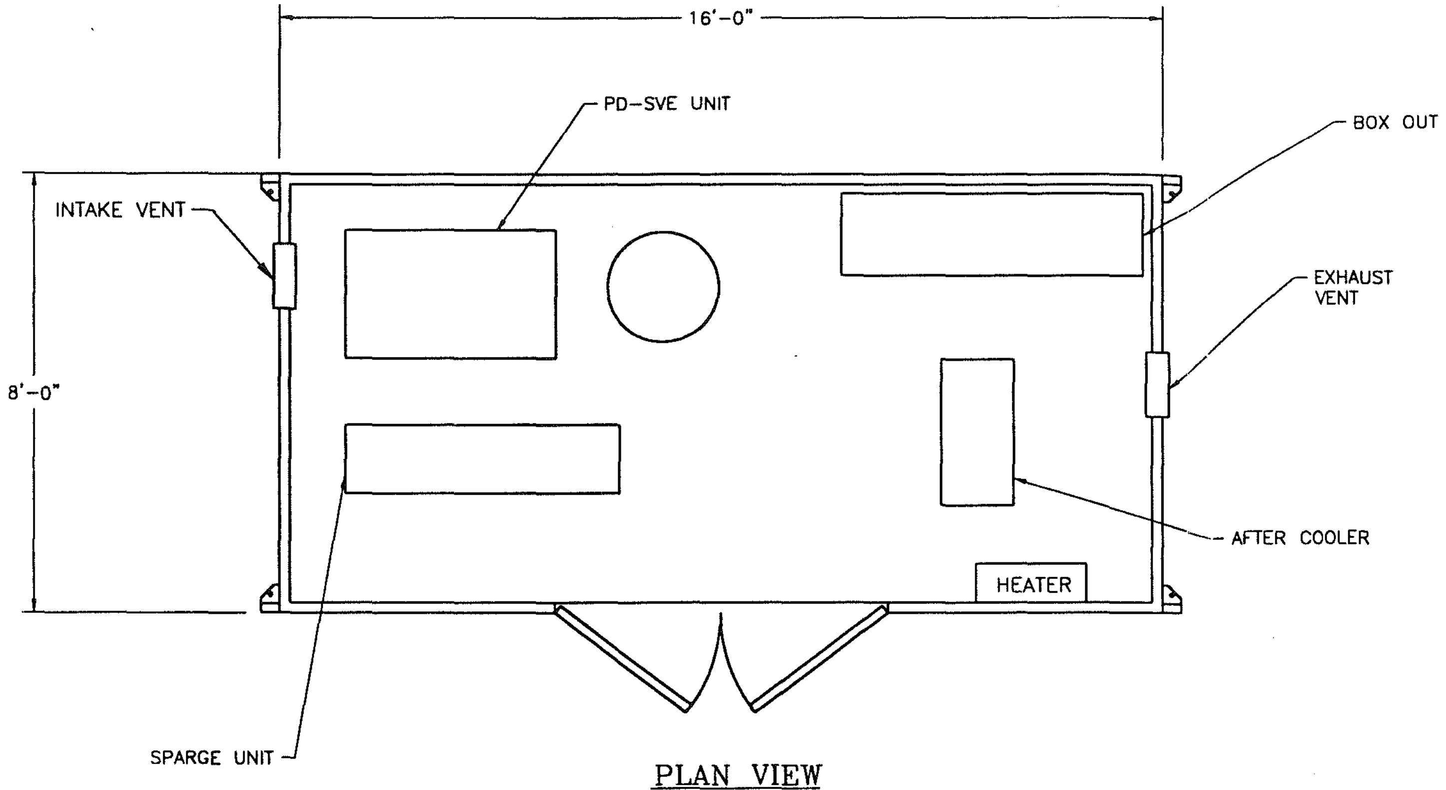
Japan Machinery Co. Ltd.
Central PO Box 1451
Tokyo, 100-91 Japan
TEL: 81-3-3573-5421
FAX: 81-3-3571-7865
or: 81-3-3571-7896

NOTE: General Correspondence should be sent to—
Gast Manufacturing Corp.
P O Box 97
Benton Harbor, MI 49023-0097

# APPENDIX E

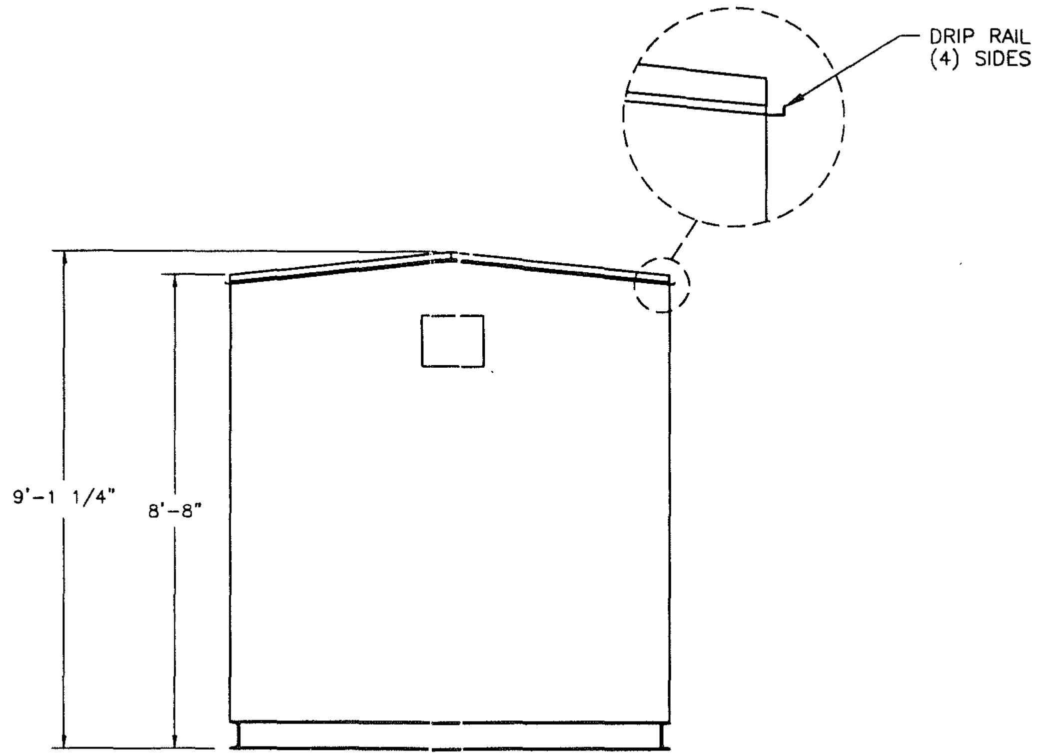
# REMEDIATION BUILDING DRAWINGS

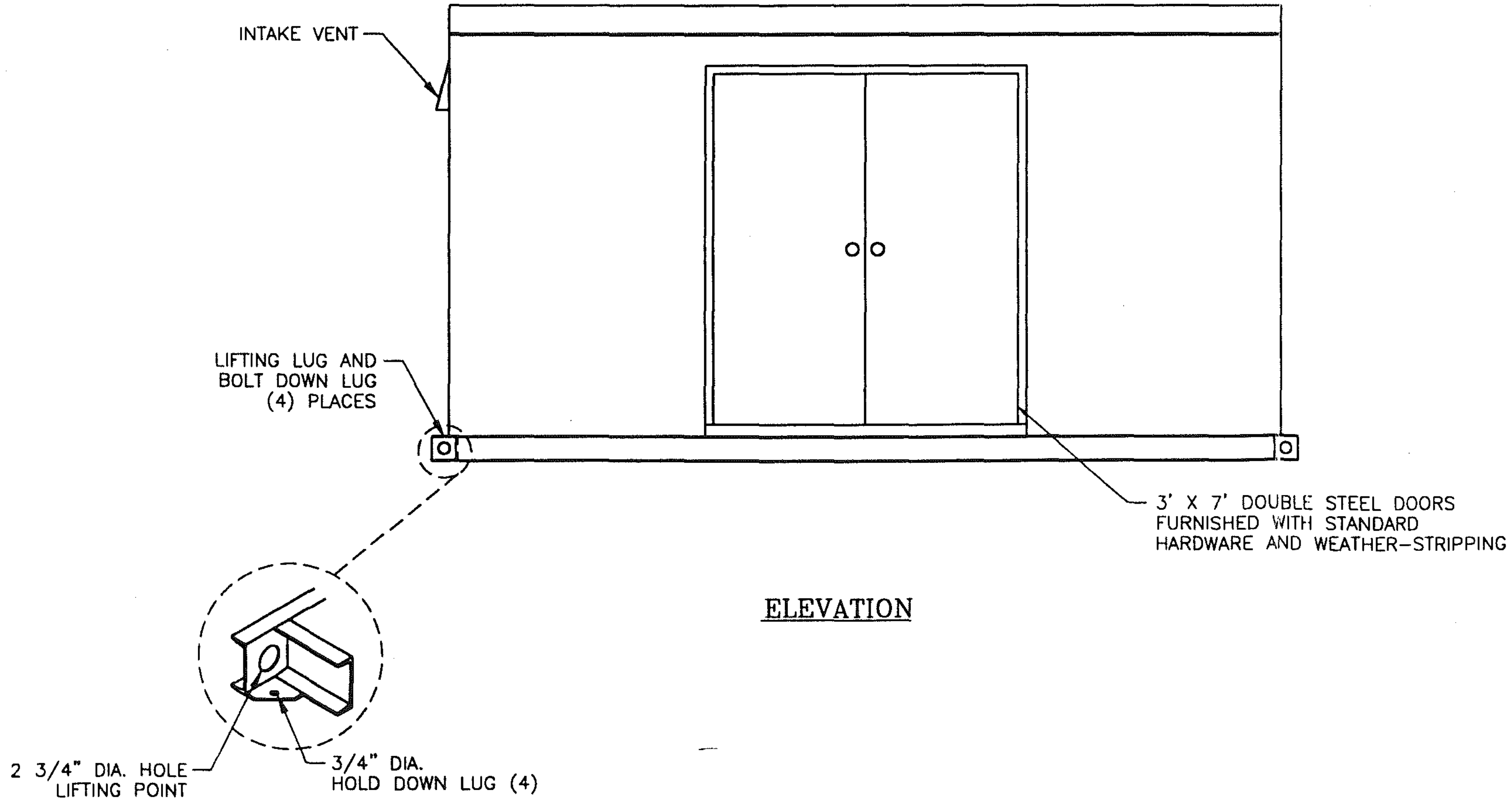
| REVISIONS | | | | |
|---|---|---|---|---|
| REV | ECO | DESCRIPTION | DATE | DRN |
| - | --- | --- | -- | -- |



PLAN VIEW

NOTE:
1. BUILDING INTERIOR TO BE 14'-0" LONG, 8'-0" WIDE AND HAVE 8' TALL WALLS. FLOOR TO BE CONSTRUCTED OF 6" CHANNEL WITH 3/16" FLOORING. THE ENCLOSURE TO BE WOOD FRAME.
2. ENCLOSURE SUPPLIED WITH A 1 GALLON FLOOR SUMP AND 3" TALL SPILL CONTAINMENT ON BUILDING FLOOR.
3. ENCLOSURE TO BE PAINTED WHITE WITH A STANDARD PAINT SYSTEM ON EXTERIOR.





