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CH2MHILL

August 27, 1999

Mr. Tony Rutter
Remedial Project Manager
U.S. Environmental Protection Agency
Remedial Response Branch (SR-6J)
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Tony:

Subject: Prefinal Design Submittal
Penta Wood Products Remedial Design
Town of Daniels, Wisconsin
Work Assignment No. 040-RDRD-05WE
Contract No. 68-W6-0025

Enclosed please find the Prefinal Design Submittal for Penta Wood Products Remedial Design. The Prefinal Design Submittal consists of the following:

- Basis of Design Report, which includes Value Engineering Screening Results, Biddability, Constructability, and Operability Review, RA Schedule, and Cost Estimate
- Site Preparation/Earthworks Subcontract Documents
- Demolition Subcontract Documents
- Drilling/Well Installation Subcontract Documents
- Bioventing/Groundwater Treatment Subcontract Documents

The Subcontract Documents include specifications, drawings, and bidding procedures for each of the four subcontractors for the Remedial Action.

Please call me if you have any questions or concerns.

Sincerely,

CH2M HILL

Regina Bayer

Regina Bayer

Site Manager

MKE/COVERLET.DOC

c: Stephen Nathan/PO/USEPA (w/o enclosure)
Eben Greybourne/CO/USEPA (w/o enclosure)
Tom Kendzierski/PM/WDNR
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BASIS OF DESIGN

PENTA WOOD PRODUCTS
Town of Daniels, Wisconsin

Remedial Design

WA No. 040-RDRD-05WE/Contract No. 68-W6-0025

August 1999

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SECTION 1

Introduction

This Prefinal Basis of Design (PBD) Report is being prepared for the United States Environmental Protection Agency (USEPA) by CH2M HILL under Contract 68-W6-0025 in accordance with the Statement of Work (SOW), the Record of Decision (ROD) issued on September 29, 1998, and the Remedial Design/Remedial Action (RD/RA) Handbook. The PBD Report incorporates comments from USEPA, WDNR and TN & Associates, the Value Engineering reviewer, on the Design Criteria Report (DCR) submitted in June 1999. It also updates the design approach and assumptions based on results of the predesign site investigations that were documented in the Data Evaluation Report. The PBD includes nearly all the elements of the DCR, although they have been reorganized to more closely match the project delivery strategy. The PBD is organized as follows:

- Section 1 Introduction
- Section 2 Project Delivery Strategy
- Section 3 Design Approach, Assumptions, and Parameters
- Section 4 Construction Schedule
- Section 5 Cost Estimate
- Section 6 Review Summary

Prefinal design specifications and drawings accompanying this report are bound as separate submittals. Drawings referred to in this PBD Report can be found in the individual subcontract specification and drawing submittals.

1.1 Site Description

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 approximately 78 miles northeast of Minneapolis, Minnesota, and 60 miles south of Duluth, Minnesota (Earthworks Drawing __G-1). The Village of Siren, Wisconsin, is approximately 2 miles east of the site and there are three residences within 200 feet of the site using private wells.

The PWP property currently consists of approximately 82 acres which were actively used; 40 undeveloped acres consisting of forest 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 plateau 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, a glacial till that is not continuous throughout the site, and a lower sand. The depth to groundwater is over 100 feet on the plateau. Groundwater occurs both in a thin unconfined aquifer and within a multi-layered semiconfined aquifer system. The regional groundwater flow direction is to the north. Since the closing of the onsite production well, groundwater flow at the site has been radial, with a strong downward vertical gradient.

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. The Amsterdam Slough Public Hunting area covers 7,233 acres and is located 1 mile north of the site.

1.2 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 water borne salt treatment called Chemonite consisting of ammonia, copper II oxide, arsenate, and zinc (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 (Earthworks Drawing C-1). Process wastes were also 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 μg/L of PCP. The State of Wisconsin Department of Justice (WDOJ) filed a preliminary injunction against PWP in 1991, citing Wisconsin Pollutant Discharge Elimination System (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 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 offsite, and metals-contaminated soils were excavated and mixed onsite with cement to form a 3-acre concrete biopad. 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, culminating with the issuance of an ROD in September 1998.

1.3 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 are 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 light non-aqueous phase liquid (LNAPL) layer, is in equilibrium with pore pressures and is not expected to continue spreading. An LNAPL of PCP/oil is floating on the water table over an estimated 4-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, and some of the wells have 11 rounds of sampling data. PCP groundwater concentrations have shown consistent declines at the majority of monitoring wells over time, although many of the wells have been monitored for only 3 years. There is a general decrease in the size of the PCP plume, and the total contaminant mass of PCP in the saturated zone has declined since 1994. For example, PCP contamination detected at 2,000 µg/L at MW17 in 1994 has declined to non-detect levels in 1997. There is no evidence of contaminated groundwater discharging to the wetland or migrating below the wetland to surface water bodies.

Additional evidence that PCP is biodegrading in groundwater is supported by the natural attenuation parameter data. The groundwater is under anaerobic conditions in both the unconfined and semiconfined aquifer in the LNAPL plume area. The anaerobic plume is not expanding, which is important because aerobic biodegradation has a faster decay rate than anaerobic biodegradation; therefore, biodegradation should be capable of preventing the further expansion of the plume.

The northern lagoon wall is collapsing and overland transport of oil saturated soil and wood debris has resulted in sediment and surface water contamination in an offsite wetland (Earthworks Drawing __C-2).

Wastewater was discharged into a ravine filled with wood chips. Despite elevated levels of PCP and TPH detected in the wood chips, the soil and groundwater below the wood chip pile appear to be minimally impacted. The wood chips may be retaining the contamination.

Surficial soils are contaminated with arsenic. The metals-contaminated soil is mainly around the treatment building and on the eastern portion of the site where ACZA-treated wood was stored. Surficial soil PCP contamination exists along the gully corridor and in hot spots near the rail tracks, treatment cylinder, and areas used to store the treated wood.

1.4 Description of the Selected Remedial Action

The ROD specifies that the selected remedial action for the site consists of soil and sediment consolidation and bioventing, LNAPL collection and disposal, groundwater collection and treatment in the LNAPL area, and monitored natural attenuation for the remainder of the groundwater plume. The selected remedy focuses on removing free phase LNAPL and the grossly contaminated groundwater while slowly drawing down the water table and enhancing natural biodegradation of the soils above the LNAPL by bioventing (adding air to the soils above the water table). PCP/fuel oil contaminated soils, wood chips, and sediments will be consolidated in a designated Corrective Action Management Unit (CAMU), mixed with the shallow layer of wood debris/soil, and covered. Bioventing wells will be installed in this area of the CAMU and air will be blown into the subsurface soils. Near-surface arsenic/metals contaminated soil will be segregated where possible; highly contaminated soils will be solidified in cement and placed onsite in a separate area of the CAMU.

The overland transport of contaminated site materials through a collapsing lagoon wall to an adjacent wetland will be eliminated with reconstruction of the slope, regrading of the site for surface water runoff control, and reestablishing vegetation. The natural degradation of contaminants that is occurring in the groundwater plume will be monitored. If monitoring detects that offsite receptors are threatened, or if the remedy fails to effectively reduce contaminant mass within a reasonable amount of time, contingency plans will be implemented.

The major components of this remedy consist of:

- Building demolition
- Segregation, select solidification, and placement of all arsenic contaminated soils in an onsite Corrective Action Management Unit (CAMU)
- Consolidation of PCP/fuel oil soils and wood chips in the CAMU under a soil cover
- Bioventing PCP/fuel oil contaminated material
- Biopad removal and disposal onsite in the CAMU
- Erosion control measures
- Revegetation
- LNAPL removal
- Containment, collection, treatment, and discharge of grossly contaminated groundwater (exceeding 1,000 μg/L PCP)
- Monitored natural attenuation of groundwater contamination
- Institutional controls
- Environmental monitoring/maintenance
- Point-of-entry (POE) carbon treatment for residences, if necessary
- 5-year site reviews

SECTION 2

Project Delivery Strategy

This section presents the project delivery strategy for remedial action (RA) for the PWP selected remedial action. The primary components of the RA are summarized below. Key project delivery strategies, relative to a specific RA component, are noted below in their respective section.

2.1 Prefinal/Final Design

This Prefinal Design consists of the following:

- Basis of Design Report, which includes the Value Engineering Results, Cost Estimate, and Biddability, Operability, and Constructability Reviews
- Request for Bid Documents, which includes Specifications, Drawings, Bidding Process, and Contract Terms

USEPA and WDNR will review the prefinal design and comments will be incorporated into the Request for Bid Documents. If needed, the Basis of Design Report will be revised to document substantial revisions.

Detailed design drawings and specifications are provided for the majority of the remedial action components. However, design details are structured to allow several of the remedial action components to be performed by the remedial action contractor or subcontractor based on a performance specification. A performance specification describes the desired outcome of an action and specifies the requirements of the result, as opposed to specifying the details of how to perform the work. This leaves the subcontractor free to choose the most effective and efficient methods for implementation and also places the responsibility for the result on the subcontractor. The remedial components that consist primarily of performance specifications are as follows:

- Arsenic soil solidification. The method of solidification and the ratio of cement to soil is left to the discretion of the subcontractor. The remedial design documents specify meeting the TCLP limit for arsenic in the solidified soil, and meeting a minimum compressive strength requirement. A performance specification is used here to reduce costs by allowing the subcontractor flexibility to use available equipment and minimize the cost of cement while meeting the remedial objectives.
- Biopad and building demolition. The methods of demolition are not specified to allow the subcontractor flexibility. The performance specification includes maximum rubble size for concrete demolition, and dust control.
- Cover construction/soil backfill. Although cover and soil backfill performance objectives are required, the method of cover and backfill compaction is not specified to allow the subcontractor flexibility in choosing methods and equipment for achieving these performance requirements.

- Access road to lagoon bottom and wetlands. The method and means of conveying equipment and soil up and down the steep slope at the northeast corner of the property are being left to the subcontractor.

The following tasks will begin simultaneously with preparation of the final design:

- Draft O&M Manual
- Construction Quality Assurance (CQA) Plan

These documents will be submitted and revised during the solicitation and award of construction bids.

2.2 Remedial Action

The primary components of the RA are presented below in their expected construction sequence. Key project delivery strategies, relative to a specific RD component, are noted below in their respective section.

Establishment of Erosion Control Measures. To minimize further erosional effects to the site due to existing conditions and/or scheduled construction activities, erosion control measures will be implemented immediately after mobilization of the earthwork subcontractor and before any additional site disturbance.

Site Preparation. Select clearing and grubbing of vegetated areas will be completed in areas designated for soil excavation and removal. Efforts will be made to minimize impacts to existing vegetation. Weather permitting, soil samples will be collected from the arsenic-contaminated wooded slope area before clearing and grubbing to determine if any of the woods may be left in place. The portion of the CAMU designated for disposal of concrete and arsenic contaminated soil will be prepared by removing wood debris and establishing erosion control to prevent wood debris from being washed into the area.

Building Demolition. In order to better integrate the site into the existing surroundings and minimize risks to potential receptors, all existing buildings will be demolished. To minimize demolition costs, efforts will be made to salvage materials and concrete will be disposed onsite within the CAMU.

Biopad Removal and Backfill Onsite. The existing biopad will be demolished and disposed onsite within the CAMU in an area immediately north of the lagoon.

Excavation, Segregation, Select Solidification, and Placement of Arsenic Soils in an Onsite CAMU. To minimize the potential development of reducing conditions and subsequent mobilization of arsenic, arsenic-contaminated soils, sediment, and debris will be segregated from the PCP-contaminated wastes and placed in the northeastern portion of the CAMU. The Remedial subcontractor will be instructed, via the plans and specifications, to minimize potential for recontamination of excavated areas due to surface water runoff and/or vehicle traffic.

Excavation and Consolidation of PCP/Fuel Oil Contaminated Wood Chips Under a Soil Cover. The PCP-contaminated portion of the wood chip pile in the western portion of the site will be excavated, mixed with other PCP contaminated soils, and placed in the CAMU.

Additional PCP contaminated wood debris currently within the CAMU boundaries will be excavated and mixed with PCP soil prior to placement in the CAMU. This will provide better air distribution for a more rapid degradation rate during bioventing and reduce the seepage of PCP contaminated water from the wood debris.

Soil Cover and Revegetation. The CAMU will be covered with 6 inches of onsite sand, followed by 6 inches of topsoil. The remainder of the site will be graded as necessary to minimize erosional impacts, and disturbed areas will be revegetated in a timely manner. Additional erosion controls (e.g., erosion matting, mulch, etc.) will be implemented where required. To integrate the site into its surroundings, native grasses and conifer seedlings (saplings on steep slopes) will be planted across the site.

Bioventing/Groundwater Treatment Facility. The building housing the bioventing blower and groundwater treatment system and controls will be located outside the CAMU area to allow construction to proceed simultaneous with the soil consolidation in the CAMU. Once the sand portion of the soil cover is in place over the CAMU, the bioventing and groundwater collection system wells and piping will be installed. The groundwater collection system will be initially operated to lower the water table slowly to allow LNAPL recovery with minimal smearing. Once LNAPL is no longer being recovered in substantial quantities, the bioventing system will be placed in operation. This will minimize the effects of positive pressure in the LNAPL recovery wells reducing LNAPL thickness.

Activities that are part of the RA but follow completion of construction are:

Monitored natural attenuation. The groundwater will be routinely sampled for the site COCs and natural attenuation parameters throughout the entire PCP plume. The effects of the groundwater collection and treatment system and natural attenuation mechanisms will be evaluated through contaminant trend analysis and evaluation of natural attenuation parameters. Details of the monitoring and data evaluation will be presented in the site Operations and Maintenance Manual.

Institutional controls. Institutional controls in the form a restrictive covenant on the property deed for the PWP site will be established by USEPA to limit site land and groundwater use. Activities necessary to secure institutional controls are not currently anticipated to be performed as part of the remedial design.

Environmental monitoring/maintenance. Environmental monitoring of soil, groundwater and surface water will be performed to determine the effectiveness of the remedy. A groundwater flow and contaminant transport model will be developed to assist in the evaluation of the groundwater remediation and natural attenuation. The details of environmental monitoring and modeling will be established in the site Operations and Maintenance Manual.

Point-of-use carbon treatment, if necessary. If monitoring shows consistent exceedances of Wisconsin PALs at residential wells, an activated carbon treatment system will be installed for the house water supply.

5-year site reviews. Data collected under the monitoring program will be reviewed on 5-year intervals to determine whether human health and the environment continue to be protected and to determine whether additional remedial action is warranted. Alternate remedial technologies will be considered if it is determined that remedial objectives will not be obtained within 30 to 40 years from the start of the remedial action

2.3 Contracting

The contract documents are being prepared based on the understanding that CH2M HILL is the construction contractor. Four major subcontracts will be awarded as follows:

- Demolition
- Site Preparation/Earthwork
- Drilling/Well Installation
- Bioventing/Groundwater Treatment Facility Installation

Demolition has been selected for a separate subcontract largely because demolition requires specialty subcontractors knowledgeable and experienced in demolition. Also, because the demolition debris will be disposed offsite, minimal coordination is required between this subcontractor and the earthwork subcontractor. Demolition of concrete foundations and the biopad is not included in the demolition subcontract because there is substantial coordination and dependency between the demolition and placement of the concrete rubble into the arsenic area of the CAMU, and the construction of the arsenic CAMU. As a result, the earthwork subcontractor will have responsibility for concrete demolition and disposal.

The earthwork subcontract includes site preparation, concrete demolition and placement in the CAMU, solidification of arsenic soils, excavation and consolidation of soils in the CAMU, construction of the soil cover and erosion control measures and installation of the leach field/infiltration basin. Trenching and installation of piping/leak detection from the wells to the treatment building are also included in this subcontract. All these activities are typically performed by earthwork subcontractors.

Groundwater extraction wells, bioventing wells, groundwater monitoring wells, and piezometers will be installed under the well installation subcontract. Well pumps and piping within the wells will also be installed by the driller.

The bioventing/groundwater treatment facility will be constructed under the bioventing/groundwater treatment facility subcontract. This subcontractor will have responsibility for construction of the treatment building, the treatment system components within the building, and the installation of the product recovery pumps in the deep biovent wells.

SECTION 3

Design Approach, Assumptions and Parameters

This section defines the technical parameters upon which the prefinal design is based.

3.1 Site Preparation

3.1.1 Description of Site Preparation

Prior to excavation, consolidation, and placement of contaminated materials in the CAMU, site preparation activities will be performed by the earthwork subcontractor. These activities are necessary to allow heavy equipment to access all portions of the site that will be involved in this remedial action. It includes clearing and grubbing, erosion control measures for construction activities, and access road construction.

Additional site preparation activities to be performed include establishing physical construction limits at the site, and obtaining easements from neighboring property owners and the WDOT. CH2M HILL will perform these activities, with the assistance of the predesign-contracted surveyor (establishing construction limits), and the USEPA (obtaining easements).

3.1.2 Areas Requiring Site Preparation

Erosion control measures will be necessary throughout the areas of the site where surface vegetation is disturbed and excavation will occur. Clearing and grubbing are necessary in the vegetated portions of the site that will be excavated. The methods and means of establishing access to areas of PCP and PCP/arsenic contaminated soils in the northeastern portion of the site are being left to the subcontractor. The design of temporary access roads is dependent on the type of equipment to be used to excavate and convey soil up to the CAMU.

Wood debris will be excavated from the approximate CAMU footprint to stabilize the slope north of the lagoon, and therefore allow disposal of concrete foundations, biopad concrete and arsenic contaminated soil on native soils in the arsenic portion of the CAMU. These areas are shown on Earthwork Drawing C-2. Other existing roadways will be improved and some new roadways may be constructed at the discretion of the subcontractor if needed. A roadway from the site gate to the treatment facility will be established to allow flatbed trailers access to the treatment facility.

3.1.3 Construction Details Including Design and Construction Technical Factors

In preparation for construction activities, all required erosion control measures (e.g., straw bales, silt fence, diversion channels, etc.) will be put in place prior to soil disturbance. Once erosion control measures are in place, remaining site preparation activities will commence.

Construction erosion control measures will follow standard erosion and sediment control best management practices (BMPS) and will be based upon the USEPA Summary Guidance

Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Prior to the start of construction, a Notice of Intent (NOI) form for construction site activities will be sent to the WDNR. A Site Management Plan will be developed to address construction erosion and sediment control practices at the site. The plan will include instructions for evaluating the effectiveness of implemented erosion control measures and implementing contingency measures, if required, to address observed erosion effects.

Standard erosion control measures such as silt fencing will be located at the down-gradient side of excavation and fill areas to reduce erosion potential. Ditches may have periodic earth dikes, check dams, or sediment traps to reduce the mobility of sediment. Geofabric will be spread over sloped barren areas where construction activities have been completed to provide erosion protection, and the subcontractor will be required to plant trees and grasses shortly following excavation and confirmatory sampling.

