Operations and Maintenance Manual

Penta Wood Products

Long-term Response Action

WA No. 132-LRLR-05WE/Contract No. EP-S5-06-01

Prepared for

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CH2MHILL®

135 South 84th Street
Suite 400
Milwaukee, WI 53214

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Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
ACZA	ammonia, copper II oxide, zinc, and arsenate
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and total xylenes
BV	biovent wells
CAMU	Corrective Action Management Unit
COW	coalescing oil/water separator
DAF	dissolved air flotation
DE	diatomaceous earth
DO	dissolved oxygen
ERT	Emergency Removal Team
FP	free product
FS	feasibility study
ft^2	square foot/feet
GAC	granular activated carbon
gpm	gallons per minute
H_2O	water
HDPE	high-density polyethylene
HMI	human-machine interface
hp	horsepower
HVAC	heating, ventilation, and air conditioning
ID	inner diameter
kVA	kilovolt-ampere
LNAPL	light non-aqueous phase liquid
LTRA	Long-term Response Action
µg/L	micrograms per liter
MCC	motor control center
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MMI	man-machine interface
MW	monitoring well
NAPL	non-aqueous phase liquid
NTU	nephelometric turbidity unit
O&G	oil and grease
O&M	operations and maintenance
ORP	oxidation reduction potential
PAL	Preventive Action Limit
PC	personal computer
PCP	pentachlorophenol
PLC	programmable logic controller
psi	pounds per square inch
psig	pounds per square inch gauge
PVC	polyvinyl chloride
PWP	Penta Wood Products
RCRA	Resource Conservation and Recovery Act
RDVF	rotary drum vacuum filter
RI	remedial investigation

ROD	Record of Decision
SACM	Superfund Accelerated Cleanup model
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SOP	standard operating procedure
TDH	total dynamic head
TSD	treatment, storage, and disposal
TSS	total suspended solids
TVSS	transient voltage surge suppression
USEPA	United States Environmental Protection Agency
VFD	variable frequency drive
WDOJ	Wisconsin Department of Justice
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollution Discharge Elimination System

SECTION 1
Introduction

1.1 Purpose

The purpose of this Operations and Maintenance (O&M) Manual for the Long-Term Response Action (LTRA) is to support treatment system operations in complying with the Record of Decision (ROD), the applicable or relevant and appropriate requirements (ARARs), and the remedial goals for the site. The treatment system must be operated in conformance with the draft substantive requirements of a Wisconsin Pollution Discharge Elimination System (WPDES) discharge permit for the site.

1.2 Site Description and Background

The Penta Wood Products (PWP) site is an inactive wood-treating facility located on Daniels 70 (former State Route 70) in Burnett County, Wisconsin. It is located approximately 78 miles northeast of Minneapolis, Minnesota, and 60 miles south of Duluth, Minnesota (Figure 1-1). The Village of Siren, Wisconsin, is approximately 2 miles east of the site. There are five residences within 1,500 feet of the site that use private wells.

The PWP property currently consists of approximately 82 acres that were actively used for wood-treating activities. Forty undeveloped, forested acres were sold after the facility closed. The property is located in a rural agricultural and residential setting and is bordered to the east, west, and north by forested areas. Some of these areas are classified by the State of Wisconsin as wetlands. With the exception of an 8-acre parcel, Daniels 70 forms the southern property boundary.

The PWP site is situated on a hill with a 110-foot drop in elevation from the southern boundary to the northern boundary. The site stratigraphy consists of three layers: an upper sand layer, a silt and clay layer that is not continuous throughout the site, and a lower sand layer. The depth to groundwater is typically 100 feet or more from the ground surface. Groundwater occurs both in a thin, unconfined aquifer, and within the semi-confined aquifer. The regional groundwater flow direction is to the north, although local groundwater flows radially away from the site.

A number of surface water bodies are present north and east of the site. Doctor Lake and an unnamed lake are located 2,000 feet east and northeast of the site, respectively. Approximately 2,140 acres of lakes, 94 acres of bogs, and 7,500 acres of wetland are located within a 4-mile radius of the site. A wetland is located within 130 feet of the northern property boundary.

1.2.1 Site History

PWP operated from 1953 to 1992. Raw timber was cut into posts and telephone poles and treated with either a 5- to 7-percent pentachlorophenol (PCP) solution in a No. 2 fuel oil carrier, or with a waterborne salt treatment called Chemonite consisting of ammonia, copper II oxide, zinc, and arsenate (ACZA). During its 39 years of operation, PWP discharged wastewater from an oil/water separator down a gully into a lagoon on the northeast corner of the property. Process wastes were discharged onto a wood chip pile in the northwestern portion of the property. Ash from a boiler was used to berm a cooling pond. Beginning in the 1970s, Wisconsin Department of Natural Resources (WDNR) investigators noted several large spills, stained soils, fires and poor operating practices.

PWP began an environmental investigation in 1987. In 1988, the onsite production well was closed for potable use when it was found to contain 2,700 micrograms per liter (μg/L) of PCP. The State of Wisconsin Department of Justice (WDOJ) filed a preliminary injunction against PWP in 1991, citing WPDES violations and violations of other state statutes regarding storage of raw materials, and waste handling practices. The facility voluntarily closed in May 1992 with the promulgation of the Resource Conservation and Recovery Act (RCRA) drip track regulations.

The site was put into the Superfund Accelerated Cleanup Model (SACM) pilot program, and a removal action was conducted by the U.S. Environmental Protection Agency (USEPA) from 1994 to 1996. The ACZA treatment building and half of the oil/water separator building were demolished and remaining chemicals and sludges were disposed offsite. Grossly PCP- and metals-contaminated soils were also excavated and disposed of offsite, and other metals-contaminated soils were excavated and mixed onsite with cement to form a 3-acre concrete biopad. USEPA's Emergency Removal Team (ERT) characterized groundwater and soil contamination by collecting hundreds of soil samples and installing monitoring wells. Emergency erosion control measures were taken in 1998 in an effort to reduce washout of contaminated wood debris from the lagoon wall into the wetlands.

A remedial investigation/feasibility study (RI/FS) was conducted by CH2M HILL in 1997-1998 (CH2M HILL, 1998a&b), culminating in the issuance of a ROD in September 1998 (USEPA, 1998). The ROD specifies that the selected remedial action for the site consists of groundwater extraction and treatment in the light non-aqueous phase liquid (LNAPL) area, LNAPL or free product recovery and disposal, soil and sediment consolidation and bioventing, and monitored natural attenuation for the remainder of the groundwater plume. CH2M HILL performed remedial design activities between March and November 1999 (CH2MHILL, 1999), and conducted the remedial action from February to October 2000 (CH2MHILL, 2000). Operation and maintenance of the treatment system began in October 2000.

After initial operation of the treatment system, emulsified oil present in the groundwater resulted in repeated fouling of the granular activated carbon (GAC). It was decided that additional pretreatment would be required to remove the emulsified oil before the existing system could work properly. CH2M HILL conducted treatability studies and a pilot test in 2001 and 2002 to determine site-specific design parameters before designing a pretreatment facility. Design work was completed and construction started in 2003. The pretreatment system became operational in March 2004 and has been in operation ever since.

The continued operation of the groundwater extraction wells depresses the water table in the LNAPL zone to promote LNAPL removal and capture the groundwater plume containing 1,000 µg/L or more of PCP. Treatment system effluent is discharged in accordance with the draft substantive requirements of the WPDES discharge permit. Bioventing is operated to promote natural degradation of the residual diesel fuel petroleum hydrocarbons and PCP in unsaturated zones, including the LNAPL smear zone. Groundwater concentrations outside the capture zone of the treatment system are reduced by natural attenuation to achieve the Wisconsin administrative code requirements for the application of natural attenuation (NR 140 standards).

Effects of the continued operation of the groundwater extraction wells, LNAPL recovery, and bioventing system on the extent of contamination are monitored through semiannual groundwater sampling events. Soil gas parameters have been measured to monitor oxygen uptakes and soil samples collected to evaluate contamination reductions in soils resulting from bioventing system operation.

In 2010, an evaluation of alternatives that would either accelerate the site cleanup activities and/or reduce the long-term operation and maintenance costs associated with continued operation was performed. The purpose of the evaluation was to identify options for optimizing the overall PWP site LTRA. It was determined that with the installation of three additional extraction wells, the amount of PCP removed from the subsurface could be accelerated and potentially be closer to achieving cleanup objectives by the time the site operations are transferred to the state of Wisconsin in August of 2014.

1.2.2 Nature and Extent of Contamination

As a result of spills and past waste-handling practices at the site, subsurface soils to a depth of over 100 feet were contaminated with a PCP/oil mixture beneath the gully where wastewater was discharged from an oil/water separator to a lagoon. Over the years, PWP filled erosion gullies with wood debris. This wood debris layer is semi-saturated with the PCP/oil mixture. The PCP/oil mixture, which has traveled to the groundwater and spread horizontally as a LNAPL layer, is in equilibrium with pore pressures and is not expected to continue spreading. A LNAPL layer of PCP/oil is floating on the water table over an estimated 3-acre area.

A dissolved-phase PCP plume exists in the groundwater and appears to be stable. PCP concentrations in groundwater have been monitored at the site since 1988. PCP groundwater concentrations have shown consistent declines at the majority of monitoring wells over time. There is no evidence of contaminated groundwater discharging to the wetland or migrating below the wetland to surface water bodies.

Groundwater treatment system operation and optimization has led to continuous capture of site contaminants. In recent years, non-aqueous phase liquid (NAPL) thickness has decreased, which could be influenced by a rebounding water table, but reductions in thickness are also likely to be related to optimized NAPL removal from site recovery wells. Based on groundwater sampling results, the residential wells in the area and the onsite potable well indicate that PCP, benzene, toluene, ethylbenzene, and total xylenes (BTEX), or naphthalene are not present in any of the wells.

During the remedial action, contaminated soils were excavated and consolidated into a 7-acre Corrective Action Management Unit (CAMU). PCP-contaminated soils were deposited on the southern portion of the CAMU and arsenic-contaminated soils were placed on the northern portion of the CAMU. A wall of concrete rubble and stabilized arsenic-contaminated soil divides the two portions. The CAMU is covered with 6 inches of sand followed by 6 inches of topsoil.

1.2.2.1 Additional Contamination Found

Site characterization data collected during the removal action indicated that PCP contamination downslope of the collapsed lagoon wall was relatively shallow and was deposited by overland mass transport. Verification soil sampling conducted as part of the remedial action found an area within the confines of the CAMU, at the north end, where the PCP soil levels remained high after the top 2 to 5 feet of soil were scraped off. On June 6, 2000, a backhoe was used to excavate a test pit approximately 15 feet deep at the location where the proposed well nest is located. The estimated elevation of the bottom of the pit was about 10 feet above the water table, within what is considered the smear zone. The sandy soil was saturated and visibly contaminated, with a strong fuel odor. A soil sample collected at the bottom of this pit was analyzed at the onsite laboratory and contained 229 milligrams per kilogram (mg/kg) PCP. Groundwater samples collected from shallow monitoring well MW-09 contained 0.6 μg/L PCP (analyzed in the offsite lab), and deeper monitoring well MW-23 did not contain any detectable PCP (analyzed in the onsite lab). Additional test pits were dug to delineate the soil contamination, within the constraints of not causing slope failure. Test pits excavated just outside of the CAMU to the south and east showed no contamination.

1.3 Summary of Remedial Action

In September 1998, the ROD was finalized specifying remedies to address contamination associated with soil and sediment, surface water, LNAPL and groundwater. The following are the specific remedial action objectives:

- Reduce or eliminate the potential risk to human health and ecological receptors associated with exposure to PCP and fuel oil components in surface water and groundwater, and PCP/fuel oil components and metals in the soil and sediment.
- Reduce or control the source of contaminants.
- Meet the ARARs, including reducing contaminant concentrations in the groundwater beneath the site to below WDNR’s Preventive Action Limits.

The remedial action for the contaminated soil was completed in 2000 and included the construction and consolidation of material into an onsite CAMU. The remedial action to address LNAPL and contaminated groundwater is ongoing and includes the following:

- Groundwater extraction and treatment
- LNAPL recovery
- Bioventing
- Monitored natural attenuation

The current system configuration has been running continuously since 2004, except for scheduled downtime for routine maintenance and repairs. The biovent system, first started in September 2007, operates during the summer and is turned off for the winter months.

The performance goals for the extraction and treatment system are as follows:

- Remove LNAPL, to the extent practicable, to reduce a source of PCP to the groundwater.
- Extract and treat the most concentrated portions (exceeding 1,000 µg/L) of PCP in the groundwater, and reduce concentrations to a level that allows natural attenuation to achieve the NR 140 standards in a reasonable period of time.
- Lower the water table, to the extent practicable, to allow bioventing to promote natural degradation of the residual diesel fuel petroleum hydrocarbons and PCP in the LNAPL smear zone.
- Comply with discharge standards.

In 2010, USEPA and WDNR agreed to a plan to accelerate cleanup activities and reduce the long-term O&M costs associated with continued operation. The optimization activities included the following:

- Install three additional recovery wells to remove additional LNAPL.
- Continue operation of the groundwater extraction and treatment system and free product recovery at full capacity through August 2014.
- Shut down the extraction and treatment system when the amount of LNAPL recovered over time becomes asymptotic. The system would be restarted if monitoring shows the plume migrating offsite.
- Perform semiannual groundwater monitoring until long-term shutdown occurs, and monitor annually thereafter.
- Continue bioventing operations during the warm-weather months.

Installation of the three additional recovery wells (EW-12, EW-13, and EW-14) was completed in March 2011, and the wells were integrated into the extraction and treatment system. Based on discussions with the WDNR and USEPA in 2012, it was determined that to maximize PCP removal from the extraction system prior to the site being turned over to the WDNR in August 2014, the extraction and treatment system operations would continue full-time through that time.

1.4 Modifications to System

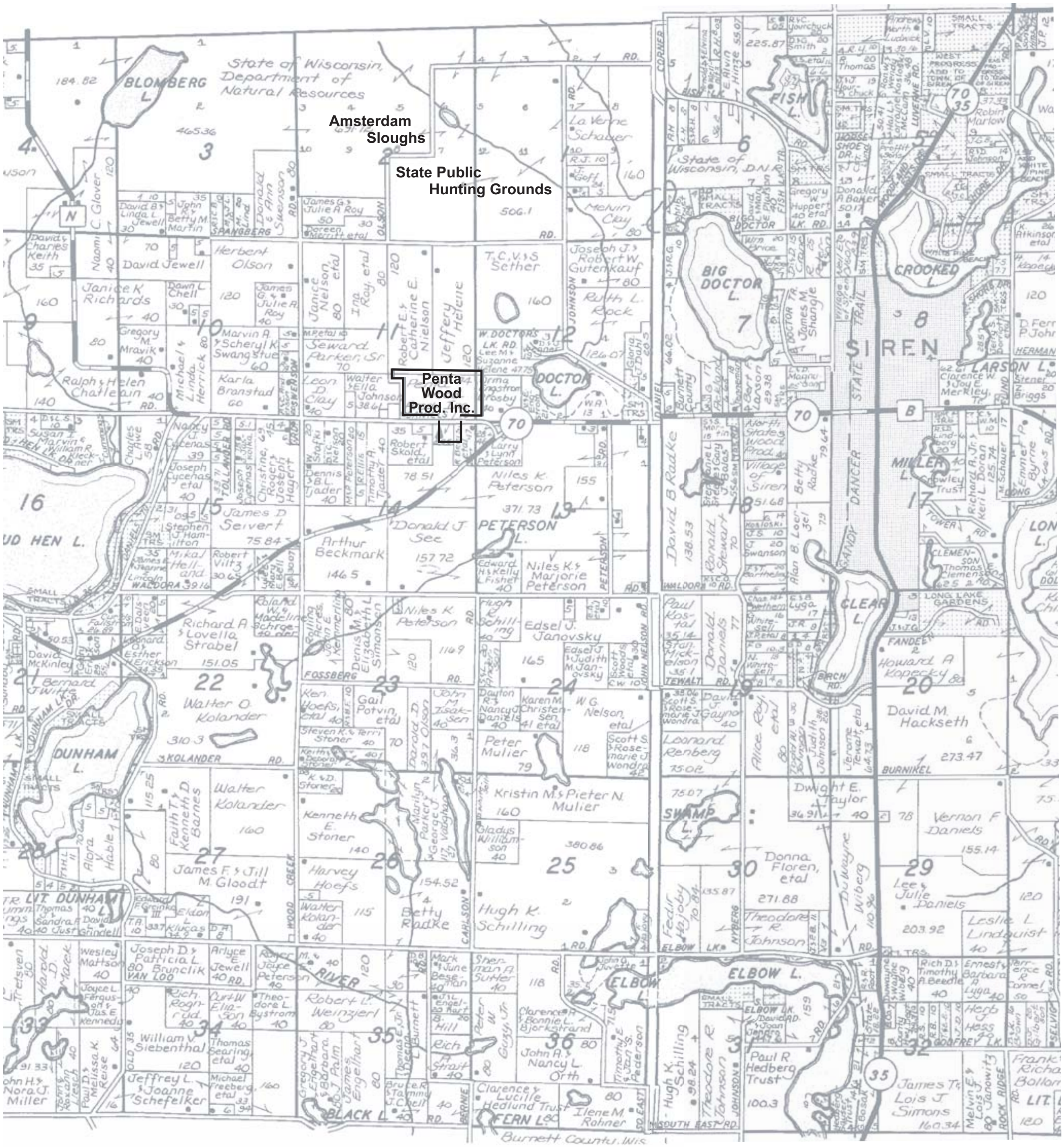
Modifications or improvements to the system or changes in operating procedures may require revisions to selected portions of the O&M Manual. Sections, tables, drawings or appendixes in which changes are made are revised and reissued for insertion into the existing document. The revisions are numbered sequentially beginning with Revision 0 as the original draft document. The revision number is indicated in the header on each page. The sections, tables, drawings or appendixes being revised and the revision number are described in the Master Revision Index and Summary in Table 1-1.