ELEVATION

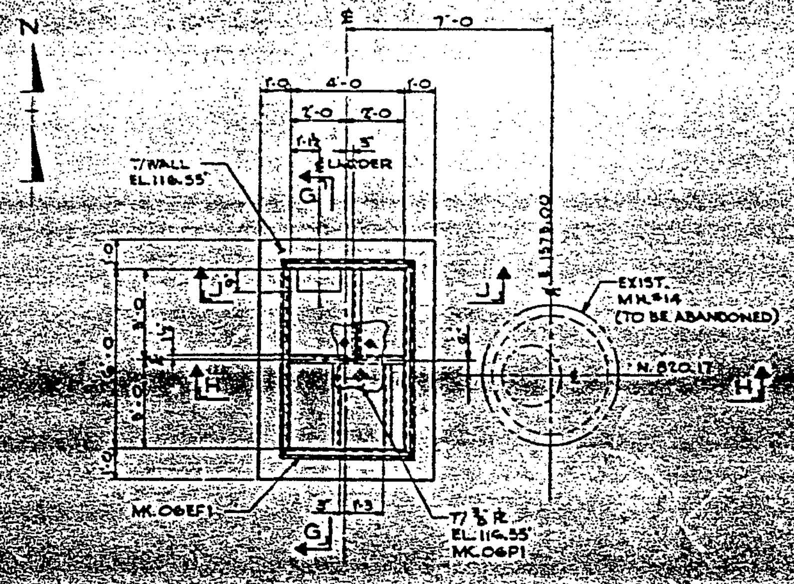
| | | | | |
|---|---|---|---|---|
| MATERIAL | DFT SHS | DATE 5/18/99 | **CARBONAIR**<br>WATER AND AIR DECONTAMINATION<br>MINNEAPOLIS, MINNESOTA<br>©1999 | |
| | CHCK | DATE | | |
| | DWSCALE 20 | LTSCALE 5 | | |
| TOLERANCES UNLESS NOTED OTHERWISE<br>DECIMAL .03 / FRACTIONAL 1/32" / ANGLES 1° | PROJECT MANAGER J M | | TITLE | PLOT & EL.<br>BUILDING LAYOUT<br>IT OAK CREEK |
| | PROJECT # 109680 | | | |
| THESE MATERIALS ARE CONFIDENTIAL AND ARE THE PROPRIETARY INFORMATION OF CARBONAIR SERVICES, INC. AND MAY NOT BE USED OR REPRODUCED WITHOUT THE CONSENT OF CARBONAIR SERVICES, INC. | THIRD ANGLE PROJECTION | | SIZE D | DWG. NO. 169726 REV * |
| | UNLESS OTHERWISE SPECIFIED:<br>• DIMENSIONS ARE IN INCHES<br>• DO NOT SCALE DRAWING | | SCALE 1=20 | EQUIP. . SHEET 1 OF 1 |

# APPENDIX F

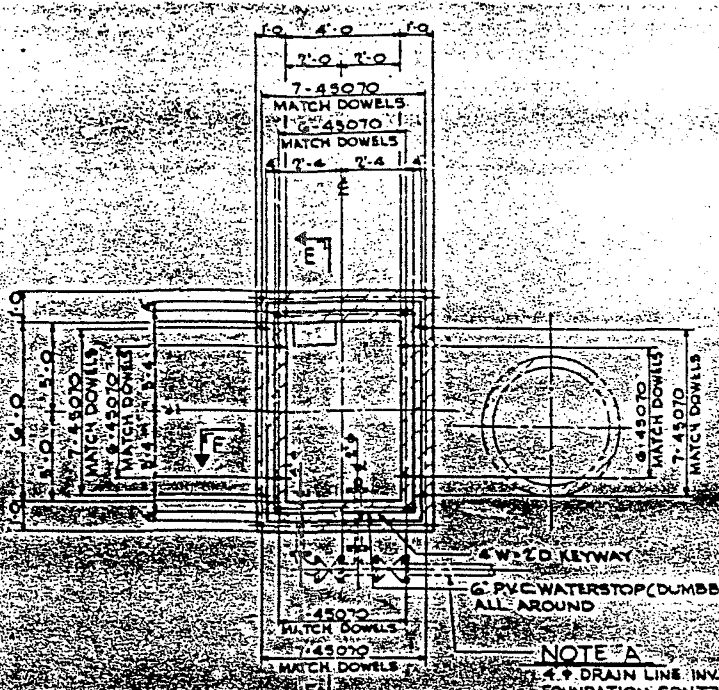
# TANK FARM UNDERDRAIN SUMP CONSTRUCTION DRAWINGS

# DESIGN DRAWINGS
# (NOTE: DRAWINGS ARE BEST QUALITY POSSIBLE)

DRAWING No. OC-7703-S-004



TOP PLAN UNDERDRAIN SUMP

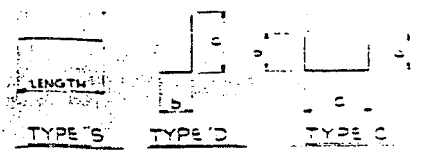


PLAN @ EL.110.55'

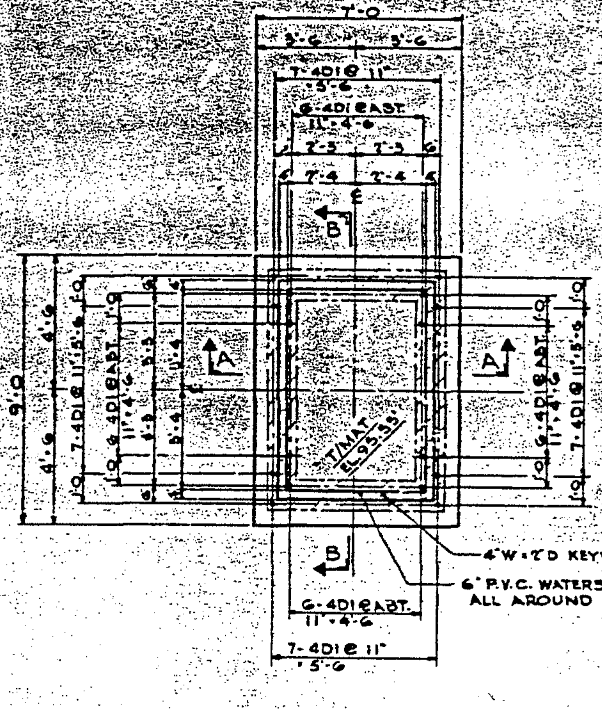
NOTE "A"
4" Φ DRAIN LINE INV. EL.108.00' ±
FOUNDATION CONTRACTOR TO COORDINATE
DRAIN LINE INSTALLATION WITH PIPING
CONTRACTOR BEFORE POURING CONCRETE

| MARK | NO. REQ'D | TYPE | LENGTH | SIZE | a | b | c | d | e | f | g | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4D1 | 52 | D | 2'-6 | 4 |  | 9 | 1-9 |  |  |  |  |  |
| 4C1 | 48 | C | 15'-6 | 4 |  | 3-11 | 7-8 | 3-11 |  |  |  |  |
| 6C1 | 19 | C | 4'-6 | 6 |  | 1-6 | 1-6 | 1-6 |  |  |  |  |
| 45050 | 48 | S | 5'-0 | 4 |  |  |  |  |  |  |  |  |
| 45059 | 52 | S | 5'-9 | 4 |  |  |  |  |  |  |  |  |
| 45069 | 20 | S | 6'-9 | 4 |  |  |  |  |  |  |  |  |
| 45070 | 100 | S | 7'-0 | 4 |  |  |  |  |  |  |  |  |
| 45089 | 16 | S | 8'-9 | 4 |  |  |  |  |  |  |  |  |
| 45100 | 52 | S | 10'-0 | 4 |  |  |  |  |  |  |  |  |

## REINFORCING BAR SCHEDULE

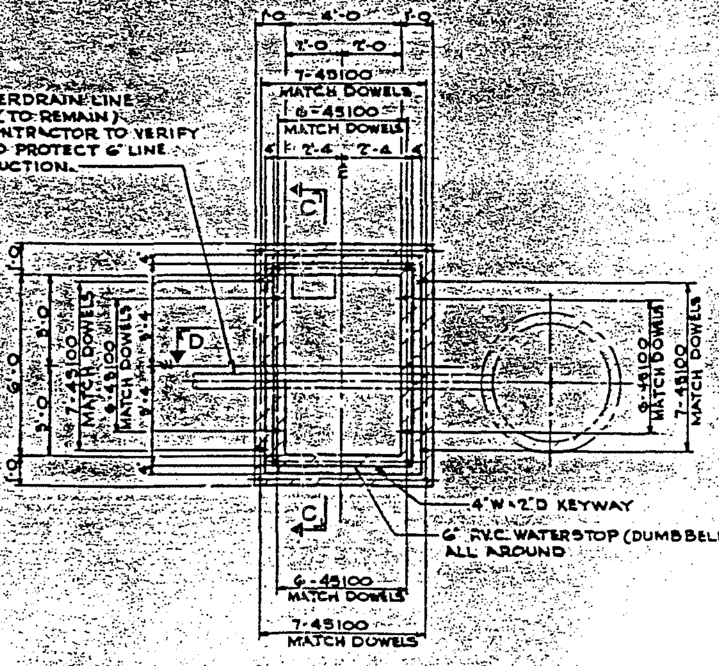


NOTE
ALL BAR DIMENSIONS ARE OUT TO OUT

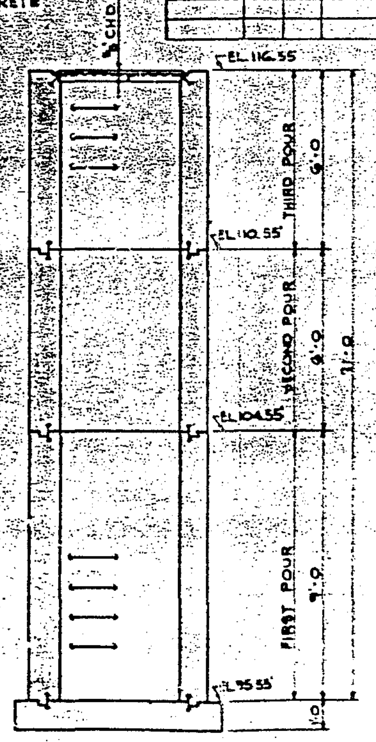


MAT PLAN

NOTE "B"
EXIST. 6" Φ UNDERDRAIN LINE
INV. EL. 99.55' ± (TO REMAIN)
FOUNDATION CONTRACTOR TO VERIFY
LOCATION AND PROTECT 6" LINE
DURING CONSTRUCTION.



PLAN @ EL.104.55



SECTION J-J

NOTES
1. FOR GENERAL CONCRETE NOTES SEE DWG.
2. WORK THIS DWG. WITH DWGS OC-7703-S-005 & OC-7703-S-006
3. FOR PIPING SEE DWG. OC-7703-M-003

CONFIDENTIAL

MATRIX ENGINEERS, INC.
CONSULTANTS - DESIGNERS - CONSTRUCTORS
PITTSBURGH, PA.

