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July 9, 1997

141158.PP.01.04.02.02

Mr. Ken Glatz
Work Assignment Manager
U.S. Environmental Protection Agency
Remedial Response Branch (SR-6J)
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Ken:

Subject: Revised RI/FS Work Plan for Penta Wood Products Site
Town of Daniels, Wisconsin
Work Assignment No. 001-RICO-05WE
Contract No. 68-W6-0025

Enclosed please find two copies of the Revised Remedial Investigation/Feasibility Study Work Plan for the Penta Wood Products Site. The revisions are based on our discussion during the June 18 fact finding/negotiation meeting, and on the written comments received from the USEPA on July 2.

Revisions discussed on June 18 primarily included deleting the pump test and installation of additional monitoring wells during the RI/FS, and reducing the effort of other tasks.

The comments received on July 2 were incorporated into the revised Work Plan, with the following exceptions: (1) ERT's May 31, 1995 Bioremediation Activity Summary Report states a landfarm treatability experiment was conducted onsite from October 1994 to March 1995. It was conducted in the garage building, and a proprietary soil amendment (Daramend) was used; (2) Figure 5 is placed after the section on subsurface soils because that is the first place the figure is called out in the text. Figure 5 depicts both surficial and subsurface soil data.

Please call me if you have questions, or need clarification.

Sincerely,

CH2M HILL

Regina Bayer

Regina Bayer

Site Manager

MKE/COVERLET.DOC

Enclosures

c: Stephen Nathan/PO/USEPA, Region 5
Peggy Hendrixson/CO/USEPA, Region 5
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Remedial Investigation/ Feasibility Study Work Plan

Penta Wood Products
Town of Daniels, Wisconsin

WA No. 001-RICO-05WE
Contract No. 68-W6-0025

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Revision 1
July 1997

Contents

Contents, Continued

Introduction

General

This Work Plan defines the scope of activities, schedule, and budget for accomplishing the Remedial Investigation/Feasibility Study (RI/FS) for the Penta Wood Products (PWP) site in accordance with Work Assignment No. 001-RICO-05WE Statement of Work (SOW). Soil and groundwater at this inactive wood treatment facility are contaminated with pentachlorophenol, arsenic, copper, zinc, and fuel oil. Failure of a wastewater lagoon retaining wall has allowed the transport of contaminants into an offsite wetland.

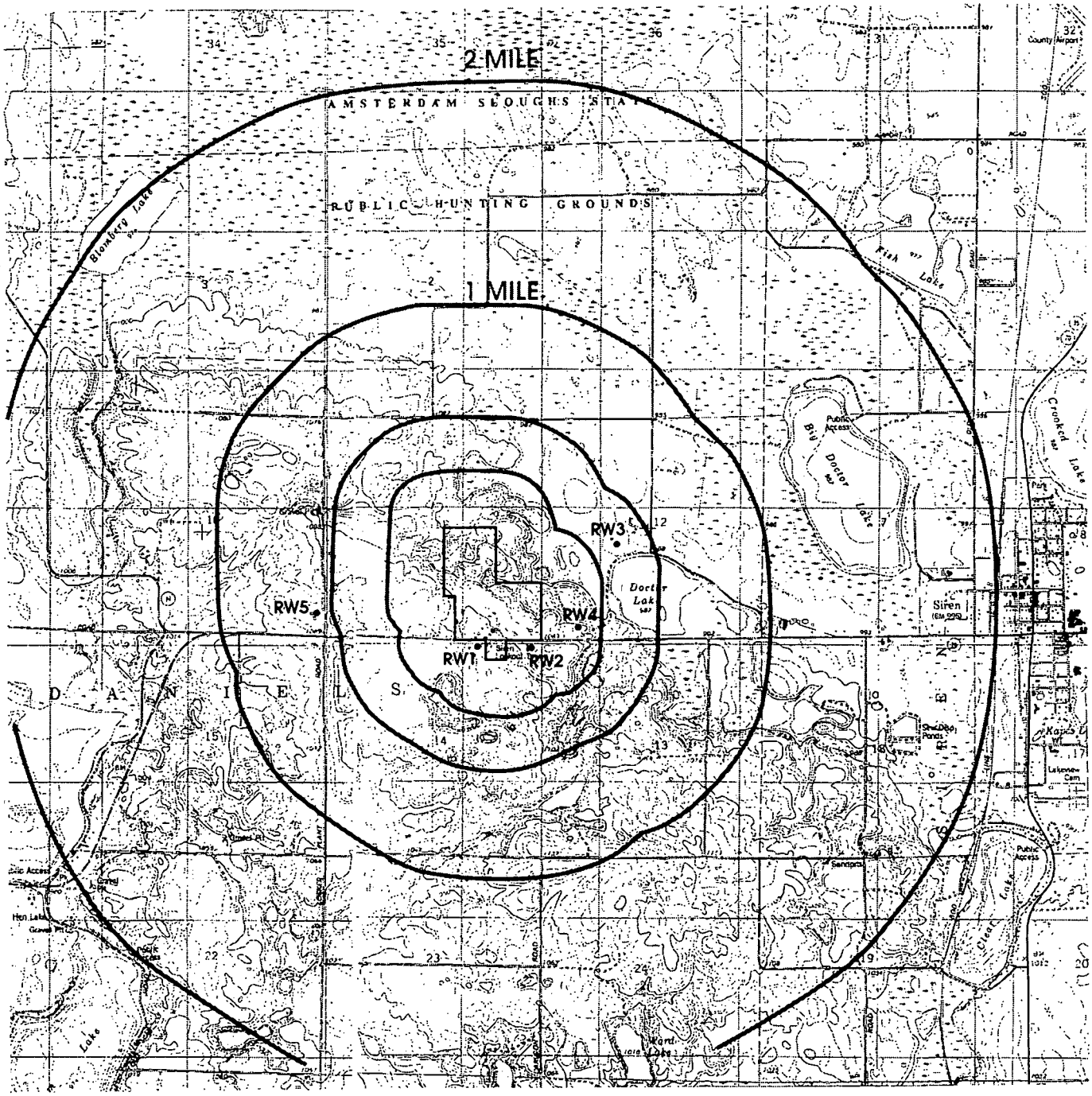
Site investigation activities, removal actions, and remedial treatability studies have been conducted by PWP, the Wisconsin Department of Natural Resources (WDNR), the USEPA Region V Emergency Response Branch (ERB), and the USEPA Emergency Response Team (ERT). The objective of this RI/FS is to supplement the existing information with the minimum amount of additional data necessary to support a Record of Decision (ROD) for site remediation. The RI/FS activities identified in the SOW are the following:

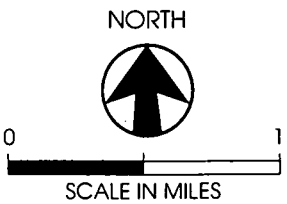
Task 1—Project Planning and Support
Task 2—Community Relations Technical Support
Task 3—Data Acquisition
Task 4—Sample Analysis
Task 5—Analytical Support and Data Validation
Task 6—Data Evaluation
Task 7—Risk Assessment—Ecological
Task 8—Treatability Study and Pilot Testing
Task 9—Remedial Investigation Report
Task 10—Remedial Alternatives Screening
Task 11—Remedial Alternatives Evaluation
Task 12—FS Report and RI/FS Report
Task 13—Post RI/FS Support
Task 16—Work Assignment Closeout

This scope of work is presented in accordance with the work breakdown structure (WBS) specified by USEPA for the Response Action Contract (RAC).

Project Background

Penta Wood Products operated from 1953 to 1992 on 80 acres of a 120-acre parcel located two miles west of Siren, Wisconsin, (Figure 1). 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 to a lagoon on the northeast corner of the property (Figure 2). Process wastes were also discharged onto the





SOURCE: USGS 7.5 min. Quadrangle for Siren West, WI, 1982.

FIGURE 1
Site Location Map and Residential Wells Sampled in 1993
Penta Wood Products RI/FS Work Plan

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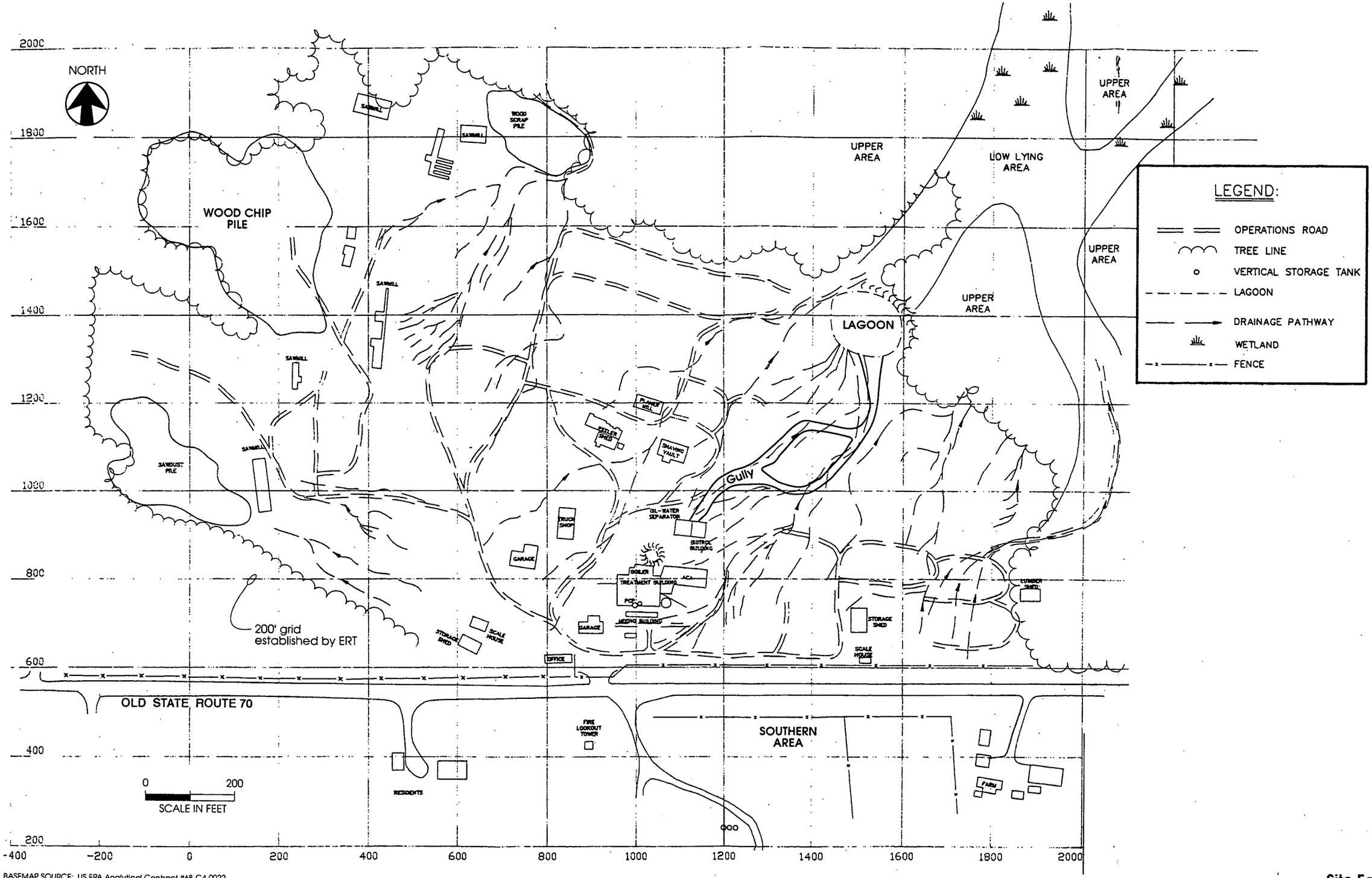

BASEMAP SOURCE: US EPA Analytical Contract #68-C4-0022,
W.O.#03347-040-001-0026-01 Figure 4, May 1994

FIGURE 2
Site Features Map
Penta Wood Products RI/FS Work Plan

E141158.PP.01.04.02.02 A-Site Features 7-7-97mms

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wood chip pile in the northwestern portion of the property. Several large spills, stained soils, and poor operating practices were noted by WDNR investigators in 1986. A 6-acre portion of the site, located south of old Highway 70, was used to transfer bulk PCP/oil mix to buyers.