TABLE 1-1
Master Revision Index and Summary
Penta Wood LTRA O&M Manual

Revision Number	Date	Applicable Sections, Tables, Drawings or Appendixes
0.0	November 1999	Original Draft Document
1.0	October 2000	Original Working Document. Incorporates changes and modifications that occurred during the remedial action.
2.0	March 2001	Addresses comments from WDNR and incorporates changes and system modifications since October 2000.

TABLE 1-1
Master Revision Index and Summary
Penta Wood LTRA O&M Manual

Revision Number	Date	Applicable Sections, Tables, Drawings or Appendixes
3.0	October 2004	Incorporates newly added treatment system equipment and building. Includes all Sections.
4.0	August 2005	Incorporates newly added backwash subsystem equipment and slight modifications to the existing process.
5.0	July 2013	Incorporates 10-year operations results and data, three additional extraction wells, and plans for turning the system over to the WDNR in 2014. Includes all Sections.



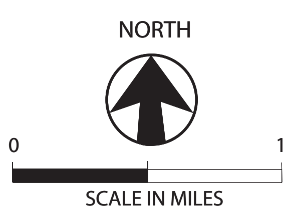


Figure 1-1
Site Location Map
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

SECTION 2

System Description and Operations

This section describes the system components that make up the groundwater extraction and treatment, LNAPL recovery, and bioventing systems. Tables 2-1 and 2-2 provide operating parameters, setpoints, and other pertinent operating information for the groundwater extraction and treatment and LNAPL recovery and bioventing system components described below.

The components are controlled via the human-machine interface (HMI; i.e., desktop computer) using a series of process screens (Figures 2-1 through 2-9). Detailed descriptions of individual system component operating procedures are provided in the Standard Operating Procedures (SOPs) in Appendix A.

2.1 Treatment Building

The current treatment building configuration was constructed in two phases. The original treatment building was constructed to house the initial groundwater treatment and free product recovery system. The second building was constructed to house the pretreatment equipment. The original building layout is 30 feet by 42 feet and is shown in Drawing M-1 in Appendix B.

The pretreatment building is divided into five separate areas: control room (including computers and a restroom), treatment room, storage area on the mezzanine, laboratory and the rotary drum vacuum filter (RDVF) room, and is attached to the original building by a breezeway. The pretreatment building layout is 52 feet by 67 feet and is shown in Drawing P-1. Manufacturer's information for the electrical and heating, ventilation and air conditioning (HVAC) equipment is provided in Appendix C. Additional information is provided in the drawings in Appendix B.

2.1.1 Secondary Containment

To minimize the potential for LNAPL or groundwater to threaten human health and the environment, both the original treatment and pretreatment buildings have been designed with secondary containment. The original treatment building was designed with a 4-inch curb, process drains, an overflow sump, and a 2,500-gallon underground containment vessel (T-2) to contain any spill that may occur within the building and that will provide containment of 100 percent of the volume of the largest vessel (i.e., one 10,000-pound-capacity carbon vessel). In the unlikely event of a spill, water would be collected through two floor drains and directed to a flow-through sump equipped with a level switch. The level switch will alarm the programmable logic controller (PLC) to shut down the groundwater extraction wells and LNAPL recovery pumps, and initiate the autodialer program to notify the operator. Water collected in the 2,500-gallon underground containment vessel would be pumped out and treated by the groundwater treatment system after addressing the cause of the spill. The underground containment vessel (T-2) is oriented east-west, about 10 feet south of the original building.

The pretreatment building was designed with a 7-inch curb, several floor and hub drains, and a 375-gallon drain sump that will provide containment of 100 percent of the volume of the largest vessel (i.e., 5,400-gallon float storage tank) in the pretreatment building. In the unlikely event of a spill, the same alarm and notification process will occur as indicated above for the original treatment building.

2.1.2 Security

The treatment system and office are located in a secured building. A chain-link fence surrounds the CAMU area, which includes the well heads. Additionally, the following additional sensors have been installed in the building:

- Contacts on the overhead door
- Contacts on all exterior pedestrian doors

The opening and closing of the doors are logged in the PLC.

2.1.3 Utilities

Several utilities are used in the building, including a septic system, electric, and propane for heating the buildings. The discharge to the septic system collects in an approximately 2,500-gallon sanitary holding tank. When the tank is full, a beacon light above the bathroom door alerts the operator to schedule a cleanout.

Electricity is supplied to the site through the transformer located adjacent to the pretreatment building. Propane is stored onsite in two 1,000-gallon tanks and used for heating the buildings. Contact information for additional assistance for these utilities or for ordering more supplies can be found in Appendix D.

2.2 Treatment System

The PWP treatment system consists of the following subsystems:

- Groundwater extraction and treatment
- LNAPL recovery
- Bioventing

Groundwater extraction and treatment and LNAPL recovery are operated on a continuous basis, whereas bioventing is operated 1 week per month during the spring, summer, and fall. Note that USEPA and WDNR have determined that the groundwater, LNAPL, and other waste generated at the site are F032 listed hazardous waste. The PCP wood treating waste also carries a secondary designation of F027 waste code in Wisconsin only. Details concerning the management of these wastes are in the *Waste Handling Plan* (CH2M HILL 2013a).

2.2.1 System Startup and Shutdown

A detailed shutdown plan (for long-term shutdown) is detailed in the *Penta Wood Shut Down Plan* (CH2M HILL, 2013b). Detailed procedures for a standard shutdown and startup are summarized in SOPs 01 through 04. The remaining SOPs in Appendix A provide additional details on procedures for operating each system component.

2.2.2 Groundwater Extraction and Treatment and LNAPL Recovery

The groundwater extraction and treatment and LNAPL recovery system consists of extraction and LNAPL recovery wells, well pumps, connecting piping, an oil/water separator, a free product storage tank, equalization tank, chemical conditioning to achieve coagulation and flocculation, a dissolved air flotation (DAF) unit, DAF pump tank, DAF float management system, bag filters, prefilter vessel (currently filled with GAC for use as a particulate filter), GAC treatment, a neutralization tank, controls, and discharge piping. The treated water is discharged to an infiltration basin located northwest of the treatment building (Figure 2-10). The infiltration basin was designed to infiltrate the pumping capacity of the groundwater wells (120 to 160 gallons per minute [gpm]).

The groundwater treatment system is designed to reduce the design influent PCP concentration of approximately 15,000 μg/L to less than 1 μg/L. The treated water is a combination of three different sources: groundwater from the groundwater extraction wells, the coalescing oil/water separator (COW) effluent (subnatant) from the equalization tank (T-11), and the filtrate tank water (T-20). Treatment requirements for the groundwater treatment system are outlined in the draft substantive requirements of a WPDES discharge permit conditions (Appendix E).

A metals removal treatment system for the three metals expected to exceed PALs (iron, arsenic, and manganese) was not included. It is anticipated that these inorganics will oxidize and precipitate in the upper few feet of the infiltration basin. Monitoring within and below the infiltration basin is performed to evaluate the removal of iron and manganese.

Groundwater contamination exceeding the cleanup goals outside the influence of the groundwater collection system is allowed to naturally attenuate to the cleanup goals. Also, once the objectives of the groundwater collection and treatment system are met and the system is shut down, the remaining groundwater exceeding the cleanup goals is allowed to naturally attenuate. Semi-annual groundwater monitoring is used to track the progress of natural attenuation.

The following treatment areas are shown in Figure 2-10:

- Target Groundwater Collection Area (the containment zone defined by the 2011 1,000 μg/L PCP contour).
- Target LNAPL Recovery Area
- Target Bioventing Area
- The area of groundwater contamination exceeding cleanup goals (defined by the 2011 PCP 0.1 µg/L contour)

2.2.2.1 Groundwater Extraction and LNAPL Recovery Wells

The eleven groundwater extraction wells (EW-02 through -07, EW-10 through 14) are designed to depress the water table and capture the area of PCP groundwater exceeding 1,000 μg/L. LNAPL recovery pumps have been installed in six deep extraction wells and four product recovery wells as indicated in Figure 2-11.

The groundwater extraction wells (EW-02 to -07 and EW-10 and EW-11) are placed in the same borehole as the bioventing/free product recovery wells. To accommodate a 6-inch groundwater extraction well and a 4-inch bioventing/free product recovery well, a 16-inch-diameter borehole was advanced to a depth of approximately 150 feet below the pre-CAMU ground surface. Similarly, EW-12 through EW-14 were constructed in a 16-inch-diameter boring hole to allow for a 4-inch LNAPL recovery well and a 6-inch groundwater extraction well; however, these wells do not include bioventing. The groundwater extraction wells are screened at the bottom 20 feet of the borehole. Table 2-3, 2-4 and 2-5 contains specific well construction information for the monitoring wells, groundwater extraction/LNAPL recovery/bioventing wells and soil gas wells respectively.

2.2.2.2 Groundwater Extraction and LNAPL Recovery Well Pumps

The groundwater pumps are 2-horsepower (hp) electric submersible pumps (Grundfos Model 16S20-18). The riser pipe exits the well via a pitless adapter and is connected to the containment pipe via flexible hydraulic hose.

Each groundwater pump is equipped with a variable frequency drive (VFD) to control the speed of the motor and thus the flow rate from the well. The VFDs are housed in a control cabinet equipped with forced air ventilation to reduce heat buildup within the cabinet.

Aquifer pump tests conducted at the site indicate that approximately 0.2 foot of drawdown (decrease in water level) can be maintained 64 feet from the pumping well at a 15-gpm flow rate. Modeling results indicated seven extraction wells capture groundwater in the containment zone at a flow rate of 15 gpm and produce 1.5 to 2 feet of drawdown.

The LNAPL recovery pumps are QED Hammerhead top-loading pneumatic pumps placed approximately at the elevation of the groundwater table to collect and pump the floating LNAPL. When activated, the pump sends LNAPL (and water, if present at the pump inlet) to the oil/water separator located in the treatment building.

2.2.2.3 Piping

As detailed in the ROD, the groundwater and free product are both considered listed hazardous wastes F032 with a secondary designation of F027 waste code (in Wisconsin only). Therefore, to prevent a release to the environment, the groundwater and free product are pumped to the treatment building in dual-containment pipes equipped with a leak detection system; however, the leak detection system is no longer operational.

The groundwater piping is a 2- by 3-inch-diameter, dual-wall high-density polyethylene (HDPE) pipe and the free product pipe is a 1- by 2-inch-diameter, dual-wall HDPE pipe. The groundwater piping specifically for EW-12, 13, and 14 was constructed with 1 ½ -inch conveyance pipe within a 6-inch containment pipe. Once inside the building, the groundwater pipes converge into a Schedule 40 polyvinyl chloride (PVC) manifold and exit as a single 4-inch Schedule 40 PVC pipe. The free product pipes converge into a carbon steel manifold and exit as a single carbon steel pipe connected to the oil/water separator.

2.2.2.4 Coalescing Oil/Water Separator

The COW is relocated into the pretreatment building addition and equipped with aggressive ventilation to protect site workers. The purpose of the COW is to remove free phase product (i.e., No. 2 fuel oil) from the liquid stream sent to it from the LNAPL recovery pumps. It is not designed to remove emulsified oils that are present in the liquid stream.

The COW can receive flow from the LNAPL recovery wells, specifically wells EW-02, EW-03, EW-04, EW-05, EW-06, EW-07, EW-10, EW-12, EW-13, and EW-14. The oil skimmed off in the COW collects in a reservoir and is pumped out by the oil pump when the liquid level is sufficient to activate the high level control switch. The free product is sent to the free product storage tank (T-5) until sufficient volume has been collected for shipment offsite.

After passing through the separation chamber, water flows over a weir into the discharge reservoir. COW effluent water is intermittently pumped to the equalization tank (T-11) prior to being fed into the coagulant reaction tank (T-12) influent.

The COW is equipped with level switches and a control panel that is connected to the PLC. The control panel operates the oil pump via a solenoid valve and also powers the water pump that pumps effluent water from the COW into the equalization tank (T-11).

2.2.2.5 Free Product Storage Tank (T-5)

The double-walled free product storage tank (T-5) is located outside the pretreatment building addition. This tank is insulated and equipped with immersion heaters that are compatible with the waste oil to prevent the liquid contents from freezing. The storage tank is equipped with a level sensor to monitor the interstitial space of the double-walled tank (i.e., leak detection) and alarms when liquid is sensed in the interstitial space, shutting down the LNAPL recovery pumps. An ultrasonic level element and transmitter are also supplied with the tank to provide the PLC with information regarding the level of free product in the tank. The entire system was designed to be in compliance with the appropriate hazardous waste storage regulations. The contents of the storage tank will be pumped out periodically for disposal. The *Waste Handling Plan* (CH2M HILL 2013a) contains detailed information concerning free product storage and handling.

2.2.2.6 Equalization Tank (T-11)

The equalization tank (T-11) functions to chemically and hydraulically equalize the COW effluent water to provide a stable stream to the coagulant reaction tank (T-12). Typically, seven product recovery wells will be active and have varying flows as the fluid level in the extraction wells change. Further, the COW works on a batch-continuous basis, with the COW effluent pumped intermittently to the EQ tank as the level changes in the COW effluent discharge reservoir.

The equalization tank (T-11) is a continuously mixed tank sized to provide equalization of approximately one day of COW effluent. Although the flow surges into the equalization tank, the flow out of the equalization tank (T-11) to the coagulant reaction tank (T-12) is variable to maintain a constant level in the tank. The speed is limited to a minimum speed of 10 percent and a maximum speed of 95 percent. The EQ pump (P-11-2) starts when the tank level is greater than 5 percent plus the stop level, and stops when the tank level is less than the stop level setting. Flow is monitored with a flowmeter on this line. The flow out of the equalization tank is modulated to keep the level within a set operating range.

2.2.2.7 DAF System

The DAF system was designed to greatly improve the performance of the GAC system. The DAF system is intended to provide removal of total suspended solids (TSS) and free and emulsified oil and grease (O&G) from the combined groundwater, COW effluent, and filtrate waste streams. The DAF system is operated in a continuous mode with a float handling system to remove the floated solids. The design includes a single-stage, open style DAF unit with chemical coagulation and flocculation to improve suspended solids removal. The hydraulic loading on a forward flow basis (exclusive of recycle) has been established based on historical data and projection of future loadings.

Chemical Conditioning

Chemical conditioning of the DAF influent is required to enhance removal of TSS and free and emulsified O&G in the DAF.

Two separate tanks with continuous mechanical mixing are used for coagulation (T-12) and flocculation (T-13), and involve the use of ferric sulfate and cationic polymer, respectively. Variable speed mixing allows adjustment of mixing energy to optimize coagulation and flocculation for various flow rates, wastewater quality, and chemical feed. Although the speed can be modified for different chemicals, the speed has not been changed since startup of the plant. The mixers (M-12-2 and M-13-2) are turbine style mixers that are designed to match each tank's mixing requirements.