In order to prevent sediment from being tracked offsite on roads, the construction entrance will be stabilized with crushed rock transition sections between unpaved and paved areas. The subcontractor will also specify and implement methods to wash/decontaminate trucks prior to leaving the site and to minimize cross contamination of soils from different areas of the site. Decon residual soils will be placed in the CAMU and covered. Decon liquids will be containerized for later treatment in the wastewater treatment system. As the construction erosion control practices are implemented, they will be visually evaluated for effectiveness and adjusted as appropriate to limit the erosion potential at the site.

Clearing and grubbing will be performed, as required, in areas scheduled for soil excavation and/or regrading. An effort will be made to preserve portions of the woods by analyzing soil samples for arsenic from this area prior to clearing. If rapid-turn soil tests indicate there are substantial sections of the woods not affected by the arsenic-contaminated soils that eroded from the site plateau, these sections will be saved. Details on the distribution and statistical evaluation of the soil samples will be defined in the Remedial Action Sampling and Analysis Plan. Vegetative matter removed during clearing and grubbing activities will be shredded onsite and used as onsite fill and/or erosion control mulch as described in the specifications. Tree stumps will be uprooted, shredded, and placed within designated areas of the CAMU.

The arsenic portion of the CAMU is located in the northeast portion of the CAMU. This area currently contains wood debris that has eroded from the steep slopes of the lagoon area. The wood debris located on the steep slopes immediately north of the lagoon and the wood debris present within the footprint of the arsenic portion of the CAMU will be relocated to the southern portion of the CAMU (PCP portion). This will avoid placement of building foundation concrete, biopad concrete and arsenic-contaminated soil on wood debris that may degrade, producing conditions that could increase the leachability of arsenic.

Additional wood chips located within the PCP portion of the CAMU (under the former lagoon and gully area) will also be excavated prior to commencement of disposal activities within the CAMU. This will stabilize the slope and allow transport of materials to the arsenic portion of the CAMU for disposal.

Two existing inactive groundwater production wells, PW-1 and PW-2, as shown on Earthwork Drawing C-1 (PW-2 is not shown on the drawing but is located adjacent to PW-1), will be abandoned, per WDNR requirements, during site preparation activities. They are approximately 175 feet deep and one contains a pump that must be removed prior to abandonment.

3.2 Building Demolition and Debris Disposal

3.2.1 Description of Building Demolition

All existing buildings will be demolished to ground level or concrete flooring by the demolition subcontractor. Demolition of concrete flooring and foundations will be the responsibility of the earthwork subcontractor. To the extent possible, demolished buildings and metal scrap piles will be salvaged. Material with no salvage value will be disposed in a nearby solid waste landfill. Wood scrap piles will be salvaged for fuel value at the discretion of the subcontractor. Buildings, tanks, etc., will be visually inspected prior to demolition for signs (e.g., staining) of PCP and/or arsenic contamination. Prior to commencement of demolition activities, all existing above ground utilities will be located by the demolition subcontractor and, in consultation with CH2M HILL, designated for either removal or protection. Underground utilities below buildings will be removed by the earthwork subcontractor during concrete removal.

3.2.2 Buildings to be Demolished

Table 1 lists structures onsite that will be demolished and Demolition Drawing C-1 shows the approximate building locations. Approximate dimensions and construction materials of each structure are also given in Table 1. A total of 16 (at least partially standing) buildings will be demolished. Also, a 10-foot-diameter by 30-foot long steel tank, a 10-foot-diameter by 20 feet high steel tank, and a 6-foot-diameter by 42-foot long retort chamber will require removal. One of the buildings onsite (the former treatment building) has two smokestacks approximately 36 inches in diameter standing about 75 and 100 feet high, which will require dismantling. Two debris piles containing miscellaneous wood and metal debris will be removed.

3.2.3 Investigation-Derived Waste and Debris Disposal

Prior to demolition activities, the building contents will be removed and disposed accordingly. Investigation-derived waste (IDW), such as drummed tyveks, glassware ,etc., and laboratory chemicals from Weston's and CH2M HILL's onsite laboratories will be classified, packaged, and disposed as appropriate by the demolition subcontractor. The Penta Wood Products company files stored in the former office building will be disposed, pending final approval from the USEPA, Department of Justice, and WDNR.

3.2.4 Demolition Disposal

During demolition activities, nonhazardous materials resulting from the demolition of buildings will be transported to a nearby solid waste landfill, or may be salvaged. Hazardous construction materials may be encountered in the treatment building, such as asbestos insulation and/or lead-based paint. A certified inspector will conduct an asbestos/lead survey prior to demolition activities. Any such materials will be removed and disposed in an appropriate manner under a change order to the subcontract.

TABLE 1

Structures To Be Demolished

Number	Building	Approximate Dimensions	Structural Material	Floor
1	Office	20' x 50' x 12'	Wood	6" Concrete
2	Garage	20' x 45' x 15'	Wood frame & tin shell	6" – 1' concrete with 3' high concrete berm on sides.
3	Treatment[a]	80' x 100' x 15'	Wood, tin shell, & concrete block	Concrete
	Retort Chamber near treatment building[b]	6' diameter	Steel	
4	Storage Shed[c]	25' x 50' x 6"	None	Concrete slab
5	O/W Separator	20' x 30' x 15'	Wood frame & tin shell	Partial concrete slab
	Tank near O/W Separator	10' diameter	Steel	Unknown
6	Shaving Vault[c]	25' x 50' x 6"	None	Concrete slab
	Tank near Shaving Vault	10' diameter	Steel	Unknown
7	Mission Control	10' x 12' x 12'	Wood frame & tin shell	6" concrete
8	Peeler Shed	20' x 30' x 12'	Wood frame & tin shell	6" concrete
9	Unknown[c]	10' x 10' x 6"	None	6" concrete slab
10	Truck Shop	30' x 60' x 15'	Wood frame & tin shell	1' concrete slab
11	Garage	36' x 42' x 15'	Wood frame & tin shell	1' concrete slab
12	Sawmill	20' x 30' x 6'	Wood frame & tin shell (trusses only)	Dirt
13	Sawmill	10' x 60' x 12'	Wood frame & tin shell	Dirt
14	Unknown	12' x 30' x 15'	Wood frame & tin shell	Dirt
15	Unknown	12' x 20' x 10'	Wood	Dirt
16	Sawmill	30' x 60' x 15'	Wood frame & tin shell	Partial 6" concrete (10' x 35')
17	Slasher Control House	10' x 15' x 12'	Wood	6" concrete slab
18	Sawmill[c]	20' x 45' x 6"	None	Concrete slab
19	Sawmill	10' x 15' x 12'	Concrete block & tin roof	1' concrete slab with two 10' x 30' x 6" concrete slabs on north and south sides.
20	Scale House[c]	10' x 25' x 1'	None	6" – 1' concrete
21	Unknown	6' x 6' x 10'	Wood frame & tin shell	1' concrete slab
22	Debris Pile		Scrap materials	
23	Debris Pile		Scrap materials	
24	Wood Scrap Pile		Wood scrap	
25	Wood Scrap Pile		Wood scrap	
26	Inactive Electrical Lines		Poles and wires	

[a]Two smoke stacks are present. One is roughly 100' high x 36" diameter, the other 75' high x 36" diameter.

[b]Approximate dimensions of retort chamber are 42' length x 6' diameter.

[c]These buildings have been demolished, the materials have been removed, and only the concrete slab remains.

Materials remaining from demolition activities will be disposed based upon visual observations. Metallic materials such as siding and piping will be cleaned with a high-pressure wash, if visibly contaminated, and salvaged. Visibly uncontaminated wood will be stockpiled and transported offsite for use as fuel, if possible. Visibly contaminated wood will be fed into a chipper/shredder and mixed into the PCP (southern) portion of the CAMU. General demolition debris such as glass, plastics, insulation, shingles, and unsalvageable wood and metal will be transported to a nearby solid waste landfill for disposal.

3.3 Concrete Demolition and Backfill in CAMU

3.3.1 Description of Concrete Demolition

Concrete slabs will be demolished and placed in the arsenic portion of the CAMU by the earthwork subcontractor. Prior to commencement of demolition activities, all existing utilities within 10 feet of the concrete will be located by the demolition subcontractor and designated for either removal or protection by CH2M HILL. Utilities below the concrete that are uncovered during demolishing of the slabs and designated for removal will be demolished and placed in the CAMU. Concrete surfaces will be visually inspected prior to demolition for signs (e.g., staining) of PCP and/or arsenic contamination.

Concrete identified during visual inspections will be tested for Toxicity Characteristic Leaching Procedure (TCLP) arsenic. Uncontaminated concrete and concrete passing the TCLP test will be disposed in the CAMU. Concrete failing the TCLP test will stabilized prior to disposal in the CAMU. Stabilized concrete shall be tested for TCLP arsenic for approval of the method of stabilization.

3.3.2 Concrete to be Demolished

Table 1 lists buildings with concrete floors onsite that will be demolished and Demolition Drawing C-1 shows the approximate building locations. Approximate dimensions are also given in Table 1. A total of 16 concrete slabs will be demolished and placed in the arsenic portion of the CAMU.

3.3.3 Construction Details Including Design and Construction Technical Factors

3.3.3.1 Concrete Demolition

Concrete that does not appear to be visibly contaminated will be broken up into manageable slabs of at least 1 foot in diameter. The intent is to minimize creation of small rubble sized pieces and allow stacking of slabs upon placement to minimize void space. The demolished concrete will be placed in the arsenic-contaminated (northern) portion of the CAMU.

3.3.3.2 Disposal of Concrete

Concrete not visibly contaminated will be placed as a physical barrier between the arsenic and PCP portions of the CAMU as shown on Earthworks Drawing C-7. Visibly contaminated and solidified concrete will be placed in the arsenic portion of the CAMU adjacent to the visibly uncontaminated concrete.

3.3.4 Performance Standards

Samples of visibly stained concrete will be collected and submitted to a laboratory for TCLP analysis by CH2M HILL. If analytical results indicate the concrete passes the TCLP test for arsenic, the concrete will be broken into pieces of at least 1-foot-diameter and placed in the CAMU. If analytical results indicate the concrete does not pass the TCLP test, the concrete will be scarified and resampled until it passes the TCLP limits prior to placement in the CAMU. The scarified particles of concrete will be stabilized with cement, retested, and upon passing TCLP, placed in the arsenic CAMU.

Verification samples will be collected from the soil below every concrete slab that appears visually contaminated. The number of soil samples collected will be based on the *Guidance Document for Verification of Soil Remediation, Michigan Department of Natural Resources, April 1994, Revision 1* (see Table 2). Samples for verification of the adequacy of soil excavation will be performed using quick turnaround AA analysis for arsenic and GC/MS analysis for PCP. Areas of arsenic soil contamination above a background concentration of 1.25 mg/kg (the upper 95 percent confidence limit of the mean for ten background samples) or above 2.1 mg/kg PCP will be excavated and consolidated within the CAMU. (A PCP criteria of 0.9 mg/kg may be substituted for the 2.1 mg/kg criteria; see the discussion in Section 3.6.4). The area will be considered to exceed arsenic background based on a "t" test evaluation of the mean of the verification samples compared to the background samples. The area will be considered to exceed the PCP performance standard if the upper 95% confidence limit of the mean exceeds 2.1 mg/kg. Additional soil will be excavated and consolidated in the CAMU if the soil exceeds one of the performance standards. If the arsenic exceeds 200 mg/kg, the soil will be solidified as discussed later and disposed in the arsenic portion of the CAMU. The area will be resampled following soil excavation and excavation will continue until passing conditions are found.

TABLE 2
Excavation Floor Samples
Penta Wood Products

Area of Floor (ft^2)	Number of Sample
<500	2
500 < 1,000	3
1,000 < 1,500	4
1,500 < 2,500	5
2,500 < 4,000	6
4,000 < 6,000	7
6,000 < 8,500	8
8,500 < 10,890	9

3.4 Biopad Removal and Backfill in CAMU

3.4.1 Description of Biopad Removal and Backfill

The concrete biopad (Earthworks Drawing C-1) will be broken up into manageable sized blocks and placed in the arsenic portion of the CAMU by the earthwork subcontractor. Approximately 3 inches of soil beneath the biopad will be removed and placed in the CAMU. The estimated volume of soil and concrete to be removed is presented in Table 3. Concrete and soil debris removed from the biopad will be placed in the arsenic portion of the CAMU. The disturbed area will be regraded and revegetated as described in Section 3.7.

TABLE 3
Areas and In Situ Volumes of Soil for Excavation and Consolidation in CAMU
Penta Wood Products Prefinal Design

	Location (structures #s on Drawing D-1)	Site Plan Coordinates	Notes	Dia. (ft)	Length (ft)	Width (ft)	Drawing C-2 Area (ft²)	Thickness (ft)	In Situ Volume (yd³)
				Approximate Dimensions[a]					
Areas of Arsenic Contamination to be Solidified and Consolidated in Arsenic CAMU Areɛ									
1	ACZA Treatment area of CAMU	N800 E1100	Based on revised criteria of 200 mg/kg. Re-sampling prior to solidification.		140	40	5,200	1 to 5'	670
2	SW area of CAMU	N1000 E1200	Based on revised criteria of 200 mg/kg		100	70	7,000	1	259
4	Central area of CAMU	N1200 E1300	Based on revised criteria of 200 mg/kg		100	150	15,000	1	556
6	NE wooded area	N1300 E1900	Based on revised criteria of 200 mg/kg		180	100	18,000	1	667
7	East wooded area	N800 E2000	Based on revised criteria of 200 mg/kg	80			3,900	1	144
								Subtotal	2,296
Concrete to be Consolidated in Arsenic CAMU Area									
	Biopad	N1400 E900	Concrete average 1 foot thick		295	430	126,850	1.00	4,698
	#1 -- Office	N600 E800	6" thick concrete		20	50	1,000	0.50	19
	#2 -- Garage	N800 E800	Building has 3' high wall around perimeter (assumed 8 in. thick: (20+20+45+45) x 8/12=87cf=3.2 cy)		20	45	900	1.00	36
	#3 -- Treatment Building	N800 E1000	Assume 8" thick concrete		80	100	8,000	0.67	199
	#4 -- Former Storage Shed	N700 E1500	6" thick concrete		25	50	1,250	0.50	23
	#5 -- O/W Separator	N900 E1200	Assume 8" thick concrete		20	30	600	0.67	15
	#6 -- Former Shaving Vault	N1100 E1100	6" thick concrete		25	50	1,250	0.50	23
	#7 -- Mission Control	N1100 E1000	6" thick concrete		10	12	120	0.50	2
	#8 -- Peeler Shed	N1100 E1000	6" thick concrete		20	30	600	0.50	11
	#9 -- Unknown (concrete slab)	N1100 E1100	6" thick concrete		10	10	100	0.50	2
	#10 -- Truck Shop	N900 E900	1' thick concrete		30	60	1,800	1.00	67
	#11 -- Garage	N850 E800	1' thick concrete		36	42	1,512	1.00	56
	#16 -- Sawmill	N1900 E500	6" thick concrete		10	35	350	0.50	6
	#17 -- Slasher Control House	N1700 E600	6" thick concrete		10	15	150	0.50	3
	#18 -- Sawmill	N1800 E700	6" thick concrete		20	45	900	0.50	17
	#19 -- Sawmill	N1300 E500	1' thick concrete		10	45	450	1.00	17
	#19 -- Sawmill (add'l concrete slabs)	N1300 E500	6" thick concrete		20	30	600	0.50	11
	#20 -- Scale House	N600 E1500	1' thick concrete		10	25	250	1.00	9
	#21 -- Unknown	N300 E1000	1' thick concrete		6	6	36	1.00	1
								Subtotal	5,215
Areas of Arsenic Contamination to be Consolidated in Arsenic CAMU Areɛ									
3	Biopad Drainage Area	N1400 E1200	Based on revised criteria of 200 mg/kg	70			3,400	1	126
8	NW of Biopad	N1600 E700			180	410	64,600	1	2,393
8A	Below Biopad	N 1400 E900	Upper 3 " of soil from below biopad		295	430	126,850	0.25	1,175
9	North site perimeter	N1900 E700	Re-check sample 1861N 822E		140	90	12,600	1	467
10	Biopad Drainage Area	N1400 E1200	Area= Area of 10 minus area 3				3,700	1	137
11	SE of CAMU	N900 E1500					118,000	1	4,370
12	NE wooded area	N1300 E1800	Re-sampling prior to excavation to minimize tree removal.				162,000	1	6,000

TABLE 3
Areas and In Situ Volumes of Soil for Excavation and Consolidation in CAMU
Penta Wood Products Prefinal Design

	Location (structures #s on Drawing D-1)	Site Plan Coordinates	Notes	Approximate Dimensions[a] Dia. (ft)	Length (ft)	Width (ft)	Drawing C-2 Area (ft^2)	Thickness (ft)	In Situ Volume (yd^3)
								Subtotal	14,667
							Arsenic CAMU Area Subtotal		**22,178**
Areas of PCP and Arsenic Contamination to be Consolidated in PCP CAMU Area									
13	Lagoon washout area	N1500 E1900	Remove washed out soils to native soil-assumed at 1.5 ft average depth				114,400	1.5	6,356
								Subtotal	6,356
Areas of PCP Contamination to be Consolidated in PCP CAMU Area									
14	Wood Chip Pile	N1400 E200	Wood chips to be mixed with PCP soil		100	150	19,500	10	7,222
15	Area around "stained area 6"	N800 E400			110	150	16,000	1	593
16	"Stained Area 7"	N900 E450			65	60	3,500	1	130
17	"Stained Area 8"	N1000 E500	Sample SS-20 had 21.4 ppm @ 3'		30	60	1,800	3	200
18	"Stained Area 10"	N950 E550			70	40	2,600	1	96
19	"Stained Area 11"	N850 E550			60	50	3,000	1	111
20	"Stained Area 12"	N800 E600	370 ppm @ 1' bgs		80	90	8,100	2	600
21	"Stained Area 14"	N650 E600			30	60	1,800	1	67
22	"Stained Area 15"	N700 E700			50	70	3,200	1	119
23	NW of "Stained Area 20 "	N850 E700			40	40	1,400	1	52
15-23	Combined Excavation Area	N800 E600	Added excavtion between Areas 15-23						2,000
24	"Stained Area 18"	N950 E850			60	50	2,300	1	85
25	North of Biopad	N1600 E1000			100	150	14,200	1	526
26	East of sawdust pile	N1000 E200			40	30	1,200	1	44
27	North side of Old State Route 70	N600 E1200	All samples were < 0.5'bgs.		60	830	40,400	0.5	748
28	South side of Old State Route 70	N550 E900	Single sample was surface sample		50	130	6,300	0.5	117
29	Wetland sediment	N2300 E1900	Remove visible washout soil and wood debris at a minimum		120	140	16,800	1	622
30	Lagoon washout area south of wetland	N2000 E1900	Remove visible washout soil and wood debris at a minimum		330	150	52,400	1	1,941
								Subtotal	15,272
							PCP CAMU Area Subtotal		**21,628**
							Total for All Areas		**43,806**

[a]Approximate dimensions are not used in calculation of areas.