12291A-F04

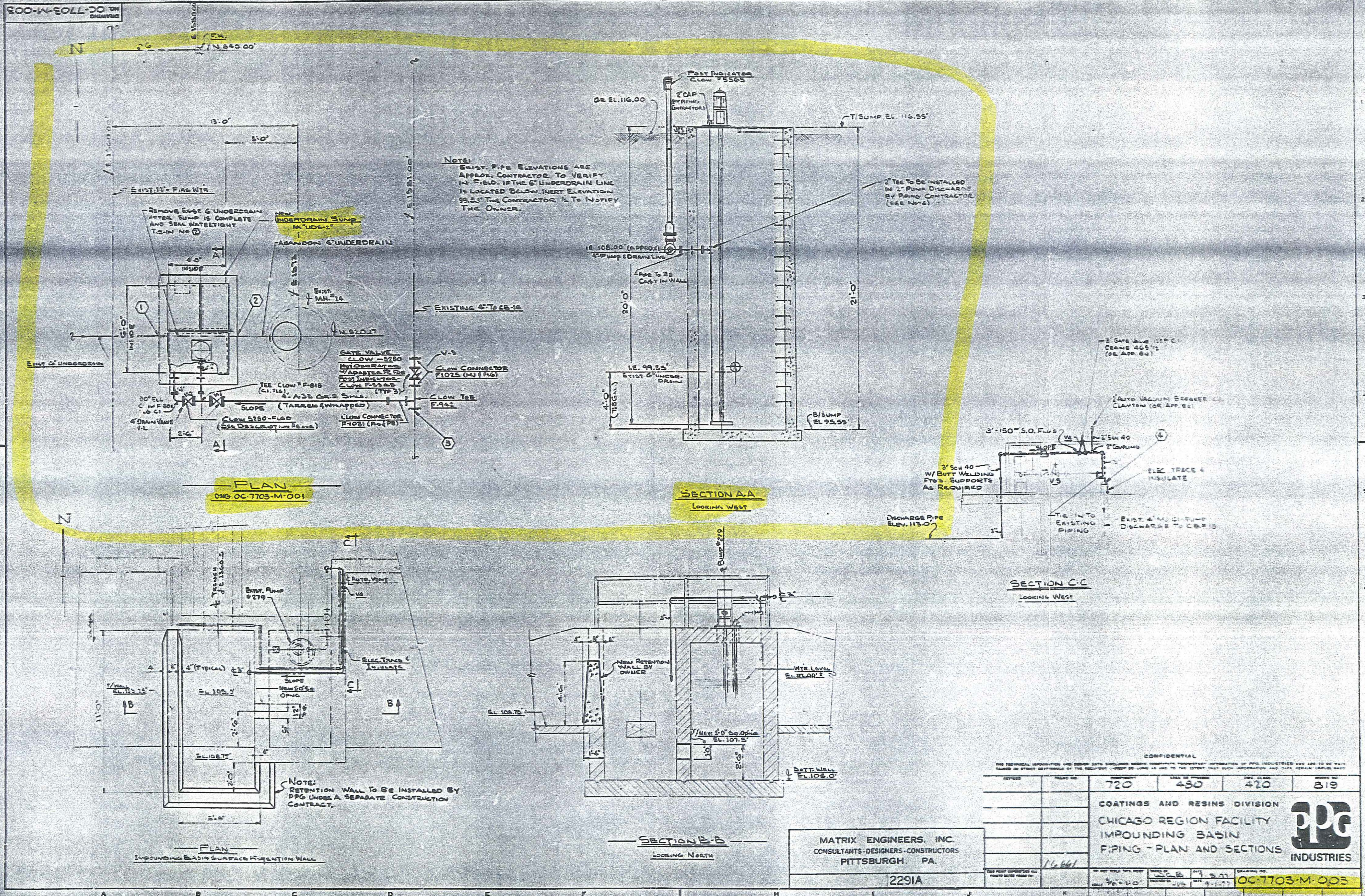
12465

| 60 | 480 | 330 | 8.9 |
|---|---|---|---|

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
UNDERDRAIN SUMP FOUNDATION
PLANS AND SECTION

PPG INDUSTRIES

3/8" = 1'-0"
3-15-77
OC-7703-S-004



Note:
Exist. Pipe Elevations Are Approx. Contractor To Verify In Field. If The 6" Underdrain Line Is Located Below Inert Elevation 99.85' The Contractor Is To Notify The Owner.

Note:
Retention Wall To Be Installed By PPG Under A Separate Construction Contract.

Drawing No. OC-7703-M-003

CONFIDENTIAL

| | | Component | Area or Process | Dwg. Class | Works No. |
|---|---|---|---|---|---|
| | | 720 | 430 | 420 | 819 |

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
IMPOUNDING BASIN
PIPING - PLAN AND SECTIONS

PPG INDUSTRIES

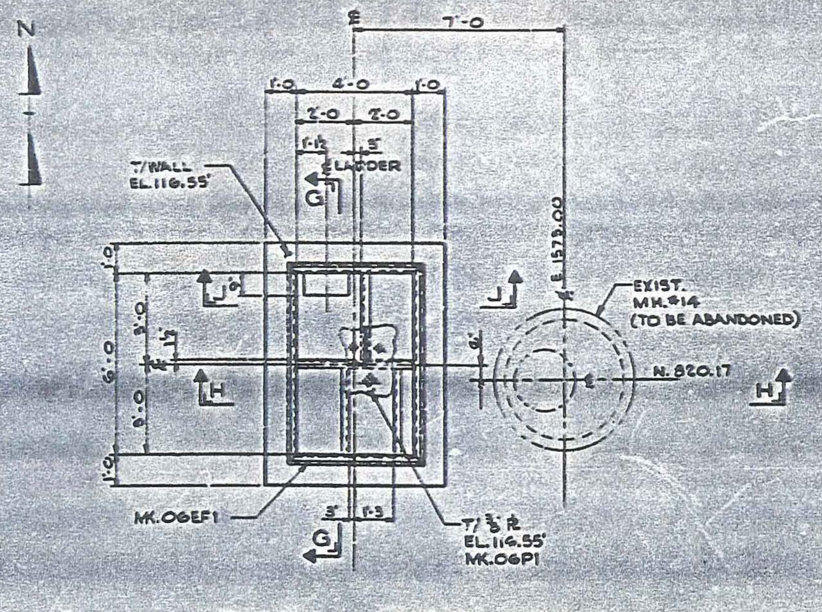
MATRIX ENGINEERS. INC.
CONSULTANTS · DESIGNERS · CONSTRUCTORS
PITTSBURGH. PA.

2291A

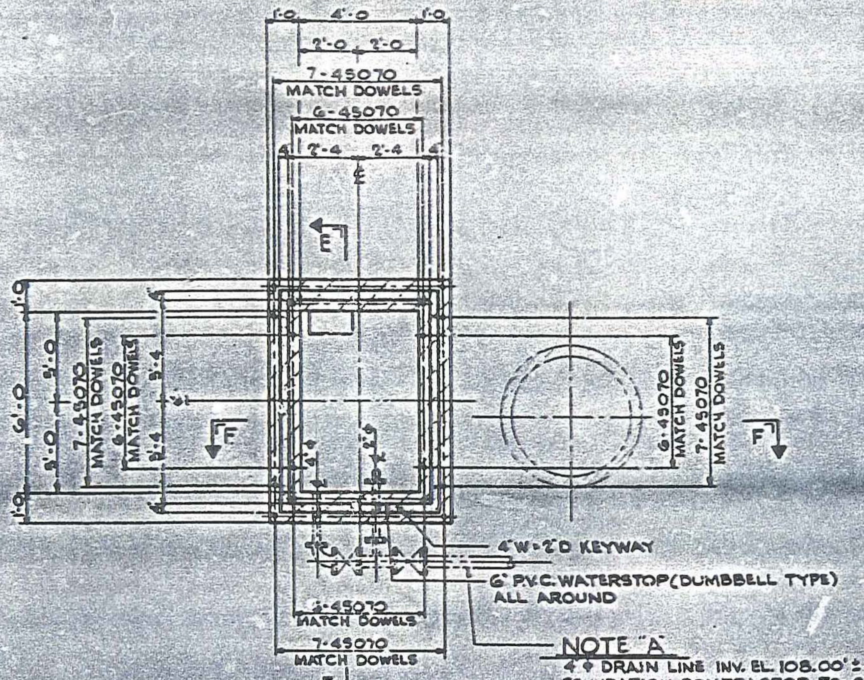
16661

Scale 3/8" = 1'-0"
Drawn by WGB Date 7-5-77
Checked by JHS Date 9-1-77
Drawing No. OC-7703-M-003

DRAWING NO. OC-7703-S-004



TOP PLAN UNDERDRAIN SUMP



PLAN @ EL.110.55'

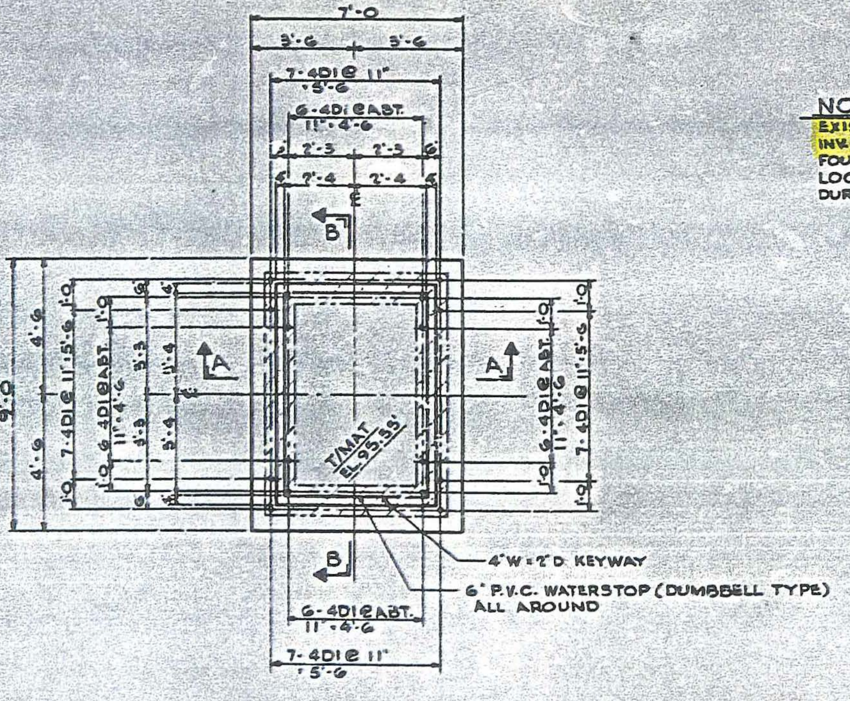
NOTE "A"
4" ⌀ DRAIN LINE INV. EL. 108.00'±
FOUNDATION CONTRACTOR TO COORDINATE DRAIN LINE INSTALLATION WITH PIPING CONTRACTOR BEFORE POURING CONCRETE