Chemical feed varies by tank. The coagulant (ferric sulfate) is fed on a pH control basis. This required the installation of pH probes in the coagulation tank. Ferric sulfate is added to maintain pH at approximately 5.2. The pH in the coagulant tank is a critical component for operation of the system. If too little buffering is present and the pH drops below 5.2, the coagulation process works poorly because the pH is too low for the iron to form the hydroxide solid required to achieve effective flocculation and removal in the DAF.

Flocculent polymer is added on a flow-paced basis using the flowmeter just upstream of the coagulation tank. Flocculent polymer used for the DAF unit is a highly concentrated liquid emulsion. The emulsion is diluted in a polymer makeup system to achieve the proper feed strength to maintain an approximate 2 mg/kg concentration of the polymer in the reacted liquid. Given its high strength, emulsion polymers are stored in a small container or drum of 55 gallons or less. At the automatic polymer makeup station (M-23), the concentrated liquid flocculent is dosed and mixed with fresh water to the specified concentration in the top compartment of the makeup tank. The diluted flocculent is then dosed using a chemical feed pump to the injection point in the flocculation tank.

Coagulation and flocculation tanks were designed using the following criteria:

Design Criteria	Coagulation Tank	Flocculation Tank
Retention Time	15 minute (average) 10 minute (maximum)	10 minute (average) 5 minute (maximum)
Tank Size	1,500 gallons	1,000 gallons

Effluent from the coagulation tank flows by gravity to the flocculation tank, and by gravity from the flocculation tank to the DAF. The operator manually adjusts mixing energy by adjusting the VFD in the coagulation and flocculation tanks (T-12 and T-13) to maintain acceptable floc formation prior to DAF treatment. Flocs formed by chemical conditioning of the DAF influent are removed in the DAF unit.

Dissolved Air Flotation Unit (DAF-14)

DAF sizing at the site is controlled by hydraulic loading. The float removal mechanism is operated so as to remove float at a rate roughly equal to its generation rate, to minimize the volume of float generated and thus the water carried out with the float. If the float removal mechanism operates too quickly, additional water could be removed from the DAF along with float solids, resulting in excess float volume with low TSS content. If it operates more slowly, additional float dewatering will take place, resulting in smaller float volume with high TSS content. The downside of this approach is that TSS in DAF effluent quality may deteriorate; that is, TSS and O&G may increase as a result of the overlaying float layer. DAF effluent quality is monitored for turbidity to identify instances when this or other operating problems occur and must be quickly addressed.

Float removed from the DAF by the skimmer will drop into a float hopper. When the amount of float in the hopper reaches a predetermined level, a level monitor will actuate a float transfer pump to convey the float to the float storage tank equipped with a mechanical mixer.

DAF effluent water flows over a weir and into the DAF pump tank (T-15).

2.2.2.8 DAF Pump Tank (T-15)

The DAF pump tank (T-15) is a 1,000-gallon tank that receives DAF effluent from the DAF unit and from which the GAC feed pump (P-15-3) pumps DAF effluent to the GAC treatment process.

A sample pump (P-14-5) pumps a small stream of water from the DAF pump tank (T-15) to a turbidity meter and back into the tank. The turbidity meter continuously monitors the DAF effluent turbidity and sends a signal back to the supervisory control and data acquisition (SCADA) system, where it is compared to the alarm setpoint.

2.2.2.9 DAF Float Management System

The DAF float management system is intended to dewater the float generated at the DAF unit. The float dewatering system consists of the DAF float storage tank, the float conveyance systems, and a precoat RDVF.

2.2.2.10 Float Handling System

Float Storage Tank (T-18)

DAF float is pumped from the float hopper to the float storage tank (T-18). The 5,000-gallon tank generally can hold up to 2 to 3 days of DAF float volume so that the RDVF should not be required to operate over the weekend but will be dependent on the amount of float generated by the DAF system. When the RDVF is operated, it was designed to operate for sufficient time to allow the float storage tank (T-18) to be completely drained.

The storage tank (T-18) is equipped with a top-mounted turbine mixer (M-18-2) to provide a homogeneous feed to the RDVF and to minimize the potential for septic conditions. The mixer includes a VFD so that operators can adjust mixing energy to avoid shearing flocs when sludge sits for an extended period. The mixer runs once the level in the tank reaches about 30 percent.

Flocculent polymer is added to the float storage tank (T-18) the day before dewatering to condition the float and increase dewatering efficiency with the RDVF.

Rotary Drum Vacuum Filter Dewatering System (M-19)

The RDVF (M-19) is used to dewater float from the DAF system. The RDVF dewaters float on a diatomaceous earth (DE) precoat built up at the beginning of each batch run.

Based on design parameters, the design includes a RDVF unit with a precoat system and a surface area of 56.5 square feet (ft^2). The precoat media chosen for operation is DE. The DE is only purchased from Alar Chemical Sales, for quality control purposes (see contact sheet in Appendix D for ordering). The RDVF was sized to operate 4 to 8 hours a day, three times a week during average conditions. The RDVF has a 4- to 6-gpm vacuum pump seal water demand.

The RDVF system includes a precoat slurry makeup system and automatic precoat feed system. At the beginning of a run, the operator makes up a batch of precoat slurry by adding to the slurry tank approximately one bag of dry precoat for every 10 percent of volume in the float tank. Water is added to the slurry tank and agitated to provide consistent slurry feed characteristics. The slurry then is fed automatically to the RDVF drum basin, where it is applied to the drum surface under vacuum.

Generally, at the start of a batch run the RDVF is started and a precoat applied to the drum to a thickness of about 2 to 3 inches, which is typically sufficient for one run. After precoat has been applied to the drum, DAF float then is fed to the RDVF basin. Under vacuum, the float adheres to the surface of the precoat, where water will be pulled through the float to the interior of the drum and exits as filtrate. Solids remaining on the precoat material are scraped off by a doctor blade and fall into a collection dumpster where they are stored until transported offsite for disposal. The filtrate from RDVF is collected in a filtrate collection tank equipped with a filtrate transfer pump included in the RDVF system. The filtrate is pumped to the filtrate storage tank (T-20) and combined with the extracted groundwater and equalization tank effluent to create the DAF system influent.

Approximately 30 minutes is required to start the RDVF process and 30 minutes to shut it down. Once the process is running there are a few checks, as described in the SOP, approximately every 30 minutes for the 4 to 6 hours of run time.

Controls for the RDVF are included as part of the package. These controls are integrated to control both the RDVF and the pre-coat skid. Some signals are transmitted into the PLC and SCADA system that monitor and control the overall facility; however, the operator has the ability to shut down the RDVF system from the SCADA computer or

PLC. Startup of the RDVF is performed at the RDVF unit so that the operator is present to watch the initial precoat operations, as well as shutdown so they can confirm that the drum fabric is fully clean at the end of the run.

Filtrate Storage Tank (T-20)

Filtrate is pumped from the RDVF to the filtrate storage tank (T-20). The tank holds up to 3 days of filtrate generated from dewatering DAF float, in addition to accommodating wash water generated during cleanup; however, if a backwash is performed, one backwash cycle fills about 25 percent of the tank volume.

The storage tank is equipped with a top-mounted turbine mixer (M-20-2) to provide a homogeneous feed back to the DAF system and to minimize the potential for septic conditions. The mixer includes a VFD so the operator can adjust mixing energy; however, the mixer in this tank is not operated.

2.2.2.11 Bag Filters

DAF effluent is pumped from the DAF pump tank (T-15) to particulate bag filters located in the original building to filter suspended solids from the DAF effluent. There are several sizes of mesh available for the bags (50-micron, 75-micron, or 100-micron). Selection of the appropriate mesh size is based on the DAF effluent turbidity. For nephelometric turbidity units (NTUs) < 5, a 75- or 100-micron bag is typically used. For NTUs > 5, a 50-micron bag is typically used.

The spent bag filters are managed as F032-listed hazardous waste (with a secondary designation as F027 in Wisconsin only) and disposed at a RCRA Subtitle C treatment, storage, and disposal (TSD) facility. In general, bag filters are changed out prior to the maximum differential pressure (22 pounds per square inch gauge [psig]) being reached (or approximately once every 3 days or more frequently depending on the DAF effluent turbidity). The procedure for changing out the bags is summarized in SOP #17. Refer to the *Waste Handling Plan* (CH2M HILL 2013a) for more information on handling and disposing of the bags.

2.2.2.12 Granular Activated Carbon Prefilter

This 2,500-pound GAC prefilter vessel removes the remaining particulates from the system water so that the 10,000-pound vessels are able to function more efficiently.

2.2.2.13 GAC Prefilter Vessel Backwash System

The GAC prefilter backwash is a manually operated system that is run on an as-needed basis when pressure on the prefilter is between 5 and 10 pounds per square inch (psi) to flush the GAC prefilter vessel. Backwashing is necessary to lift the particulates out of the carbon bed and back into the solid separation process of the treatment system. This system is comprised of a carbon steel centrifugal-type pump that has a design rate of 200 gpm at 100 feet total dynamic head (TDH). The pump is connected to the neutralization tank via a vacuum-rated flexible piping with cam-lock fittings.

Clean water from the neutralization tank is pumped into the base of the GAC prefilter vessel as described in the SOP. Additional clean water is added to the neutralization tank via a 2-inch copper pipe from the lab. The backwash water is routed, via 4-inch Schedule 80 PVC pipe, to either the float storage tank or the filtrate storage tank. The filtrate storage tank is the preferred destination for the flushed water to be recycled into the treatment system for treatment. If backwash is routed to the float tank, the carbon present in the backwash will be pumped to the RDVF and can clog the pumps and/or pipes. This option is rarely used but is available as a contingency.

2.2.2.14 Granular Activated Carbon

GAC prefilter effluent is further treated by the two 10,000-pound-capacity GAC vessels connected in series (20,000 pounds GAC total). The vessels are operated in a lead-lag scenario so that the bulk of the contaminant adsorption occurs in the first (lead) vessel and the second (lag) vessel further polishes the water. The vessels are sized to reduce the PCP concentration in the groundwater from approximately 15 milligrams per liter (mg/L) to less than 1 μg/L.

The lead vessel effluent is monitored for PCP breakthrough to determine when the GAC requires replacement. Once PCP breakthrough has occurred, arrangements are made to replace the carbon in the lead vessel, and the flow path will be reversed so that the former lead vessel becomes the lag vessel and the former lag vessel is now the lead vessel (SOPs 06-09). The spent activated carbon will be managed as F032-listed hazardous waste (with a secondary designation as F027 in Wisconsin only) and disposed at a RCRA Subtitle C TSD facility. See the *Waste Handling Plan* for more information.

2.2.2.15 Neutralization Tank (T-16)

Prior to discharge to the infiltration basin, GAC effluent pH is adjusted up from approximately 5.2 to a pH of 6.5 with 20 percent sodium hydroxide (caustic soda). The pH is continuously measured by two pH probes mounted on the tank and the speed of the chemical feed pump is automatically adjusted to be sure the required pH is achieved before the water is discharged to the infiltration basin. The tank is equipped with a top-mounted turbine mixer (M-16-2) to provide complete mixing of the sodium hydroxide and a homogeneous feed to the infiltration basin. The mixer includes a VFD so the operator can adjust the mixing energy.

2.2.2.16 Treated Groundwater Discharge

Treated groundwater is discharged to an onsite infiltration basin (see Figure 2-10) designed to infiltrate 120 to 160 gpm. The infiltration basin is located to minimize the potential for treated water to discharge over the target groundwater collection area and induce gradients away from the groundwater collection system.

Several features have been added to the infiltration basin design as precautions for severe operating conditions. First, the potential for freezing of the infiltration basin was evaluated. The thermal mass balance indicted that it is likely the infiltration basin will freeze during typical winter conditions at the site. As a result, the infiltration basin is designed so that the influent pipe can be diverted from being a surface discharge to the infiltration basin to being discharged into an underground leach field by opening and closing a valve located in the infiltration basin. When the valve is closed water is diverted to the infiltration basin; if the valve is opened, the water is diverted to the underground leach field.

Secondly, the potential for clogging of the infiltration basin was considered. If the infiltration basin becomes clogged from the iron and manganese that precipitate from the groundwater, the water level will rise in the basin. Before the water level overtops the basin, the water will flow into a manhole inlet and enter the below ground leach field in a manner similar to the winter conditions when the infiltration basin freezes. The clogged layer can be easily scraped off to expose a fresh sand layer by simply diverting the influent directly to the manhole and allowing the standing water to drain. These two options give the treatment effluent the capability to infiltrate under these severe operating conditions without compromising the operation of the system.

2.2.3 Bioventing System

The objective of bioventing is to enhance aerobic degradation of PCP-contaminated soil by injecting air into the unsaturated zone above the groundwater table. The bioventing system consists of nine injection wells, connecting piping, blower, and the associated controls.

The target depth of treatment extends to approximately 102 feet below the existing (pre-CAMU) ground surface (bgs), about 2 feet below the current water table elevation. The groundwater collection system is used to lower the water table to expose the LNAPL smear zone at the current water table to the air supplied by the bioventing system.

2.2.3.1 Soil Treatment Area

The target bioventing area is shown in Figure 2-10. The depth of PCP-contaminated soil in the central area of the CAMU is about 120 feet and extends from the existing surface to about 10 feet below the current water table. The southern area of the CAMU near the former treatment building has a shallow PCP-contaminated soil top approximately 10 feet deep. The volume of contaminated soil to be bioventеd is approximately 400,000 cubic yards. The average PCP concentration in the unsaturated zone is 150 mg/kg and in the smear zone is 1,500 mg/kg, based on samples collected in 2011. The wood debris and buried wood chips placed in the CAMU are also treated by the bioventing system.

2.2.3.2 Biovent Wells

Biovent wells are screened from approximately 12 feet below the final CAMU ground surface to 10 feet below the static water table to achieve air distribution over the full target depth. Based on the results of the bioventing treatability test, the design maximum airflow rate for six of the biovent well nests was 500 standard cubic feet per minute (scfm) (BV-02-D to -07-D, -11-D) and 200 scfm for two shallow biovent well nests (BV-08-S and -09-S), at a pressure of approximately 50 inches water (H_2O) to the subsurface target area. The deep biovent wells operate between 300 and 430 scfm and the shallow wells operate at 160 scfm.

The bioventing system was first started on September 24, 2007. Because of the increases of methane and the frozen ground surface (which may prevent upward release of the methane and may result in a lateral spreading of the methane to nearby residences), the bioventing system is shut down during the winter months. The system is restarted after the spring ground thaw. In June 2009, the bioventing operation was modified to reduce the operating time to 5 days per month. Evaluation of the monitoring data showed that oxygen levels can reach saturation levels within the first several days of blower operation in the majority of the unsaturated zone, and that during 1 month of not operating, only a small decrease in the oxygen levels is observed. The effectiveness of the biovent, therefore, is not compromised by this pulsed operation, which can provide a reduction in operation costs through lowered energy consumption.

Well nest locations are based on the 125-foot design radius of influence for each biovent well nest, using the results of the treatability study. Radius of influence is typically defined as a soil gas pressure reading of greater than 0.1-inch H_2O. Soil gas pressures well above 0.1-inch H_2O and oxygen measurements near 20 percent were detected 100 feet from the test well. The data were plotted and a design radius of 125 feet is expected to have soil gas pressures above 0.1-inch H_2O. The design radius resulted in the installation of eight bioventing wells within the bioventing area as described above.

The design airflow rate was also determined using the treatability study results. The treatability study was conducted using a 500-scfm airflow rate at a pressure of 50 inches H_2O. This airflow rate was able to saturate the subsurface soil with oxygen to a depth of 90 feet. The ability of the biovent wells to accommodate this airflow rate was confirmed using a mathematical model. The model predicts the airflow rate across the injection well screen. The model predicted the injection well could handle 328 scfm per foot of well screen. This rate is well above the treatability study airflow rate of 5 scfm per foot. Because the treatability study achieved oxygen saturation at the 500-scfm flow rate, there is no need to increase the airflow rate. The two shallow biovent wells located in the southern end of the CAMU are designed for treating the upper 10 feet of soil. Given the shallower depth, an airflow rate of 100 to 200 scfm per well was determined to be adequate to saturate the soil with oxygen.

The biovent wells are constructed with Schedule 80, 4-inch inner diameter (ID) PVC pipe and installed in the same borehole as the groundwater extraction wells. Table 2-4 contains the well construction information.