3.4.2 Treatment Details Including Design and Construction Technical Factors

3.4.2.1 Biopad Demolition

The concrete biopad measures 295 feet wide by 430 feet long and is approximately 12 inches thick (approximately 4,700 cubic yards). It will be demolished into manageable slabs of at least 1 foot in diameter. The intent is to minimize creation of small rubble sized pieces that may increase leachability of arsenic, and to allow stacking of the concrete slabs in the CAMU. The pad will likely be saw-cut, using water which minimizes particle generation. A shallow layer of soil (approximately 3 inches) will be excavated below the biopad footprint to remove arsenic contaminated materials that may be present below the biopad, or that have resulted from the biopad demolition.

3.4.2.2 Placement in CAMU

The concrete and soil from the biopad demolition will be placed in the arsenic portion of the CAMU at the base of the lagoon to provide slope stability. This material will be placed after site preparation activities have removed PCP-contaminated wood and soil from this area. The 1-foot minimum diameter of the concrete pieces will reduce the chance of subsidence in the CAMU due to void spaces filling with soil or collapsing. Additionally, no concrete, either from the biopad or other demolished building foundation, will be placed within 5 feet of the top of the CAMU to prevent frost action from pushing the concrete through the soil cover.

3.4.3 Performance Standards

Soil verification sampling will be performed by CH2M HILL immediately following removal of the upper 3 inches of soil under the biopad to determine whether additional soil requires removal. Remaining soils will be sampled at random locations throughout the bottom of the excavation to determine whether performance standards have been obtained or whether additional soil should be excavated. The number of bottom soil samples are presented in Table 4. The number of samples was determined based on the methodologies presented in the *Guidance Document for Verification of Soil Remediation, Michigan Department of Natural Resources, April 1994, Revision 1.*

Samples for verification of the adequacy of soil excavation will be performed using quick turnaround AA analysis for arsenic. The area will be considered to exceed the arsenic background of 1.25 mg/kg based on a "t" test evaluation of the mean of the verification samples compared to the background samples. Additional soil in lifts of 6 inches will be excavated in the area surrounding the samples exceeding background and consolidated in the CAMU if the soil exceeds background. The area will be re-sampled following soil excavation and additional excavation continued until passing conditions are found. Further details on confirmation test procedures will be provided in the Remedial Action Sampling and Analysis Plan.

3.4.4 Long-term Performance Monitoring and O&M

Monitoring will be conducted as part of the CAMU long-term performance monitoring and inspection. The former biopad area will be inspected periodically to verify that vegetation has taken hold and other implemented erosion control measures have been successful.

TABLE 4
Soil Verification Samples
Penta Wood Products Prefinal Design

	Location	Site Plan Coordinates	Approximate Dimensions[a] (ft)					Verification Samples			
			Diameter	Length	Width	Perimeter	Area[a]	Bottom Samples	Perimeter Samples	Distance Between Perimeter Samples	Total Samples
Areas of Arsenic Contamination to be Solidified and Consolidated in Arsenic CAMU Area											
1	ACZA Treatment area of CAMU	N800 E1100		140	40	360	5,200	3	4	90	7
2	SW area of CAMU	N1000 E1200		100	190	410	15,100	5	4	103	9
4	Central area of CAMU	N1200 E1300		110	220	460	22,500	6	4	115	10
6	NE wooded area	N1300 E1900		180	150	580	23,700	6	4	145	10
7	East wooded area	N800 E2000	80			251	3,900	2	4	63	6
								Subtotal for arsenic field screening analysis			**43**
Areas of Arsenic Contamination to be Consolidated in Arsenic CAMU Area											
	Biopad	N1400 E900		295	430		126,850	14			14
8	NW of Biopad	N1600 E700		180	410	810	64,600	8	5	170	13
9	North site perimeter	N1900 E700		140	90	400	12,600	5	4	100	9
10	Biopad Drainage Area	N1400 E1200				310	3,700	2	4	78	6
11	SE of CAMU	N900 E1500				1,150	118,000	7	6	203	13
12	NE wooded area	N1300 E1800				1,570	162,000	8	6	242	15
								Subtotal for arsenic AA analysis			**69**
Areas of PCP and Arsenic Contamination to be Consolidated in PCP CAMU Area											
13	Lagoon washout area	N1500 E1900				1,260	114,400	8	6	213	14
								Subtotal for As AA and PCP GCMS analysis			**14**
Areas of PCP Contamination to be Consolidated in PCP CAMU Area											
14	Wood Chip Pile	N1400 E200		100	150	440	19,500	6	4	110	10
15-23	Combined Areas 15 to 23	N800 E600				1,250	97,200	8	6	212	13
24	"Stained Area 18"	N950 E850		60	50	220	2,300	2	4	55	6
25	North of Biopad	N1600 E1000		100	150	400	14,200	5	4	100	9
26	East of sawdust pile	N1000 E200	40	40	30	126	1,200	2	4	31	6
27	North side of Old State Route 70	N600 E1200		60	830	1,710	40,400	5	7	254	11
28	South side of Old State Route 70	N550 E900		50	130	310	6,300	3	4	78	7
29	Wetland sediment	N2300 E1900		120	140	300	16,800	6	4	75	10
30	Lagoon washout area south of wetland	N2000 E1900		330	150	1,200	52,400	6	6	207	12
								Subtotal for PCP GCMS analysis			**85**
										Total for All Areas	**210**

[a]Area based on CAD system calculation from drawing of site excavation areas.

3.5 Solidification of Arsenic Soil

3.5.1 Description of Excavation and Solidification of Arsenic Soil

Soil with arsenic concentrations greater than 200 mg/kg will be excavated, solidified with cement and disposed onsite in the arsenic portion of the CAMU by the earthwork subcontractor. The area containing solidified arsenic within the CAMU will be separated from the area containing organic-contaminated soil and wood debris. This is intended as a precaution to limit mobilization of arsenic under reducing conditions that may occur in the organic-contaminated soil area. Previous investigations at the site have shown that solidification will reduce the leachability of the arsenic-contaminated soil to below the TCLP limit for arsenic (REAC, December 1994).

3.5.2 Soil Requiring Treatment

The Data Evaluation Report (CH2M HILL, 1999) presents the results of the predesign soil sample SPLP testing and the development of the 200 mg/kg arsenic solidification standard. The revised areas of arsenic-contaminated soil requiring excavation and solidification are shown on Earthwork Drawing C-2. The revised soil volume requiring solidification is 2,300 cys and is presented in Table 3. Additional soil may require excavation and consolidation depending on the results of verification sampling. Also soil sampling in the former ACZA Treatment Building area will be performed by CH2M HILL to refine the area requiring excavation and solidification.

3.5.3 Treatment Details Including Design and Construction Technical Factors

3.5.3.1 Solidification of Arsenic with Cement

Solidification will be performed onsite using cement for soils exceeding 200 mg/kg arsenic, independent of whether the unsolidified soil passes the TCLP test. The solidification method will be at the discretion of the remedial contractor. The performance specification for solidification is to meet the TCLP arsenic limit of 5 mg/L in the extract and meet a minimum compressive strength of 200 psi. Specifications limiting the amount of organic debris and size of stones will also be included.

3.5.3.2 Placement of Solidified Arsenic in CAMU

The soil-cement mix will be placed at the base of the lagoon to improve slope stability in the area identified on Earthwork Drawing C-7. As part of Site Preparation, the area will be cleared and grubbed so that it is clear of wood debris and other organics. The soil-cement mixture will be placed prior to set-up to allow a solidified mass to be placed easily in the required areas. It will be poured over previously placed cement slabs to reduce void space. The mix will be contained by placement of berms, if necessary.

3.5.4 Performance Standards

Soil exceeding 200 mg/kg arsenic will be excavated and solidified. Solidified soil will be TCLP tested and must meet the TCLP limit of 5 mg/L arsenic and a compressive strength of 200 psi.

Post-excavation sampling will be conducted by CH2M HILL in the excavation areas immediately following excavation. Remaining soils will be sampled at random locations throughout the bottom of the excavation to determine whether performance standards have been obtained or whether additional soil should be excavated. A soil verification plan will be submitted in the Remedial Action Sampling and Analysis Plan. Soils will also be sampled at regular intervals around the perimeter of the excavation area to determine whether additional soil requires excavation beyond the horizontal limits of the excavated area. Preliminary estimates of number of bottom and perimeter soil samples are presented in Table 4. The number of samples was determined based on the methodologies presented in the *Guidance Document for Verification of Soil Remediation, Michigan Department of Natural Resources, April 1994, Revision 1.*

Samples for verification of the arsenic solidification areas will be analyzed using field portable X-ray fluorescence analysis with a detection limit of about 50 mg/kg because the performance standard is 200 mg/kg. Additional excavation will be performed if the upper 95 percent confidence limit of the mean (UCL) of the samples exceeds 200 mg/kg. If the calculated UCL marginally exceeds the performance standard, additional soil samples will be analyzed and the UCL recalculated. When the UCL exceeds the performance standard, the sample results will be evaluated to determine where additional soil should be excavated. If bottom samples exceed the performance standard, the area around the exceeding samples would be further excavated. When perimeter samples are the cause of the UCL exceedance, additional excavation outward from the perimeter a distance of one half the distance between perimeter samples will be performed to the depth previously excavated. The area of excavation will be re-sampled following excavation and the UCL recalculated. Excavation is complete when the UCL is less than 200 mg/kg.

3.5.5 Long-term Performance Monitoring and O&M

Long-term monitoring of the groundwater below the arsenic area of the CAMU will be performed by an EPA contractor. The arsenic performance standard for groundwater is the Wisconsin preventative action limit (PAL) of 5 µg/L. The long-term monitoring of the arsenic area of the CAMU will be described in the Operations and Maintenance Manual.

3.6 Excavation and Consolidation of Arsenic Soil and PCP Soil and Wood Chips

3.6.1 Description of Excavation and Consolidation

Areas of arsenic and PCP soil and sediment contamination outside the CAMU area and exceeding the performance standard will be excavated and placed within the CAMU by the earthwork subcontractor prior to placement of the soil cover. The arsenic area refers to those soils exceeding background concentrations but less than the solidification standard of 200 mg/kg. Portions of the wood chip pile will also be excavated and consolidated within the PCP portion of the CAMU. Removal of trees will be necessary in the area north and east of the lagoon prior to excavation. Prior to clearing and grubbing of this wooded slope area, soil samples will be collected and analyzed for arsenic to confirm if the entire woods needs to be excavated, or if it is just the soils in the vicinity of the runoff channels need excavating.

Co-mingling of arsenic and PCP contaminated soils in the CAMU will be avoided to the extent possible. Arsenic contaminated soil will be placed in the arsenic portion of the CAMU located north of the former lagoon while PCP contaminated soils will be placed in the lagoon and gully area portion of the CAMU. Wood debris currently within the CAMU will be excavated, mixed with PCP contaminated soils, and placed back in the CAMU. For payment purposes, the amount of material the subcontractor is handling will be measured by surveying the hole created after material is removed prior to mixing, and comparison to the pre-excavation topography.

3.6.2 Soil and Sediment Requiring Excavation

The areas and depths of contaminated soil and sediment requiring excavation and consolidation are shown on Earthwork Drawing C-2. The areas, depths of excavation and in-situ volumes of soil for consolidation are listed in Table 3. Verification sampling will be performed as described below and additional soil excavated and consolidated if the performance standards are exceeded. For design purposes, it was assumed that the total volume of soil, sediment, and wood chips to be consolidated within the CAMU was equal to the calculated total plus a 40 percent contingency to account for additional excavation that may be required as result of verification sampling, and expansion of the excavated materials.

Excavated PCP contaminated soil areas (listed separately from the arsenic soil areas in Table 3) will be consolidated in the central and southern portions of the CAMU. The majority of these areas will be excavated to a depth of 1 foot prior to verification sampling. The PCP wood chip area will be excavated to a depth of 10 feet. Verification sampling will be performed as described below and additional soil or wood chips excavated and consolidated if the performance standards are exceeded.

3.6.3 Treatment Details Including Design and Construction Technical Factors

3.6.3.1 Wetland and Upland Excavation

Prior to excavation activities, erosion berms or silt fences will be erected to trap particles in direct runoff from the excavation area, and to direct run-on from upslope areas around the contaminated areas. Excavation in the lower wetland area (northeastern portion of the site) will be conducted with equipment that will allow removal without entering the wetland area, if possible. If this is not possible, removal from the wetland area will be attempted in winter, to allow heavy equipment to operate in the wetland area without the need of support mats to prevent the equipment from sinking. A berm will be constructed to prevent recontamination of wetlands until all soils are consolidated and the excavation is completed. If excavation cannot be performed during the winter, the excavated sediments will be dewatered, as necessary, and placed in the CAMU. The pore water will be sampled and treated, if necessary.

The remedy for PWP includes excavation of about 0.4 acre and 620 cubic yards of PCP-contaminated wetland sediments. Activities with wetlands and other waters of the United States are regulated under Section 404 of the Clean Water Act (CWA), Wisconsin Administrative Code (WAC) NR 103 and Executive Order 11990. Executive Order 11990 requires that federal actions at a site be conducted in ways that minimize the destruction, loss or degradation of wetlands. The proposed design for remediation of the PWP site minimizes impacts to wetlands by limiting removal to areas of greatest contamination. Removal of contaminated sediments from the wetland area will ultimately improve wetland function and reduce continued degradation by eliminating ecological risk associated with the presence of site-related contaminants.

Section 404 of the CWA , which is administered by the US Army Corps of Engineers, regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. Coordination with local Corps staff has been initiated. If sediment removal can be conducted without entry of heavy equipment into the wetland area, the clean-up action will be exempt from Corp jurisdiction (J. Weinzierl, personal communication, August, 1999). The Corps of Engineers has also provided initial concurrence with the concept of leaving excavated wetland areas without restoration to original grades.

NR 103 is the State of Wisconsin's water quality standard for wetlands. As with Section 404 of the CWA, NR 103 establishes an approach to determining if an action meets the standard by examining elements such as wetland dependency, level of impact, and evaluation of practicable alternatives. The proposed remedy for wetland areas within the PWP site represents the most practicable alternative given project costs and the best available technology for removal of contaminated sediments. The action may also be considered wetland dependent, in that contaminants present with wetland sediments dictate removal in order to reduce risk to ecological receptors. Impacts to wetlands will be limited, by an action that will allow for the return of original wetland hydrology. Backfilling the excavated area with fill is not proposed at this time.

3.6.3.2 Placement in CAMU

Arsenic contaminated soils will be placed in the northern portion of the CAMU along the regraded slope. Erosion control measures, such as diversion berms and sediment traps, will be constructed upgradient of the disposal area prior to the filling of the CAMU to avoid runoff erosion during construction activities.

The PCP-contaminated wood chips in the western portion of the site will be excavated, and mixed with the PCP-contaminated soils (basically sand) before placing the material in the CAMU. This will improve air and water permeability, reduce the potential for perched water conditions in the wood chips, and allow better bioventing system air flow. The volume of wood chips, located on the western edge of the site, is approximately 7,200 cubic yards based on the area (Area 14) shown on Earthwork Drawing C-2 and a depth of excavation of 10 feet.

The PCP contaminated wood debris located within the CAMU in the lagoon and gully area and along the slope north of the lagoon will also be mixed with PCP contaminated soil. Approximately 30,000 cubic yards of wood debris from these areas will be mixed with PCP contaminated soil within the CAMU. Table 5 presents the estimated volume of wood debris. The ratio of wood chips to sand to be mixed will be based on the availability of PCP contaminated soil to be consolidated, and is estimated to be approximately two to one.

TABLE 5
Wood Debris Volumes To Be Mixed With PCP Soil
Penta Wood Products

				In Situ Wood Debris					
	Location	Site Plan Coordinates	Notes	Length (ft)	Width (ft)	Area (ft^2)	Thickness (ft)	Volume (yd^3)	PCP Soil for Mixing[a] (yd)
14	Wood Chip Pile	N1400 E200	Wood chips to be mixed with PCP soil	100	195	19,500	10	7,200	3600
	Lagoon Area	N1400 E1500	Wood debris to be mixed with PCP soil	130	170	22,100	15	12,278	6139
	Gully Area	N1200 E1400	Wood debris to be mixed with PCP soil	170	250	42,500	8	12,593	6296
							Total	**32,070**	**16,035**
			PCP Soil Volume to be Consolidated (from Soil Excavation Table)[b]						**14,406**

[a]Mix ratio is 2 parts wood debris to 1 part PCP soil.

[b]PCP soil volume from Table 2, Soil Excavation Volumes. It is the sum of PCP soil to be consolidated minus the wood chip volume.

3.6.4 Performance Standards

Areas of arsenic soil contamination above a background concentration of 1.25 mg/kg but below the 200 mg/kg threshold for solidification will be excavated and consolidated within the CAMU.

Currently, the PCP performance standard for soil excavation and consolidation is 2.1 mg/kg for onsite soils and 0.9 mg/kg for offsite soils. These standards correspond to the 10^{-6} excess lifetime cancer risk values for industrial and residential exposures, respectively. During verification sampling the analytical results will be evaluated to determine if the 0.9 mg/kg PCP standard can be applied site-wide with minimal increase in soil volume requiring consolidation. Due to the elevated detection limits used during the removal action site characterization, this determination can not be made with the existing database.

The performance standard for excavation of wetland sediment (Area 29) identified on Earthwork Drawing C-2 will be the presence of visible contamination or washout debris such as pole butts. Verification sampling will not be performed for the wetland sediment.

Verification sampling will be conducted by CH2M HILL immediately following excavation as previously described. The preliminary number of bottom and perimeter verification soil samples are presented in Table 4. Samples for verification of the adequacy of arsenic soil excavation will be performed using quick turnaround AA analysis. PCP analysis will be performed by quick turnaround GC/MS analysis.

3.6.5 Long-term Performance Monitoring and O&M

Long-term performance monitoring and operation and maintenance will be presented in the Operations and Maintenance Manual.

3.7 Soil Cover, Erosion Control Measures and Revegetation

3.7.1 Description of Soil Cover, Erosion Control Measures and Revegetation

After soil and sediment consolidation is completed, a soil cover will be placed over the treatment, gully, and lagoon source areas by the earthwork subcontractor (labeled as "arsenic-contaminated materials" and "PCP-contaminated materials" on Earthwork Drawing C-8). This area will be designated as a CAMU in accordance with NR 736 of the Wisconsin Administrative Code.

The CAMU will initially be covered with 6 inches of soil from the uncontaminated areas west of the main source area onsite. Following installation of the erosion control measures, an additional 6 inches of clean, imported topsoil suitable for revegetation will be placed on the CAMU. Low permeability soils found onsite will be used, as available, for the soil cover on the arsenic portion of the CAMU. A fence will be erected around the CAMU. Uncontaminated onsite soils will be used to the extent possible.