In 1988 the onsite production well was closed for potable use when it was found to contain 2,700 ppb of PCP. During 1989 to 1992, PWP funded an investigation to characterize soil and groundwater contamination with 58 soil borings, test pits, and 10 monitoring wells (Conestoga-Rovers & Associates, 1992). In 1989 the Wisconsin Department of Transportation (WDOT) detected 2,800 ppm of PCP in a surficial soil sample within the right-of-way on the south side of old Highway 70 (Aqua-Tech, 1990).

The PWP facility was closed in May 1992 because of its inability to comply with RCRA regulations. A Screening Site Inspection conducted by the WDNR in 1993 detected 13 ppm PCP, 190 ppm copper, and 74 ppm of arsenic in a sediment sample collected from a wetland located downhill from the lagoon. Five residential wells (shown in Figure 1) were sampled and did not contain site contaminants (WDNR, 1994).

Surficial soils and ash from the boiler where PCP sludges were burned were sampled at various times for dioxin. Sample results detected dioxin at less than 1 ug/kg toxicity equivalent using the 1987 USEPA toxicity equivalency factors (ERT, 1995).

The State of Wisconsin selected PWP as a Superfund Accelerated Cleanup Model (SACM) site in 1994. A federally funded removal action was conducted between April 1994 and June 1996 by USEPA Region V ERB. About 28 storage tanks containing liquids and sludges were emptied, and 43,000 gallons of PCP oil and sludge were disposed of offsite for incineration. The ACZA treatment building was demolished, and the grossly contaminated soils from that area were excavated. Sitewide, about 1,600 cubic yards of soils contaminated with both PCP and arsenic were excavated and hauled offsite. About 4,000 cubic yards of ACZA-contaminated soil was excavated and mixed onsite with concrete to form a 580- by 260-foot, one-foot-thick concrete pad. The pad was intended to be used for ex situ bioremediation of PCP-contaminated soils.

In response to a June 1995 heavy rain that released water from the lagoon into the wetlands northeast of the site, the removal team built a retention pond adjacent to the lagoon, and stockpiled excavated soil across gullys to reduce soil erosion.

During the removal action, ERB requested removal assistance and site characterization support by the USEPA ERT. ERT conducted a hydrogeological and an on and offsite surficial soil investigation in 1994. The hydrogeological investigation included installation of 12 additional wells, three lysimeter nests, infiltration tests, and seismic studies (ERT, 1994). About 300 soil samples were collected during soil boring installation and analyzed for PCP, total petroleum hydrocarbons (TPH), arsenic, copper, and zinc.

For the soil investigation, a 200-foot interval grid system was established over the entire site and northeast of the property boundary. Soils were collected at one-foot intervals down to five feet and analyzed with immunoassay kits for PCP and field portable X-ray fluorescence (XRF) for arsenic (ERT, 1995). ERT also conducted laboratory treatability studies, including soil washing and stabilization/solidification (ERT, 1994a); and pilot-sized bioremediation treatability studies including landfarming, ex situ biopiles, anaerobic dechlorination, and white rot fungus (ERT, 1995a). Contaminated groundwater and wash water were treated

with a Biotrol fixed-film biological reactor. ERT did not complete all its intended activities as federal funding was cut back in 1995, and the site was placed in the remedial program in 1996.

Site Physical Characteristics

Topography

The PWP site is situated on a plateau that ranges from 20 to 50 feet above the adjacent land to the east, west, and north. The treatment area is located on the highest elevation of the site. Well defined drainage pathways, erosional areas, and depositional areas have been created in the sandy overburden soils. A large gully extends northeast from the treatment area to the lagoon.

Geology

Site geology was characterized by ERT as consisting of three distinct stratigraphic layers: a glacial till, the upper sands, and the lower sands. The glacial till consists of sand and silt and forms a discontinous boundary between the upper and lower sands. The upper sands extend from the surface to 90 to 120 feet below ground surface. The lower and upper sands may be indistinguishable when the glacial till layer is missing. The deepest soil boring of 300 feet below ground surface did not encounter bedrock. Regional maps indicate the Pleistocene deposits overlay Cambrian sandstones and Precambrian basalt flows.

Geotechnical analysis of the upper sands indicates the material to have neutral to alkaline pH, low cation exchange capacity, and little organic carbon in noncontaminated areas. The permeabilty of the material is quite high with a median value of 19.3 ft/day.

Hydrogeology

Groundwater at the PWP site occurs both in a thin, unconfined, water-bearing unit about 100 feet below ground surface and within a multilayered system of semiconfined water-bearing units. In most areas of the site, the upper sands form a deep unsaturated zone. Semiconfined conditions are a result of the discontinous, dipping till deposit of varying thickness. Beneath the lagoon area, the gully and eastern portion of the site, and the PCP treatment area where the glacial till is absent, the sandy outwash deposits function as a single, water-bearing unit.

The site is situated in a groundwater recharge zone. Because of the high permeability of surficial soils, precipitation rapidly infiltrates the soil.

Regional groundwater flow is to the north. An analysis of the onsite well water levels indicate the water table is relatively flat with a north-northeast flow direction. Potentiometric surface maps of the unconfined water-bearing unit created in 1994 indicate the lagoon area can create a mounding effect. The calculated horizontal hydraulic gradients range from 0.31 to 1.20 $\times 10^{-3}$ ft/ft.

Groundwater Use

Three residences served by private wells screened in the semiconfined aquifer are within 200 feet of the site. Thirty-eight are private wells within 1 mile of the site. The Town of Siren's wells are located two miles east of the site.

Surface Water Hydrology

Surface water that does not infiltrate the sandy soils drains primarily northeast of the site. A 1979 aerial photo of the site shows that at that time, the lagoon consisted of a number of overflow impoundments down the steep hill towards the wetland. Wood chips and log ends, materials used to construct the impoundments, have been found in a depositional path from the lagoon to the wetland. Migration of contaminants to the wetland is suspected through overland flow and possibly through groundwater discharge to surface water.

Surrounding Land Use

The site is located in a residential/agricultural/recreational area. A dairy farm is located across from the site on old Highway 70. Located within a 4-mile radius of the site are 2,137 acres of lakes, a 94-acre bog lake and 7,500 acres of wetlands. The 7,233-acre Amsterdam Slough Public Hunting Area is located within 1 mile of the site and provides nesting areas for bald eagles, osprey, red-shouldered hawk, trumpter swan, and other waterfowl.