2.2.3.3 Blower and Piping System

The blower is a 75-hp centrifugal blower capable of providing up to a total of 5,000 scfm at 55 inches H_2O in order to provide the required airflow rate to each biovent well. The blower has been initially set up to provide 4,000 scfm, but the blower has been specified to easily accommodate expansion by changing the sheaves, in case additional injection wells are required or higher flow rates are needed in the future.

The piping system consists of a 12-inch HDPE intake pipe attached to an intake filter/silencer, a 16-inch HDPE manifold that feeds seven 8-inch (one 8-inch header is a spare and capped off outside the treatment building) and two 6-inch headers. Each pipe is equipped with a flowmeter, flow control valve, and a pressure indicator, and excess air is vented to the outside of the building via a vent pipe. At the well vault, the 8-inch or 6-inch HDPE pipe is reduced to a 4-inch flexible pipe connected to the biovent well. Airflow to the biovent well can be further controlled using the additional flow control valve located in the well vault.

2.2.4 Air Compressor System

Process air is required for the following pieces of equipment:

- Free product pumps
- COW waste oil transfer pump
- DAF unit
- DAF float hopper transfer pump
- RDVF feed pump
- RDVF unit
- RDVF filter cake chute controls

The main air compressor located in the pretreatment building supplies process air to the equipment listed above. The estimated total air demand is 36 scfm at 105 psi maximum. The replacement air compressor installed in spring 2012 is capable of supplying 81 scfm at 125 psi. A backup air compressor is located in the original building and can be used to run limited operations at the plant. The discharges for the two air compressors have been connected to a common manifold so that the backup air compressor can serve as a supplement to the main compressor if additional air demand is required in the future.

Each air compressor is supplied with its own control panel, with connections to the PLC. The receiver tanks are equipped with a low-level pressure switch connected to the PLC and an automatic drain valve. The main air compressor consists of a 20-hp air compressor with 132-gallon receiver tank, an air dryer with pre- and after-filters, and bypass. The backup air compressor consists of a 7.5-hp air compressor with 120-gallon receiver tank, an air dryer with pre- and after-filters, and bypass.

The main air compressor is connected with a 1-inch manifold to provide air to the ¾-inch line to the DAF unit and DAF float hopper transfer pump, a 1-inch line to the RDVF, a ¾-inch line to the existing compressor, and a ¾-inch line to the oil pump. Each of these lines is controlled by the PLC by means of solenoid valves. The COW control panel controls the solenoid valve for the oil pump.

2.3 Process Automation, Control, and Security

The controls from the original treatment system remain in place in the original treatment building and monitor that same equipment, except for the COW that was moved to the pretreatment building. An additional control system and PLC were installed in the control room of the pretreatment building that monitors pretreatment equipment, the COW, and information from the original PLC system, which is linked through an information highway that allows all operating systems to be monitored from one PLC.

2.3.1 Motor Control Center

2.3.1.1 Original Treatment Building MCC (MCC-1)

The motor control center (MCC) in the original building (MCC-1) is a Cutler-Hammer Freedom 2100 Series that receives a 3-phase, 480-volt incoming electrical service and has provisions for a lightning arrestor and an IQ data monitor. MCC-1 is equipped with a 225-amp main breaker and contains the motor starters for the blower motor, recovery pumps, and the backwash pump. It also holds the circuit breakers for the air compressor, low-voltage panel, and the two unit heaters. MCC-1 also includes a 10-kilovolt-ampere (kVA) transformer to provide 120/240-volt power to Panelboard PL1.

2.3.1.2 Pretreatment Building MCC (MCC-2)

The MCC in the pretreatment building (MCC-2) is a Cutler-Hammer Freedom 2100 Series that receives a 3-phase, 480-volt incoming electrical service and has provisions for a lightning arrestor and an IQ data monitor. MCC-2 is equipped with a 500-amp main breaker and contains the motor starters for the pumps, mixers, HVAC blowers, etc., that were installed during the pretreatment system installation.

Circuit breakers for the low-voltage panels (LP-2A and LP-2B) and the office unit heater are mounted in the office, as well as the 15-kVA and 30-kVA transformers, which provide 120/240-volt power to panelboards LP-2A and LP-2B.

Following an electrical event in August 2008 that resulted in damage to the electrical distribution, PLC, Cutler-Hammer Clipper transient voltage surge suppression (TVSS) module in the service-entrance MCC-2, and other site equipment, a fully integrated and staged TVSS system using devices as manufactured by Surge Suppression, Inc. of Destin, Florida, was installed. This system will provide surge voltage and current protection at every stage of the electrical distribution system, including all electronic point-of-use devices (i.e., PLCs, computers, flowmeters).

2.3.1.3 Backup Generator

A backup generator is located outside the pretreatment building that will supply power to the office equipment (PLC, MCC, computers) during power outages. The generator does not power the water treatment system or other components in the building. The backup generator performs a self-test every Friday afternoon and runs for approximately 10 minutes.

2.3.2 Supervisory Control and Data Acquisition

The treatment system operation and data acquisition functions are supervised by a PLC. The PLC monitors all automatic functions of the system and receives all alarm inputs. Upon receiving a shutdown alarm input, the PLC will call out (using an autodialer software program) and notify the operator that the system is down.

The bioventing and groundwater treatment systems are designed to operate continuously with operator oversight. Each system is equipped with an automated shutdown control system that activates under abnormal conditions. Critical conditions and process parameters can be monitored by remote access to the SCADA system and an autodialer will notify the operator when an alarm condition occurs. The operator is required to evaluate the alarm condition, make adjustments, reset the equipment, and restart the system, as described in Section 3.1. The following sections describe the instrumentation and controls associated with the system. Figures 2-1 through 2-9 show the man-machine interface (MMI) display screens.

2.3.3 Programmable Logic Controller

2.3.3.1 Original Treatment Building PLC

A PLC is located in the original treatment building and controls the operation of the backup air compressor control panel, biovent blower, solenoid valves for the LNAPL recovery pumps, and groundwater pumps. The inputs from pressure/level/temperature switches and intrusion sensors located in the original treatment building are routed through the original treatment building PLC. There are also several analog inputs to the original treatment building PLC, including differential pressure transmitters for the bag filters, prefilter vessel, carbon vessels, and the effluent flow transmitter.

2.3.3.2 Pretreatment Building PLC

An additional PLC operates the pretreatment equipment installed as part of the pretreatment system. The pretreatment building PLC controls the operation of the coagulation and flocculation, DAF, and RDVF processes, as well as the odorous air fans, potable water well pump, the oil/water separator control panel, and the equalization tank mixer. The PLC logs the following parameters, which are available to download off of the system computer:

- Pressures and differential pressures in the bag filters, prefilter, lead and lag carbon filters
- Caustic pump speed and caustic tank level
- Coagulation tank pH and neutralization tank pH
- DAF pump tank level and DAF turbidity
- Effluent flow rate and totalized effluent (gallons)
- Equalization tank flow and tank level
- Ferric pump speed and ferric tank level
- Filtrate tank flow and tank level
- Groundwater influent flow rate
- LNAPL tank level

- Polymer dosage
- Total plant flow rate
- Individual groundwater and free product well run times (hours)
- Blower run time (hours)

2.3.4 Man-machine Interface

The MMI is the desktop computer (personal computer [PC]) and is the mechanism that allows the operator to control and monitor the system and its processes. The system cannot be operated automatically without the MMI. The operator should be familiar with the operation of PCs and their associated terminology in order to operate the system. Figures 2-1 through 2-9 show all the interactive screens used to control the system.

2.3.5 Groundwater Treatment/LNAPL General Control Description

The groundwater extraction pumps are turned on and off through the PLC (Figure 2-3). The flow rates from each well are adjusted through the PLC by changing the frequency of the VFD and local display flowmeters. The total influent groundwater flow rate is monitored with a flowmeter that is remotely displayed (Figures 2-1 and 2-2).

The PLC controls the operation of the LNAPL recovery pumps by opening and closing the solenoid controlling the process air to the pump (Figure 2-3). The PLC allows air to flow to the pump for a preset time period (e.g., 10 minutes) on a routine schedule (e.g., 60 minutes). The PLC is programmed to operate up to eleven product recovery pumps at a time. Changes to the pumping intervals and schedules are made based on field conditions and can be easily accommodated with the PLC.

Differential pressure transmitters are located before and after every pressure vessel. The PLC receives inputs from the pressure transmitters and shuts the system down at a preset pressure differential (Figure 2-9). Table 2-2 lists the pressure setpoints.

The GAC system is not equipped with any system redundancy. Shutdown of the groundwater system for a short time is not detrimental to the remediation and may in fact be beneficial by reintroducing moisture to the target LNAPL smear zone.

2.3.6 Bioventing General Control Description

The bioventing system can be operated in either a manual or automatic mode. In the automatic mode, the PLC will monitor the alarm inputs from the downstream pressure switch. If the pressure increases or decreases beyond a preset pressure range, an alarm is activated and the PLC will shut the blower off to prevent damage to the blower. Operation of the blower in the manual mode will bypass the pressure switch alarm settings. The blower will normally be operated in the automatic mode. The bioventing system is run from spring through fall for 5 days each month.

Airflow measurements are conducted at the site using pilot-static, equal annuli flowmeters. The airflow rate to each well is set manually at the site. The blower is equipped with an upstream vacuum pressure indicator and a downstream pressure switch, pressure indicator, and a temperature indicator. The pressure switch is equipped with preset LOW and HIGH alarm points to indicate when the blower is not functioning properly.

The bioventing system is not equipped with any system redundancy. Based on the results of the treatability study, shutdown of the bioventing system for a short time is not expected to deprive the target area of oxygen. The system is operated 5 days each month, from spring (ground thaw) until fall.

2.3.7 Treatment System Alarms and Sensing Devices

The operator is notified by the autodialer program of the alarm and the operator can call into the system to identify the alarm. In the case of a general process alarm, the operator will have to go to the site to identify which specific general process alarm exists. Activated alarms are recorded and displayed on the alarms screen (Figure 2-7).

Activation of an alarm will initiate the autodialer program. The autodialer is programmed to dial a list of predefined telephone numbers. The autodialer will continue to call each phone number in succession until the call is acknowledged. The autodialer program will provide a verbal description of the alarm and the operator will need to acknowledge the autodialer by pressing “0” on their phone keypad. The autodialer program controls are listed below and correspond to the numbers on a phone keypad.

1 — First alarm
2 — Next alarm
3 — Previous alarm
4 — Most recent alarm
5 — Listen to selected alarm
6 — Listen to selected value
7 — Listen to all alarms
0 — Ack selected alarm
* — Exit phone program
Password – “5”

Upon arrival at the site, the operator is required to acknowledge the alarm by clicking on the “Ack Current” button located on the Alarms screen (Figure 2-7) and evaluate the alarm condition and make adjustments and/or corrections. After the condition that activated the alarm is corrected and prior to restarting the system, the operator will need to reset the system interlock that was activated. Interlocks are reset by clicking on the RESET button located on the Interlock screen (Figure 2-6). After resetting the interlock, the system should be restarted, as described in the SOP.

TABLE 2-1

Groundwater Extraction and Treatment and LNAPL Recovery Operating Parameters

System Component	Parameter	Set Points	Comments
Groundwater Extraction Well Pumps	Flow rate	9 gpm	Set at control room computer.
	VFD speed	--	Set at control room computer.
Free Product Recovery Pumps	Pump level	Adjust to draw free product	Set at pump in well, adjust monthly.
	Flow rate	variable	
COW oil reservoir pump to T-5	Pump frequency	variable	Pumps out when level activates high level switch
COW effluent water to T-11	Flow rate	variable gpm	
Free Product Storage Tank (T-5)	Temperature	60-70 degrees F in winter	Monitor in Control Room, see Figure 2-3
	Level Sensor	Empty when storage tank reaches 50%	Monitors leak detection
Equalization Tank (T-11)	Flow rate of effluent to T-12	variable	30% tank level, the pump turns on, (flow rate adjusts based on the level of the tank)
	Stop Mixer/Pump	30%	Stop mixer operation when tank at set point level: See Figure 2-9
	Level condition: HI Level	75%	Activates COW interlock to stop discharge pump operation to avoid overfilling the equalization tank: See Figure 2-9
Coagulation Tank (T-12)	Mixer speed	4.2	Manually adjustable on the side of the tank. There is a knob (0-10) to turn up or down. Coag tank mixer should be set slighter higher than floc tank mixer
	pH	5.2 (HI = 8.00, LOW = 2.00)	Check ph probe daily per SOP/Calibrate weekly or when out of compliance with SOP
	Ferric sulfate flow rate	variable	Adjusted by the pH automatically
Flocculation Tank (T-13)	Mixer speed	4.0	Manually adjustable on the side of the tank. There is a knob (0-10) to turn up or down.
	cationic polymer flow rate	variable	Based on the concentration setpoint.
Chemical Storage Tanks	Temperature	variable	Must be above 40 degrees F.
Polymer Makeup System	Polymer concentration	0.7ppm	Adjustable based on visual determination of floc quality
Odorous Air Fans			
DAF Unit	Hydraulic loading	variable	Gravity fed from floc tank, varies with how many wells are pumping, approximately the same flow rate as the system flow rate
	DAF float hopper transfer level	variable	Adjusted by the level senser in the hopper.
DAF Pump Tank (T-15)	Ultrasonic Level Sensor/Transmitter	40%	Monitors water level in tank and sends signal to the GAC feed pump VFD to maintain desired setpoint water level.
	Level Switch High-High	85%	Activates DAF interlock to stop operation of the groundwater, free product, and the DAF float discharge pumps to avoid overfilling the storage tank
	DAF effluent turbidity	Maintain LOW turbidity (HI = 20.00 NTU, HIHI = 25.00)	
Float Storage Tank (T-18)	Mixer speed	--	Mixer on "ON AUTO", no speed control.
	Level Switch Low	20%	Stop mixer operation
	Level Switch High	90%	Starts mixing if the system was shut down due to low level. Activates DAF interlock to stop operation of the groundwater, free product, and the DAF float discharge pumps to avoid overfilling the storage tank
Rotary Drum Vacuum Filter (RDVF) Dewatering System			
Filtrate Tank (T-20)	Mixer speed	0	Do not run mixer
	Level Switch Low	8%	Stop mixer operation
	Level Switch High	85%	Starts mixing if the system was shut down due to low level. Activates RDVF interlock to stop operation of the RDVF feed pump to avoid overfilling the storage tank
Bag Filters	Pressure	12 psi	12 psi maximum before change out, alarm is set at 22.3 psi
GAC Pre-Filter	Pressure	5 to 10 psi	5 to 10 psi maximum before backwash, alarm is set at 20 psi
Lead GAC Vessel	PCP breakthrough	Alarm at 20 psi	Usually wait to collect a mid-GAC sample at 18 weeks as long as the pressure is below 5.0 psi
Neutralization Tank (T-16)	pH	6.5 (HI = 15.00, LOW = 2.00)	
	Caustic flow rate	Variable	Adjusted by the pH automatically
	Mixer speed	--	Always on "ON HAND", no speed control.
	Level Switch Low	--	Mixer runs all of the time
	Level Switch High	--	Tank gravity feeds to infiltration basin.
Infiltration Basin	Treated water discharge flow	50-100 gpm	
	Surface vs. Underground Discharge	surface	Adjust with valve in basin

TABLE 2-2

Bioventing System Operating Parameters

System Component	Parameter	Set Points	Comments
Biovent Wells	Airflow Rate	--	Individually set at main valve on well
Biovent Blower	Airflow Rate	> 10 H2O	
	Pressure	0.4 psi	
Air Compressor	Pressure	130 psi	