The erosion control plan for the PWP site will involve controlling surface water runoff such that the volume and velocity of overland flow is reduced to a level that will not result in the severe erosion of surface soils currently occurring at the site. This goal will be achieved by constructing a system of ditches, diversion berms, downchutes and through revegetation.

The Surface Water Control Plan (SWCP) is shown on Earthwork Drawings C-8 through C-11.

Revegetation of the CAMU and disturbed areas of the site will involve establishment of native grasses and trees. Species were determined through consultation with the WDNR and Natural Resources Conservation Service (NRCS), and were based on a site soil nutrient analysis. To assist in initial establishment of native grasses, soil amendments (topsoil, fertilizer) will be admixed as needed with the soil. In addition, temporary erosion control features (matting, mulch, etc.) may be implemented to assist with erosion control.

The lagoon repair and recontouring plan will involve stabilizing the existing gully area and diverting the surface water that currently reaches the lagoon to one of the downchutes. The goal of the repair effort north of the lagoon will be to create a uniform slope of about 15 to 20 percent, consistent with the slopes on either side of the existing gully.

3.7.2 Construction Details Including Design and Construction Technical Factors

3.7.2.1 Soil Cover

The following design objectives were identified regarding the design of the CAMU cover:

- Accommodate the estimated volumes of arsenic- and PCP-contaminated soil, sediments, wood chips, and concrete debris (Table 3) to be consolidated within the CAMU.
- Construct the CAMU over the approximate area shown on Earthwork Drawing C-6 (approximately seven acres).
- Design and construct a 1-foot thick soil cover cross section consisting of 6 inches of onsite soil overlain by 6 inches of topsoil sufficient for revegetation. The lower 6 inches will be soil excavated from the onsite borrow area sampled as part of predesign investigations, or soil from excavation of the infiltration basin.
- Design CAMU cover grades to control surface water runoff.
- "Blend" cover grades into existing topography as much as possible.

Utilizing these design objectives, allowable ranges for cover grades were developed for the CAMU as shown on Earthwork Drawing C-6. Given the estimated excavation volumes, the maximum height of the CAMU, given its current areal extent, is approximately twenty feet (along the ridgeline). The approximate contours shown on Earthwork Drawing C-6 indicate that the CAMU will dip longitudinally to the northeast at an average slope of 6 percent (similar to existing grades) with transverse sideslopes ranging from 5 to 11 percent. The CAMU footprint and slopes shown on Earthworks Drawings C-6 and C-7 are approximate. The subcontractor shall construct the CAMU to the slope allowances shown to accommodate all required disposal volume.

Since clay deposits have been observed during preinvestigation sampling within the proposed borrow area, these soils will be used, to the extent available, as cover construction material for the northeast portion of the CAMU where arsenic-contaminated concrete and soil will be consolidated. Although not required by the ROD, the use of low permeability soils in the arsenic portion of the CAMU will reduce infiltration through the arsenic soils.

This is not a goal for the PCP portion of the CAMU because infiltration is necessary to provide moisture for bacterial degradation of the PCP.

3.7.2.2 Erosion Controls

Erosion from the site after implementation of the remedy will be controlled through the stormwater management system and through the revegetation plan.

The soils found on the site are primarily sand. The barren slopes with grades less than 10 percent will be protected from erosion by spreading mulch over the barren areas during revegetation. Slopes greater than 10 percent will be covered with erosion control mats and vegetation. Erosion control mats will have typical life expectancies of three years, which is expected to be sufficient to allow vegetation to become well established. The mulch and matting will reduce the erosion potential from rainfall and help establish vegetation by maintaining the soil moisture content in the soil. Fertilizer and/or topsoil may be applied to revegetate barren locations. Native grasses and a mix of jack pine and red pine seedlings will be planted. On the steep slopes, white pine saplings will be planted.

The stormwater management ditches, downchutes, and diversion berms will be designed with erosion resistant linings. The ditches and diversion berms at the site will be designed with mild side slopes to prevent side slope erosion. Ditches will be designed to convey a 25-year return period storm. The ditches will be located along the perimeter of the CAMU to convey runoff to the downchute as well as from the bottom of the downchute to the wetland area. In addition to these ditches, diversion berms will be constructed to prevent runoff from continuing to erode gullies on steep barren slopes resulting from construction. Instead, the diversion berms will funnel the runoff to an erosion-resistant downchute.

Rock check dams and sediment traps will be constructed along the ditches to provide erosion and sediment control during the construction phase. Because the revegetation will occur slowly over several seasons, the rock check dams and sediment traps in the ditches will be left in place and will continue to provide erosion and sediment control benefits after construction has ended.

The downchutes will be constructed on the steepest slopes of the site in order to prevent the gully erosion that is currently occurring. The downchutes will be constructed of rock or rock gabion mattresses. Abrasion and corrosion resistant mesh will be used to construct the gabion mattresses. A geotextile lining will form a boundary between the rock and the underlying soils to prevent the migration and erosion of fines and sands through the rock material. An energy dissipation apron will be located at the end of the downchute to slow the water velocity before the flow continues into the downstream ditch.

3.7.2.3 Revegetation

Barren areas at the site will be revegetated with a combination of grasses and trees. The grass seed mix used at the site was selected in consultation with the WDNR and NRCS and based on soil nutrient analysis. The native grass mix will consist of Indian grass, switch grass, and big blue stem grass. Fertilizer is required for the grass areas. Bare-root jack pine and red pine seedlings will be planted over the site at a density of 600 to 700 per acre. This mix of pines provides good wildlife habitat/food supply. On the steep slopes, 3- to 4-year old balled white pine trees will be planted at a density of 500 per acre. The older trees are thought important to provide erosion control that much quicker. The revegetation plan is shown on Earthworks Drawing C-3.

3.7.3 Performance Standards

Erosion control during construction will be monitored according to the Site Management Plan developed for the construction activities. The plan will specify periodic visual inspection of the construction erosion control elements and the necessary repair of any elements that have failed since the previous inspection.

After construction, long-term erosion control at the site will be controlled through revegetation. The goal of erosion control is to prevent the reoccurrence of gully erosion along steep slopes and to maintain soil stability throughout the site. Some temporary erosion control measures left over from construction will remain functional long enough in order to establish long-term vegetative erosion control measures. These goals will be measured visually to see if erosion is occurring and if vegetation is growing.

Revegetation performance will be measured for grasses by the percentage of area that does or does not have vegetative growth. The measurement will occur within several months after revegetation. If vegetation is not established over the required percentage of area shown in the plans and specifications, then the area will have to be reseeded. The establishment of trees will be measured in a similar fashion, except a longer duration will be used to evaluate success. The measurement for successful tree planting will occur at least 1 year after planting. Trees that have died within 1 year will be replaced.

3.7.4 Long-term Performance Monitoring and O&M

Long-term erosion control at the site will be achieved primarily through vegetation. The site will be visually inspected at the beginning and end of each growing season for locations experiencing increased erosion or decreased vegetation. The primary focus for erosion control will be the downchutes and CAMU areas. Erosion control at the rest of the site will be monitored and repaired only if the erosion will negatively impact the long-term performance of the CAMU or offsite properties at levels beyond what would be expected for the final land use. Subsidence of the CAMU cover will be monitored through visual inspections. Repairs will be made to prevent water from ponding on the CAMU cover.

Erosion control maintenance may require excavation of ditches that fill with sediment and the repair of rill erosion where there is potential for severe gully erosion to develop on the CAMU. Erosion control is expected to be more significant in the first few years after construction while vegetation continues to establish. Long-term maintenance should be minimal as vegetation develops at the site.

Vegetation maintenance functions may include reseeding and the placement of erosion matting if severe erosion occurs. Vegetation maintenance will be also be more significant in the first few years after construction and should be minimal as the vegetation develops.

The downchutes will be visually inspected for damage and functionality on an annual basis. Maintenance activities may include the rock placement as the gabions settle and the gabion mesh deteriorates.

3.8 Bioventing

3.8.1 Treatment System Description

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 wells will be installed in the CAMU after the soil consolidation and the first 6 inch lift of the cover is completed. The bioventing system will consist of injection wells, connecting piping, blower, controls, treatment building, and piezometers.

The biovent wells will be installed by the drilling subcontractor. Piping from the wells to the treatment building will be installed by the earthwork contractor and the blower and controls within the treatment building will be installed by the treatment system subcontractor.

The target depth of treatment extends to approximately 102 feet below the existing (pre-CAMU) ground surface (bgs), about 2feet below the current water table elevation. The groundwater collection system will be 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.

A process flow diagram for the bioventing system is provided on Treatment Drawing N-1. The major design criteria for bioventing are the air flow rate and the radius of influence of the biovent wells. These design criteria were summarized in the Design Criteria Report (CH2M HILL, 1999).

3.8.2 Soil Requiring Treatment

The depth of soil contamination 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 shallow PCP contaminated soil top a depth of approximately 10 feet. The volume of contaminated soil to be biovented is 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. The wood debris and buried wood chips placed in the CAMU will be treated with the bioventing system.

3.8.3 Treatment Details Including Design and Construction Technical Factors

3.8.3.1 Biovent Wells

Shallow and deep biovent wells will be located in the same borehole, to achieve better air distribution over the full 102-foot thick (pre-CAMU) target depth. The design air flow rate for each of the biovent well nests is 500 scfm, at approximately 50 inches H_2O to the subsurface target area, based on the results of the bioventing treatability test (CH2M HILL, 1998). The air flow rate to each biovent well (shallow or deep) within the well nest will be manually adjusted based on oxygen and soil gas pressure readings collected at various monitoring points.

Well nest location was based on the 125-foot design radius of influence for each biovent well nest determined using the results of the treatability study. Radius of influence has been defined as a soil gas pressure reading of greater than 0.1 inch H_2O (AFCEE, 1992). 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 air flow rate was also determined using the treatability study results. The treatability study was conducted using a 500-scfm air flow rate at a pressure of 50 inches H_2O. This air flow 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 air flow rate was confirmed using a mathematical model. The model predicts the air flow 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 air flow rate of 5 scfm per foot. Since the treatability study achieved oxygen saturation at the 500-scfm flow rate, there is no need to increase the air flow rate. The two shallow biovent wells located in the southern end of the CAMU are designed for treatment of the upper 10 feet of soil. Given the shallower depth, an air flow rate of 100 to 200 scfm per well was determined to be adequate to saturate the soil with oxygen.

The biovent wells will be constructed with Schedule 80, 4-inch diameter polyvinyl chloride (PVC) pipe and installed in the same borehole as the groundwater wells. The deep biovent wells (BV-02-D to BV-07-D) will be screened from approximately 25 feet below grade (bg) to 10 feet below the groundwater table. The shallow biovent wells will also be constructed with Schedule 80, 4-inch PVC pipe, however, six of the eight shallow biovent wells (BV-02-S to BV-07-S) will be screened from approximately seven feet bg to 20 feet bg. The other two shallow biovent wells (BV-08-S and BV-09-S) will be constructed with approximately 15 feet of screen each. The well nest site plan and well details are shown on Drilling Drawings C-1 through C-3.

3.8.3.2 Piping

Air from the blower will be sent to a stainless steel manifold pipe, located inside the treatment building, then to each injection well through individual 8-inch high density polyethylene (HDPE) pipe. Each process line will be equipped with a flow meter, flow control valve, and a pressure indicator. At the well head, the 8-inch pipe will be reduced to 4-inch flexible pipe and connected to each biovent (shallow and deep) well. Air flow to the deep and shallow biovent well will be further controlled using the additional flow control valves located in the well vaults.

3.8.3.3 Blower

The bioventing blower will be specified to provide a total of 5,000 scfm at 50-inches H_2O in order to provide the required air flow rate to each injection well. The blower will be a 75-hp centrifugal blower and has been sized to easily accommodate expansion in case additional injection wells are required or higher flow rates are needed in the future. Excess air will be vented to the outside of the building via a vent pipe. The blower intake pipe will be equipped with a silencer for noise suppression.

3.8.3.4 Instrumentation and Controls

Supervisory Control and Data Acquisition.

This treatment system operation will be supervised by a programmable logic controller (PLC). The PLC and the man-machine interface (computer) will be supplied by the

Bioventing/Groundwater Treatment Facility subcontractor and CH2M HILL will supply the PLC programming software and will program the PLC. Based on the control requirements of the treatment system, CH2M HILL has determined it is more cost effective to purchase the PLC programming software and program the PLC, rather than prepare PLC logic loop descriptions and then review the subcontractors programming. The PLC will monitor all automatic functions of the system and receive all alarm inputs. Upon receiving a shutdown alarm input, the PLC will call out (using an autodialer) and notify the Operations Contractor that the system is down.

General Control Description.
The biovent 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 will be 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 also capable of operating in either a pulsed or continuous operation mode. Pulsed operation refers to an operation mode whereby the blower is turned on for a specified period of time followed by a period of nonoperation (e.g., bring the oxygen concentration up to 20 percent and shut off the system until oxygen concentration drops to 5 percent). The goal of this type of operation is to reduce the electrical cost associated with operating the blower. This would also lessen the drying of the soil and minimize the potential need to increase soil moisture.

Airflow measurements will be conducted at the site using insertion-type pitot tube flow meters ("Annubar" type). and the air flow rate to each well will be set manually at the site. The blower will be equipped with an upstream vacuum pressure indicator, and a downstream pressure switch, pressure indicator, and a temperature indicator. The pressure switch will be equipped with preset LOW and HIGH alarm points to indicate when the blower is not functioning properly.

The bioventing system will not be 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.

3.8.3.5 Bioventing System Startup

In general, startup of the bioventing system will consist of the following steps:

- Initiation of blower operation
- Adjustment of the air flow rate to the injection wells
- Perform soil gas pressure measurements to determine the radius of influence
- Perform oxygen uptake studies to evaluate duration of pulse operation
- Additional adjustments of air flow rates

The actual operating conditions will be compared to the bioventing treatability study to determine if the wells are performing as predicted.

3.8.4 Performance Standards

Per the ROD, the soil is considered remediated when it no longer causes groundwater contamination exceeding 0.1 µg/L PCP, the NR 140 PAL (ROD page 41). The soil cleanup goal protective of groundwater presented in the ROD (ROD Table 1) is 4.6 mg/kg. It was developed based on the Sommers Model methodology (Roy F. Weston, 1994) which does not account for the relatively slow leaching rate of PCP. Also it has a relatively high degree of uncertainty because of the assumptions made in the model. Although the bioventing performance standard is set at 4.6 mg/kg, it may be modified in the future if it is found that a differing value is protective of groundwater.

3.8.5 Long-term Performance Monitoring and O&M

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 will include:

- Lysimeter sampling
- Soil gas analyses below bioventing treatment areas
- Soil sampling within bioventing treatment areas
- Routine inspection of cover and sampling if necessary

The existing lysimeter nests LY-02 and LY-03 will be sampled on an annual basis for the first 5 years to determine whether observable trends in pore water PCP concentrations are evident, and to determine the amount of electron acceptors and donors and degradation byproducts. Subsequent sampling, if necessary, will be based on these initial results. Analysis will include PCP, chloride, nitrate, sulfate, dissolved iron, hydrogen, oxidation/reduction potential, and pH.

A total of 12 (four sets of three) new piezometers, nested at varying depths will be installed in discrete locations (Drilling Drawings C-1 and C-5). The purpose of the piezometers is to allow for the monitoring of soil gas composition to assess effectiveness in delivering air to the affected subsurface regions. Soil gas analyses will be conducted semiannually, at a minimum. Analyses for oxygen, carbon dioxide, temperature, and humidity will be measured in the piezometers and the monitoring wells identified for groundwater sampling. If levels are out of acceptable ranges, process modifications may be proposed.

Soil samples for PCP and other degradation indicators (i.e., chloride, pH) will be collected one to three times during the operational period. Samples will be collected at discrete locations and at various depths and analyzed for PCP, chloride, nitrate, sulfate, dissolved iron, hydrogen, oxidation/reduction potential, and pH. Based on the results, a decision to continue bioventing operation and/or implement another treatment alternative will be made at that time.

The effectiveness of bioventing will be evaluated after 5 years. The evaluation will be based on analytical results collected from the groundwater and soil environmental monitoring. If the bioventing was unsuccessful in treating the areas highly contaminated with PCP, then either continued bioventing and/or implementation of other treatment alternatives, such as in-situ steam stripping, may be considered.

3.9 Groundwater and LNAPL Collection and Treatment

3.9.1 Treatment System Description

The objectives of the Groundwater and LNAPL Collection and Treatment System are to:

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

Groundwater and product recovery wells and biovent wells will be installed by the drilling subcontractor. Piping and leak detection from the wells to the treatment building will be installed by the earthwork subcontractor. The earthwork subcontractor will also install the infiltration basin. The treatment system and building will be constructed by the treatment system subcontractor.

Seven groundwater extraction wells will be designed to depress the water table and capture the area of PCP groundwater exceeding 1,000 µg/L. LNAPL recovery systems will be installed in the six deep biovent wells and the one product recovery well located at the well nest locations. The LNAPL and groundwater treatment system will consist of connecting piping, an oil/water separator, a product recovery tank, an oil bag filter, activated clay treatment, granular activated carbon (GAC) treatment, controls, building, and discharge piping. The treated water discharge will be to an infiltration basin to be constructed northwest of the treatment building. A process flow diagram for the LNAPL and groundwater collection and treatment system is provided on Treatment Drawing N-2 and N-3.

The groundwater treatment system has been designed to treat the PCP and other organic contaminants to the required discharge standards. A metals removal treatment system for the two metals expected to exceed PALs (iron and manganese) is 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 will be performed to evaluate the removal of iron and manganese.

Groundwater contamination exceeding the cleanup goals outside the influence of the groundwater collection system will be 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 will be allowed to naturally attenuate. Groundwater monitoring will be used to track the progress of natural attenuation.

3.9.2 LNAPL and Groundwater Requiring Collection and Treatment

The depth of groundwater contamination is approximately 40 feet below the water table. The average PCP concentration in the groundwater is approximately 15,000 μg/L based on the area weighted mean of the October 1997 groundwater monitoring results for wells within the target remediation area (Table 6). A summary of the estimated influent concentrations and discharge standards are presented in Table 7.

3.9.3 Treatment Details Including Design and Construction Technical Factors

3.9.3.1 LNAPL and Groundwater Extraction Wells

Four aquifer pump tests were completed on the PWP site during the month of May 1999 as part of predesign investigations. These tests indicate that approximately 0.2 feet of drawdown (decrease in water level) can be maintained 64 feet from the pumping well at a 15-gpm flow rate. Results of the model indicate at a flow rate of 15 gpm, seven extraction wells would capture groundwater in the containment zone and produce 1.5-2 feet of drawdown.