Project Approach

Extensive investigation and treatability testing has been conducted at the site. This data has been reviewed and used to build a conceptual model, identify potential response actions, and develop this Work Plan. Technical direction from the USEPA Work Assignment Manager (WAM), and use of the presumptive remedies for wood treatment sites were also used to identify potential response actions. The identification of potential response actions is used to aid in defining further investigative needs and is not intended as a substitute for the more detailed process of technology screening during the FS. Evaluating the potential response actions with preliminary ARARs shows where data gaps exist in the current conceptual site model, and focuses the risk assessment and engineering data collection to support the FS.

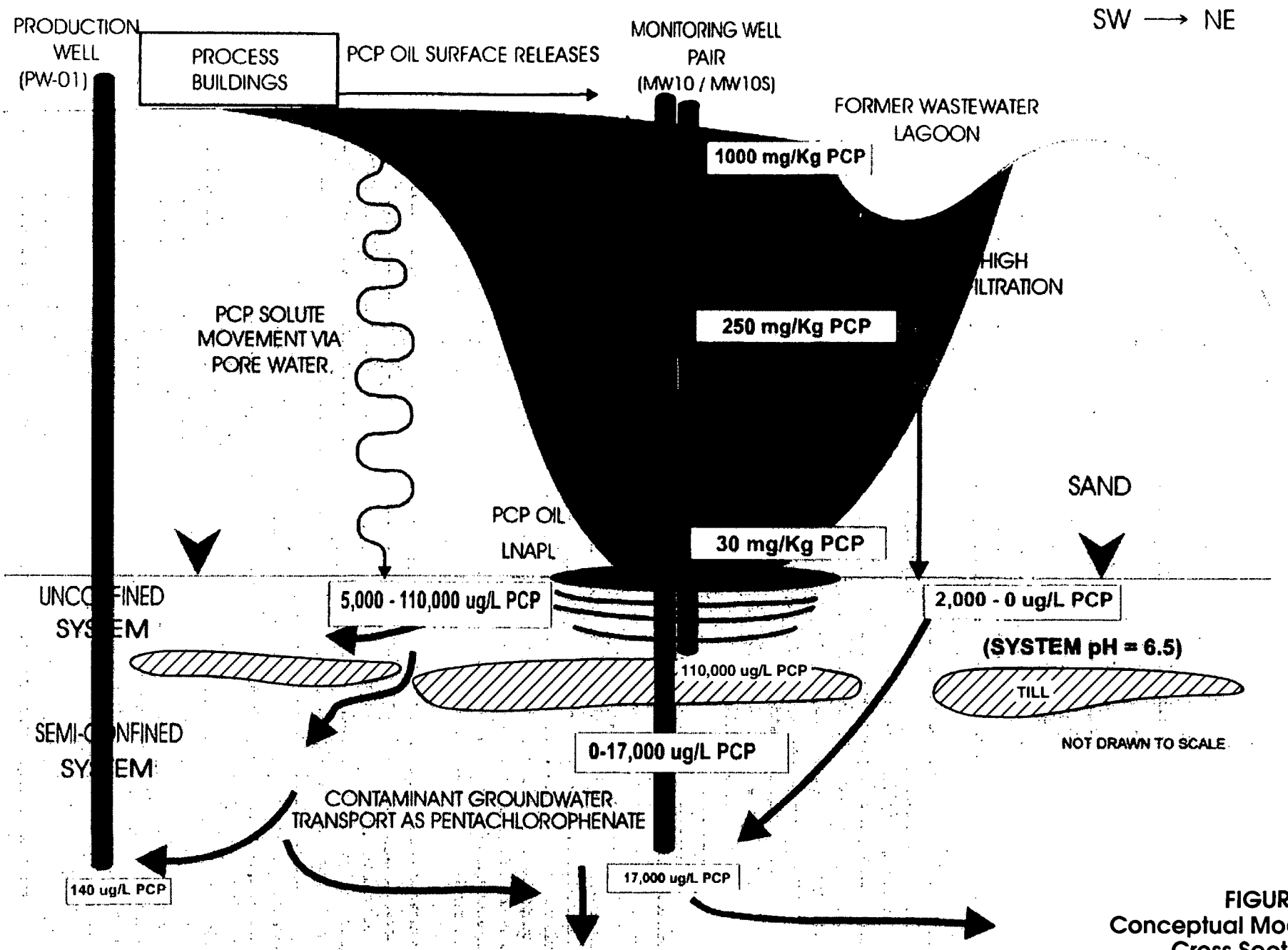
Conceptual Site Model

The conceptual site model is a framework within which source areas, contaminant release mechanisms, and environmental pathways of potential concern at a site are identified. Media that should be sampled to determine whether a release has occurred can be identified using the model. The model also serves as the framework for conceptualizing general response actions.

The site history and previous site investigations indicate that the soil beneath the PCP treatment areas, and the entire gully corridor from the oil/water separator to the lagoon are contaminated with a PCP oil residual. The contamination was caused by spills around the treatment area, and the practice of discharging wastewater through the gulley to the lagoon. Along the gully corridor, PCP and TPH contamination has been detected throughout the vadose zone soil down to the water table (Figure 3). The average PCP/TPH ratios found in the soil are similar to that of the initial PCP oil formulation, indicating that the mixture was traveling through the soils as a single pseudo-component. Upon reaching the water table, the PCP oil mix formed a light non-aqueous phase layer (LNAPL). It is postulated that dissolved PCP travels in the groundwater as pentachlorophenate. The contaminated soils and LNAPL layer serve as a continuing source of PCP contaminant to the groundwater (ERT, 1994).

A second significant area of contamination is the wood chip pile in the northwest corner of the site. Wood chips from the pole peeling operation were deposited in a 30 to 50 foot ravine. Wastewater from the processing tanks were discharged in the wood chip pile, in volumes of approximately 300 gallons, five to six times a week for six to seven years (at least 450,000 gallons). The wood chip pile covers an area of 136,000 square feet, with an average depth of 15 feet (75,000 cubic yards). Analytical results of the wood chips detected PCP up to 1,300 mg/kg and TPH at 24,000 mg/kg (CRA, 1992).