TABLE 2-3
Summary of Monitoring Wells Screen Intervals

		Well Construction					
Well ID	Aquifer	Top of Casing Elevation (ft MSL)	Top of Screen Elev (ft MSL)	Depth to Top of Screen (ft)[1]	Bottom of Screen Elev (ft MSL)	Depth to Bottom of Screen (ft)[1]	Screen Length (ft)
MW-01	UC	1070.83	978.93	93.39	973.93	98.39	5
MW-02	UC	1064.18	984.05	80.80	979.05	85.80	5
MW-03	SC	1127.96	950.87	178.63	945.87	183.63	5
MW-04	SC	1087.65	906.28	181.53	901.28	186.53	5
MW-05	UC	1071.58	958.72	113.01	953.72	118.01	5
MW-06S	UC	1092.10	999.72	108.91	979.72	128.91	20
MW-07	SC	1094.42	931.07	165.32	926.07	170.32	5
MW-08	SC	1088.98	934.28	157.00	929.28	162.00	5
MW-09	UC	1018.21	973.69	47.02	963.69	57.02	10
MW-10	SC	1082.71	956.49	133.25	951.49	138.25	5
MW-10S	UC	1083.02	995.49	94.94	975.49	114.94	20
MW-11	SC	1083.43	943.51	142.07	928.51	157.07	15
MW-12	SC	1079.73	959.24	122.75	945.24	136.75	14
MW-13	UC	1003.99	986.15	19.95	977.15	28.95	9
MW-14	SC	1076.78	917.27	161.23	902.27	176.23	15
MW-15	SC	1125.81	971.09	156.13	956.09	171.13	15
MW-16	UC	1079.96	991.97	89.95	976.97	104.95	15
MW-17	SC	1081.48	957.43	127.07	947.43	137.07	10
MW-18	UC	1074.07	978.74	93.70	958.74	113.70	20
MW-19	UC	1085.15	993.30	94.87	973.30	114.87	20
MW-20	UC	1085.43	988.29	109.47	978.29	119.47	10
MW-21	UC	1093.63	991.13	104.57	981.13	114.57	10
MW-22	UC	1082.84	990.84	93.86	980.84	103.86	10
MW-23	SC	1015.45	900.45	117.12	890.45	127.12	10
MW-24	UC	1098.42	985.42	98.68	975.42	108.68	10
MW-25	UC	1092.84	987.34	107.90	977.34	117.90	10
MW-26	UC	1087.1	959.07	128.00	944.07	143.00	15
MW-27	UC	1111.00	996.00	115.00	976.00	135.00	20
MW-28	SC	1083.1	968.10	115.00	948.10	135.00	20

Notes:
(1) Depths are referenced to the December 2000 top of casing elevation
DTB = Depth to Bottom of the well
SC = Semiconfined aquifer
UC = Unconfined aquifer

TABLE 2-4
Summary of Extraction Well/LNAPL Recovery and Bioventing Wells Screen Intervals

Well ID	Aquifer	*Depth to Top of Screen (ft)*	Depth to Bottom of Screen (ft)	Screen Length (ft)
Extraction Wells				
EW-02 (GW)	SC	125.00	145.00	20.00
EW-02 (LNAPL/Biovent)	UC	12.00	115.00	103.00
EW-03 (GW)	SC	133.00	153.00	20.00
EW-03 (LNAPL/Biovent)	UC	12.00	123.00	111.00
EW-04 (GW)	SC	145.00	165.00	20.00
EW-04 (LNAPL/Biovent)	UC	13.00	135.00	122.00
EW-05 (GW)	SC	121.00	141.00	20.00
EW-05 (LNAPL/Biovent)	UC	12.00	111.00	99.00
EW-06 (GW)	SC	126.00	146.00	20.00
EW-06 (LNAPL/Biovent)	UC	12.00	116.00	104.00
EW-07 (GW)	SC	130.00	150.00	20.00
EW-07 (LNAPL/Biovent)	UC	12.00	120.00	108.00
EW-10 (GW)	SC	133.00	153.00	20.00
EW-10 (LNAPL/Biovent)	UC	12.00	123.00	111.00
EW-11 (GW)	SC	90.00	110.00	20.00
EW-11 (LNAPL/Biovent)	UC	20.00	80.00	60.00
EW-12 (GW)	SC	130.00	150.00	20.00
EW-12 (LNAPL)	UC	95.00	125.00	30.00
EW-13 (GW)	SC	135.00	155.00	20.00
EW-13 (LNAPL)	UC	95.00	125.00	30.00
EW-14 (GW)	SC	133.00	153.00	20.00
EW-14 (LNAPL)	UC	98.00	128.00	30.00
Bioventing Wells				
BV-08	UC	12.00	27.00	15.00
BV-09	SC	12.00	27.00	15.00

Notes:
SC = Semiconfined aquifer
UC = Unconfined aquifer

TABLE 2-5

Summary of Soil Gas Wells Screen Intervals

Well ID	Depth to Top of Screen (ft)	Depth to Bottom of Screen (ft)	Screen Length (ft)
Soil Gas Wells			
SG-04 (shallow)	6.00	8.00	2.00
SG-04 (intermediate)	46.00	48.00	2.00
SG-04 (deep)	86.00	88.00	2.00
SG-05 (shallow)	8.00	10.00	2.00
SG-05 (intermediate)	41.00	43.00	2.00
SG-05 (deep)	87.00	89.00	2.00
SG-06 (shallow)	8.00	10.00	2.00
SG-06 (intermediate)	50.00	52.00	2.00
SG-06 (deep)	92.00	94.00	2.00
SG-07 (shallow)	6.00	8.00	2.00
SG-07 (intermediate)	64.00	66.00	2.00
SG-07 (deep)	105.00	107.00	2.00
SG-22 (shallow)	6.00	8.00	2.00
SG-23	6.00	8.00	2.00
SG-24	6.00	8.00	2.00
SG-25	6.00	8.00	2.00
SG-26	6.00	8.00	2.00

Notes:

SC = Semiconfined aquifer

UC = Unconfined aquifer

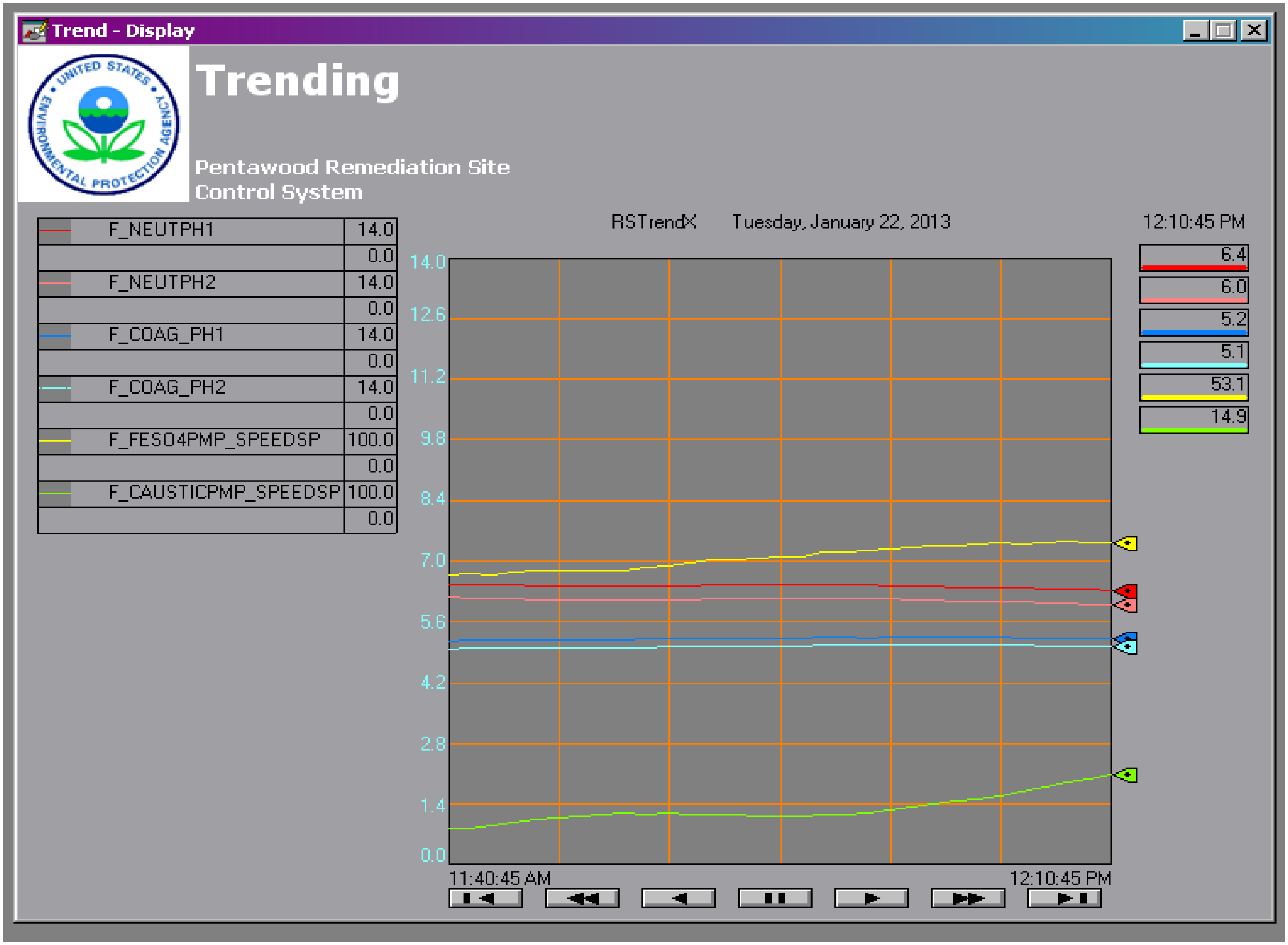


Figure 2-1
Trending Main Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

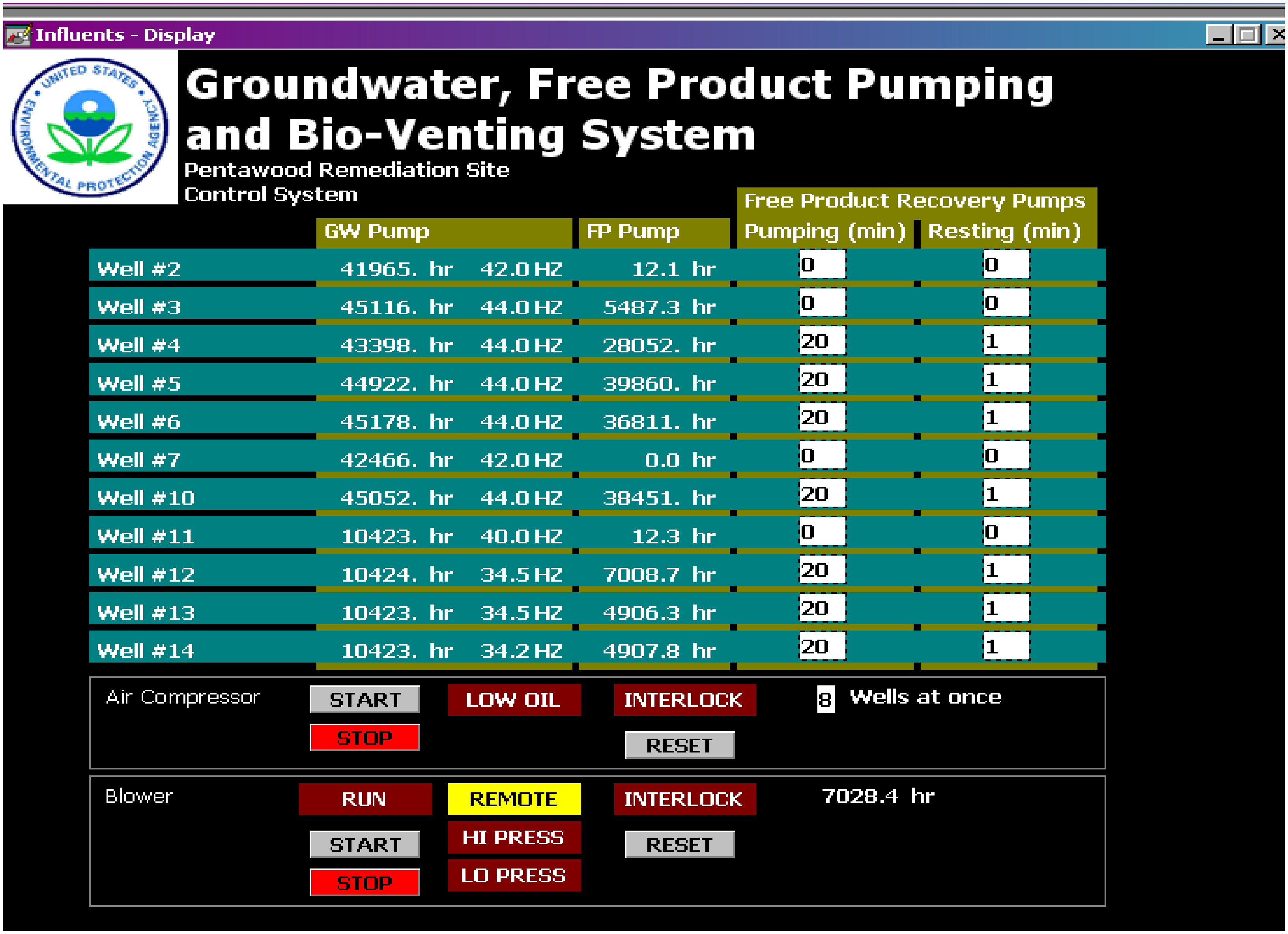


Figure 2-2
Influent Main Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

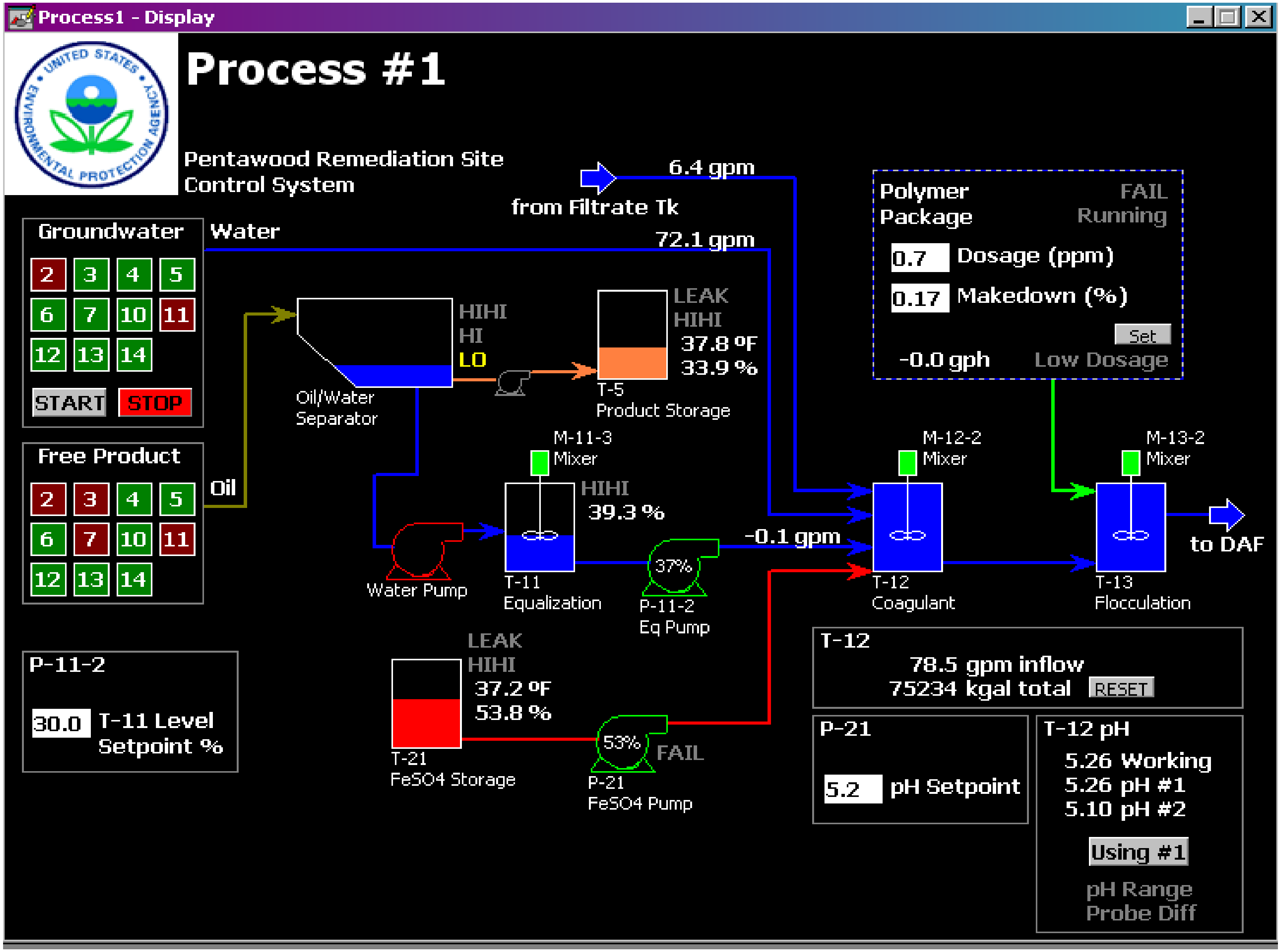


Figure 2-3
Treatment Process #1 Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