The groundwater extraction wells (EW-02 to EW-07 and EW-10) will be placed in the same borehole as the biovent and LNAPL recovery wells (Drilling Drawing C-3). In order to accommodate a 6-inch groundwater extraction well and the two 4-inch bioventing/LNAPL recovery wells, a 24-inch diameter borehole will be advanced to a depth of approximately 150 feet below the pre-CAMU ground surface . The groundwater extraction well will be screened at the bottom 20 feet of the borehole.

The groundwater extraction wells will be performance tested once the treatment system is installed and operating. First, a preliminary capacity pumping test (step drawdown) will be performed by operating each extraction well for a duration of 1 hour per step at the rates of 10, 15, and 20 gpm. The static water level in the well will then be allowed to recover for a period of time approximately equal to the duration of the test. A performance test will then be performed at each extraction well by pumping for a maximum of 48 hours. The static water level will then be allowed to recover for an amount of time approximately equal to 25% of the test duration. During this time, water level recovery measurements will be taken.

3.9.3.2 Piping

As detailed in the Record of Decision (ROD), the groundwater and LNAPL are both considered listed hazardous wastes (F032). Therefore, it was determined that the groundwater and LNAPL should be pumped to the treatment building in dual-containment pipe with leak detection in accordance with RCRA requirements. Because the amount of settling that may occur in the CAMU PCP wood chip area is unknown and the settling may not be uniform, the use of manholes as leak detection was considered impractical because of the sloping of the pipes. A continuous leak detection system consisting of a single wire installed on the bottom of the containment pipe will be used instead.

The groundwater piping will be 1½-inch diameter HDPE pipe and the LNAPL pipe will be ¾-inch diameter HDPE pipe contained in a 6-inch HDPE pipe. Once inside the building, the groundwater pipes will converge into a manifold and exit as a single 4-inch Schedule 80 PVC pipe. The LNAPL pipe will converge into a manifold and flow into the oil/water separator (Treatment Drawings M-1 through M-3).

TABLE 6
Estimate of Groundwater Treatment Sytem Influent Concentrations
Penta Wood Products

		Contaminant Concentration (µg/l)												
		Unconfined Subareas						Semiconfined Subareas						
	Subarea	A- MW 5	B- MW10S	C- MW 20[e]	D- MW 18	E- MW 6S	F- MW 19	A- MW 12	B- MW10	C- MW 10	D- MW 14	E- MW 6[d]	F- MW 4	Total
	Area (ft^2)	110,000	46,200	46,200	81,000	37,500	96,000	110,000	46,200	46,200	81,000	37,500	96,000	
	Aquifer Volume[a] (ft^3)	880,000	369,600	369,600	648,000	300,000	768,000	880,000	369,600	369,600	648,000	300,000	768,000	6,670,400
Contaminant	PAL (µg/L)													Volume Weighted Concentration (µg/L)
PCP	0.1	28,000	30,000	29,000	27,000	1	19,000	13,000	8,200	8,200.0	1	4,300	1	**14,591**
Arsenic	5	3.2	1.0	1.0	8.2	1.0	1.0	1.0	1.4	1.4	1.0	1.4	1.0	2.1
Benzene	0.5	0.05	0.40	0.05	0.05	0.05	0.05	1.00	0.20	0.20	0.05	0.20	2.00	0.4
Chloride	125,000[b]	50,000	38,000	38,000	49,000	57,400	47,000	50,000	35,000	35,000	8,000	35,000	7,300	37,227
Copper	130	24	11	11	44	1	3	5	3	3	1	3	1	10
Ethylbenzene	140	3.0	0.9	0.5	2.0	0.5	0.5	2.0	2.0	2.0	0.5	2.0	3.0	1.7
Iron	150[b]	4,860	45	45	32,000	10	5	267	2,190	2,190	10	2,190	36	**4,137**
Manganese[c]	25[b]	12,900	10,300	10,300	10,600	4,720	2,690	1,660	2,330	2,330	4	2,330	56	**4,984**
Toluene	69	5.0	1.0	0.5	16.0	0.5	0.5	3.0	3.0	3.0	0.5	3.0	1.0	3.4
Xylene	124	21.0	8.0	0.1	19.0	0.5	0.2	14.0	17.0	17.0	0.5	17.0	3.0	10
Zinc	2,500[b]	1	8	8	26	2	2	11	9	9	1	9	1	7.0

Note: All data are from groundwater sampling in October 1997.
[a]Aquifer thickness of unconfined and semiconfined estimated at 20 feet for each. Porosity =0.4.
[b]PAL based on public welfare concerns (taste and odor).
[c]Data is for total manganese. Dissolved manganese may be much lower.
[d]BTEX and inorganic data unavailable for MW 6. Data from MW10 used.
[e]Inorganic data unavailable for MW20. Data from MW10S used.

TABLE 7
Treatment System Influent Concentrations and Discharge Standards (PALs)
Penta Wood Products

Chemical of Concern	Estimated Influent Concentration [a] (μg/L)	PAL Discharge Standard (μg/L)
Arsenic	2	5
Benzene	1	0.5
Chloride	37,000	125,000 [b]
Copper	10	130
Ethylbenzene	2	140
Iron	4,100	150 [b]
Manganese	5,000 [c]	25 [b]
Naphthalene	NA	8
Pentachlorophenol	15,000	0.1
Toluene	3	69
Xylene	10	124
Zinc	7	2,500 [b]

[a] Influent concentrations based on area weighted mean concentrations of October 1997 groundwater monitoring results (see Table 6).

[b] Discharge standard based on public welfare concerns (taste and odor aesthetics).

[c] Estimated influent concentration is based on total manganese and is likely an overestimate.

3.9.3.3 LNAPL and Groundwater Pumps

Based upon the May, 1999 pump test data, the expected flow rate from each well is approximately 15 gpm. The groundwater pumps will be 2-hp electrical submersible pumps and have been sized to pump the water through the entire treatment process. The riser pipe will exit the well at the top and be connected to the containment pipe via flexible hose.

The LNAPL recovery pumps will be top-loading pneumatic pumps placed approximately at the elevation of the groundwater table to skim off the floating LNAPL. When activated, the pump will send LNAPL (and water if present) to an oil/water separator located in the treatment building (Drilling Drawings C-2 and C-3).

3.9.3.4 Groundwater Treatment System and LNAPL Storage

The groundwater treatment system is designed to reduce the expected influent PCP concentration of approximately 15,000 µg/L to less than 1 µg/L, the practical analytical quantification limit for PCP. The required amount of carbon to treat groundwater containing 15,000 µg/L of PCP at a 100-gpm flow rate was determined using several carbon adsorption models which to estimate the carbon usage rate. These results along with the field results generated during the May, 1999 pump test and carbon vendor experience were used to estimate the carbon volume and vessel size.

In order to treat the expected influent PCP concentration to less than 1 µg/L and minimize carbon vessels exchanges, two 10,000-pound capacity high pressure vessels connected in series will be used. The estimated carbon exchange frequency for the lead vessel is every 200 days. The GAC treatment system specifications will be performance based and focus on reducing the PCP concentration to less than 1 µg/L. The GAC will be a F032-listed hazardous waste and will be regenerated/disposed at a RCRA Subtitle C TSD facility.

An oleophilic bag filter and another high pressure vessel containing 2,500 pounds of activated clay will be placed prior to the GAC vessels to extend carbon life by adsorbing emulsified LNAPL and filtering suspended solids from the groundwater. The spent activated clay and bag filters will be managed as F032-listed hazardous waste and will be disposed at a RCRA Subtitle C TSD facility. The groundwater treatment system will be operated under continuous flow conditions with minimal contact with air to prevent oxidation of the iron and manganese prior to discharge to the infiltration basin.

LNAPL collected from the recovery wells will be pumped to an oil/water separator in the treatment building. The oil/water separator will be equipped with separate pumps to transfer oil to an outside storage tank and water back into the influent groundwater treatment stream. LNAPL storage will be in accordance with all applicable RCRA requirements. The contents of the storage tank will need to be pumped out periodically.

Recovered LNAPL is a F032-listed waste and will be treated, stored and disposed in accordance with RCRA requirements. The treatment system will be constructed to comply with the standards for owners and operators of hazardous waste facilities outlined in 40CFR265. The groundwater treatment system is designed to shut down an individual groundwater pump if a leak is detected in the containment pipe. The treatment system building is designed to provide containment of 100 percent of the volume of the largest vessel (i.e., one 10,000-pound capacity carbon vessel). The building is designed with process drains and an overflow sump equipped with a level switch to indicate a leak has occurred. This level switch will alarm the PLC to shut all groundwater pumps down and notify the operator. Water from the overflow sump is directed to a 2,500-gallon containment vessel buried next to the treatment building (Treatment Drawings A-1, S-1 and S-2).

Storage of the recovered LNAPL will meet the hazardous waste accumulation requirements outlined in 40CFR262.34. Hazardous wastes will be stored onsite for no longer than 90 days in containers that comply with Subpart I of 40CFR265 within either a drip pad or a containment building that meets the appropriate requirements of 40CFR265. The main requirement of the LNAPL storage area is that it provides secondary containment in the event of a leak or spill. Other requirements include:

- Tank corrosion protection
- Spill prevention controls
- Overfill prevention controls
- Inspections
- Leak detection system

The proposed location of the treatment building is near the southeast corner of the biopad area, near the building identified as the Peeler Shed (Building No. 8). The main 480V electrical service is located in a small electrical control building next to the Peeler Shed. This service would be disconnected from its current location and moved to the new treatment building. Electric motors and controls will be specified as 480V to the extent practicable. See Treatment Drawings E-1 through E-4 for electrical details.

3.9.3.5 Treated Groundwater Discharge

The infiltration basin will be located northwest of the current biopad site (Earthworks Drawing C-4). 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. The infiltration basin will be designed to infiltrate the pumping capacity of the groundwater wells (100 gpm). Direct infiltration measurements have not been taken at the proposed infiltration basin location. Instead, vertical hydraulic conductivity information gathered from monitoring well and infiltration test wells was used to estimate the infiltration capacity of the proposed site. A soil boring will be conducted at the infiltration basin site prior to construction.

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 was 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 (Earthwork Drawing C-12, Treatment Drawing N-3).

Secondly, the potential for clogging of the inflitration 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 allow the treatment effluent the capability to infiltrate under these severe operating conditions without compromising the operation of the system.

3.9.3.6 Instrumentation and Controls

Supervisory Control and Data Acquisition

This treatment system operation will be supervised by a programmable logic controller (PLC). The PLC and the man-machine interface (computer) will be supplied by the Bioventing/Groundwater Treatment Facility subcontractor and CH2M HILL will supply the PLC programming software and will program the PLC. Based on the control requirements of the treatment system, CH2M HILL has determined it is more cost effective to purchase the PLC programming software and program the PLC, rather than prepare PLC logic loop descriptions and then review the subcontractors programming. The PLC will monitor all automatic functions of the system and receive all alarm inputs. Upon receiving a shutdown alarm input, the PLC will call out (using an autodialer) and notify the Operations Contractor that the system is down (Treatment Drawing E-2).

General Control Description

The operation of the groundwater extraction pumps and the LNAPL recovery pumps will be controlled by the PLC. A level transmitter probe will be installed in each groundwater extraction well and will provide real time water level information. The PLC will be programmed to turn off a groundwater pump if the water level in the well reaches a preset elevation. This will provide additional protection for the pump. Once the water level rises above the preset elevation, the pump will resume operation automatically.

The flow rates from each well will be adjusted with manually operated flow control valves and local display flow meters. The system effluent flow rate will be monitored with a flow meter that will be remotely displayed. The PLC will track the volume of water discharged on a daily basis and archive the data for use at a later date.

The PLC will control the operation of the LNAPL pumps by opening and closing the solenoid controlling the process air to the pump. The PLC will allow air to flow to the pump for a preset time period (e.g., 10 minutes) on a routine schedule (e.g., every day). To minimize the size of the compressor required to supply the air, the PLC will be programmed to operate one product recovery pump at a time. Changes to the pumping intervals and schedules will be made based on field conditions and can be easily accommodated with the PLC.

Pressure indicator transmitters will be located before and after every pressure vessel and a programmable logic controller (PLC) will receive inputs from the pressure transmitters and shut the system down at a preset pressure differential. This alarm would indicate the media bed or bag filter requires replacement.

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

3.9.4 Startup

Startup of the LNAPL and groundwater recovery system will focus on refining the system operation to meet the remedial objectives and performance standards. The main areas that startup will address are:

- Adjustment of groundwater collection system flow rates to achieve capture of the target collection area, optimize drawdown while avoiding excessive groundwater extraction flows. Emphasis will be on measurement of groundwater elevations and LNAPL thickness at variable flow rates.
- Adjustment of flow rates to improve LNAPL removal in the LNAPL recovery wells while preventing LNAPL emulsions or free product in the groundwater collection wells.
- Operation of the groundwater treatment system to minimize the potential for oxidation of iron and manganese in the activated clay and carbon vessels. If necessary addition of polyphosphates to sequester iron and manganese would be considered.
- Optimization of carbon grade to minimize total carbon replacement and disposal costs. Because of high disposal cost of carbon as a hazardous waste, it is important to optimize adsorption of PCP relative to carbon cost.
- Optimizing discharge configurations and infiltration basin dimensions to minimize plugging of the basin from precipitates and minimize freezing problems during cold weather.

3.9.5 Performance Standards

The performance standard for the LNAPL recovery system is to remove the pumpable LNAPL. Once the water table has been depressed and pumpable LNAPL is no longer being removed, the LNAPL recovery will be considered complete. The LNAPL recovery system will remain operable for 1 year after shutdown in the event that measurable LNAPL reappears during monitoring.

The groundwater collection system will continue operating during the bioventing operational period to continue depressing the water table to allow bioremediation of the smear zone. In addition, it will operate for sufficient time to reduce the PCP contaminant mass in groundwater by at least 90 percent from 1998 concentrations.

The groundwater treatment system will be operated to meet discharge requirements. The discharge requirements are the cleanup goals listed in the ROD (ROD Table 2). They were presented earlier in Table 7.

3.9.6 Long-term Performance Monitoring and O&M

It is anticipated that the system will be operated for 10 years to remove the majority (90 percent) of the PCP contaminant mass. Routine maintenance items would include:

- Bag filter replacement
- Replacement of the activated clay
- Carbon changeouts (10,000 pounds approximately every 200 days)
- Mechanical preventative maintenance tasks

- LNAPL storage and handling requirements
- Well and infiltration basin maintenance tasks

Environmental monitoring will be used to assess the effectiveness of LNAPL removal and groundwater treatment and to assess the degree of natural attenuation. If monitoring data indicate further spreading of the plume above remedial goals, treatment process modifications, such as the installation of additional extraction wells, may be necessary.

The groundwater monitoring network will include the following wells:

- Unconfined monitoring wells 1, 2, 6S, 9, 10S, 13, 16, and 19
- Semiconfined monitoring wells 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 17
- Two residential wells

The monitoring wells will be sampled annually and analyzed for PCP and TAL metals and for 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, ferrous iron, and ferric iron
- Manganese
- Carbon dioxide (CO_2)
- Chloride

A smaller set of five monitoring wells (MW 3, 10, 10S, 13, 15) will be sampled and analyzed for the parameters listed above on a quarterly basis. Water level elevations will be taken in all wells on a quarterly basis. LNAPL thickness will be measured in unconfined wells in the LNAPL area on a quarterly basis.

SECTION 4

Construction Schedule

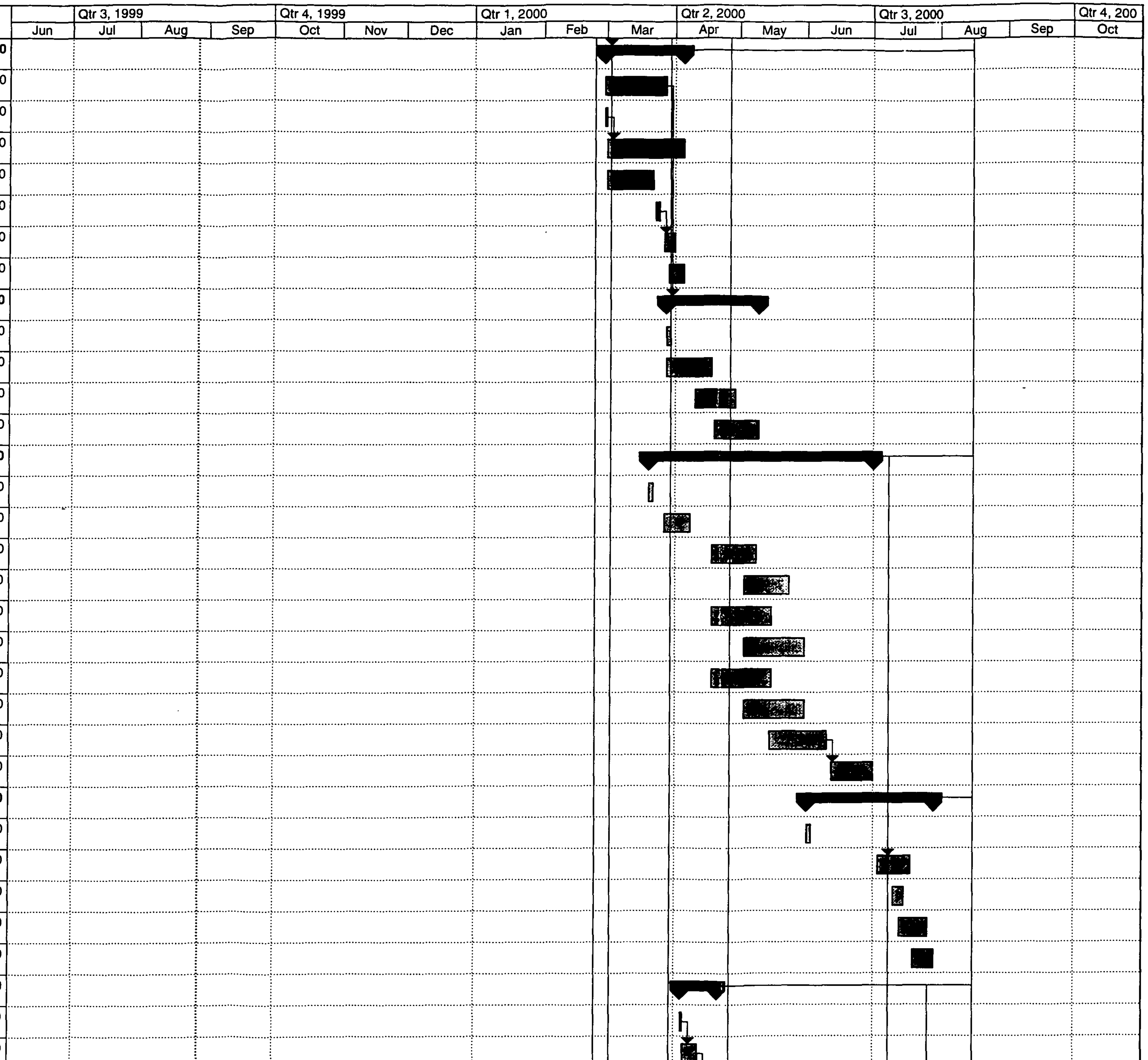
A prefinal construction schedule follows this page.