Arsenic, copper, and zinc contamination is largely limited to the upper five feet of soil on the eastern third of the site where the ACZA-treated wood was stored. Much of the ACZA-contaminated soil was reported to have been excavated by ERT/ERB and stabilized in the "biopile" cement pad. Grid and biased soil sampling for PCP and arsenic show a few other



SOURCE: US EPA Analytical Contract #C4-68-0022, W.O.#03347-040-001-0026-01 Figure 4.4-1, December 1994.

FIGURE 3
Conceptual Model Cross Section
Penta Wood Products RI/FS Work Plan

hot spots on the south side of old Highway 70, along the treeline on the northern boundary of the site where wastewater was discharged with a portable tank, and west of the treatment buildings. The USEPA On-scene Coordinator (OSC) Reports indicate the hot spot soils south of old Highway 70 may have been excavated (ERB Pollution Report #21, 1994).

Preliminary Identification of Remedial Action Technologies

The USEPA has developed presumptive remedies for contaminated soil and groundwater at wood treatment facilities by studying the FS/RODs from over 25 National Priority List (NPL) wood treatment facilities and evaluating the available existing treatment technologies. Bioremediation is the primary presumptive remedy for treating soils contaminated with organic contamination; thermal desorption, and incineration complete the remedy options. The presumptive remedy for inorganic soil contamination is immobilization. For contaminated groundwater, the guidance suggests site characterization and response actions be implemented in a phased approach. The site investigation should delineate both LNAPL zones and aqueous plumes. Source removal/treatment is suggested to the extent practicable (USEPA OSWER, 1995).

ERT has conducted numerous treatability tests at the PWP site including soil washing, solidification/stabilization, and biodegradation tests including landfarming, biopiles, anaerobic dechlorination, and white rot fungus. Contaminated water was treated with an existing on-site Biotrol fixed-film biological reactor unit.

Based on review of this data, and discussion with the WAM, potential treatment actions have been identified to guide further data collection. The vadose-zone soils between the treatment area and the lagoon are contaminated from the surface to about 100 feet below ground surface with a PCP oil residual. Ex situ bioremediation studies with the PCP oil contaminated soils have shown positive results without the need for added nutrients. Due to the extended depth (about 100 feet of vadose soils) and sheer volume of the contaminated soil, in situ bioremediation of the vadose zone soils has been identified as a potential treatment option rather than ex-situ bioremediation. ERT proposed to excavate the upper 20 feet of contaminated soils, leaving the majority of the contaminant mass in the ground. In situ bioventing will potentially treat all the vadose soils by injecting air to enhance aerobic biodegradation of the residual fuel oil and PCP. CH2M HILL proposes to field test this process. Ex-situ bioremediation will be considered for treatment of some of the more highly contaminated soils.

Potential remediation options for groundwater that have been identified at this time include collection and treatment, removal of LNAPL layer, in situ bioremediation, and natural attenuation. Subsequent to a literature study and laboratory studies, field tests may be proposed for ultraviolet treatment of extracted groundwater, carbon polishing, and possibly a Biotrol unit.

Data Needs Evaluation

Groundwater

PCP concentrations in groundwater during the last round of monitoring well sampling conducted by ERT in November 1994 are shown in Figure 4. The federal Maximum Contaminant Level (MCL) for PCP in groundwater is 1 μg/L, which is also the WDNR Enforcement Standard (ES) for PCP in groundwater. The WDNR Preventive Action Limit (PAL) is 0.1 μg/L.

Perimeter wells

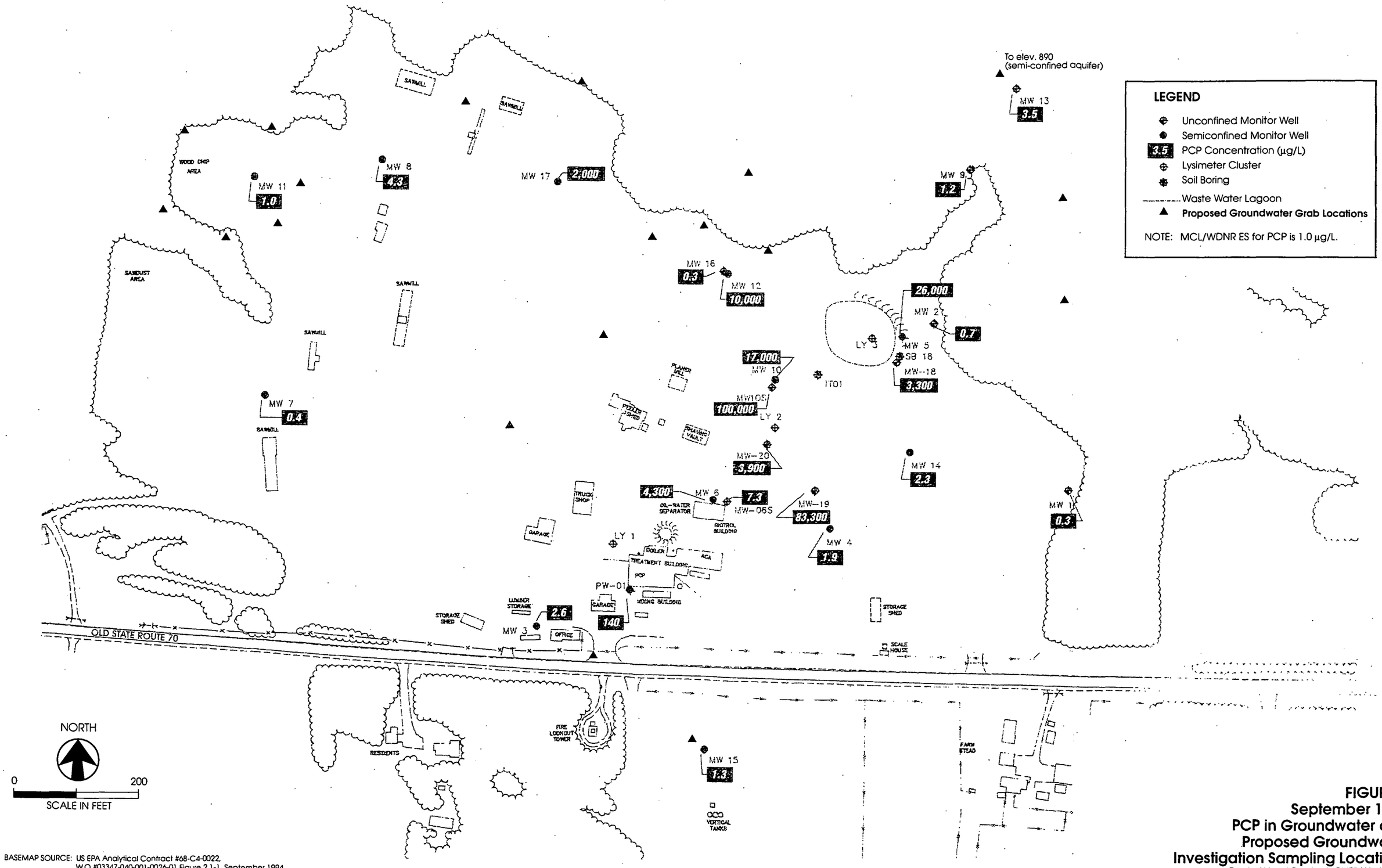
Based on the MCL/ES, neither the horizontal nor the vertical extent of the plume has been defined. Perimeter wells to the northeast, north, and south had concentrations of PCP greater than 1 μg/L in 1994. Of particular concern are the nearest potential receptors. Two residents are located within 400 feet of MW 15, which contained 1.3 μg/L PCP in 1994. Two other residential wells are located east and northeast of the site, in the direction that groundwater appears to be migrating.