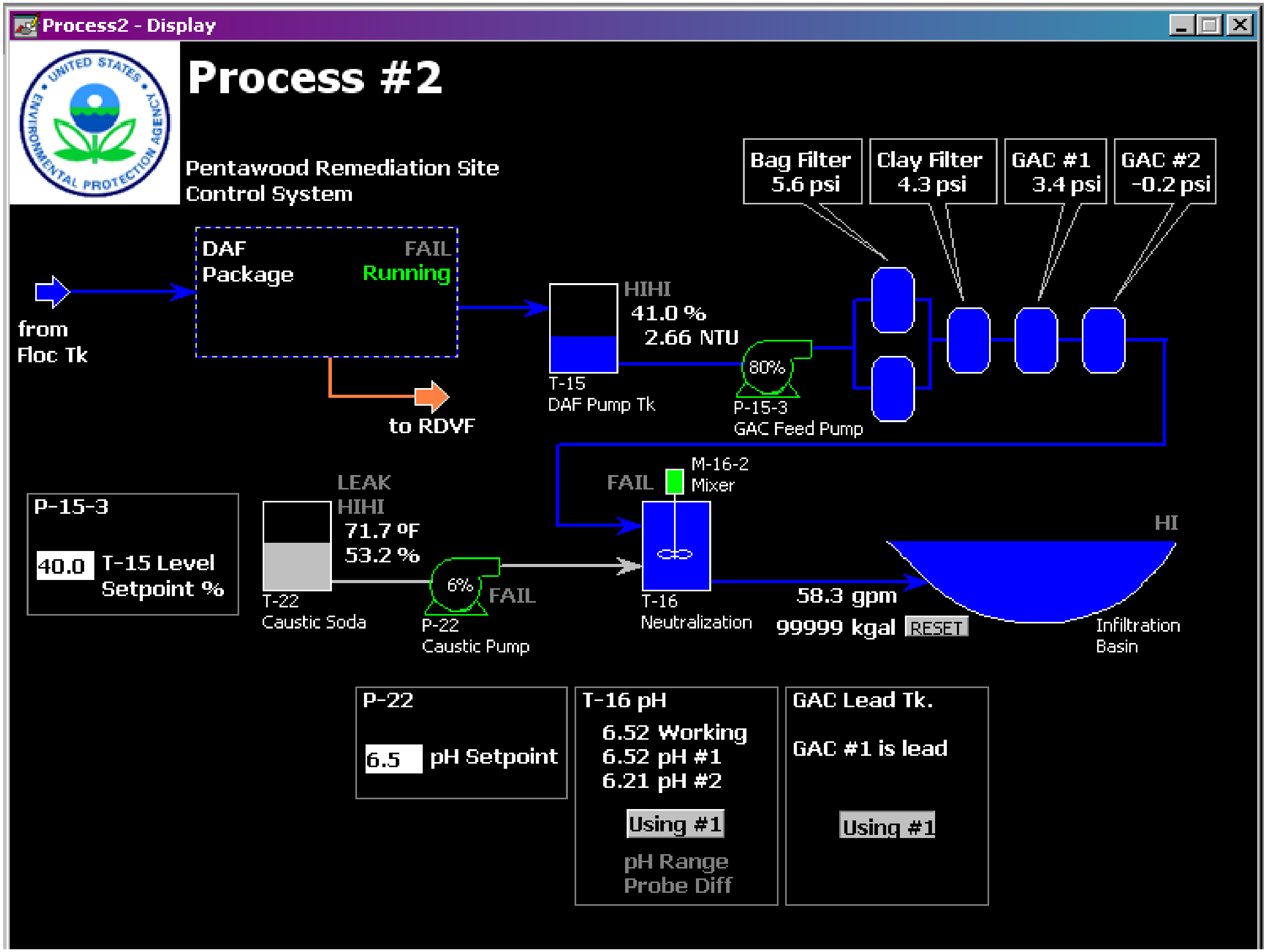


Figure 2-4
Treatment Process #2Screen
O&M Manual
Penta Wood Products Superfund Site
Siren,Wisconsin

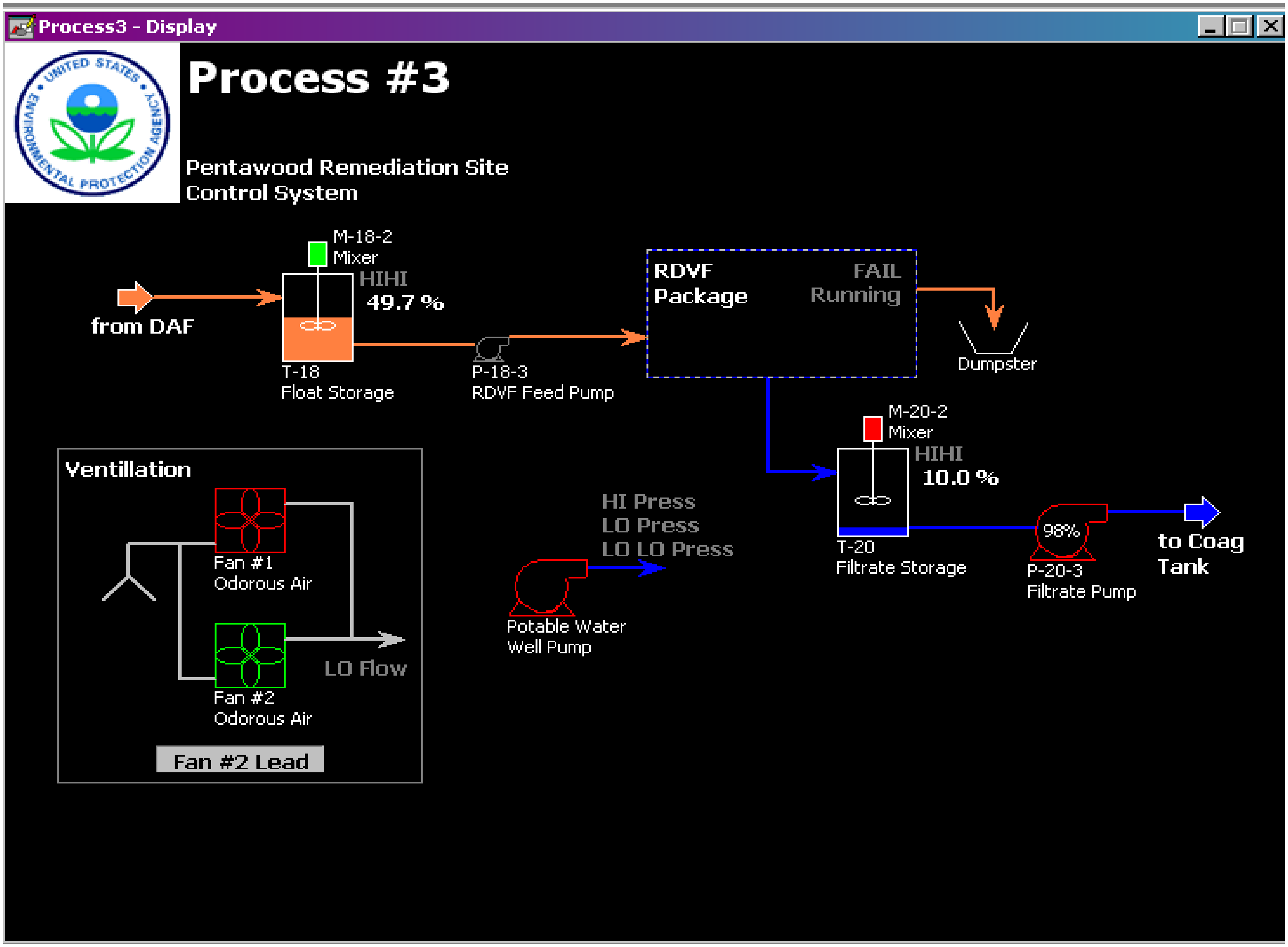


Figure 2-5
Treatment Process #3 Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

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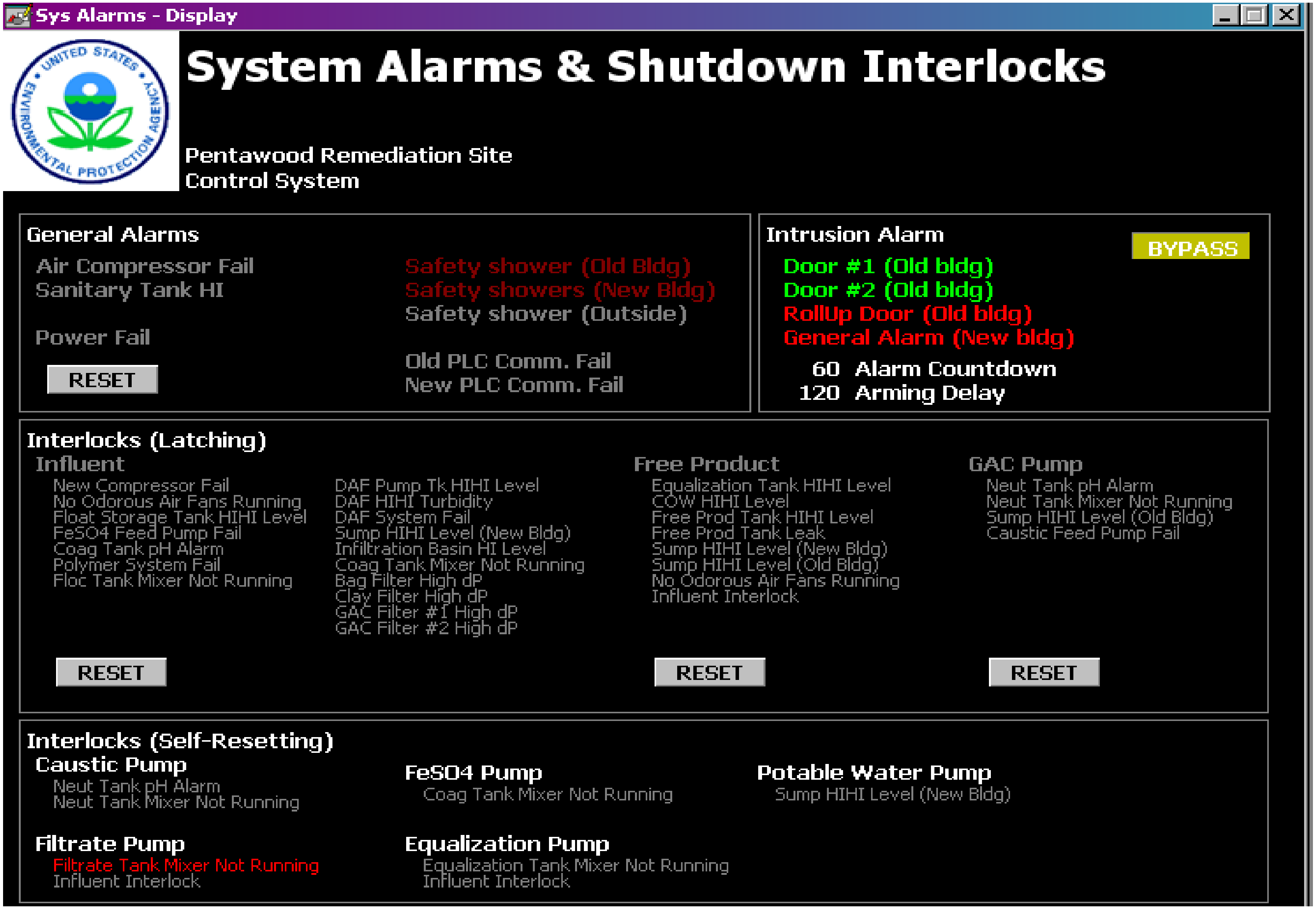
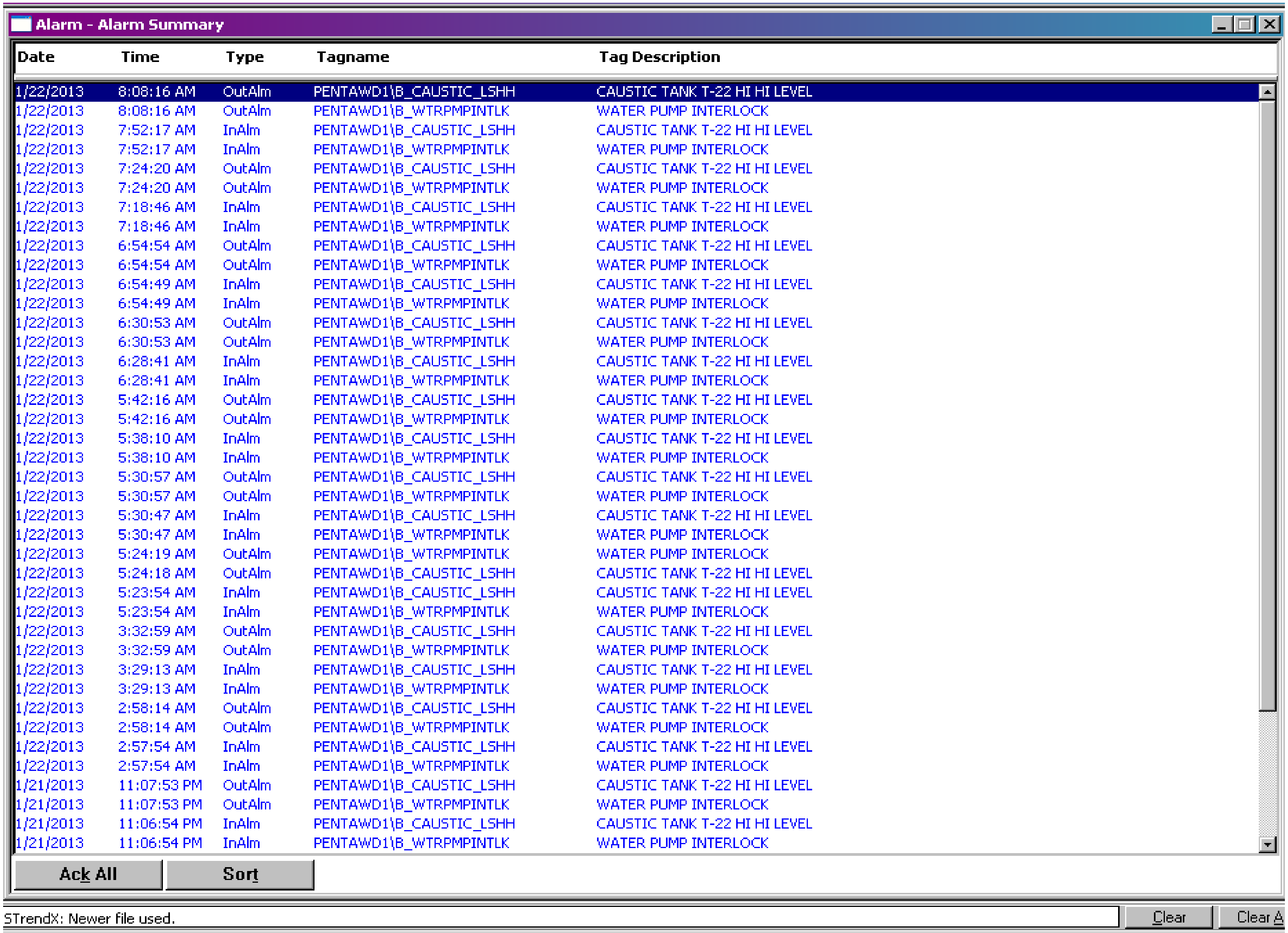


Figure 2-6
System Alarms & Shutdown Interlocks Screen



Date	Time	Type	Tagname	Tag Description
1/22/2013	8:08:16 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	8:08:16 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	7:52:17 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	7:52:17 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	7:24:20 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	7:24:20 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	7:18:46 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	7:18:46 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	6:54:54 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	6:54:54 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	6:54:49 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	6:54:49 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	6:30:53 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	6:30:53 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	6:28:41 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	6:28:41 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
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1/22/2013	5:42:16 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
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1/22/2013	5:38:10 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
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1/22/2013	5:30:57 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
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1/22/2013	5:30:47 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	5:24:19 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	5:24:18 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	5:23:54 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	5:23:54 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	3:32:59 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	3:32:59 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	3:29:13 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	3:29:13 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	2:58:14 AM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	2:58:14 AM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/22/2013	2:57:54 AM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/22/2013	2:57:54 AM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/21/2013	11:07:53 PM	OutAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/21/2013	11:07:53 PM	OutAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK
1/21/2013	11:06:54 PM	InAlm	PENTAWD1\B_CAUSTIC_LSHH	CAUSTIC TANK T-22 HI HI LEVEL
1/21/2013	11:06:54 PM	InAlm	PENTAWD1\B_WTRPMPINTLK	WATER PUMP INTERLOCK