ID	Task Name	Duration	Start	Finish
1	**Task 11 Prefinal/Final Design**	**109 days**	**Tue 07/13/99**	**Fri 10/29/99**
2	Prepare Prefinal Design Packages	46 days	Tue 07/13/99	Fri 08/27/99
3	Prefinal Design Briefing	0 days	Thu 09/02/99	Thu 09/02/99
4	Agency Review of Prefinal Design	30 days	Mon 08/30/99	Tue 09/28/99
5	Incorporate Agency Comments	15 days	Thu 09/30/99	Thu 10/14/99
6	Prepare Final Design Packages	19 days	Thu 09/30/99	Mon 10/18/99
7	Prepare Draft O&M Manual	30 days	Thu 09/30/99	Fri 10/29/99
8	Prepare CQAP	30 days	Thu 09/30/99	Fri 10/29/99
9	**Task 12 Post-RD Support (Bid Mtg and Evaluation)**	**107 days**	**Mon 10/04/99**	**Tue 01/18/00**
10	Advertise Bid	17 days	Mon 10/04/99	Wed 10/20/99
11	Pre Bid Meeting	3 days	Tue 11/02/99	Thu 11/04/99
12	Bid Evalution	23 days	Tue 11/30/99	Wed 12/22/99
13	Modify Site Plans	30 days	Mon 12/20/99	Tue 01/18/00
14	**Task 13 WA Closeout**	45 days	Thu 01/20/00	Fri 03/10/00
15	**Remedial Action (RA) WP and Subcontract Award**	**135 days**	**Thu 09/30/99**	**Fri 02/11/00**
16	Prepare RA Work Plan	30 days	Thu 09/30/99	Fri 10/29/99
17	Agency Review of RA WP	30 days	Tue 11/02/99	Wed 12/01/99
18	Negotiate/Revise WP	9 days	Thu 12/02/99	Fri 12/10/99
19	Agency Approval of WP	16 days	Mon 12/20/99	Tue 01/04/00
20	Agency Approval of Subcontractors	12 days	Fri 12/24/99	Tue 01/04/00
21	Award Bid/Subs plans	23 days	Wed 01/05/00	Thu 01/27/00
22	Notice to Proceed	5 days	Mon 02/07/00	Fri 02/11/00
23	**Remedial Construction Submittals and Mobilization**	**10 days**	**Tue 02/15/00**	**Mon 02/28/00**
24	Subcontractor Submittal Review	10 days	Tue 02/15/00	Mon 02/28/00
25	Mobilization	5 days	Tue 02/15/00	Mon 02/21/00
26	**Site Preparation/Earthwork Subcontract**	**114 days**	**Tue 02/22/00**	**Fri 07/28/00**
27	**Site Preparation**	**30 days**	**Tue 02/22/00**	**Mon 04/03/00**
28	Establish Erosion Control Meas. & As CAMU Prep.	5 days	Tue 02/22/00	Mon 02/28/00
29	Clearing & Grubbing (except As wooded slope)	25 days	Tue 02/29/00	Mon 04/03/00
30	**Onsite laboratory**	**77 days**	**Thu 03/16/00**	**Fri 06/30/00**
31	Mobilization	2 days	Thu 03/16/00	Fri 03/17/00
32	Sampling and Analysis	75 days	Mon 03/20/00	Fri 06/30/00
33	Delineate initial excavation areas	2 days	Thu 03/23/00	Fri 03/24/00

Project: Penta Wood RA Scedule
Date: Fri 08/27/99

Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks

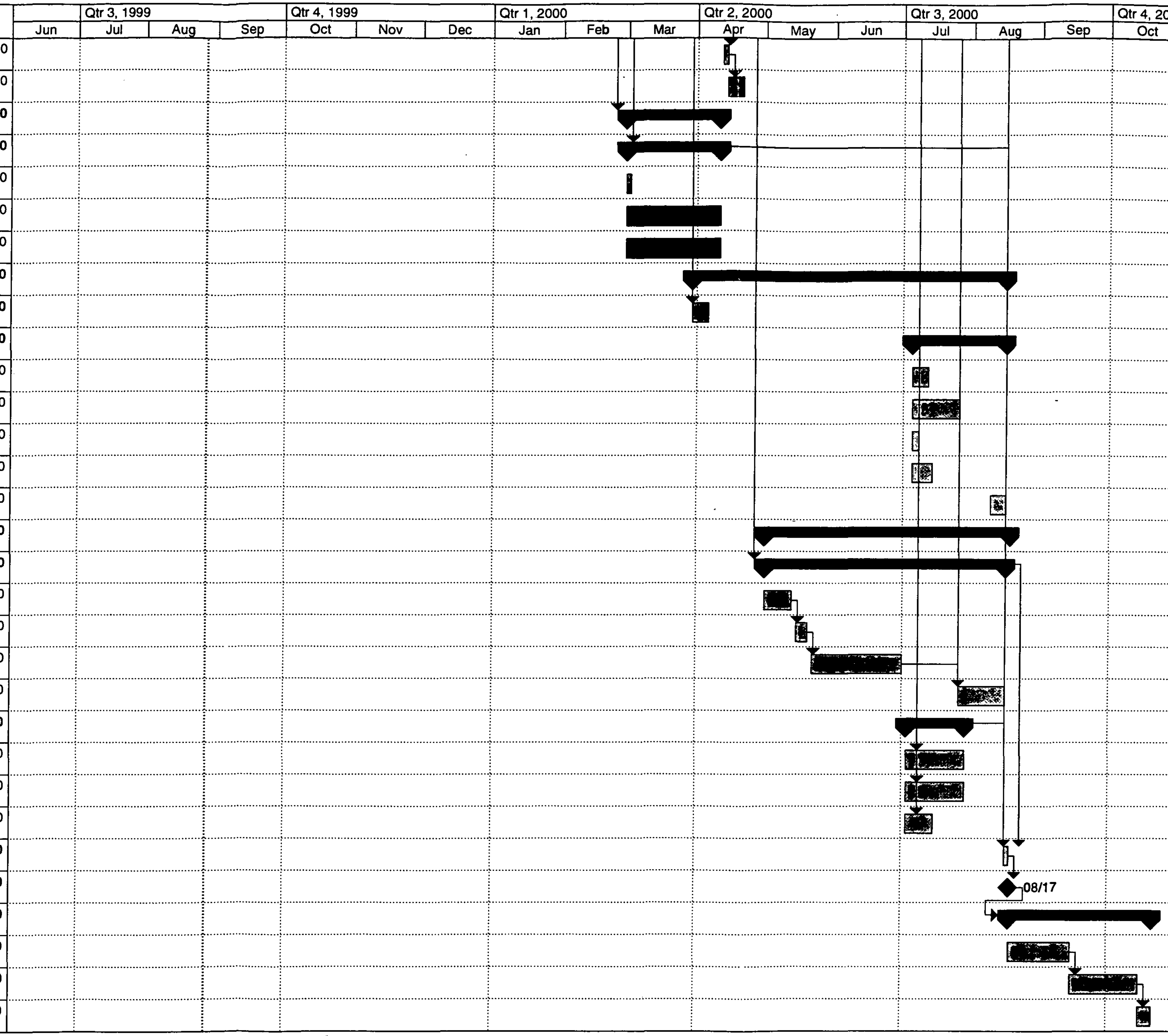
ID	Task Name	Duration	Start	Finish
34	**Biopad/Concrete Removal & CAMU Disposal**	**26 days**	**Tue 02/29/00**	**Tue 04/04/00**
35	Biopad demolition & CAMU disposal (4,700 cy)	20 days	Tue 02/29/00	Mon 03/27/00
36	Visual Inspection of Concrete Foundations	1 day	Tue 02/29/00	Tue 02/29/00
37	Concrete TCLP Sampling & Testing	25 days	Wed 03/01/00	Tue 04/04/00
38	Concrete Removal & CAMU disposal	15 days	Wed 03/01/00	Tue 03/21/00
39	Biopad subgrade soil excavation & CAMU disposal	2 days	Thu 03/23/00	Fri 03/24/00
40	Biopad Footprint Verification Sampling & Testing	5 days	Mon 03/27/00	Fri 03/31/00
41	Biopad add'l excavation, sampling, testing, & disposal	5 days	Wed 03/29/00	Tue 04/04/00
42	**Arsenic (> 200 mg/kg) Solidification & Consol.**	**31 days**	**Tue 03/28/00**	**Tue 05/09/00**
43	Treatment bldg area sampling and testing	2 days	Tue 03/28/00	Wed 03/29/00
44	Arsenic Excavation & Solidification (2,300 cy)	15 days	Tue 03/28/00	Mon 04/17/00
45	Confirmatory Sampling & Testing	15 days	Mon 04/10/00	Fri 04/28/00
46	Add'l excavation, solidification, sampling, & disposal	15 days	Wed 04/19/00	Tue 05/09/00
47	**Excavate & Consol. As & PCP soil & wood chips**	**75 days**	**Mon 03/20/00**	**Fri 06/30/00**
48	Pretest As soil on wooded slope	2 days	Mon 03/20/00	Tue 03/21/00
49	Clear and Grub Wooded As Slope	10 days	Mon 03/27/00	Fri 04/07/00
50	Excavate and Consolidate As Soil (14,700 cy)	15 days	Tue 04/18/00	Mon 05/08/00
51	As Verification Sampling & Testing	15 days	Wed 05/03/00	Tue 05/23/00
52	Excavate, mix, and consolidate PCP soils (14,400 cy)	20 days	Tue 04/18/00	Mon 05/15/00
53	PCP soil Verification Sampling & Testing	20 days	Wed 05/03/00	Tue 05/30/00
54	Excavate, mix, and consol. PCP wood chips (7,200 cy)	20 days	Tue 04/18/00	Mon 05/15/00
55	PCP wood chip Verification Sampling & Testing	20 days	Wed 05/03/00	Tue 05/30/00
56	Additional excavation, sampling, testing, & disposal	20 days	Mon 05/15/00	Fri 06/09/00
57	Trenching and pipe installation	15 days	Mon 06/12/00	Fri 06/30/00
58	**CAMU Cover construction**	**42 days**	**Thu 06/01/00**	**Fri 07/28/00**
59	Borrow Site Setup	2 days	Thu 06/01/00	Fri 06/02/00
60	Borrow Soil Excav., Transport, and Placement	11 days	Mon 07/03/00	Mon 07/17/00
61	Topsoil Import	5 days	Mon 07/10/00	Fri 07/14/00
62	Topsoil Placement	9 days	Thu 07/13/00	Tue 07/25/00
63	Top Soil Stabilization	8 days	Wed 07/19/00	Fri 07/28/00
64	**Infiltration Basin Construction**	**13 days**	**Tue 04/04/00**	**Thu 04/20/00**
65	Boring and infiltration testing	1 day	Tue 04/04/00	Tue 04/04/00
66	Excavation	5 days	Wed 04/05/00	Tue 04/11/00



Project: Penta Wood RA Scedule
Date: Fri 08/27/99

Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks

ID	Task Name	Duration	Start	Finish
67	Material Delivery & Placement	2 days	Wed 04/12/00	Thu 04/13/00
68	Discharge Pipe Installation	5 days	Fri 04/14/00	Thu 04/20/00
69	**Demolition Subcontract**	**30 days**	**Tue 02/29/00**	**Mon 04/10/00**
70	**Demolition and Offsite Disposal**	**30 days**	**Tue 02/29/00**	**Mon 04/10/00**
71	Asbestos, lead, PCB Inspection	2 days	Tue 02/29/00	Wed 03/01/00
72	IDW, lab chemicals, misc. debris disposal	30 days	Tue 02/29/00	Mon 04/10/00
73	Bldg demo and disp. (15 bldgs, 3 tanks, 3 structures)	30 days	Tue 02/29/00	Mon 04/10/00
74	**Drilling Subcontract**	**99 days**	**Thu 03/30/00**	**Tue 08/15/00**
75	**GW Production Well Abandonment**	**5 days**	**Thu 03/30/00**	**Wed 04/05/00**
76	**Bioventing & GW/LNAPL Systems Construction**	**30 days**	**Wed 07/05/00**	**Tue 08/15/00**
77	Pilot Boreholes and Soil Sampling & Testing	5 days	Wed 07/05/00	Tue 07/11/00
78	Well Installation	15 days	Wed 07/05/00	Tue 07/25/00
79	Well Development	3 days	Wed 07/05/00	Fri 07/07/00
80	Pump Placement	7 days	Wed 07/05/00	Thu 07/13/00
81	Well performance testing	5 days	Wed 08/09/00	Tue 08/15/00
82	**Treatment System Subcontract**	**79 days**	**Mon 05/01/00**	**Thu 08/17/00**
83	**Treatment Building Construction**	**77 days**	**Mon 05/01/00**	**Tue 08/15/00**
84	Foundation Constr.	10 days	Mon 05/01/00	Fri 05/12/00
85	Building Constr.	5 days	Mon 05/15/00	Fri 05/19/00
86	Equipment and I&C Installation	30 days	Mon 05/22/00	Fri 06/30/00
87	System Startup	15 days	Wed 07/26/00	Tue 08/15/00
88	**Site Restoration**	**20 days**	**Mon 07/03/00**	**Fri 07/28/00**
89	Grass Seeding	20 days	Mon 07/03/00	Fri 07/28/00
90	Tree Planting	20 days	Mon 07/03/00	Fri 07/28/00
91	Erosion Controls Installation	10 days	Mon 07/03/00	Fri 07/14/00
92	**Final Inspection**	**2 days**	**Wed 08/16/00**	**Thu 08/17/00**
93	**Remedial Action Complete**	**0 days**	**Thu 08/17/00**	**Thu 08/17/00**
94	**RA Completion Report**	**64 days**	**Fri 08/18/00**	**Fri 10/20/00**
95	Preparation of Draft RA Completion Report	28 days	Fri 08/18/00	Thu 09/14/00
96	Agency Review	30 days	Fri 09/15/00	Sat 10/14/00
97	Final RA Report	6 days	Sun 10/15/00	Fri 10/20/00



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Task	Progress	Summary	Rolled Up Split	Rolled Up Progress	Project Summary
Split	Milestone	Rolled Up Task	Rolled Up Milestone	External Tasks	

SECTION 5

Prefinal Cost Estimate

The estimated capital cost for the remedial action was calculated to be approximately $4,131,633 million. This cost estimate includes construction costs, and preliminary estimates of CH2M HILL's cost to implement the RA. The estimated cost in the M-CACES Gold format is attached (Attachment 1).

SECTION 6

Review Summary

The Value Engineering review and the Biddability, Constructability and Operability review are summarized below. In addition, this Basis of Design (BOD) Report and all plans and specifications were reviewed by the project review team and comments were incorporated as appropriate.

6.1 Value Engineering Summary

The Value Engineering Review was conducted by TN & Associates on the Design Criteria Report (preliminary design submittal). The technical review comments were submitted on June 25, 1999 are included as Attachment 2. The value engineering comments were reviewed in detail and the majority were incorporated into this report, and the design plans and specifications. The identified design changes were not significant enough in the opinion of TN Associates to warrant a full-scale value engineering study.

The most significant comments and their resolution (in italics) are presented below. The comments have been paraphrased for the sake of brevity:

- Clarify who is performing which tasks throughout the DCR. *The identity of who is performing tasks was added throughout the BOD and plans and specifications.*
- Segregation area for arsenic and PCP soil were not clearly identified on drawings. *The areas are now clearly identified.*
- Trees to be saved should be marked prior to site walkover with potential bidders. *Approach to tree removal has been changed in an attempt to save more trees and minimize construction problems. Area will be re-sampled prior to excavation because it is possible that much of the wooded area will not exceed performance standards. Trees within the smaller excavation area will all be removed. Area will be replanted with white pine following excavation.*
- Photographs should be used to identify buildings requiring demolition. *Photographs have been incorporated.*
- Clarify performance criteria for solidification of soils. Also use consistent terminology for performance criteria. *Criteria for arsenic soil solidification were revised and clarified. Terminology was made consistent.*
- Wetland restoration should be clarified. *The need for restoration of the wetland was researched and requirements were identified.*
- Is there a chance for underground fires in the biovent area because of the organic-rich soil? *Bioventing of the shallow soils that will be a mix of PCP contaminated soil and wood chips may behave more like a compost pile than typical soil bioventing applications. This is anticipated and measurement of soil temperature through soil gas monitoring is planned. Soil temperature*

will be controlled by adjusting air flow rates. If the temperature rises above 55° C, air flow will be reduced or stopped until temperatures decline to below 55° C.

- Biovent wells should be constructed to allow even air injection over the entire length of the well. *Air injection was changed from injection in one biovent well to injection in 2 wells, a shallow and deep well at each location, to allow for variations in air permeability between the soil/wood debris shallow zone and the sandy deeper zone.*
- Will piping be double-walled? *U.S. EPA was consulted on the need for double wall containment piping and it was decided to double wall the groundwater and LNAPL piping.*
- Recommend discharge of treated groundwater to a large drainfield. If a surface infiltration basin is used consider ramping and building two rectangular basins. *Additional evaluation of the infiltration basin heat balance lead to incorporation of underground discharge to a drainfield in addition to discharge to the surface basin. Evaluation of the mass of precipitate showed less than a 0.1 inches of precipitate accumulation per year.*
- Project schedule shows starting in March. Consider starting in May because of winter conditions. *A March start date is necessary because of EPA concerns relative to the need to complete construction within the current CH2M Hill contract that expires at the end of this fiscal year.*

6.2 Biddability, Constructability and Operability Review

Biddability, constructability and operability of the designed systems were reviewed on an ongoing basis throughout the design process. The project review team included engineers and hydrogeologists with construction and operation experience. Staff from CH2M Hill's affiliate CH2M Hill Constructors Inc. (CCI) participated in the design process and reviewed the BOD and plans and specifications with an emphasis on biddability, constructability and operability. The more significant comments incorporated as part of this review were:

- Division of the construction work into 4 subcontracts consisting of; 1) Demolition, 2) Site Preparation/Earthwork, 3) Drilling/Well installation, and 4) Bioventing/Groundwater Treatment Facility Installation
- This treatment system operation is to be supervised by a programmable logic controller (PLC). CH2M HILL will supply the PLC programming software and will program the PLC. Remote operation capability was considered but it was decided that this was not cost effective, particularly given WDNR requirements for an part-time onsite operator.
- Division 1 specifications were standardized between the 4 subcontract packages based on review comments so that bidding, bid review and subcontract management proceed more smoothly.
- Constructability was reviewed constantly with modifications made in all subcontract documents. Items receiving most attention included wetland excavation, slope stability, erosion control, construction sequencing, and secondary containment for piping.