The first field task CH2M HILL proposes to perform is to measure water levels, and sample all the existing monitoring wells and the four residential wells. These samples will be analyzed with a 7-day turnaround time (except the residential wells) so the results can be used to guide the investigation. The monitoring well samples will be analyzed for PCP, arsenic, copper, zinc, and 20 of the wells will be analyzed for the following natural attenuation indicators: nitrate, sulfate, manganese, chloride, methane, BTEX, carbon dioxide, TOC, ferrous iron, and alkalinity. Dissolved oxygen, pH, redox potential, conductivity, and temperature will be measured in the field. ERT also analyzed for these parameters during three sampling rounds so a data trend comparison over time will be available.

The northeast extent of the groundwater plume may be an ecological concern as contaminated groundwater could potentially be discharging into the wetlands, which is considered a sensitive environment and is potentially habitat for several endangered species. It is also unknown whether the groundwater is contaminated at depth and migrating under the wetland towards Little Doctor Lake.

To fill the groundwater perimeter data gap, groundwater grab samples will be collected from push-technology borings and analyzed with a field PCP immunoassay kit. Table 1 presents the proposed number of borings, locations, sample collection method and analysis, and rationale for each boring location. Proposed groundwater grab locations are shown on Figure 4. Based on the groundwater grab results, a limited number of piezometers may be installed for the purpose of measuring water levels.

To help determine whether groundwater is discharging into the wetland, one surface water sample will be collected from each finger of the wetland, along with a background surface water sample. Four groundwater grab samples will also be collected adjacent to the wetland fingers using hand-collected shallow well points. The shallow well point sample locations are also shown on Figure 4.



BASEMAP SOURCE: US EPA Analytical Contract #68-C4-0022.
W.O.#03347-040-001-0026-01 Figure 2.1-1, September 1994

FIGURE 4
September 1994
PCP in Groundwater and Proposed Groundwater Investigation Sampling Locations
Penta Wood Products RI/FS Work Plan

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TABLE 1
Groundwater Grab Sampling

Number of Borings	Location	Sample Collection Method/Analysis	Rationale
3 to 5[b]	In wetland area northeast of the facility	CPT/TPH[a], immunoassay for PCP	Determine lateral extent of groundwater contamination to the northeast and if the contaminated groundwater is discharging to the wetland. One grab sample will be collected from the semiconfined layer (elevation 890) to determine if PCP may be migrating below the wetland.
5	Northwest, northeast, west, southeast and south of MW 17	CPT/TPH[a], immunoassay for PCP	Determine potential source of PCP (2,000 µg/L) detected in MW 17
2 to 3[c]	Northwest and northeast of MW 12	CPT/TPH[a] immunoassay for PCP	Determine if PCP contamination (10,000 µg/L) identified in MW 12 is migrating to the north.
6 to 9[d]	In Wood Chip Pile Area	CPT/TPH[a], immunoassay for PCP in unconfined aquifer	Determine if contamination from the Wood Chip Pile is impacting the underlying groundwater.
2	In southcentral portion of the site, south of former production well	CPT/TPH[a], immunoassay for PCP	Determine PCP concentration in unconfined zone south of the treatment area.

[a] CPT = Cone penetrometer testing. TPH concentrations will be determined in situ using a laser-induced fluorescence system connected to the cone penetrometer probe. No actual groundwater samples will be collected or analyzed for TPH.
[b] Two optional borings included if initial three borings are contaminated and additional borings are needed to define the lateral extent of contamination to the wetland
[c] One optional boring included if initial 2 borings are contaminated and additional borings are needed to define lateral extent of contamination.
[d] Borings will be located based on soil results, GW grabs collected downgradient from locations with potential soil contamination.

Subsurface Soil

The extent of TPH contamination in subsurface soils has not been fully defined. The boundaries of the PCP oil residual in the vadose zone is important if in situ bioventing is chosen as the remediation alternative for soils. Figure 5 presents PCP and TPH soil data collected by CRA and ERT. Areas with both PCP and TPH contamination are focused in the gully area between the oil/water separator and the lagoon, and in the wood chip pile. There are a few hot spot areas near the PCP treatment building where spills occurred.

To delineate the TPH contamination, cone penetrometer testing (CPT) is proposed. TPH concentrations can be determined in situ using a laser-induced fluorescence system connected to the cone penetrometer probe. There is no need to collect or analyze the soil. Table 2 presents proposed boring numbers, locations, and rationale. Sample locations are also shown in Figure 5.