Figure 2-7
Alarm History Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

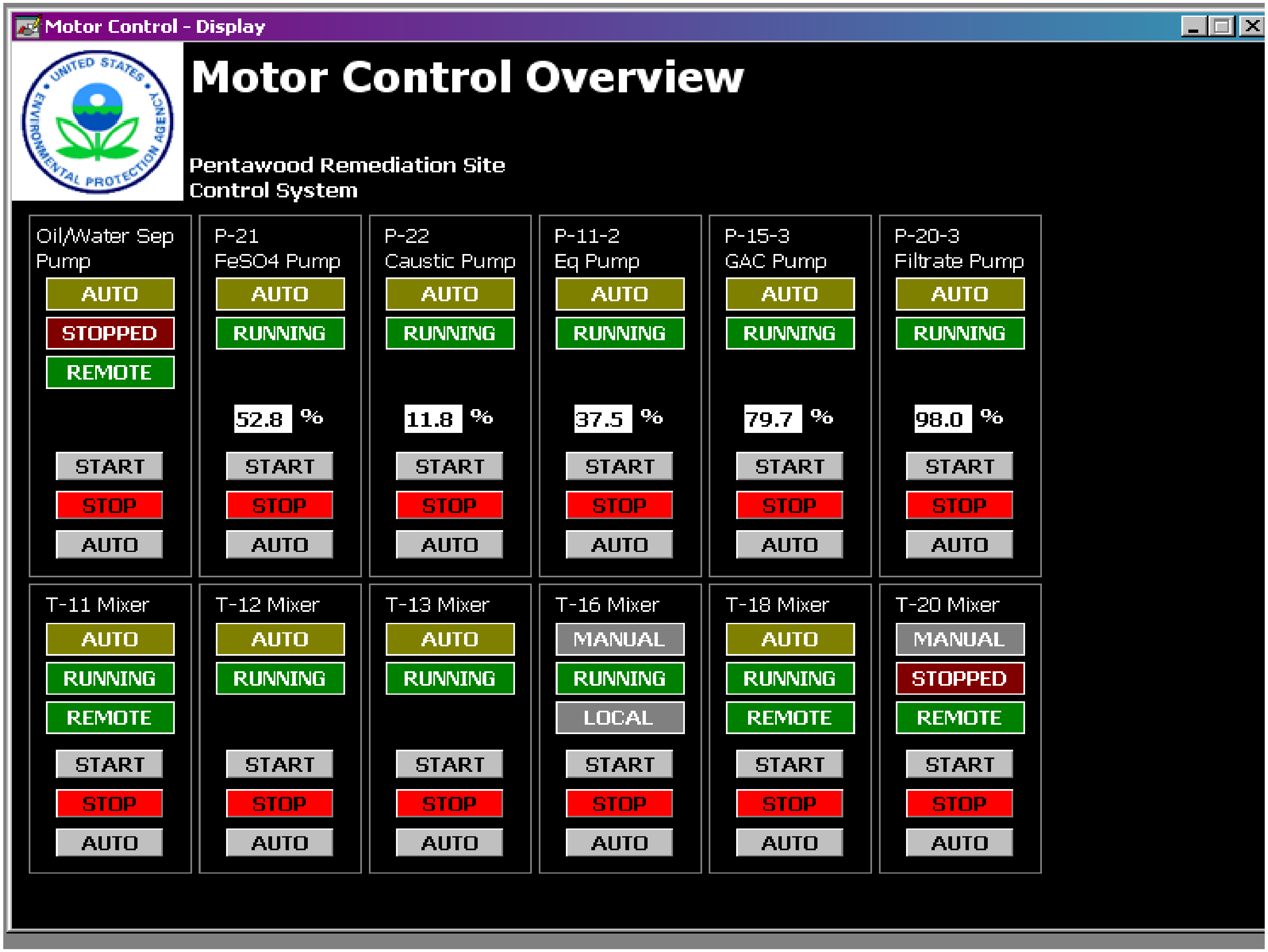

Figure 2-8
Motor Control Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

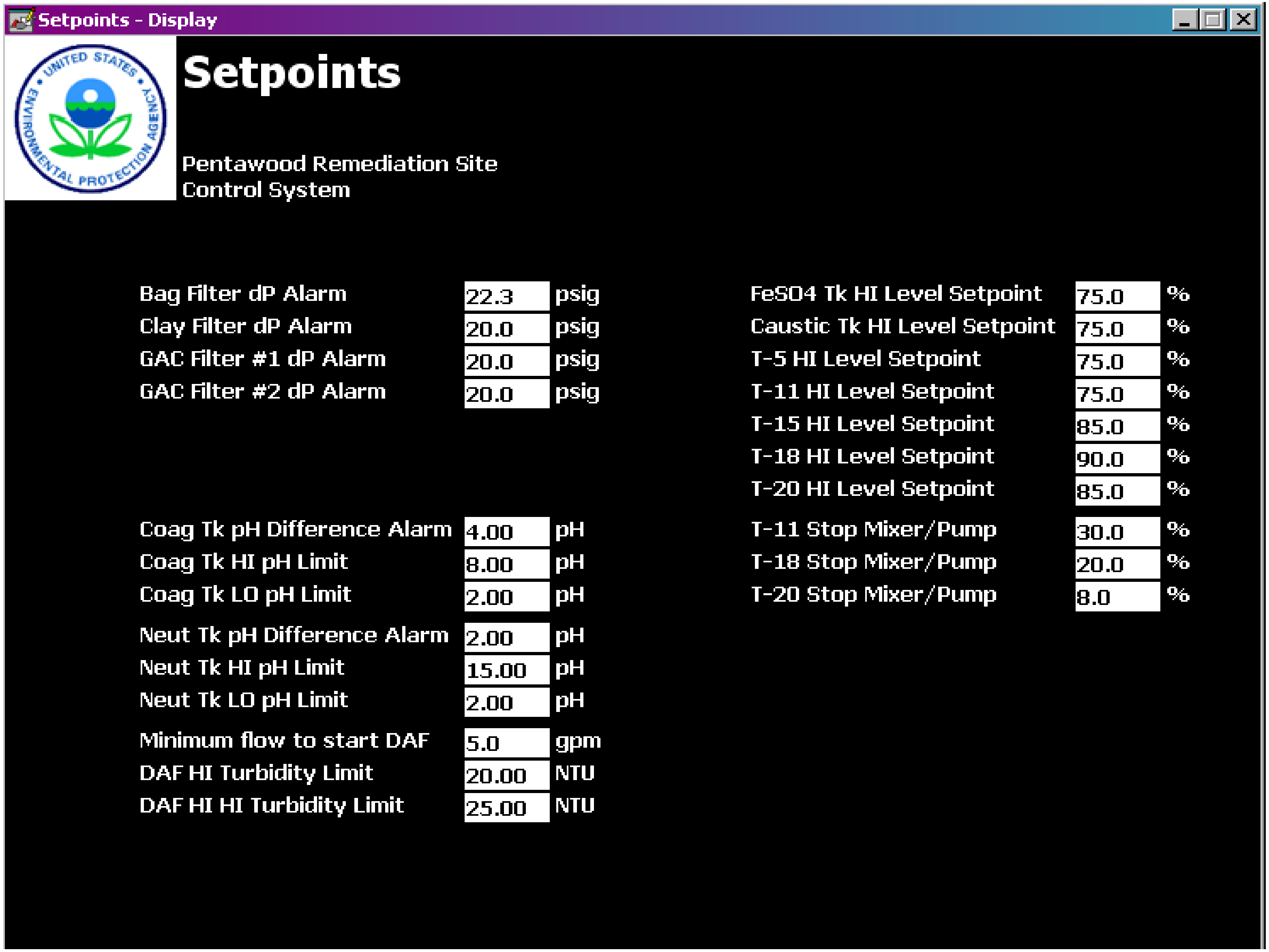

Figure 2-9
Setpoints Screen
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

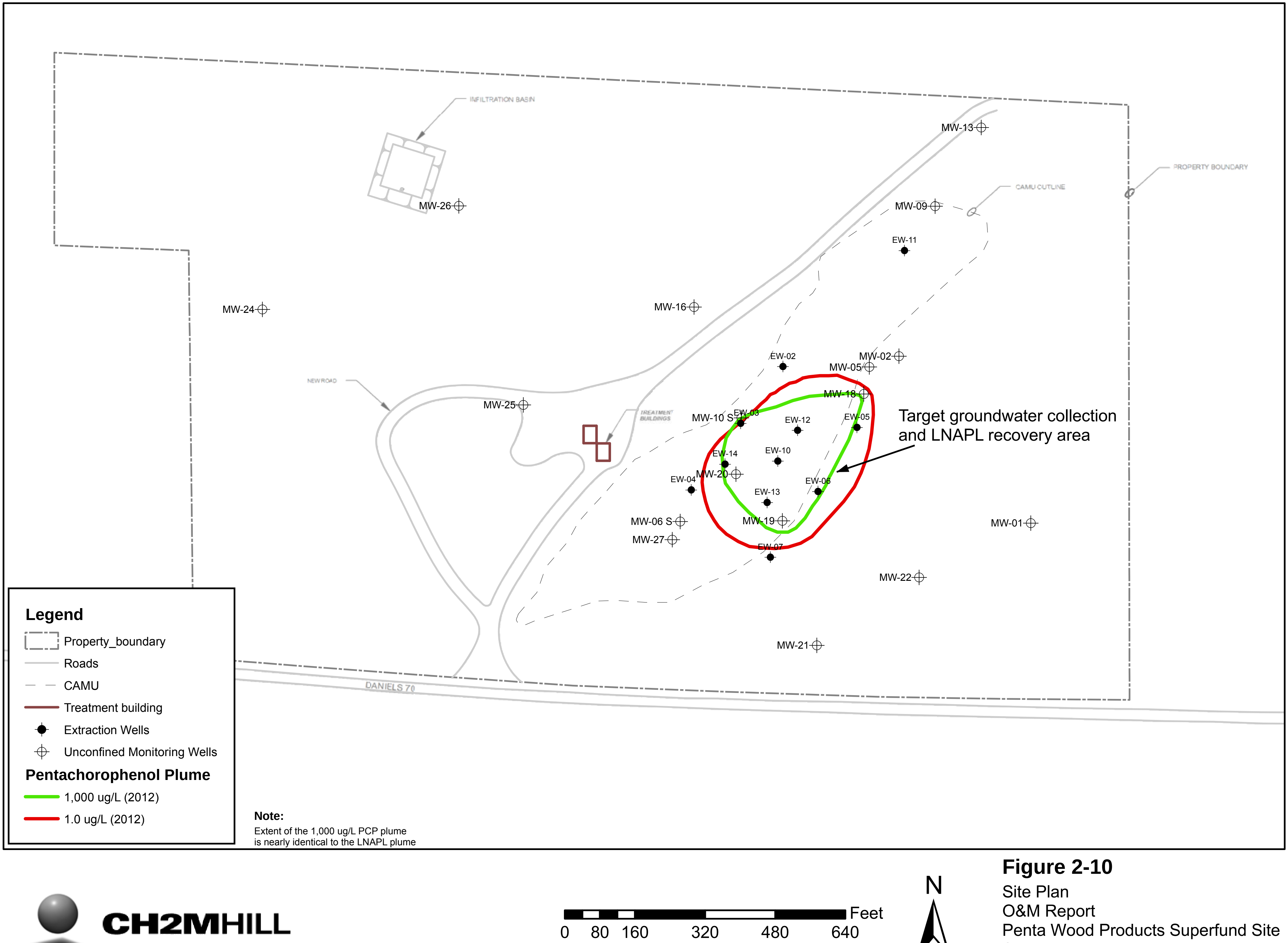

Figure 2-10
Site Plan
O&M Report
Penta Wood Products Superfund Site
Siren, Wisconsin

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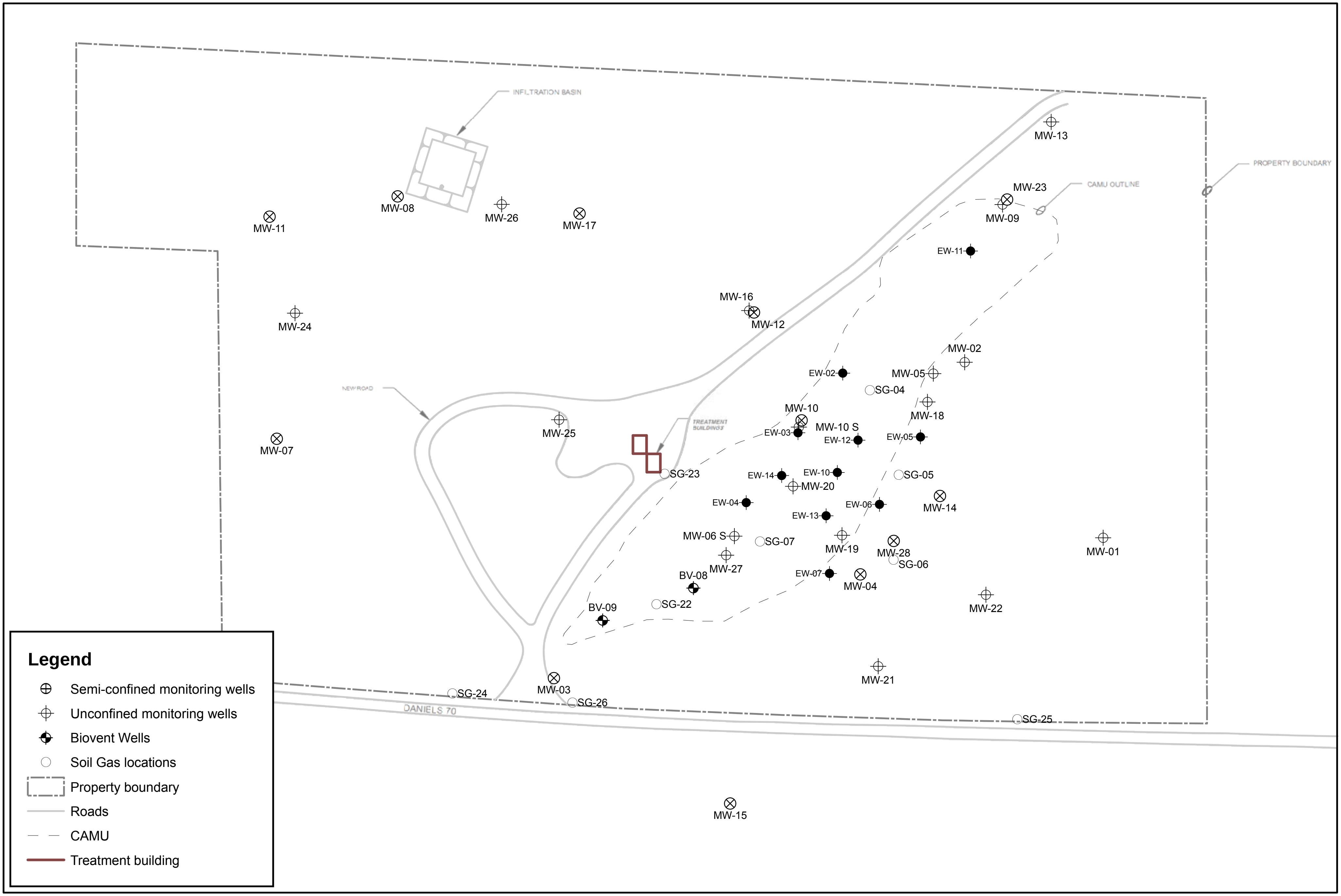

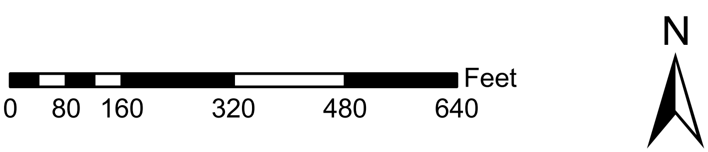

Figure 2-11
Well Location Map
O&M Manual
Penta Wood Products Superfund Site
Siren, Wisconsin

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SECTION 3

Inspection and Maintenance Procedures

This section describes the routine and periodic maintenance required for the system and facilities. Maintenance requirements are based on equipment manufacturers' recommendations when available. Manufacturers' O&M recommendations and instructions are available for reference in Appendix C.