## REINFORCING BAR SCHEDULE

TYPE S — LENGTH
TYPE D — b, c
TYPE C — b, c, d

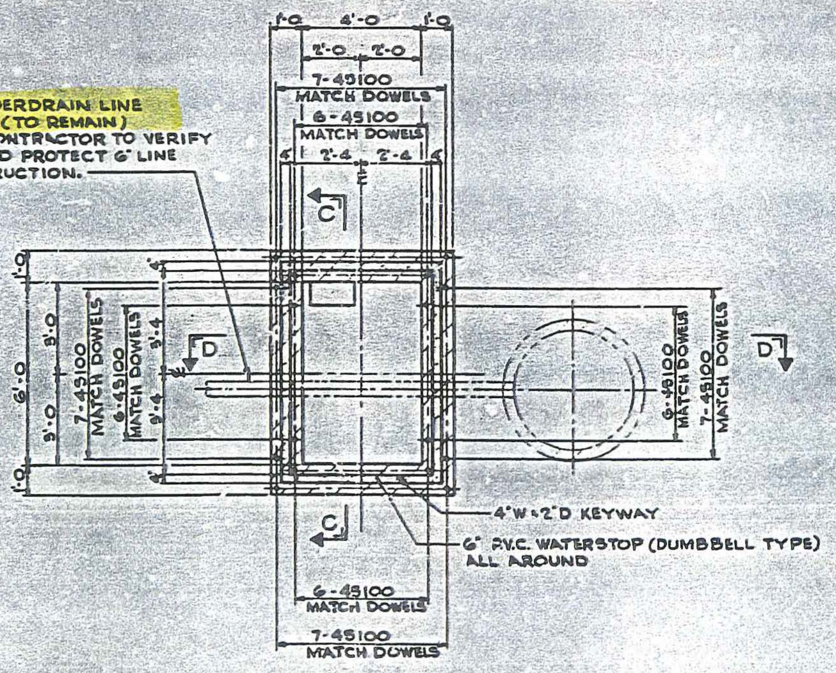
NOTE
ALL BAR DIMENSIONS ARE OUT TO OUT

| MARK | NO. REQD | TYPE | LENGTH | SIZE | a | b | c | d | e | f | g | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4D1 | 52 | D | 2'-6 | 4 |  | 9 | 1'-9 |  |  |  |  |  |
| 4C1 | 48 | C | 15'-6 | 4 |  | 3'-11 | 7'-8 | 3'-11 |  |  |  |  |
| 6C1 | 19 | C | 4'-6 | 6 |  | 1'-6 | 1'-6 | 1'-6 |  |  |  |  |
| 4S050 | 48 | S | 5'-0 | 4 |  |  |  |  |  |  |  |  |
| 4S059 | 52 | S | 5'-9 | 4 |  |  |  |  |  |  |  |  |
| 4S069 | 20 | S | 6'-9 | 4 |  |  |  |  |  |  |  |  |
| 4S070 | 100 | S | 7'-0 | 4 |  |  |  |  |  |  |  |  |
| 4S089 | 16 | S | 8'-9 | 4 |  |  |  |  |  |  |  |  |
| 4S100 | 52 | S | 10'-0 | 4 |  |  |  |  |  |  |  |  |

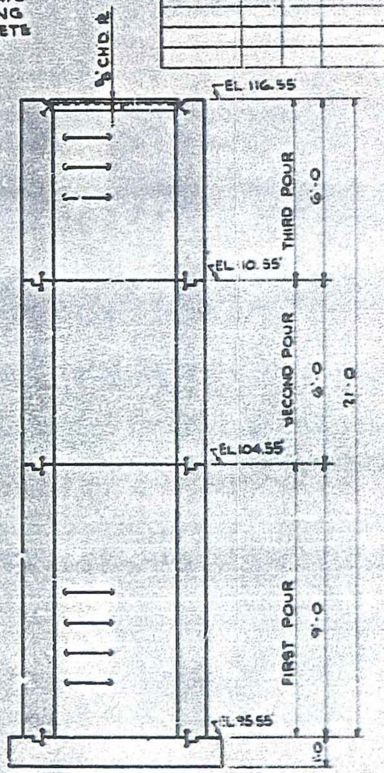


MAT PLAN

NOTE "B"
EXIST. 6" ⌀ UNDERDRAIN LINE INV. EL. 99.55'± (TO REMAIN)
FOUNDATION CONTRACTOR TO VERIFY LOCATION AND PROTECT 6" LINE DURING CONSTRUCTION.



PLAN @ EL.104.55



SECTION J-J

NOTES
1. FOR GENERAL CONCRETE NOTES SEE DWG.
2. WORK THIS DWG. WITH DWG'S OC-7703-S-005 & OC-7703-S-006
3. FOR PIPING SEE DWG. OC-7703-M-003

| COMPONENT | AREA OR PROCESS | DWG. CLASS | WORKS NO. |
|---|---|---|---|
| 160 | 450 | 330 | 819 |

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
UNDERDRAIN SUMP FOUNDATION
PLANS AND SECTION

PPG INDUSTRIES

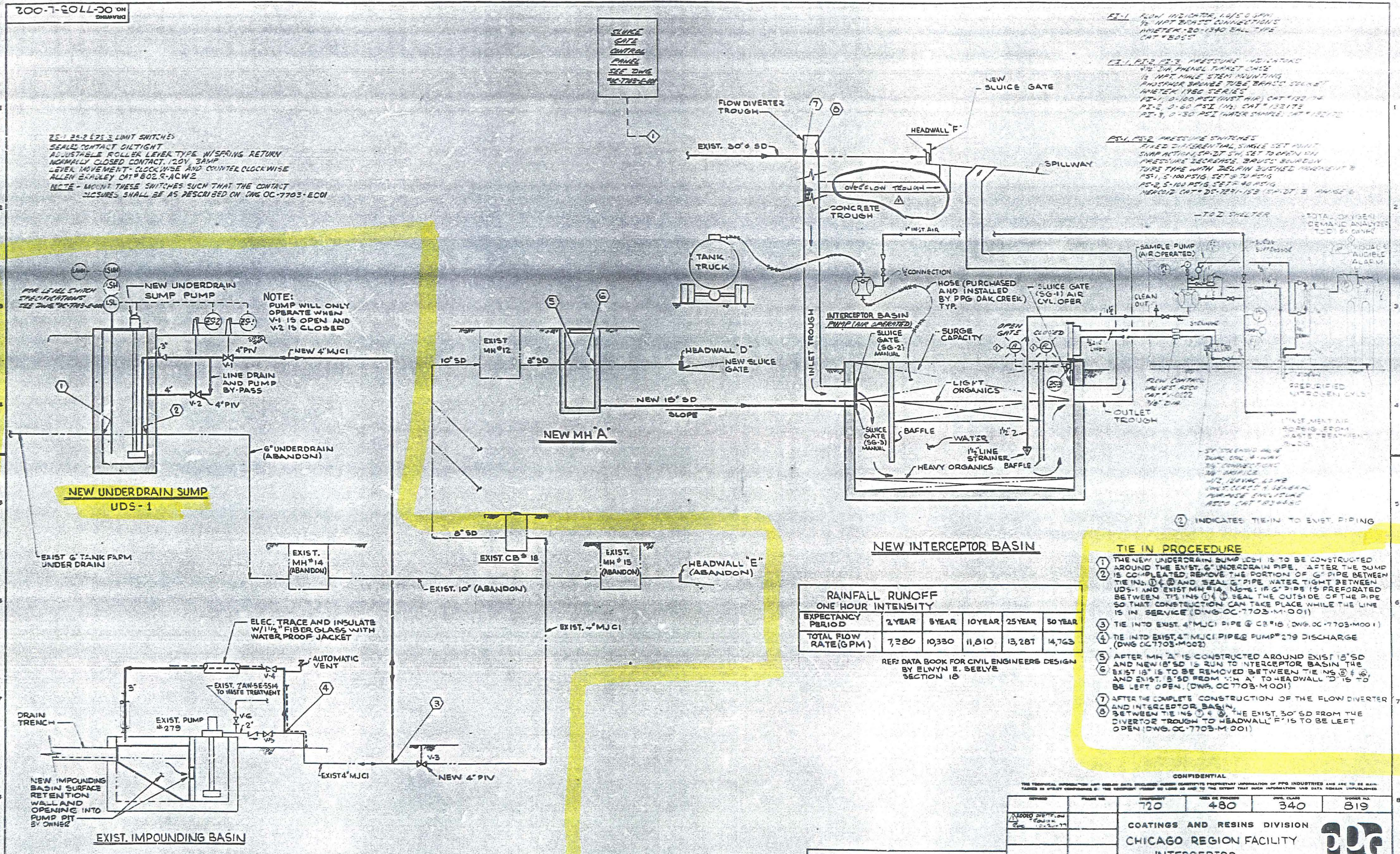
MATRIX ENGINEERS. INC.
CONSULTANTS - DESIGNERS - CONSTRUCTORS
PITTSBURGH. PA.

2291A-F04

14665

SCALE ⅜"=1'-0"
DRAWN BY R.J. LEJA
DATE 5-15-77
DRAWING NO. OC-7703-S-004

DRAWING NO. OC-7703-L-002



ZS-1, ZS-2 & ZS-3 LIMIT SWITCHES
SEALED CONTACT OILTIGHT
ADJUSTABLE ROLLER LEVER TYPE W/SPRING RETURN
NORMALLY CLOSED CONTACT, 120V, 3AMP
LEVER MOVEMENT - CLOCKWISE AND COUNTER CLOCKWISE
ALLEN BRADLEY CAT # 802R-ACW2
NOTE - MOUNT THESE SWITCHES SUCH THAT THE CONTACT CLOSURES SHALL BE AS DESCRIBED ON DWG OC-7703-E001

FI-1 FLOW INDICATOR, 1.0/5.0 GPM
½" NPT BRASS CONNECTIONS
AMETEK - 20-1340 BALL TYPE
CAT # 8055

PI-1, PI-2, PI-3 PRESSURE INDICATORS
3½" DIA. PHENOL TURRET CASE
½" NPT MALE, STEM MOUNTING
PHOSPHOR BRONZE TUBE, BRASS SOCKET
AMETEK 1980 SERIES
PI-1, 0-100 PSI (INST AIR) CAT # 132174
PI-2, 0-60 PSI ($N_2$) CAT # 132173
PI-3, 0-30 PSI (WATER SAMPLE) CAT # 132172

PS-1, PS-2 PRESSURE SWITCHES
FIXED DIFFERENTIAL, SINGLE SET POINT
SNAP ACTION, SP-DT SW, SET TO OPEN ON PRESSURE DECREASE. BRASS BOURDON TUBE TYPE WITH DELRIN BUSHED MOVEMENT &
PS-1, 5-100 PSIG, SET @ 70 PSIG
PS-2, 5-100 PSIG SET @ 40 PSIG
MERCOID CAT # DS-7221-153 (SP-DT, 3 RANGE 6

SV SOLENOID VALVE
DUAL COIL 4-WAY
3/4" CONNECTIONS
3/8" ORIFICE
4W, 120VAC 60HZ
CONST. CLASS & GENERAL PURPOSE ENCLOSURE
ASCO CAT # 834480

② INDICATES TIE-IN TO EXIST. PIPING

## TIE IN PROCEEDURE

① ② THE NEW UNDERDRAIN SUMP UDS-1 IS TO BE CONSTRUCTED AROUND THE EXIST. 6" UNDERDRAIN PIPE. AFTER THE SUMP IS COMPLEATED, REMOVE THE PORTION OF 6" PIPE BETWEEN TIE INS ① & ② AND SEAL 6" PIPE WATER TIGHT BETWEEN UDS-1 AND EXIST MH #14. NOTE: IF 6" PIPE IS PREFORATED BETWEEN TIE INS ① & ② SEAL THE OUTSIDE OF THE PIPE SO THAT CONSTRUCTION CAN TAKE PLACE WHILE THE LINE IS IN SERVICE (DWG OC-7703-M-001)

③ TIE INTO EXIST. 4" MJCI PIPE @ CB #18 (DWG. OC-7703-M001)

④ TIE INTO EXIST. 4" MJCI PIPE @ PUMP #279 DISCHARGE (DWG OC-7703-M002)

⑤ ⑥ AFTER MH "A" IS CONSTRUCTED AROUND EXIST 18" SD AND NEW 18" SD IS RUN TO INTERCEPTOR BASIN THE EXIST 18" IS TO BE REMOVED BETWEEN TIE INS ⑤ & ⑥, AND EXIST. 18" SD FROM MH "A" TO HEADWALL "D" IS TO BE LEFT OPEN. (DWG. OC-7703-M001)

⑦ ⑧ AFTER THE COMPLETE CONSTRUCTION OF THE FLOW DIVERTER AND INTERCEPTOR BASIN, BETWEEN TIE INS ⑦ & ⑧, THE EXIST. 30" SD FROM THE DIVERTOR TROUGH TO HEADWALL "F" IS TO BE LEFT OPEN (DWG. OC-7703-M001)

| RAINFALL RUNOFF<br>ONE HOUR INTENSITY | | | | | |
|---|---|---|---|---|---|
| EXPECTANCY PERIOD | 2 YEAR | 5 YEAR | 10 YEAR | 25 YEAR | 50 YEAR |
| TOTAL FLOW RATE (GPM) | 7,280 | 10,330 | 11,810 | 13,287 | 14,763 |

REF: DATA BOOK FOR CIVIL ENGINEERS DESIGN
BY ELWYN E. SEELYE
SECTION 18

CONFIDENTIAL

| COMPONENT | AREA OR PROCESS | DWG. CLASS | WORK NO. |
|---|---|---|---|
| 720 | 480 | 340 | 819 |

⚠ ADDED OVERFLOW TROUGH
Rev 10-20-77

16657

MATRIX ENGINEERING, INC.
CONSULTANTS-DESIGNERS-CONSTRUCTORS
PITTSBURGH, PA.