I: 141158 DRAWINGS 4115802.DGN

LEGEND

- SURFACE, 1, 2, 3, AND 5 FT SAMPLE LOCATION
- DOT BORING LOCATION
- SURFACE SAMPLE LOCATION
- CRA BOREHOLES/HAND AUGERS
- SURFACE AND 1 FT SAMPLE LOCATION
- LYSIMETER LOCATION
- INFILTRATION TEST BORING LOCATION
- UNCONFINED MONITORING WELL LOCATION
- CONFINED MONITORING WELL LOCATION
- PROPOSED SURFACE WATER SAMPLING LOCATION
- PROPOSED SEDIMENT SAMPLE LOCATION
- PROPOSED CPT BORINGS
- PROPOSED WELL POINT GROUNDWATER GRAB LOCATIONS

NOTE:
PCP AND TPH RESULTS ARE IN mg/Kg

N 0 100' 200'

N 2400
N 2200
N 2000
N 1800
N 1600
N 1400
N 1200
N 1000
N 800
N 600

E -200 E 0 E 200 E 400 E 600 E 800 E 1000 E 1200 E 1400 E 1600 E 1800 E 2000 E 2200 E 2400 E 2600

WWL AREA
WOOD CHIP AREA
WOOD CHIP PILE
WHITE WOOD STORAGE AREA
WASTE WOOD DISPOSAL AREA
WEST PCP WOOD STORAGE AREA
LAGOON
EAST PCP WOOD STORAGE AREA
EAST DRAIN AREA
SOUTHERN DRAIN AREA
OIL-WATER SEPARATOR BUILDING
SCALE HOUSE
GARAGE
OLD STAFF ROAD

BH 46
DEPTH	PCP	TPH
16-17	1300	14000
18-20	12	2500

NOTE: WOOD CHIPS TO 18'

DEPTH	PCP
0	ND (13)
	ND (18)

MW11 N 1657 E 140
DEPTH	PCP
	ND (5.0)
3	
5	
7	
9	
11	
15	
20	
40	
60	
80	
100	
109	

NOTE: WOOD CHIPS TO 7'

DEPTH	PCP
0	ND (15)

BH 47
DEPTH	PCP	TPH
17-18'	ND	1000

NOTE: AREA WOOD CHIPS TO 19.5'

BH 48
DEPTH	PCP	TPH
4-7.5'	1300	24000

NOTE: WOOD CHIPS TO 13'

DEPTH	PCP
0	520

N 1367 E 273
DEPTH	PCP
0	ND (4.0)
1	ND (4.1)
3	ND (5.3)

N 1400 E 229 JULY '95
DEPTH	PCP
0-1	25,000

HA6
DEPTH	PCP	TPH
3.5-4	200	1000

HA5
DEPTH	PCP	TPH
3.5-4	ND	400

MW 17
DEPTH	PCP	TPH
0	ND (5)	ND
3		12
5		ND
11		
40		
60		
100		
140		

MW 12 N 1432 E 1205
DEPTH	PCP
	ND (5.1)
	ND (5.3)
	ND (5.2)
	ND (5.2)
	ND (5.1)
135	3.5

LY 3 N 1288 E 1516
DEPTH	PCP
0	36
1	69
2	960
3	180
5	100
7	170
9	360
11	200
14	130
20	ND
25	1.2
65	1.6
85	190

MW 9 (CRA 1991)
DEPTH	PCP	TPH
5-7	7.6	68
15-17	ND (.93)	<3

N 2246 E 1914
DEPTH	PCP
0	5.3 J
1	ND (28)

N 1941 E 1935
DEPTH	PCP
0	ND (9.5)
1	0.24

N 1950 E 1955 JULY '95
DEPTH	PCP
0-1	5.1 U

MW 13 N 1850 E 1855
DEPTH	PCP
0	4.3 J
1	4.7 J
2	2.1 J
3	ND (5.4)
5	ND (5.5)
20	ND

N 1910 E 1915 JULY '95
DEPTH	PCP
0-1	1.5 J

N 1580 E 1920 JULY '95
DEPTH	PCP
0-1	3.2 U

N 1600 E 1780 JULY '95
DEPTH	PCP
0-1	1.0 J

N 1791 E 1936
DEPTH	PCP
0	3.8 J
1	1.6 J

N 1939 E 2251
DEPTH	PCP
0	ND (10)
1	ND (5)

N 1771 E 2066
DEPTH	PCP
0	14
1	ND (5.0)

N 1526 E 1895
DEPTH	PCP
0	17
1	440
2	ND (5)
3	ND (5)
5	ND (5)

1101
DEPTH	PCP	TPH
0	1.7	85
1	85	6500
2	1600	48000
3	3600	12000
5	3600	43000
6	1500	8800
7	470	5800
9	1000	14000
11	1200	21000
15	490	11000
20	230	3300
40	260	2700
57	58	1800
80	270	4700
100	10	14
120	6.3	14

MW 10S
DEPTH	PCP	TPH
0	W2U	120
1	ND (5)	ND (11)
3	ND (5)	ND (11)
5	ND (5)	ND (11)
11	ND (5)	ND (11)
20	ND (5)	10
40	ND (5)	ND
60	5.1	NA

LY 1 N 820 E 941
DEPTH	PCP
0	12
1	550
2	12
3	2
5	23 J

HA4 PCP 58000 @ 3.5' TO 4'
TPH 770

N 800 E 600
DEPTH	PCP
0	3300
1	370

N 818 E 480
DEPTH	PCP
0	6000
1	40
2	1.6 J
3	ND (5.0)
5	ND (4.6)

N 795 E 946
DEPTH	PCP
0	1300
1	2200
2	5 J
3	2 J
5	6.2 J

DEPTH	PCP
0	170
1	950
2	1.6 J
3	ND (8.2)
5	ND (8.4)

N 810 E 1102
DEPTH	PCP
1	50000
2	1900
3	1600
5	2900

MW 6S
DEPTH	PCP	TPH
0	4.2	38
1	510	15000
2	2.1	14
3	320	2800
5	ND	22
11	1.3	19
13	8.1	55
15	27	120
20	280	3300
40	ND (5.2)	25
100	ND (5.1)	ND (10)

B-4 (DOT-BORING)
DEPTH	PCP
0	2800
4.5'	18

MW 20
DEPTH	PCP	TPH
0	1300	12000
1	1900	16000
2	630	7100
3	780	7700
5	580	7300
7	320	6000
9	180	4000
11	12	10
100	300	4400
106	2.7	ND
121	2.6	ND