SECTION 7
References

Air Force Center for Environmental Excellence. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*. May, 1992.

CH2M HILL. *Penta Wood Remedial Investigation Report.* June, 1998.

CH2M HILL. *Penta Wood Feasibility Report.* June, 1998.

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Lohman. *Groundwater Hydraulics, Geological Survey Professional Paper.* 1989

Michigan Department of Natural Resources. *Guidance Document for Verification of Soil Remediation, Revision 1.* April, 1994

REAC. *Final Report, Phase I—Remedial Technology Evaluation.* December, 1994

USEPA. *Penta Wood Record of Decision.* 1998

USEPA. *Remedial Design/Remedial Action (RD/RA) Handbook,* 1995

USEPA. *Summary Guidance Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices,* 1992

Weston, Roy F. *Draft Report Hydrogeologic Investigation Penta Wood Products Site,* December, 1994

Attachment 1

M-CACES Cost Estimate

Penta Wood Products

Designed By:
Estimated By:

Prepared By:

Preparation Date: 08/26/99
Effective Date of Pricing: 08/26/99

Sales Tax: 0.00%

SUMMARY REPORTS SUMMARY PAGE

DETAILED ESTIMATE DETAIL PAGE

DETAILED ESTIMATE DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

Site Preparation		QUANTY	UOM	UNIT COST	TOTAL COST
Site Preparation and Earthwork					
Site Preparation					
Mobilization/Demobilization					
	Mobilization/Demobilization	1.00	LS	35000.00	35,000
Clear,grub,&chip in excav. area					
	PCP contaminated wood chip area	2.00	ACR	760.00	1,520
	PCP/Arsenic contaminated soil	5.00	ACR	6000.00	30,000
	Arsenic Contaminated Soil	4.00	ACR	6000.00	24,000
	Stabilized Ar. Contaminated Soil	1.00	ACR	760.00	760
Temp. erosion control measures					
Hay Bales					
	PCP contaminated wood chip area	8.80	TON	375.00	3,300
	PCP/Arsenic contaminated soil	4.00	TON	375.00	1,500
	Arsenic contaminated soil	3.70	TON	375.00	1,388
	Stabilized Ar. contaminated soil	0.60	TON	375.00	225
Silt Fence					
	PCP contaminated wood chip area	7800.00	LF	1.00	7,800
	PCP/Arsenic contaminated soil	3500.00	LF	1.00	3,500
	Arsenic contaminated soil	3300.00	LF	1.00	3,300
	Stabilized Ar. contaminated soil	600.00	LF	1.00	600
Crushed rock entrance to site					
	Crushed rock entrance to site	6.00	CY	40.00	240
Decontamination facilities					
	40 mil HDPE liner	1800.00	SF	1.06	1,908
	Obtain & place 12" layer of sand	67.00	CY	10.00	670
Concrete Demolition and Disposal					
Concrete Demolition					
	Office	1000.00	SF	4.00	4,000
	Garage	900.00	SF	6.00	5,400
	Garage wall	390.00	SF	5.00	1,950
	Treatment building	8000.00	SF	5.00	40,000
	Storage shed	1250.00	SF	4.00	5,000
	Oil/Water separator	600.00	SF	5.00	3,000
	Shaving vault tank	1250.00	SF	4.00	5,000
	Mission control	120.00	SF	4.00	480
	Peeler shed	600.00	SF	4.00	2,400
	Unnamed structure	100.00	SF	4.00	400
	Truch stop	1800.00	SF	6.00	10,800
	Garage	1512.00	SF	6.00	9,072
	Sawmill	350.00	SF	4.00	1,400
	Slasher control house	150.00	SF	4.00	600

Concrete Demolition and Disposal		QUANTY	UOM	UNIT COST	TOTAL COST
	Sawmill	900.00	SF	4.00	3,600
	Sawmill	150.00	SF	6.00	900
	Sawmill (add'l concrete)	600.00	SF	4.00	2,400
	Scale house	250.00	SF	6.00	1,500
	Unnamed structure	36.00	SF	6.00	216
Concrete Disposal					
	Concrete not visually stained	460.00	CY	7.00	3,220
	TCLP testing of concrete	10.00	EA	210.00	2,100
	Solidification of concrete	52.00	CY	33.00	1,716
	Excav. of soil below concrete	200.00	CY	1.70	340
	Transport & place soil in CAMU	200.00	CY	2.30	460
Existing MW Extensions in CAMU					
	Remove & save protective covers	17.00	EA	20.00	340
	8" PVC casing extension	17.00	EA	170.00	2,890
	2" well casing extension	17.00	EA	25.00	425
	Bentonite for annular space	17.00	EA	87.00	1,479
Solidification of Arsenic Soil					
	Install temp. access road	700.00	SY	5.00	3,500
	Excavate arsenic soil >200mg/kg	2300.00	CY	3.00	6,900
	Solidify arsenic soil >200mg/kg	2300.00	CY	33.00	75,900
	Transport arsenic soil to CAMU	2300.00	CY	1.70	3,910
Biopad Removal/Backfill in CAMU					
	Biopad demolition	126850	SF	2.00	253,700
	Placement of biopad in CAMU	4700.00	CY	3.50	16,450
	Excavate ~3in. of soil	1170.00	CY	6.50	7,605
Excavation/Consolidation					
	Excavate/relocate Arsenic soil	19000	CY	3.90	74,100
	Excavate/relocate PCP soil	11000	CY	3.90	42,900
	Excavate/relocate PCP/Ar. soil	9000.00	CY	3.90	35,100
	Excavte/relocate PCP wood chips	45000	CY	3.90	175,500
	Mix PCP wood chips with soil	65000	CY	0.43	27,950
	Demo & reset existing fence	350.00	LF	15.00	5,250
Soil Cover					
	Excavate borrow material	5200.00	CY	2.35	12,220
	Transport/place borrow for cover	2600.00	CY	5.00	13,000
	Transport/place Ar. soil	2600.00	CY	5.00	13,000
	Import/place topsoil	31000	SY	2.91	90,210
	Chain-link fence	3200.00	LF	13.65	43,680
	Access gates in fence	2.00	EA	970.00	1,940

Erosion Control Measures		QUANTY	UOM	UNIT COST	TOTAL COST
Erosion Control Measures					
Drainage Ditches					
Type 1					
	Excavate ditch	1900.00	CY	1.51	2,869
	Grade & compact subgrade	4500.00	SY	0.50	2,250
	Erosion matting	4500.00	SY	1.18	5,310
Type 2					
	Excavte ditch	2300.00	CY	1.51	3,473
	Grade & compact subgrade	4300.00	SY	0.50	2,150
	Erosion matting	4300.00	SY	1.18	5,074
Type 3					
	Grade & compact subgrade	130.00	SY	0.50	65
	Woven geotextile	130.00	SY	1.75	228
	Riprap	20.00	CY	19.79	396
Rock check dams					
	Rock check dams	37.00	EA	63.00	2,331
Surface Water Downchute					
	Grade & compact subgrade	1500.00	SY	0.50	750
	Install 60 mil HDPE geomembrane	14000	SF	1.58	22,120
	Place 6" downshooy gravel	260.00	CY	17.00	4,420
	Non-woven geotextile	1500.00	SY	1.00	1,500
	Gabions A	24.00	EA	189.00	4,536
	Gabions X	12.00	EA	220.00	2,640
	Gabions Z	168.00	EA	286.00	48,048
Diversion Berms					
	Construct berms (cut-and-fill)	900.00	CY	3.00	2,700
	Erosion matting	400.00	SY	1.18	472
Sediment Basins					
	Sediment basins	3.00	EA	1000.00	3,000
Revegetation					
	Import/place 4" topsoil	22000	SY	1.96	43,120
	Rake areas to be reseeded	2000.00	MSF	25.00	50,000
	Apply fertilizer (800lb/acre)	18.00	TON	297.00	5,346
	Reseed with grasses	46.00	ACR	1700.00	78,200
	Erosion matting	53000	SY	1.18	62,540
	Type 1 trees (saplings 3" dia)	5.00	ACR	16500.00	82,500
	Type 2 trees (seedlings)	42.00	ACR	1000.00	42,000

Treatment System		QUANTY	UOM	UNIT COST	TOTAL COST
Treatment System					
Excavate					
	For footings of bldg. foundation	80.00	CY	2.35	188
Grading					
	Of soil in bldg. footprint	220.00	SY	2.40	528
Pipe Detail 1					
	Trenching	315.00	CY	2.35	740
	Piping materials & installation	115.00	LF	380.00	43,700
	Trench backfill	315.00	CY	4.30	1,355
Pipe Detail 2					
	Trenching	98.00	CY	2.35	230
	Piping material & installation	60.00	LF	262.00	15,720
	Trench backfill	98.00	CY	4.30	421
Pipe Detail 3					
	Trenching	117.00	CY	2.35	275
	Piping material & installation	75.00	LF	150.00	11,250
	Trench backfill	117.00	CY	4.30	503
Pipe Detail 4					
	Trenching	183.00	CY	2.35	430
	Piping material & installation	130.00	LF	112.00	14,560
	Trench backfill	183.00	CY	4.30	787
Pipe Detail 5					
	Trenching	100.00	CY	2.35	235
	Pipe materials & installation	75.00	LF	94.00	7,050
	Trench backfill	100.00	CY	4.30	430
Pipe Detail 6					
	Trenching	1400.00	CY	2.35	3,290
	Piping materials & installation	1050.00	LF	56.00	58,800
	Trench backfill	1400.00	CY	4.30	6,020
Pipe Detail 7					
	Trenching	80.00	CY	2.35	188
	Piping materials & installation	60.00	LF	41.00	2,460
	Trench backfill	80.00	CY	4.30	344
Pipe Detail 8					
	Trenching	48.00	CY	2.35	113
	Piping materials & installation	160.00	LF	36.00	5,760
	Trench backfill	48.00	CY	4.30	206

Treatment System		QUANTY	UOM	UNIT COST	TOTAL COST
Pipe Detail 9					
	Trenching	98.00	CY	2.35	230
	Piping materials & installation	325.00	LF	18.00	5,850
	Trench backfill	98.00	CY	4.30	421
Pipe Detail 10					
	Trenching	246.00	CY	2.35	578
	Piping materials & installation	745.00	LF	12.00	8,940
	Trench backfill	82.00	CY	4.30	353
Well Vault					
	With manhole covers	9.00	EA	1400.00	12,600
Infiltration Basin Construction					
	Excavate	5500.00	CY	2.35	12,925
	Grade & compact surface	10000	SF	0.02	200
	Leach gravel	370.00	CY	16.00	5,920
	4" perforated PVC pipe	650.00	LF	6.00	3,900
	Woven geotextile	1100.00	SY	1.75	1,925
	Pea gravel, 3" layer	90.00	CY	14.00	1,260
	Backfill with excavated material	2000.00	CY	0.75	1,500
	Haul remaining fill onsite	3500.00	CY	2.00	7,000
	Manhole	1.00	EA	1345.00	1,345
	Erosion matting	280.00	SY	1.18	330
	Install gate valves, box & cover	2.00	EA	1500.00	3,000
	Gate valve handle	1.00	EA	150.00	150
	Valve box	2.00	EA	150.00	300
	4"x4" marker post & installation	1.00	EA	50.00	50
Leak Detection System					
	Control panel	1.00	LS	4000.00	4,000
Permanent Roadway					
	Prepare subgrade for roadway	3400.00	SY	1.00	3,400
	Construct roadway 1' crushed agg	3400.00	SY	19.00	64,600
Management of H2O as Hazardous					
	To be stored onsite	5000.00	GAL	1.00	5,000
Health & Safety					
	PPE upgrade - Level C	465.00	HR	15.00	6,975
	TOTAL Site Preparation and Earthwork	1.00	EA	1935987	1,935,987

Mobilization & Demobilization		QUANTY	UOM	UNIT COST	TOTAL COST
Demolition					
Mobilization & Demobilization					
	Includes submittal & decon setup	1.00	LS	10000.00	10,000
Building Demolition					
	Asbestos and lead survey	1.00	LS	5000.00	5,000
	Office	1.00	LS	3600.00	3,600
	Garage	1.00	LS	4000.00	4,000
	Treatment building	1.00	LS	46000.00	46,000
	Oil/Water separator	1.00	LS	2700.00	2,700
	Mission control	1.00	LS	400.00	400
	Peeler shed	1.00	LS	2200.00	2,200
	Truck stop	1.00	LS	8100.00	8,100
	Garage	1.00	LS	6800.00	6,800
	Sawmill	1.00	LS	1100.00	1,100
	Sawmill	1.00	LS	2200.00	2,200
	Unnamed structue	1.00	LS	1600.00	1,600
	Unnamed structure	1.00	LS	700.00	700
	Sawmill	1.00	LS	8100.00	8,100
	Slasher control	1.00	LS	500.00	500
	Sawmill	1.00	LS	500.00	500
	Unnamed structure	1.00	LS	100.00	100
	Tank cleaning/removal 10'x30'	1.00	LS	5000.00	5,000
	Tank cleaning/removal 10'x20'	1.00	LS	5000.00	5,000
	Retort chamber cleaning/removal	1.00	LS	5000.00	5,000
	Smokestack dismantle 36"x75'	1.00	LS	5500.00	5,500
	Smokestack dismantle 36"x100'	1.00	LS	7500.00	7,500
	Debris piles	1.00	LS	6000.00	6,000
	Electrical poles and lines	1.00	LS	2000.00	2,000
Miscellaneous					
	Transformer removal	1.00	LS	1000.00	1,000
Solid Waste Disposal					
	Clean metal siding & pipe	50.00	TON	20.00	1,000
	Gen. debris disposal @ landfill	165.00	TON	40.00	6,600
	Haz. IDW & lab chemical disposal	600.00	LB	10.00	6,000
	TOTAL Demolition	1.00	EA	154200.00	154,200

Drilling		QUANTY	UOM	UNIT COST	TOTAL COST
Drilling					
Drilling					
	Mobilization	1.00	LS	25000.00	25,000
	GW/SBV/DBV drilling & sampling	980.00	LF	100.00	98,000
	MW/SGW drilling	550.00	LF	25.00	13,750
	Cutting and fluids handling	20.00	HR	200.00	4,000
	55 gallon drums	60.00	EA	65.19	3,911
	Demobilization	1.00	LS	15000.00	15,000
Groundwater Extraction Well					
	Screen	140.00	FT	80.00	11,200
	Riser	945.00	FT	15.00	14,175
	Pitless adapter	7.00	EA	200.00	1,400
	Drop pipe	805.00	FT	2.00	1,610
	Filter pack	74.00	CF	11.30	836
	Adapter kit	7.00	EA	3.00	21
	Flexible hose	35.00	FT	4.04	141
	Electric submersible pump	7.00	EA	1400.00	9,800
	Pipe fittings (well caps & ends)	7.00	SET	300.00	2,100
	Development	56.00	HR	200.00	11,200
	Testing	48.00	HR	100.00	4,800
Shallow Biovent					
	Screen	120.00	FT	5.26	631
	Riser	96.00	FT	3.80	365
	Air flow control valves	8.00	EA	150.00	1,200
	Flexible hose	40.00	FT	9.14	366
	Filter pack	52.00	CF	11.30	588
	Pipe fittings	8.00	SET	200.00	1,600
Deep Biovent/Free Product Recov.					
	Screen	560.00	FT	5.26	2,946
	Riser	210.00	FT	3.80	798
	Air flow control valves	7.00	EA	150.00	1,050
	Flexible hose	35.00	FT	9.14	320
	Filter pack	250.00	CF	11.30	2,825
	Pipe fittings	8.00	SET	200.00	1,600
GWE/SBV/DBV Labor & Material					
	Bentonite seal	18.00	CF	32.56	586
	T split	6.00	EA	60.00	360
	Labor	55.00	HR	200.00	11,000
Monitoring/Soil Gas Wells					
	Riser	674.00	FT	3.80	2,561
	Screen	26.00	FT	5.26	137
	Filter pack	7.00	CF	11.30	79
	Pipe fittings	5.00	SET	200.00	1,000
	Concrete pad	5.00	EA	200.00	1,000
	Well cover & lock	5.00	SET	130.00	650

Monitoring/Soil Gas Wells		QUANTY	UOM	UNIT COST	TOTAL COST
	Development	10.00	HR	200.00	2,000
	Bentonite seal	0.16	CF	32.56	5
	Labor	20.00	HR	200.00	4,000
Extended MW Completion					
	Labor	340.00	FT	30.00	10,200
	Concrete pad	17.00	EA	200.00	3,400
	Bentonite	37.00	CF	32.56	1,205
Production Well Abandonment					
	Labor	350.00	FT	30.00	10,500
	Bentonite	69.00	CF	32.56	2,247
	TOTAL Drilling	1.00	EA	282162.41	282,162

Treatment Building		QUANTY	UOM	UNIT COST	TOTAL COST
Treatment System					
Treatment Building					
	Building	1.00	EA	45000.00	45,000
	Electrical	1.00	LS	56658.00	56,658
	HVAC	1.00	LS	1000.00	1,000
	Containment vessel	1.00	EA	4000.00	4,000
	Connecting pipe (biovent & GW)	1.00	LS	90000.00	90,000
Instrumentation and Controls					
	PLC	1.00	EA	4310.00	4,310
	Computer hardware & software	1.00	EA	3500.00	3,500
	Magnetic flow meter	1.00	EA	6000.00	6,000
	Pressure/Differ. Transmitter	4.00	EA	600.00	2,400
	Well level transmitters	7.00	EA	515.00	3,605
	Product tank level transmitter	1.00	EA	1500.00	1,500
	Infiltration basin level switch	1.00	EA	500.00	500
	Rotameters	7.00	EA	215.00	1,505
	Pitot and gauges	8.00	EA	525.00	4,200
Bioventing					
	Blower	1.00	EA	7500.00	7,500
	Silencer/Filter	1.00	EA	2500.00	2,500
GW/LNAPL Collection & Treatment					
LNAPL Recovery System					
	LNAPL free product pump	7.00	EA	2395.00	16,765
	Slip cap w/ filter/regulator	7.00	EA	210.00	1,470
	Cycle counter	7.00	EA	240.00	1,680
	Pump positioning kit	1.00	EA	225.00	225
	Air compressor	1.00	EA	6830.00	6,830
	Valves & tubing	1.00	LS	5500.00	5,500
	Product recovery tank	1.00	EA	2500.00	2,500
GW Treatment System					
	Oil filter	1.00	EA	950.00	950
	Activated clay vessel	1.00	EA	14000.00	14,000
	Granular activated carbon vessel	2.00	EA	30000.00	60,000
	TOTAL Treatment System	1.00	EA	344098.00	344,098