3.1 Routine Inspection and Maintenance

Routine inspections and maintenance should be done in accordance with equipment manufacturer's recommendations (see Appendix C). Daily, Weekly, Monthly, Semi-annually, and Annual maintenance items are included in an O&M tracking tool (Microsoft Access database). Directions for use of the O&M tracking tool are in Appendix F. The O&M tracking tool creates daily Work Orders that provide a list of items due for the day, and tracks waste streams. An example of the daily work order and daily inspections has been included in Appendix G.

3.2 Corrective Action Management Unit

Long-term erosion control at the site has been achieved primarily through vegetation. The site is visually inspected at the beginning and end of each growing season for locations experiencing increased erosion or decreased vegetation. At a minimum, the site is inspected during the biannual sampling events. Subsidence of the CAMU cover is monitored through visual inspections. Repairs will be made, if needed, to prevent water from ponding on the CAMU cover.

Erosion control maintenance may require excavating ditches that fill with sediment, and repairing rill erosion where there is potential for severe gully erosion to develop on the CAMU.

The grass around the monitoring wells, biovent wells, and extraction wells is mowed to maintain accessibility and to minimize biological hazards in these areas.

3.3 Records and Reporting

3.3.1 Inspection and Maintenance Records

Routine inspection and maintenance activities are documented in the site O&M database for each major system or piece of equipment. The operator will document if the item requires further attention, and the possible corrective action(s) to be taken.

3.4 Troubleshooting

Troubleshooting tables for the major pieces of equipment are included in the manufacturers' O&M manuals (Appendix C).

TABLE 3-1

Process-related Isolation Valve Positions for Normal Operation

Equipment isolated	Located near	P&ID sheet	Description	Type of valve	Normal position[1]
Groundwater and product flow streams					
COW oil pump	Coalescing oil-water separator (COW)	N-2	Isolation valves (2) on each side of the pump during pump maintenance	Ball	NO
COW water pump	Coalescing oil-water separator (COW)	N-2	Isolation of water pump from the COW effluent chamber	Ball	NO
EQ pump, P-11-2	Equalization tank, T-11	N-2	Isolation valves (2) on each side of the pump during pump maintenance	Ball	NO
Filtrate flow meter, FE-20-4	Coagulant reaction tank, T-12	N-3	Isolation valve ahead of check valve to allow check valve to be removed and cleaned as necessary	Ball	NO
EQ tank flow meter, FE-11-4	Coagulant reaction tank, T-12	N-2	Isolation valve ahead of check valve to allow check valve to be removed and cleaned as necessary	Ball	NO
Dissolved air flotation					
DAF float pump	Dissolved air flotation system, DAF-14	On Nijhuis drawings and N-4	Isolation valves (2) on each side of the pump during pump maintenance	Ball	NO
Turbidity sample pump, P-14-5	At ground level near DAF pump tank, T-15	N-4	Valve allows isolation of the suction side of the pump during maintenance.	Ball	NO
Filters					
GAC feed pump, P-15-3	DAF pump tank, T-15	N-4	Isolation valves (2) on each side of the pump during pump maintenance	Butterfly	NO
Bag filters	Bag filter system in old building	N-5	Isolation valves (2) on each side of each bag to isolate a bag for cleaning/replacement. Four (4) valves installed for the two (2) bag filters.	Butterfly	NO
Organo clay	Organo clay vessel	N-5	Isolation valves on each side of the organo clay vessel to isolate vessel if bypass valve is open. Three (3) valves total.	Butterfly	Isolation -- NO Bypass -- NC
GAC vessels	Between GAC vessels 1 and 2	N-5 (not in detail)	Valve array must be set as detailed in the CarbonAir Services operating manual. Valving varies depending on which vessel is lead/lag.	Butterfly	See manual
Filtrate pump, P-20-3	Filtrate storage tank, T-20	N-6	Isolation valves (2) on each side of the pump during pump maintenance	Ball	NO
Neutralization tank effluent	Between GAC vessels 1 and 2	Not shown, field install	Valve installed to allow bypass of the neutralization tank. Will cause T-16 to overflow if shut during operation!	Butterfly	NO

TABLE 3-1

Process-related Isolation Valve Positions for Normal Operation

Equipment isolated	Located near	P&ID sheet	Description	Type of valve	Normal position[1]
Chemical feed systems					
Ferric sulfate pump, P-21	Ferric sulfate pump, P-21	N-7	Isolation valves (2) on each side of the pump during pump maintenance. Suction side isolation valve is located on top of the ferric sulfate tank, T-21	Pillow	NO
	Ferric sulfate pump, P-21	N-7	Pressure relief valve located near P-21. Must be set to correct pressure so that it is higher than BPV-21, but low enough to avoid rupturing the pump tubing.	Pressure relief	NO -- adjustable
	Coagulation reaction tank, T-12	N-3	Back pressure valve located at T-12. Will act as isolation valve if too much back pressure is created.	Back pressure	NO -- adjustable
Caustic soda pump, P-22	Caustic pump, P-22	N-7	Isolation valves (2) on each side of the pump during pump maintenance. Suction side isolation valve is located on top of the caustic soda tank, T-22	Pillow	NO
	Caustic pump, P-22	N-7	Pressure relief valve located near P-22. Must be set to correct pressure so that it is higher than BPV-22, but low enough to avoid rupturing the pump tubing.	Pressure relief	NO -- adjustable
	Neutralization reaction tank, T-16	N-3	Back pressure valve located at T-16. Will act as isolation valve if too much back pressure is created.	Back pressure	NO -- adjustable

Notes:

[1] NC = Normally closed, NO = Normally open

TABLE 3-2

Odorous Air Isolation Valve Positions for Normal Operation

Equipment isolated	P&ID sheet	Type of valve	Normal position[1]
Coalescing oil-water separator (COW)	N-2	Ball	NO
Equalization tank	N-2	Ball	NO
Coagulant Reaction Tank, T-12	N-3	Butterfly	NO
Flocculant Reaction Tank, T-13	N-3	Butterfly	NO
Dissolved air flotation system, DAF-14	N-4	Butterfly	NO
DAF pump tank, T-15	N-4	Butterfly	NO
Float storage tank, T-18	N-6	Butterfly	NO
Filtrate storage tank, T-20	N-6	Butterfly	NO

Notes:

[1] NC = Normally closed, NO = Normally open

SECTION 4

Monitoring and Sampling

4.1 Bioventing System Monitoring

The objective of the long-term performance monitoring program is to assess the degree and effectiveness of PCP removal and whether the soil cover and erosion control measures are preventing transport of arsenic and PCP. Monitoring activities for bioventing include:

- Soil gas monitoring within the bioventing treatment areas
- Soil sampling within bioventing treatment areas
- Routine inspection of cover and sampling if necessary

A total of 17 soil gas monitoring wells, nested at varying depths (table 2-5), are used to monitor soil gas composition to assess effectiveness in delivering air to the affected subsurface regions. Soil gas monitoring is conducted monthly for 6 months of the year (restarted once the ground thaws in late May, and shut down in late October) when the bioventing system is operating. Real-time meters are used to measure oxygen, carbon dioxide, temperature and lower explosive limit in the piezometers at all 17 of the soil gas locations shown on Figure 2-11. If elevated levels are observed, as defined below, the bioventing system is immediately shut down:

- Methane - measurements exceeding 1% in SG-23, SG-24 or SG-25
- Methane - measurements exceeding 0.5% in the building
- Lower explosive limit - measurements exceeding 10% in SG-23, SG-24, SG-25, or building

Soil samples for PCP and total petroleum hydrocarbons are collected at discrete locations and at various depths for comparison to previous samples collected during installation. The effectiveness of bioventing was evaluated after 5 years of operation (in 2010). The evaluation was based on analytical results collected from the groundwater and soil environmental monitoring. The PCP concentrations measured in 2010 in the intermediate soil zone were all significantly less than the initial PCP concentration present in 1998.

4.2 Groundwater Level Monitoring

Groundwater levels are monitored and recorded during the semiannual and annual sampling events. Additional groundwater levels will be collected on an as-needed basis using a water level indicator.

4.3 Groundwater Monitoring

Environmental monitoring is used to assess the effectiveness of LNAPL removal and groundwater treatment, and to assess the degree of natural attenuation.

The groundwater monitoring network includes the following wells:

- Unconfined monitoring wells MW-02, MW-05, MW-09, MW-06S, MW-10S, MW-16, MW-19, MW-22, MW-26, MW-27
- Semiconfined monitoring wells MW-03, MW-07, MW-10, MW-12, MW-15, MW-17, , MW-28
- Five residential wells
- Potable well

The residential wells to be sampled are listed in Table 4-1 and shown in Figure 4-1.

TABLE 4-1
Residential Well Owner Information
Penta Wood LTRA O&M Manual

Location ID	Resident Name	Resident Address	Resident Phone Number	WI Well #
RW01	Bill Ellis (formerly Skold)	8713 Daniels 70	(715) 349-5840	FG508
RW02	LaVonne Brethorst	8627 Daniels 70	(715) 349-5237	FG506
RW03	Ken and Sheri Nelson	Daniels 70 (same driveway as V. Engstrom)	(715) 349-8070	JB 251
RW04	Vayne Engstrom	8526 Daniels 70	(715) 349-5212	AN547
RW05	Timothy Tjader	8783 Daniels 70	(715) 349-5192	Unknown

All the monitoring wells are sampled annually for PCP, BTEX, naphthalene, Target Analyte List metals, and the following natural attenuation indicator parameters:

- Dissolved oxygen (DO)
- pH, temperature, and specific conductance
- Oxidation reduction potential (ORP)
- Alkalinity
- Nitrate-and nitrite-nitrogen
- Sulfate-and sulfide-sulfur
- Total iron and ferrous iron
- Manganese
- Carbon dioxide (CO_2)
- Chloride

A smaller set of five monitoring wells (MW-12, MW-15, MW-19, MW-22, MW-26) is sampled and analyzed for the parameters listed above on a semiannual basis. Water level elevations and LNAPL thickness are measured in all wells during the sampling events.

In 2010, the WDNR and USEPA agreed that installing three additional extraction well nests would enhance the remediation occurring at the site prior to transfer to the WDNR in August of 2014. The new well nests (EW-12, -13, and -14) were constructed in a 16-inch-diameter boring hole to allow for a 4-inch LNAPL recovery well and a 6-inch groundwater extraction well. Two additional monitoring wells were installed to supplement the existing monitoring network (MW-27 and MW-28). The extraction wells were installed within the area where LNAPL was known to be present historically.

4.4 Groundwater Treatment System Monitoring

The groundwater treatment system influent is monitored for PCP on a monthly basis and shall be collected at the DAF tank pump tank.

The effluent is discharged to the infiltration basin in accordance with the effluent limitations, monitoring requirements, and other conditions specified in the WPDES permit conditions (Appendix E). The current permit limits and monitoring requirements are summarized in Table 4-2. Effluent monitoring samples must be taken at the outlet of the treatment unit prior to mixing with any other waters.

TABLE 4-2
WDPES Permit Monitoring Requirements and Limitations
Penta Wood LTRA O&M Manual

Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type
		Influent		
Pentachlorophenol	NA	NA	Quarterly	Grab-Influent
		Effluent		
Flow Rate	NA	NA	Continuous	NA
Pentachlorophenol	Monthly Average	0.1 µg/L	Weekly	Grab-Effluent
Naphthalene	Monthly Average	8.0 µg/L	Monthly	Grab
Diesel Range Organics	NA	NA	Monthly	Grab
Arsenic, Total Recoverable	Monthly Average	5.0 µg/L	Quarterly	Grab
Copper, Total Recoverable	NA	NA	Quarterly	Grab
Iron, Total Recoverable	NA	NA	Quarterly	Grab
Manganese, Total Recoverable	NA	NA	Quarterly	Grab
Zinc, Total Recoverable	NA	NA	Quarterly	Grab
Chloride	NA	NA	Quarterly	Grab
Benzene	Monthly Average	0.5 µg/L	Annually	Grab
Ethylbenzene	NA	NA	Annually	Grab
Toluene	NA	NA	Annually	Grab
Xylene	NA	NA	Annually	Grab
Phenol	NA	NA	Annually	Grab
Dioxin (2,3,7,8 TCDD)	Monthly Average	0.000003 µg/L	Annually	Grab

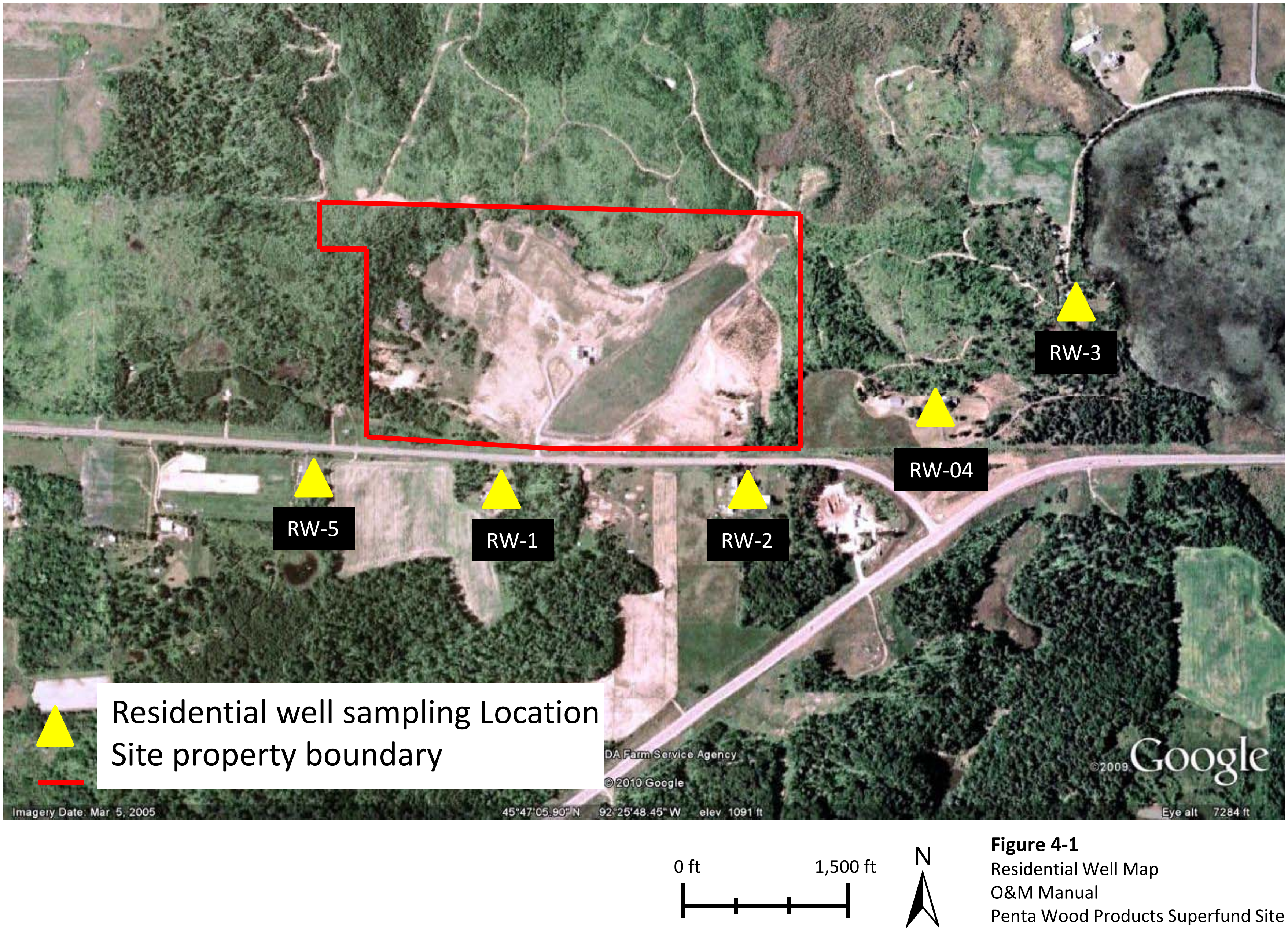

Figure 4-1
Residential Well Map
O&M Manual
Penta Wood Products Superfund Site
Siren WI

CH2MHILL

SECTION 5
References

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