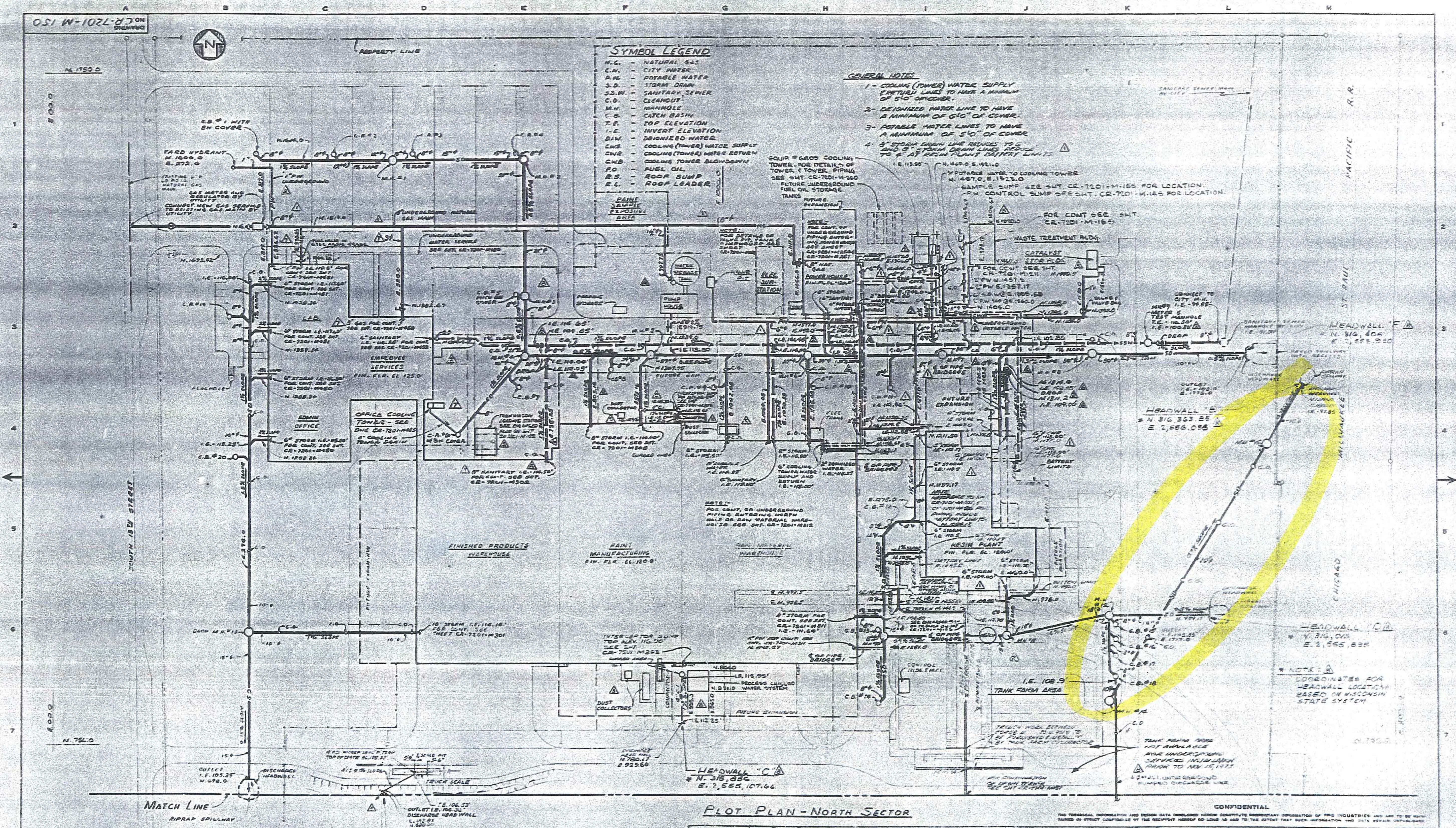
2291A

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
INTERCEPTOR
P & I DIAGRAM

PPG INDUSTRIES

DRAWN BY PAMBR DATE 6-21-77
CHECKED BY JWG DATE 9-1-77
DRAWING NO. OC-7703-L-002

DRAWING NO. CR-7201-M 150



SYMBOL LEGEND

N.G. - NATURAL GAS
C.W. - CITY WATER
P.W. - POTABLE WATER
S.D. - STORM DRAIN
S.S.W. - SANITARY SEWER
C.O. - CLEANOUT
M.H. - MANHOLE
C.B. - CATCH BASIN
T.E. - TOP ELEVATION
I.E. - INVERT ELEVATION
D.I.W. - DEIONIZED WATER
C.W.S. - COOLING (TOWER) WATER SUPPLY
C.W.R. - COOLING (TOWER) WATER RETURN
C.W.B. - COOLING TOWER BLOWDOWN
F.O. - FUEL OIL
R.S. - ROOF SUMP
R.L. - ROOF LEADER

GENERAL NOTES

1 - COOLING (TOWER) WATER SUPPLY & RETURN LINES TO HAVE A MINIMUM OF 5'-0" OF COVER.
2 - DEIONIZED WATER LINE TO HAVE A MINIMUM OF 6'-0" OF COVER.
3 - POTABLE WATER LINES TO HAVE A MINIMUM OF 5'-0" OF COVER.
4 - 8" STORM DRAIN LINE REDUCES TO 6" AND 6" STORM DRAIN LINES REDUCE TO 4" AT RESIN PLANT BATTERY LIMITS

PLOT PLAN - NORTH SECTOR

CONFIDENTIAL

THE TECHNICAL INFORMATION AND DESIGN DATA DISCLOSED HEREIN CONSTITUTE PROPRIETARY INFORMATION OF PPG INDUSTRIES AND ARE TO BE MAINTAINED IN STRICT CONFIDENCE BY THE RECIPIENT HEREOF SO LONG AS AND TO THE EXTENT THAT SUCH INFORMATION AND DATA REMAIN UNPUBLISHED

| REVISED | APPR DATE | APPR DATE |
|---|---|---|
| FINAL ISSUE | | |
| SEE ADDENDUM #5 PACKAGE #13 | | |
| REVISION (PACKAGE #20) | | |
| REVISION | | |
| SEE ADDENDUM #5 PACKAGE #2 | | |

STATE OF WISCONSIN
REGISTRATION NO. ED7129
EUGENE J. MINTUS
REGISTERED PROFESSIONAL ENGINEER

CUNNINGHAM ENGINEERS INC
BIRMINGHAM MICHIGAN

| CHECKED BY: | DATE: | APPROVED BY | DATE: |
|---|---|---|---|
| M McClintock | 5-25-73 | | |

| PROJECT NO. | DRAWING NO. |
|---|---|
| 72056 | 1M |

| REVISED | APPR DATE | APPR DATE |
|---|---|---|
| SEE ADDENDUM #4 | | |
| SEE ADDENDUM #3 | | |
| SEE ADDENDUM #2 | | |
| SEE ADDENDUM #1 | | |
| ISSUED FOR CONSTRUCTION | | |
| THIS PRINT SUPERSEDES ALL PRINTS DATED PRIOR TO | 10703 | |

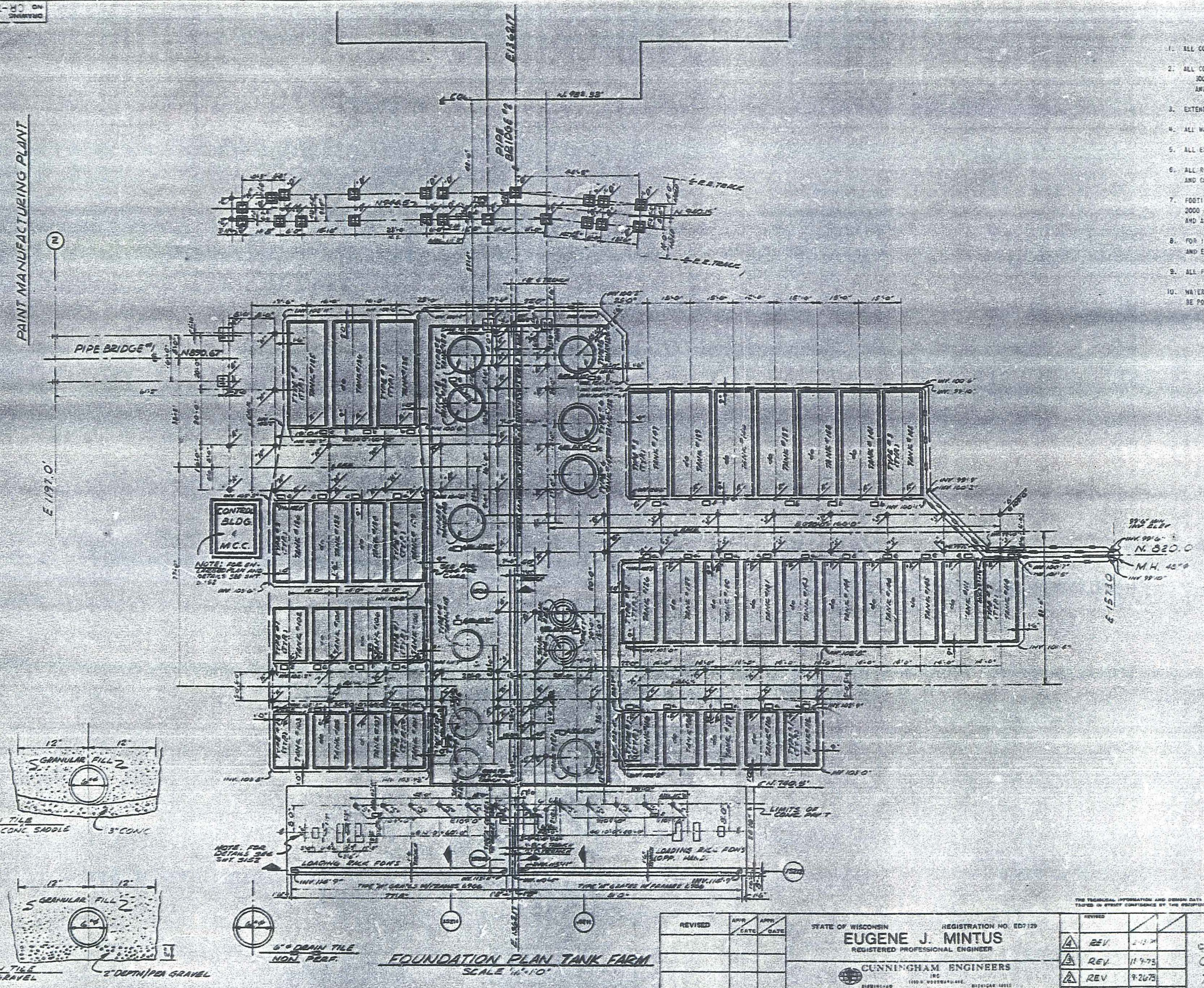
| COMPONENT | AREA OR PROCESS | DWG. CLASS | WORKS NO. |
|---|---|---|---|
| 900 | 500 | 400 | 819 |