Deliverables		QUANTY	UOM	UNIT COST	TOTAL COST
Implementation					
Deliverables					
	Remedial Action Work Plan	1.00	LS	25000.00	25,000
	GW Flow and Transport Model	1.00	LS	50000.00	50,000
	RA Completion Report	1.00	LS	30000.00	30,000
Permits					
	Land Use Deed Restrictions	1.00	LS	25000.00	25,000
Soil Verification Sampling					
	Sampling labor	550.00	HR	70.00	38,500
	Sampling travel costs	55.00	DAY	100.00	5,500
	Onsite laboratory	55.00	DAY	1700.00	93,500
Construction Management					
	Project management	1080.00	HRS	95.00	102,600
	Field Supervisor	4050.00	HR	90.00	364,500
	Subcontract administration	160.00	HR	90.00	14,400
	Administravtive assisstant	1080.00	HR	15.00	16,200
	Per diem	486.00	DAY	100.00	48,600
	Vehicle rental	13.00	MO	800.00	10,400
	Meetings	192.00	HR	80.00	15,360
PLC Software & Programming					
	Software	1.00	LS	6400.00	6,400
	Programming	120.00	HR	80.00	9,600
Survey					
	Monitoring wells & piezometers	5.00	DAY	1000.00	5,000
System Start-up					
GW Collection & Treatment System					
	Performance testing	100.00	HR	70.00	7,000
	Well production testing	50.00	HR	70.00	3,500
	GW capture & drawdown evaluation	50.00	HR	70.00	3,500
	Start-up treatment sampling	50.00	HR	70.00	3,500
	Start-up sample analysis	30.00	EA	350.00	10,500
Bioventing System					
	System performance testing	50.00	HR	70.00	3,500
	Flow balancing	50.00	HR	70.00	3,500
	Soil respiration testing	50.00	HR	70.00	3,500
	TOTAL Implementation	1.00	EA	899060.00	899,060
	TOTAL Penta Wood Products	1.00	EA	3615508	3,615,508

U.S. Army Corps of Engineers
PROJECT 151745: Penta Wood Products
Penta Wood Products Cost Estimate
** PROJECT OWNER SUMMARY - Task **

		QUANTITY	UOM	CONTRACT	CONTINGN	BOND/INS	TOTAL COST	UNIT COST
01	Site Preparation and Earthwork	1.00	EA	1,935,987	290,398	77,439	2,303,825	2303825
02	Demolition	1.00	EA	154,200	23,130	6,168	183,498	183498.00
03	Drilling	1.00	EA	282,162	42,324	11,286	335,773	335773.27
04	Treatment System	1.00	EA	344,098	51,615	13,764	409,477	409476.62
05	Implementation	1.00	EA	899,060	0	0	899,060	899060.00
TOTAL	Penta Wood Products	1.00	EA	3,615,508	407,467	108,658	4,131,633	4131633

	QUANTITY	UOM	UNIT COST	TOTAL COST
01 Site Preparation and Earthwork	1.00	EA	1935987	1,935,987
02 Demolition	1.00	EA	154200.00	154,200
03 Drilling	1.00	EA	282162.41	282,162
04 Treatment System	1.00	EA	344098.00	344,098
05 Implementation	1.00	EA	899060.00	899,060
TOTAL Penta Wood Products	1.00	EA	3615508	3,615,508
Contingency				407,467
SUBTOTAL				4,022,975
Payment & Performance Bond, Insurance				108,658
TOTAL INCL OWNER COSTS				4,131,633

Attachment 2

TN&A Value Engineering Screening Comments

T N & Associates, Inc.
Engineering and Science

1033 N. Mayfair Road, Suite 200
Milwaukee, Wisconsin 53226
(414) 257-4200

TRANSMITTAL LETTER

Date: June 25, 1999

From: John Fleissner

To: Phil Smith, P.E.

CH2M Hill
411 E. Wisconsin Ave., Suite 1600
Milwaukee, WI 532020-4421

Re: Technical Review and Value Engineering Comments on the Penta Wood Design Criteria Report

Copies	Date	No.	DESCRIPTION
1	6/25/99		Technical Review Memorandum
1	6/25/99		Markup Comments in the *Design Review Report* document

These are transmitted as checked below:

☐ For Approval ☐ Approved as submitted ☐ Resubmit____copies for approval

☒ For your use distribution ☐ Approved as noted ☐ Submit____copies for

☐ For review and comment_______

☐ For bids due______

☐ Prints returned after loan to us

Comments:
Phil – Attached is our Value Engineering (VE) screening for the Penta Wood Design Review Reports requested in your Task Order under WA 040-RDRD-05WE. As we did the review, we identified several technical design questions and added these to our review. In the end, we produced a VE screening and a preliminary design review that may be useful for further development of the remedial design. If you have questions, please call me at any time.

Signature: *John Fleissner*
John Fleissner
Project Manager

T N & Associates, Inc.
Engineering and Science

MEMORANDUM

TO: Phil Smith/CH2M HILL

FROM: John Fleissner/MKE
Dan Farrand/MKE

DATE: June 24, 1999

SUBJECT: Technical Review Comments on the Design Criteria Report for the Penta Wood Product Site in Daniels, Wisconsin, WA No. 040-RDRD-05WE, Contract No. 68-W6-0025

Introduction

The purpose of this technical memorandum is to present the technical review and value engineering screening comments on the *Design Review Report* for the Penta Wood Site, prepared by CH2M HILL and dated June 1999. The Penta Wood site is in Daniels, Wisconsin.

The technical review comments were prepared as part of a value engineering screening process. The value engineering screening was conducted to evaluate cost and function relationships in the proposed remedial actions, concentrating on high-cost areas. In accordance with the scope of work, the conclusion of the screening process is a recommendation for or against a full-scale value engineering study based on the potential for cost savings arising from design changes.

For this value engineering screening assignment, TN&A acted as a independent engineering group that was not involved in the remedial design.

The technical review and value engineering comments below are based on review of the *Design Review Report*. These comments are supplemented by additional detailed comments written by Fleissner into one copy of the text. The full set of review comments consists of this memorandum and the marked-up text of the report.

Technical Review and Value Engineering Comments

The value engineering comments below consist of comments on the preliminary remedial design and comments aimed at clarification of some of the information in the *Design Review Report*. These comments are supplemented by detailed comments written into the text.

1. In several places in the report, there are activities reported but not who did or who will do them—see notes in the text. Recommend adding this information. It becomes important to understand who is expected to do what during the execution of the RA.

2. The segregation of the arsenic-contaminated soil from the PCP and oil contaminated soil is mentioned in Section 1.4 and several other places but I did not see the segregation areas shown on the drawings. The designated disposal areas within the CAMU should be marked on the drawings so the contractor can layout the construction approach.

3. There are numerous areas of arsenic contaminated soil at the site. How will these locations be identified in the field for the contractor? Will the designers stake field locations and boundaries corresponding to the drawings? Will the construction contractor be responsible for finding the areas based on the drawings and then determining the boundaries? How will the contractor know in the field which areas are expected to be high-As compared to high-PCP concentration areas? These issues will influence the contractor's selection of equipment and material handling methods—and the bid price.

4. Page 7, 4th paragraph and Section 2.5.3.1, will the trees to be saved be marked by CH2M HILL before the prebid site walkover. Recommend that this be done before the walkover. The number and location of trees may influence the contractors' selection of equipment and approach—and the bid prices.

5. Section 2.2.1, for bid document plans, the use of photographs in the plan sheets can be very effective for communication with the bidders regarding the demolition of existing buildings. The photographs show the building materials and conditions.

6. Section 2.2.1, to accomplish "removal," will the contractor be required to excavate the full length of utilities uncovered during demolition? If so, how far—to the property line, for example?

7. Section 2.2.1, the timing of the existing utility identification and designation as either *remove* or *protect* should be before the prebid site walkover to give the contractors more specific bid information. See comments in text.

8. Section 2.2.1, define what is meant by "uncontaminated" concrete. Concrete could pass TCLP but still be stained or contaminated. What would be done with this kind of material?

9. Section 2.2.2, the tanks and retort chamber may require cleaning prior to removal—when will this determination be made and how will the contractor know what needs to be done and how to bid the work? Clarify this work element in the design.

10. Section 2.2.2, will the contractor be allowed to use explosives for demolishing the smokestacks (or other buildings)? Address in the design and bid documents.

11. Section 2.2.3.2, will the design specify how bulk concrete should be sampled for TCLP analysis? This could become a significant cost element for the contractor and the design should specify how this would be done. Also, design should specify (at least generally) how the bulk chunk concrete can be "stabilized" before disposal.

12. Section 2.2.3.2, verification for arsenic concentrations in soil below the concrete is to be by quick turn around AA, but elsewhere the report allows the use of onsite field XRF technology for soil screening for arsenic. Is there an inconsistency?

13. Sections 2.3.1 and 2.3.2, there are two volume estimates given for the "grossly contaminated soils," 6,100 CY and 4,000 CY. Should these be the same or is there a distinction that is missing in the text?

14. Section 2.3.3.1, the text seemed unclear as to whether the TCLP or the SPLP test was to be used to determine if the treated soils met the 5 mg/L As concentration in the extract. Both methods are mentioned. The design should clearly identify the performance standards and test methods, perhaps in a single table for reference.

15. Section 2.3.3.1, is the soil from the roadway (to be improved for RA) known to be contaminated? What should the bidders assume or be told for treatment volume, treatment standards, and final disposal?

16. Section 2.3.4, what is meant by "performance criteria" — does it mean the 106 mg/kg total arsenic concentration in soil or does it refer to the 5 mg/L TCLP leachate concentration? Terminology is not consistent—other terms used elsewhere are "performance standards" (Section 2.5.2), "cleanup criteria" (Section 2.5.1), and "removal criterion" (Section 2.5.2). Should these terms all be the same? Clarify.

17. Section 2.3.4, when will the criteria be revised—will it be in time for the final design and bid documents?

18. The remedial goal for arsenic in soil is unclear. Section 2.3.4, last paragraph, this procedure contradicts the 1st paragraph — must be clarified. The use of the statistical calculation of the upper 95 percent confidence limit (using the soil samples) to compare to the 106 mg/kg arsenic contradicts the statement that "**soil exceeding 106 mg/kg arsenic will be excavated and solidified**." The statistical calculation procedure would allow soil with arsenic >106 mg/kg to remain.

19. Sections 2.4.1 and 2.4.3, will verification for arsenic concentration in the soil underlying the concrete biopad be required after the scraping and removal of about 3-inches?

20. Section 2.5.2, the basis of the remedial actions is confusing here because there is a new cleanup level of 5 mg/kg total arsenic specified as a soil "removal criterion for this project." What does this concentration apply to? Where does it apply? How does it relate to the 106 mg/kg concentration applied elsewhere? The terminology and basic approach for soil identification must be clarified.

21. Section 2.5.3.1, will there be a specification for the water content of the excavated sediment before it is placed in the CAMU or can the contractor place the sediment in any conditions (e.g., perhaps pumped as a slurry to the CAMU).

22. Section 2.5.3.1 and elsewhere, will wetland restoration be required in areas where sediments are excavated?

23. Section 2.5.4, do the arsenic and PCP criteria for excavation of soil apply also to the sediment from the wetland area?

24. Section 2.6.1, what type of fence will be specified around the CAMU? Any signs required? Gates—number and placement?

25. Section 2.6.2.1, is there any compaction specification for the soil cover, either as a minimum compaction or a maximum allowable compaction (to allow sufficient infiltration)?

26. Section 2.7.2, with the introduction of air into the buried wood chips and organic-rich soil in the CAMU—is there any chance of starting an underground fire from spontaneous combustion in the wood chips (e.g., like a coal or "gob" pile fire or a landfill fire)? Monitoring for carbon monoxide or temperature or both may be warranted.

27. Section 2.7.3.1, is the design air flow rate to be 500 scfm per well or total for all wells combined?

28. Section 2.7.3.1, last paragraph, the design of the air injection wells with the long 110-foot screens must have orifice sizing and spacing to allow fairly even air distribution into the full depth of the subsurface and avoid the potential problem of having most of the air discharging in the shallow or uppermost part of the screen. Suggest that the design include provisions to monitor air flow through the entire length of the screen to assure sufficient air discharge at depth.

29. Section 2.7.3.2, is the air flow control valve to be a manual valve? There is no need for an automated valve.

30. Section 2.7.3.4, in addition to or in place of the low flow alarm, a low pressure alarm will indicate blower failure. Low air flow could be caused by a plugged line while the blower is continuing to operate.

31. Section 2.7.4, the bioventing performance standard is 4.6 mg/kg <u>of PCP in soil</u>. Text should clarify.

32. Section 2.8.2, the last paragraph, 2nd line, it appears that the concentration of PCP in the "unsaturated" zone should be "saturated" zone.

33. Section 2.8.3.2, will the piping from the LNAPL collection system to the LNAPL storage tank be double wall piping with built-in leak containment? Could Wisconsin require this for the design because of the hazardous nature of the LNAPL?

34. Section 2.8.3.4, the treatment system is designed to meet a 99.99+ percent PCP removal goal. This goal is very stringent and will require careful monitoring to determine the actual absorption behavior and the breakthrough pattern at the lead

carbon vessel. The monitoring program should include relatively frequent sampling of the effluent from the lead vessel to establish the breakthrough pattern as a function of loading and flowrate.

35. Section 2.8.3.5, the four treated groundwater discharge options presented in the report address the operational and maintenance uncertainties caused by winter weather and caused by the potential plugging of soil by precipitation of iron and manganese.

    A suggested option would be to design a large drainfield (similar to a septic system drainfield) with buried drain pipe bedded in stone below the frost line in an arrangement of trenches. The system would limit exposure of the effluent to atmosphere, reducing the potential for precipitation; it would allow year-round operation; it would eliminate the potential hazard caused by ponded water as an "attractive nuisance;" and it would be inexpensive. The drawback would be potential for failure caused by plugging.

36. Section 2.8.3.5, why is a direct surface water discharge not considered for the treated groundwater?

37. Section 2.8.3.6, the description of the I&C for the treatment system raised several questions. The variable frequency drive systems are relatively expensive compared to throttling valves for continuous flow control. How many flow meters will be included in the system? It seems like one or two should be sufficient.

38. Section 2.8.3.6, are both bag filters and activated clay adsorption to be used in the design to protect the activated carbon? Text is not clear and the process drawing shows both. The backwash system for the clay is not shown on the drawing—where will the backwash water be stored and how will it be processed? Backwashing process creates a set of operational activities and equipment that has not been discussed in the report.

39. Section 2.8.6, the maintenance items should include the long-term maintenance of the infiltration basin or whatever configuration of the discharge is finally adopted.

40. Section 2.10.1, what does it mean that the "USEPA will determine the remedy based on the preference of the well owner..."? Is the POE treatment approach undecided — will the RA contractor be required to install these systems or will these be handled separately?

41. Section 2.10.3.1, will the homeowner be responsible for disposal of the carbon from the POE systems—a big deal because the USEPA and DNR recognize the carbon will be a F032 listed hazardous waste and require disposal at a Subtitle C facility.

42. Page 32, 5th bullet, what are the effects of the positive pressure that cause concern relative to the recovery of LNAPL? It seems that positive pressure could increase the rate of LNAPL collection under some conditions.

43. Page 33, top bullet, the text says that the residential remedy is point-of-entry (POE) treatment, not point-of-use.

44. Project schedule, the time for the award bid/subs plans at 30 days seems too short—advertising, prebid site meeting, bidding period, opening/evaluation, tabulation, and formal award will probably take longer than 30 days. A period of 45 to 60 days is suggested.

45. Project Schedule, the schedule shows work starting in March, this seems too optimistic in light of the winter conditions and expected soft ground and mud. Maybe there is an advantage for some of the work but, otherwise, it may be too soon to expect progress. Consider the lower overall costs of starting in May instead of March.

46. Section 7.1.5, this is the first place that wetland restoration or reestablishment is discussed—should be also mentioned earlier as a work element in Section 2.

Additional review for the value engineering screening was performed by Dan Farrand/TN&A. His review concentrated on issues of constructability and long-term maintainability. His VE screening comments are as follows:

1. Section 2.1.3, 9th Paragraph, suggest that the abandoned well be filled with slurry and closed in accordance with applicable regulations.

2. Section 2.2.1, 1st Paragraph, consider using the debris from demolished building and concrete pad to secure and reinforce eroded embankments, as well as to provide temporary improvements to the roads.

3. Section 2.2.3.2, 3rd Paragraph, is the guidance document correctly identified as being issued by the Michigan DNR.

4. Section 2.3.4, 3rd Paragraph, same as above.

5. Section 2.7.3.5, suggest addressing the blower O&M, as well as required utility sources.

6. Section 2.8.1, 5th Paragraph (last), depending on the soil conditions, it may be less expensive to drill two smaller wells (one for the groundwater extraction wells and the other bioventing/LNAPL extraction wells), than one large 20" diameter well.

7. Section 2.8.3.5, 3rd Paragraph. From an operational and maintenance perspective, the simpler the infiltration basin is built, the easier it is to maintain. If the decision is made to go with option 1 or 4, suggest that two rectangular basis be built, no wider than 40 feet and as long as allowable. There should also be sufficient space between the basis to allow a backhoe to operate and remove clogged sand. The basins should also have a ramp, which would run along one entire end, to allow for a dozer or other piece of equipment to enter and push the clogged sand to the other end of the basin. If the clogging is happening often, a backhoe could be brought on site so it can remove the clogged sand from the end in which it has been accumulated, or to remove the sand from the top. A large square basin, as shown in the preliminary RD, would make it difficult to perform all work related to the removal of clogged sand.

8. Section 2.8.3.5, there should be some design provisions for extended shutdown periods especially if they take place during the winter. This includes draining pipes, pumps, tanks, valves, wells, etc. In addition, consider an emergency back-up power generator for heating and autodial purposes. The autodial should be set so that when the emergency back up generator turns on, it dials indicating that there is a problem.

9. Section 2.8.6, 1st Group of Bullets, suggest adding the infiltration basins to the maintenance elements.

10. Section 3.2, 1st Bullet, suggest that establishment or improvements of roads be part of the first construction actions as part of the overall efforts to manage site erosion.

11. Section 3.2, 8th Bullet, suggest that placement of wells be done much earlier in the sequence of the remedial actions. Not only will it affect the site grading and erosion control effort, but the drill spoils brought to the land surface may be contaminated and could be part of the effort covered under the 5th bullet, Excavation, Segregation, Select Solidification, and Placement of Arsenic Soils in an Onsite CAMU.

12. Project Schedule, 8th Activity. The start-up of the construction activity, which includes a large amount of earthwork, could potentially be delayed and/or extended due to winter conditions as well as wet conditions experienced in the Spring.

Conclusion

Based on our review of the *Design Review Report* for the Penta Wood Site, prepared by CH2M HILL and dated June 1999, we do not recommend a full-scale value engineering study for the remedial actions specified in the ROD for the site. The potential for cost savings from the identified design changes does not justify a full-scale value engineering study.