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
MECHANICAL PLOT PLAN
NORTH SECTOR

PPG INDUSTRIES

SCALE 1" = 60'-0"
DRAWING NO. CR-7201-M150

DRAWING NO CR-7201-S150



FOUNDATION PLAN TANK FARM
SCALE 1/16"=1'0"

## GENERAL CONCRETE NOTES

1. ALL CONCRETE WORK SHALL MEET THE A.C.I. REQUIREMENTS (318-71).
2. ALL CONCRETE TO HAVE A 28 DAY COMPRESSIVE STRENGTH OF NOT LESS THAN:- 3000 P.S.I. GR. BM'S, CONCRETE TRENCHED FOOTINGS, SPREAD FOOTINGS, AND OTHERS.
3. EXTEND DOWELS 30 DIA. BEYOND CONSTRUCTION JOINTS. LAP ALL BARS 30 DIA.
4. ALL WALL CORNERS TO HAVE CORNER BARS THE SAME SIZE AND SPACING AS HORIZ. BARS.
5. ALL EXPOSED CONCRETE TO BE AIR-ENTRAINED.
6. ALL REINFORCING SHALL BE INTERMEDIATE GRADE (40 K.S.I. YIELD) DEFORMED BARS AND CONFORM TO A.S.T.M. A-615 SPECS.
7. FOOTINGS SHALL BEAR ON FIRM UNDISTURBED SOIL OR ON COMPACTED FILL OF 2000 P.S.F. CAPACITY. ALL FOOTING BEARING LEVELS SHALL BE INSPECTED AND APPROVED BY A QUALIFIED SOIL ENGINEER.
8. FOR INSERTS, PIPES, CONDUITS, ETC. CAST IN CONCRETE SEE PROCESS, MECH., AND ELEC. DRAWINGS.
9. ALL FOOTINGS SHALL BE CENTERED ON COLUMN CENTERLINE UNLESS NOTED.
10. WATER, IF FOUND, SHALL BE REMOVED FROM ALL FOOTINGS AND CONCRETE SHALL BE POURED ON REASONABLY DRY SOIL.

NOTES:

1) FOR FOUNDATION DETAILS OF TANK MATS, PIPE BRIDGES, AND PIPE TRESTLES SEE DETAIL SHEETS S151 AND S152
2) TRESTLE AND DOCK FOOTINGS
   - "A" 20"Φ W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "B" 16"Φ W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "C" 14"Φ W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "D" 3'6"x3'6" W/BOT @ EL. 109'-6" U.N. ON PLAN
   - "E" 4'0"x4'0" W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "F" 4'0"x4'0" W/BOT @ EL. 109'-6" U.N. ON PLAN
   - "H" 24"Φ W/BOT @ 4'-6" BELOW FINISH GRADE
   - "J" 20"Φ W/BOT @ 4'-6" BELOW FINISH GRADE
   - "K" 18"Φ W/BOT @ 4'-6" BELOW FINISH GRADE
   - "L" 5'0"x5'0" W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "M" 5'0"x5'0" W/BOT @ EL. 110'-0" U.N. ON PLAN
   - "N" 2'0"x2'0" W/BOT @ EL. 109'-6" U.N. ON PLAN
   - "P" 4'0"x4'0" W/BOT @ EL. 110'-0" U.N. ON PLAN
3) FOR PUMP BASES SEE DWG'S S152 AND M101
4) PIPE SUPPORT FOOTINGS TYPE "R"
   - a) "R" 12"Φ W/BOT @ EL. 112'-0"
   - b) FOR FOOTING DETAILS SEE SHT. S152
   - c) FOR LOCATION SEE SHEETS: M103, M104 M105, M106 & M107.
5) PIPE SUPPORT FOOTINGS TYPE "S"
   - a) "S" 16"Φ W/BOT @ ELEV. 110'-0"
   - b) FOR FOOTING DETAIL SEE SH. S152

CONFIDENTIAL

THE TECHNICAL INFORMATION AND DESIGN DATA DISCLOSED HEREIN CONSTITUTE PROPRIETARY INFORMATION OF PPG INDUSTRIES AND ARE TO BE MAINTAINED IN STRICT CONFIDENCE BY THE RECIPIENT HEREOF SO LONG AS AND TO THE EXTENT THAT SUCH INFORMATION AND DATA REMAIN UNPUBLISHED.

| REVISED | APPR. DATE | APPR. DATE |
|---|---|---|
| FINAL ISSUE | 2-23-73 | HF |

STATE OF WISCONSIN
REGISTRATION NO. E07129
EUGENE J. MINTUS
REGISTERED PROFESSIONAL ENGINEER

CUNNINGHAM ENGINEERS
INC

CHECKED BY: DATE: APPROVED BY: DATE:

PROJECT NO. 72056
DRAWING NO.

| REVISED | | |
|---|---|---|
| 4 | REV. | 2-13-74 |
| 3 | REV. | 11-9-73 |
| 2 | REV. | 9-26-73 |
| 1 | GEN. REV. | 8-14-73 |
| | TANK FARM PHASE I | 7-16-73 |

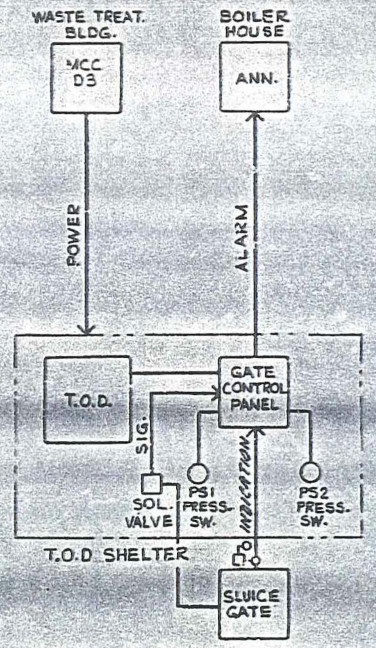
THIS PRINT SUPERSEDES ALL PRINTS DATED PRIOR TO: 11 06

| COMPONENT | AREA OF PROCESS | DWG. CLASS | WORKS NO. |
|---|---|---|---|
| 162 | 440 | 621 | 819 |

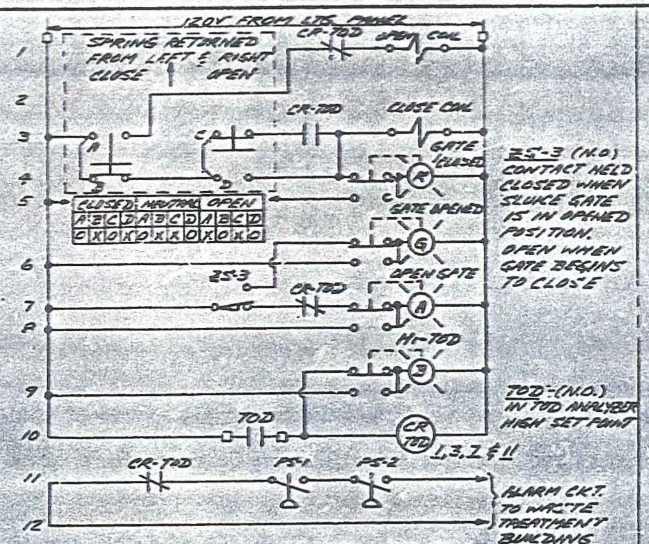
COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
TANK MATS AND TRESTLE
FOUNDATION PLANS
TANK FARM AREA

INDUSTRIES

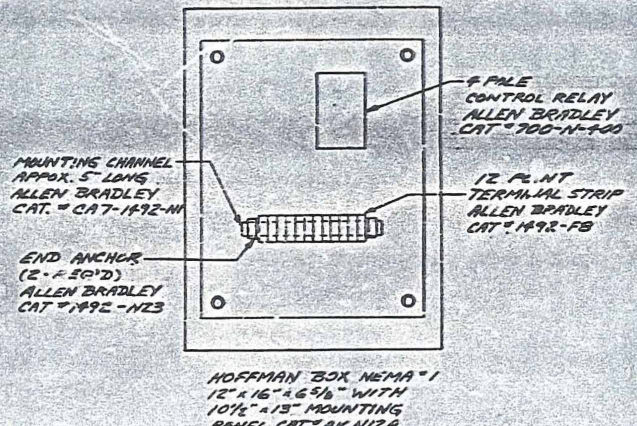
SCALE: AS SHOWN
DRAWN BY: 220
DRAWING NO. CR-7201-S150



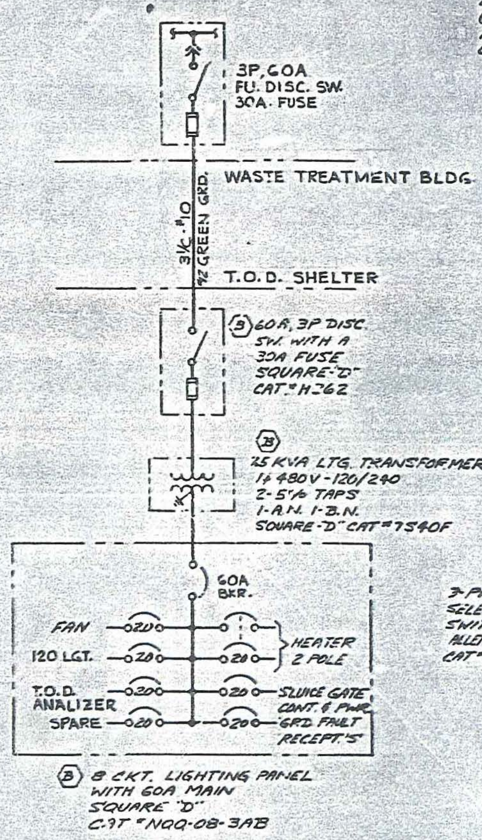
T.O.D. BLOCK DIAGRAM



SLUICE GATE CONTROL SCHEM.

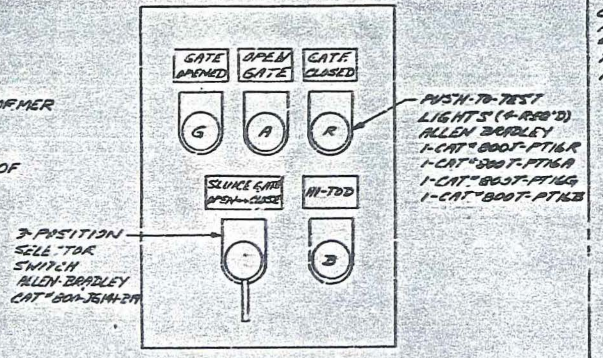


SLUICE GATE CONTROL PANEL
(SHOWN W/DOOR REMOVED)

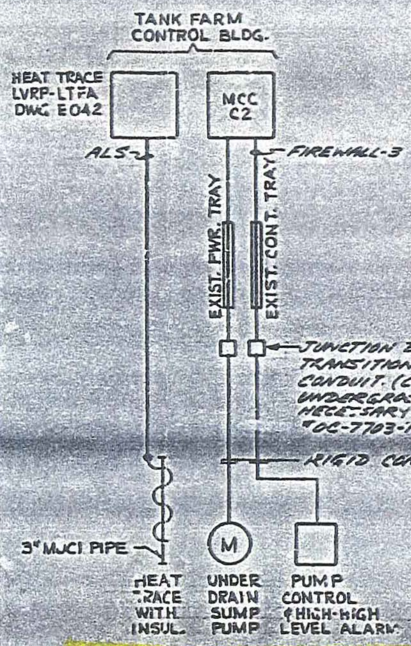


T.O.D. SHELTER SINGLE LINE DIAGRAM

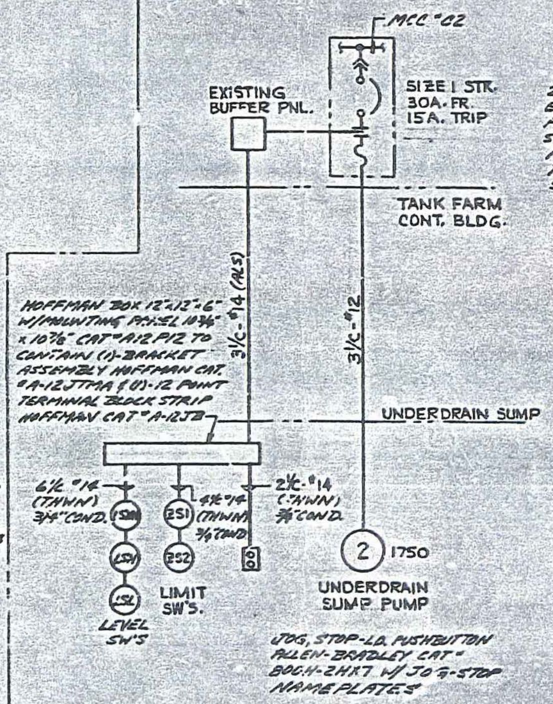
Ⓢ ITEMS SUPPLIED WITH SHELTER SEE DWG # OC-7703-L-003



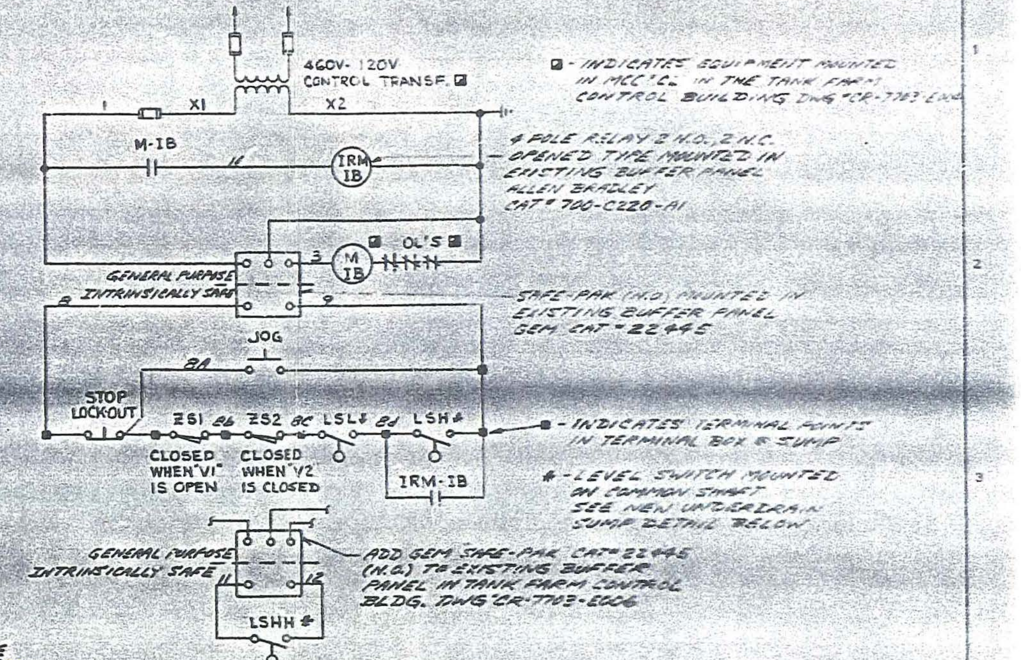
SLUCE GATE CONTROL PANEL DOOR



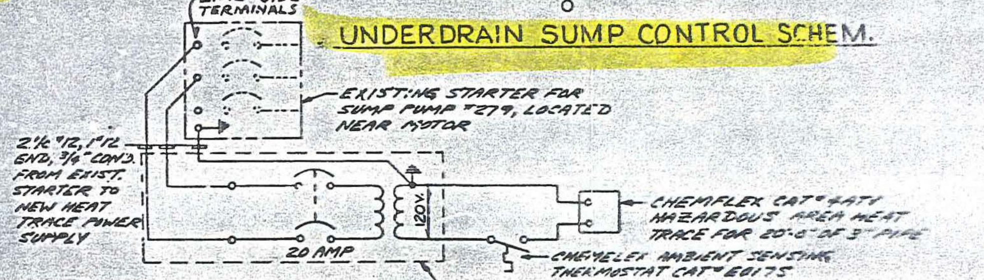
UNDERDRAIN SUMP & IMPOUNDING BASIN BLOCK DIAGRAM



UNDERDRAIN SUMP SINGLE LINE DIAGRAM

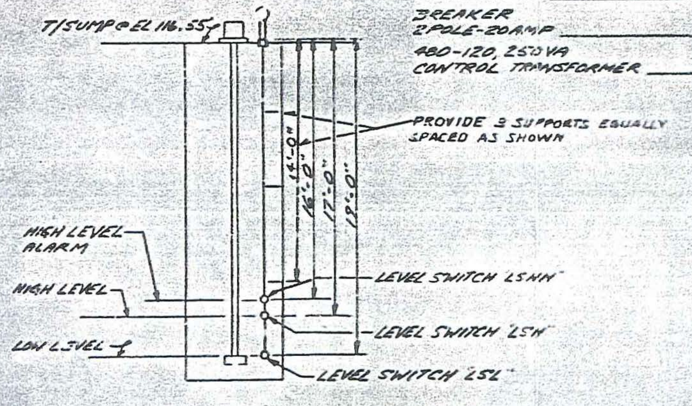


UNDERDRAIN SUMP CONTROL SCHEM.



HEAT TRACE SCHEM.

ALLEN BRADLEY UNILOCK
ENCLOSURE __________
BREAKER
2POLE-20AMP __________
480-120, 250VA
CONTROL TRANSFORMER __________



FURNISH GEMS LEVEL LIMIT SWITCH ASSEMBLY COMPLETE 316 S.S. FLOATS 2" NPT. MOUNTING PLUG & GUAC24-5302 JUNCTION BOX. A PAIR OF WIRES SHALL BE BROUGHT OUT FOR EACH LIMIT SWITCH.

NEW UNDERDRAIN SUMP LEVEL SWITCH

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THE TECHNICAL INFORMATION AND DESIGN DATA DISCLOSED HEREIN CONSTITUTE PROPRIETARY INFORMATION OF PPG INDUSTRIES AND ARE TO BE MAINTAINED IN STRICT CONFIDENCE BY THE RECIPIENT HEREOF SO LONG AS AND TO THE EXTENT THAT SUCH INFORMATION AND DATA REMAIN UNPUBLISHED

| COMPONENT | AREA OR PROCESS | DWG. CLASS | WORKS NO. |
|---|---|---|---|
| 960 | 480 | 190 | 819 |

COATINGS AND RESINS DIVISION
CHICAGO REGION FACILITY
INTERCEPTOR, UNDERDRAIN
& IMPOUNDING BASIN
POWER & CONTROL DIAGRAMS
PPG INDUSTRIES

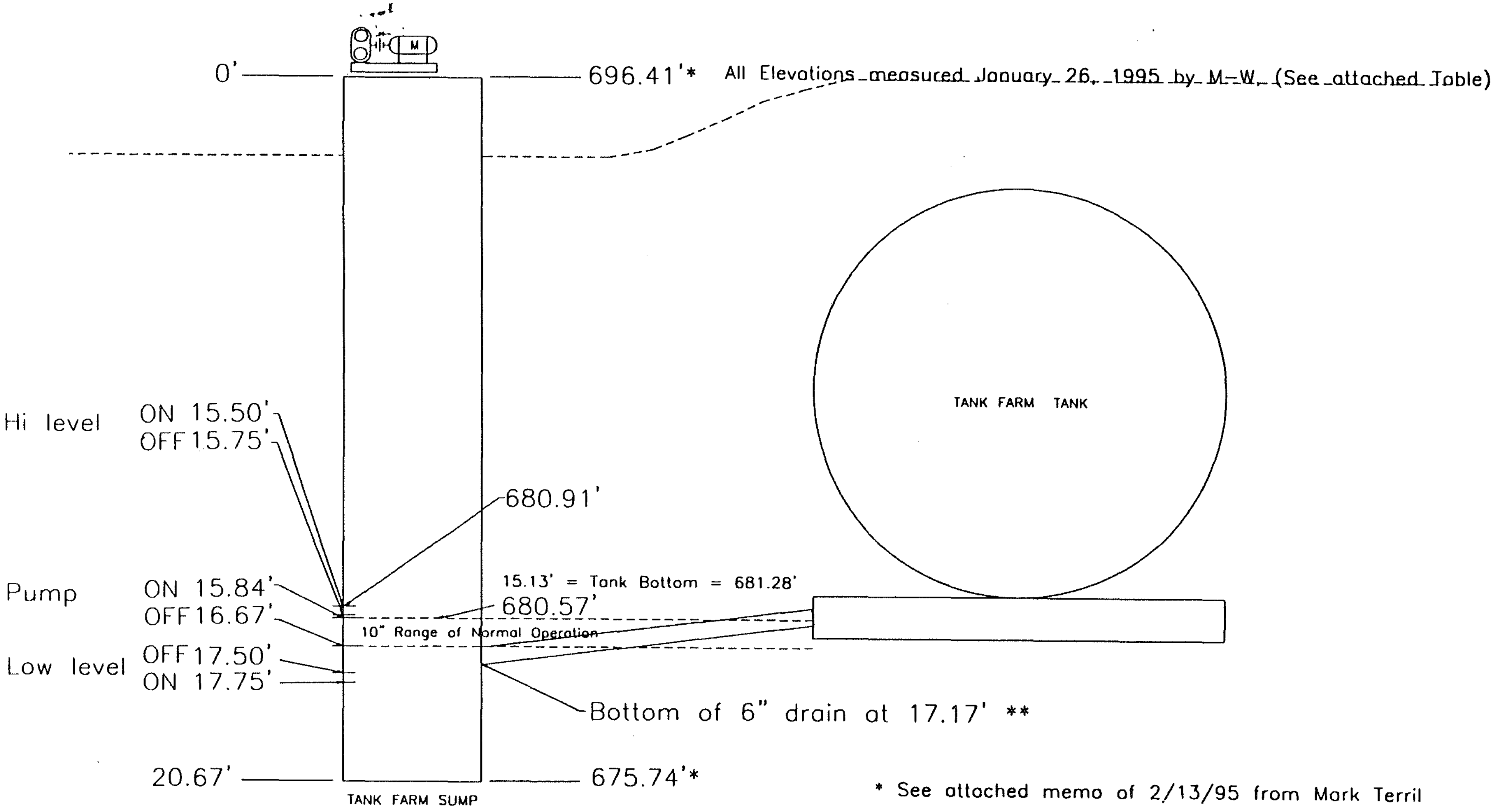
MATRIX ENGINEERS, INC.
CONSULTANTS-DESIGNERS-CONSTRUCTORS
PITTSBURGH, PA.
2291A

1665O

SCALE NONE
DRAWN BY PMC
DATE 8-24-77
CHECKED BY RLC
DATE 9/1/77
DRAWING NO. OC-7703-E-001

# As Operated Information

# Oak Creek Tank Farm
# Sump Pump Operating Limits



All Elevations measured January 26, 1995 by M-W. (See attached Table)

* See attached memo of 2/13/95 from Mark Terril

** Measure D. Mikolainis 7/10/95

# APPENDIX G

# COMPLETED CA725 INDICATOR FORM

## DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

## RCRA Corrective Action
## Environmental Indicator (EI) RCRIS code (CA725)

## Current Human Exposures Under Control

**Facility Name:** PPG Oak Creek
**Facility Address:** 10800 South 13th Street, Oak Creek, WI
**Facility EPA ID #:** WID 059972935

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   __X__ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available skip to #6 and enter"IN" (more information needed) status code.

## BACKGROUND

### Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

### Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

### Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

### Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

| | Yes | No | ? | Rationale / Key Contaminants |
|---|---|---|---|---|
| Groundwater | X | | | No complete exposure pathway with groundwater |
| Air (indoors)[2] | | X | | |
| Surface Soil (e.g., <2 ft) | X | | | Ethylbenzene, toluene |
| Surface Water | | X | | |
| Sediment | | X | | |
| Subsurf. Soil (e.g., >2 ft) | X | | | Ethylbenzene, toluene |
| Air (outdoors) | | X | | |

______ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

______ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

______ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s): Key contaminants include ethylbenzene and toluene per screening against USEPA Region IX PRGs presented in the Risk Assessment section of the RFI Report (ICF Kaiser, 1997).

Footnotes:

---

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

| **"Contaminated" Media** | Residents | Workers | Day-Care | Construction | Trespassers | Recreation | Food[3] |
|---|---|---|---|---|---|---|---|
| Groundwater | No | No | No | No | | | No |
| ~~Air (indoors)~~ | ___ | ___ | ___ | | | | |
| Soil (surface, e.g., <2 ft) | No | Yes | | No | No | No | No |
| ~~Surface Water~~ | ___ | ___ | | | | ___ | ___<br>___ ___ |
| ~~Sediment~~ | ___ | ___ | | | | ___ | ___ |
| Soil (subsurface e.g., >2 ft) | | | | No | | | No |
| Air (outdoors) | ___ | Yes | | ___ | ___ | ___ | |

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- **Human** Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6. and enter "YE" status code. after explaining and/or referencing condition(s) in-place. whether natural or man-made. preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

_____ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s): There are no complete exposure pathways with groundwater under current conditions. No "construction" or digging activities would be carried out without proper Personal Protection Equipment (PPE). Therefore, no unrestricted exposures to constituents in subsurface soil would occur. The only potentially complete exposure pathways are for workers with constituents in surface soil and with volatile constituents released to air. RFI Report (ICF Kaiser, 1997).

---

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

4 Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

_____ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

__X__ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s): The Human Health RFI Risk Assessment indicated that maximum detected concentrations of ethylbenzene and xylenes in soil samples were above conservative risk-based screening criteria. (EPA Region V DQLs, which are based on a residential scenario). (RFI Report, ICF Kaiser, 1997)

---

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

5 Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

X If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s): The summed hazard index (HI) for a full-time industrial worker assumed to work 8 hrs/day, 250 days/year for 25 years in the tank farm area was calculated to be 0.15. This HI combines hazard quotients from ethylbenzene and xylenes for the following exposure pathways: incidental ingestion of soil, dermal contact with soil, and inhalation of volatiles released from soil. The HI of 0.15 is less than EPA's acceptable HI of 1. RFI Report (ICF Kaiser, 1997).

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

YE YE - Yes. "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the PPG Oak Creek facility, EPA ID # WID 059972935, located at 10800 S. 13th St. Oak Creek, WI. under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

____ IN - More information is needed to make a determination.

Completed by (signature) ____ Date ____
(print) ____
(title) ____

Supervisor (signature) ____ Date ____
(print) ____
(title) ____
(EPA Region or State) ____

Locations where References may be found:

____
____
____
____
____

Contact telephone and e-mail numbers

(name) ____
(phone #) ____
(e-mail) ____

**FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.**

# COMPLETED CA750 INDICATOR FORM

# DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

## RCRA Corrective Action
## Environmental Indicator (EI) RCRIS code (CA750)

## Migration of Contaminated Groundwater Under Control

**Facility Name:** PPG Oak Creek
**Facility Address:** 10800 South 13th St Oak Creek, WI
**Facility EPA ID #:** WID 059972935

1. **Has all available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been considered in this EI determination?**

   X If yes - check here and continue with #2 below.

   ____ If no - re-evaluate existing data, or

   ____ if data are not available, skip to #8 and enter "IN" (more information needed) status code.

## BACKGROUND

### Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

### Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

### Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

### Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

X If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): Benzene was detected in well MW-16 at 4.3 ug/l; the screening value used is the region V DQL which is 0.39 ug/l.

Lead was detected in three unfiltered samples collected from the tank farm above this region V DQL, however lead was not detected in the filtered aliquot of these samples.

Wells downgradient of the tank farm area have not been impacted.

Source: "RCRA Facility Investigation Report" for the PPG Oak Creek Facility (ICF Kaiser, 1997).

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): The groundwater flow in the vicinity of the Tank Farm is currently controlled by an underdrain system constructed to maintain the groundwater at a level below the base of the tanks. The underdrain system consists of a ceramic tile basin backfilled with sand and gravel. A sump collects groundwater from inside the basin and a pumping system transfers water to a wastewater treatment system.

Source: "RCRA Facility Investigation Report" PPG Oak Creek Facility (ICF Kaiser, 1997)

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[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

__X__ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s): As stated in #3 groundwater flow is controlled by the underdrain system which effectively contains groundwater in the vicinity of the tank farm.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of <u>key</u> contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of <u>each</u> contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):_______________________________________________

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[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s): _____

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[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

_X_ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

____ If no - enter "NO" status code in #8.

____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s): An Interim Action (IM) is being implemented in the tank farm area consisting of a Soil Vapor Extraction (SVE) and Air Sparging (AS) system. Per section 4 of the Corrective Measures Implementation (CMI) Report, monitoring will be conducted during implementation of the IM. Additionally, the CMI specifices the contingency measures in the event the IM does not meet the remedial goals.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the PPG Oak Creek facility , EPA ID # 059972935 , located at 10800 S 13th St Oak Creek, WI. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

____ IN - More information is needed to make a determination.

Completed by (signature) ____________ Date ________
(print) ____________
(title) ____________

Supervisor (signature) ____________ Date ________
(print) ____________
(title) ____________
(EPA Region or State) ____________

Locations where References may be found:

____________________
____________________
____________________
____________________
____________________

Contact telephone and e-mail numbers

(name) ____________
(phone #) ____________
(e-mail) ____________

# APPENDIX H

# STATISTICAL DETERMINATION OF POST-REMEDY SAMPLING REQUIREMENTS

## Post Remediation Sample Quantity Methodology

The Methods for Evaluating the Attainment of Cleanup Standards was utilized to determine the estimated number of samples to be collected following site remediation to determine if the cleanup standards have been attained. This was accomplished by performing the procedures outlined in Chapter 6 (Determining Whether the Mean Concentration of the Site is Less than a Cleanup Standard).

The first step was to estimate how clean the site will be at the time of sampling. Assuming post-remediation indicates that the mean concentration of a constituent is less than the clean-up standard, this method provides an accurate statistical count of needed samples. Since the mean concentration is less than the standard, it can be considered in terms of a percentage of the standard. The lower the percentage, the cleaner the site is considered, therefore, reducing the number of samples needed. The converse is true as well; the higher the percentage of the standard, the greater the number of samples. This is true because more samples are needed to achieve the same confidence level (95%). To be conservative, high percentages of the clean-up standards were used as the mean concentration for the site. The locations of samples are independent of quantity and is, therefore, not important for this statistical method.

The second factor needed to be estimated is the standard deviation of data that does not exist yet. This was done by using the following equation:

$$\hat{\sigma} = \frac{RANGE}{6}$$

where:

$\hat{\sigma}$ = estimated standard deviation
$RANGE$ = range between estimated lowest and highest concentrations

All other values are known and are used in the following equation:

$$n_d = \hat{\sigma} \left\{ \frac{z_{1-\beta} + z_{1-\alpha}}{C_s - \mu_1} \right\}^2$$

where:

$n_d$ = estimated number of samples
$\hat{\sigma}$ = estimated standard deviation
$Z$ = obtained from Table A.2 (based on $\alpha = 0.05$ and $\beta = 0.2$)
$C_s$ = clean-up standard
$\mu_1$ = Estimated mean concentration less than $C_s$

The value for $\alpha$ provides a 5% chance the site will be characterized clean, when it may still be impacted, and conversely, $\beta$ yields a 20% chance the site will be characterized dirty, when in fact it may be clean. These values are recommended and used for a standard conservative estimation.

Each constituent that had detections above the standard was used in the estimation process. The chemical which required the greatest number of samples was the controlling factor for that media.

## Post-Remediation Sample Quantity Results

This section contains the results of the post-remediation sample quantity estimations for soils and groundwater. Since the clean-up standards are the same for surface and subsurface soils, there was no need to perform two separate estimations. It should be noted that surface and subsurface soils will be collected from each location thereby doubling the number of samples necessary to be collected.

### *Soils*

The total estimated number of soil samples required was 14 for each surface and subsurface soils. Calculations shown on Table 1 reveals that the number of samples required to be collected was 14 (each media) with a 95% confidence interval. A conservatively high percentage (85%) of the clean-up standards was used for the estimated mean concentration of the future samples.

### *Groundwater*

The total estimated number of groundwater samples required was determined to be 10 with a 95% confidence interval. A conservatively high percentage (80%) of the clean-up standards was used for the estimated mean concentration of the future samples. Groundwater sample number calculations are shown on Table 1.

## TABLE 1
## POST-REMEDIATION SAMPLE QUANTITY CALCULATIONS

### PPG Oak Creek
### Oak Creek, Wisconsin

| Media | Constituent | Clean-up Standard $C_s$ (µg/kg) | Estimated Concentration Range (µg/kg) |  | Estimated Mean Concentration $\mu_1$ (µg/kg) | $\sigma$ | $\alpha$ | $\beta$ | $Z_{1-\alpha}$ | $Z_{1-\beta}$ | Number of Post-Remediation Samples to be collected |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Min | Max |  |  |  |  |  |  |  |
| Soil | Ethylbenzene | 2,900 | 5 | 3,500 | 2,465 | 583 | 0.05 | 0.20 | 1.645 | 0.842 | 11 |
|  | Toluene | 1,500 | 5 | 2,000 | 1,275 | 332.5 | 0.05 | 0.20 | 1.645 | 0.842 | 14 |
|  | Xylenes | 4,100 | 5 | 5,000 | 3,485 | 832.5 | 0.05 | 0.20 | 1.645 | 0.842 | 11 |
| Groundwater | Ethylbenzene | 700 | 1 | 1,000 | 560 | 167 | 0.05 | 0.20 | 1.645 | 0.842 | 9 |
|  | Toluene | 1,000 | 1 | 1,500 | 800 | 249.8 | 0.05 | 0.20 | 1.645 | 0.842 | 10 |
|  | Xylenes | 10,000 | 1 | 12,000 | 8,000 | 2000 | 0.05 | 0.20 | 1.645 | 0.842 | 6 |