MW 18
DEPTH	PCP	TPH
65	15	1430
95	3	ND
300	ND	ND

MW19
DEPTH	PCP	TPH
0	8.3	360
5	3.3	14
15	ND	36
100	120	3300

NOTE: 6" LNAPL

MW-14 N 1023 E 1614
DEPTH	PCP
0	ND (4.5)
5	ND (5.0)
15	ND (5.0)
60	ND (5.2)
100	ND (5.3)
1172	ND

LY-2 N 1083 E 1309
DEPTH	PCP
0	700
1	1700
2	940
4	1300
5	82
7	16
11	17
15	33
30	140
40	280
60	310
65	2.4
80	56
100	420

FIGURE 5
PCP-TPH IN SUBSURFACE SOIL AND PROPOSED CPT LOCATIONS
PENTA WOOD, RI/FS WORKPLAN

CH2M HILL

TABLE 2
Subsurface Soil Investigation

Number of Borings	Location	Sample Collection Method/Analysis	Rationale
3 to 5[b]	East of the gully extending from oil/water separator to lagoon	CPT/TPH[a]	Determine horizontal and vertical extent of contamination from the gully to the water table
3 to 5[b]	West of the gully extending from oil/water separator to lagoon	CPT/TPH[a]	Determine horizontal and vertical extent of contamination from the gully to the water table
1	Between the two arms of the gullies extending from the oil/water separator to the lagoon	CPT/TPH[a]	Determine horizontal and vertical extent contamination from the gullies to the water table
1	In former ACA Building	CPT/TPH[a]	Define vertical extent of shallow soil contamination previously identified in the former ACA Building area
8 to 12	In Wood Chip Pile Area	CPT/TPH[a], immunoassay for PCP from the top of the sand layer	Define vertical and horizontal extent of contamination in the Wood Chip Pile Area

[a] CPT = Cone penetrometer testing. TPH concentrations will be determined in situ using a laser-induced fluorescence system connected to the cone penetrometer probe. No actual soil samples will be collected or analyzed for TPH.
[b] Two optional borings included if initial three borings are contaminated and additional borings are needed to delineate the lateral extent of contamination from the gully

Surficial Soils

A limited number of surficial soil samples are proposed to 1) determine remaining surficial soil concentrations in the areas where it is believed ERB excavated soils 2) define in greater detail the extent of surficial soil contamination in a few hot spot areas found during the ERT 200-foot grid sampling 3) determine if the ACZA soil/cement pad is leaching arsenic, and 4) investigate the overland flow pathway from the lagoon to the wetland. The soil samples will be analyzed for PCP (with the immunoassay kit) or arsenic, as appropriate.

A series of short transects of soil samples will be collected in progression down the pathway from the lagoon to the wetland, ending with several sediment samples in each finger of the wetland. Figure 5 presents these sampling locations. The sediment samples will be analyzed at an offsite laboratory for PCP, arsenic, copper, and zinc, as these samples will be important for the ecological risk assessment. The sediment samples will be analyzed in seven days so that if contamination is detected, further sampling can be conducted to determine the extent of contamination.

Scope of Work and Task Descriptions

The WBS used in this scope of work is in accordance with the WBS specified by USEPA for the RAC.

Task 1—Project Planning and Support (PP)

The purpose of this task is to determine how the RI/FS will be managed and controlled. The following activities will be performed as part of the project planning task:

1.1 **Project Planning.** This task includes efforts related to project initiation.

1.1.1 **Attend Kickoff Meeting.** CH2M HILL participated in a kickoff meeting with the USEPA on April 24, 1997. The Site Manager (SM) and the Review Team Leader (RTL) attended the meeting, which was held at the USEPA Region 5 Office in Chicago. The estimated LOE for this subtask is 20 hours.

1.1.2 **Conduct Site Visit.** The SM and the RTL participated in a one-day site visit on May 1, 1997, with the WAM to develop a conceptual understanding of the site and the RI/FS scope and requirements. CH2M HILL personnel traveled to Minneapolis from Milwaukee via airplane and drove from the airport to the site with the WAM. The return trip was made the same day. The estimated LOE for this subtask is 24 hours.

1.1.3 **Evaluate Existing Information.** CH2M HILL reviewed available information pertaining to the site from USEPA. CH2M HILL obtained information from the WAM and visited the Region V Record Center to review documents. CH2M HILL reviewed and evaluated the existing data and documents, which included the following:

1.1.3.1 **Previous Site Investigations.** Prior site investigations were conducted at PWP by CRA, the WDOT, the WDNR, the USEPA Region V ERB, and the USEPA ERT. The various reports reviewed and evaluated are listed in the Reference Section. The estimated LOE for this subtask is 89 hours.

1.1.3.2 **Preliminary Assessment Reports.** The preliminary assessment and the preliminary assessment scoresheets prepared by the WDNR were reviewed for pertinent information. The estimated LOE for this subtask is 4 hours.

1.1.3.3 **Site Inspection Reports.** The site inspection report prepared by WDNR was reviewed for pertinent information. The estimated LOE for this subtask is 3 hours.

1.1.3.4 **HRS Scoring Package.** The HRS scoring package basically references information contained in previous reports. The estimated LOE for this subtask is 0 hours.

1.1.3.5 **Draft Human Health Risk Assessment.** A draft form of this document has been prepared by Ecology and Environment under their ARCS contract with USEPA. It is anticipated that CH2M HILL will receive this document from the USEPA when it is finalized. The estimated LOE to review the document and incorporate the findings in the development of preliminary remedial goals and the ecological risk assessment is 8 hours.

1.1.3.6 **Memos/Other Documents as required.** Additional project information obtained from the USEPA Record Center and reviewed include WDNR memorandums, Agency of Toxic Substances and Disease Registry (ATSDR) and Wisconsin Department of Health evaluations, community relations plans and newspaper articles, USEPA Regional Decision Team (RDT) memorandums and correspondence, OSC pollution reports, and WDNR and USEPA guidance documents. The estimated LOE for this subtask is 28 hours.

1.1.4 RI/FS Work Plan

1.1.4.1 **Develop RI/FS Work Plan.** CH2M HILL will prepare and submit the RI/FS Work Plan by May 23, 1997. CH2M HILL will use the existing information/documents, appropriate USEPA guidance, and technical direction provided by the WAM as the basis for preparing the RI/FS Work Plan. CH2M HILL will submit one copy of the Work Plan to the Contracting Officer (CO), Project Officer (PO) and WAM.

Develop Narrative. The RI/FS Work Plan includes a comprehensive description of project tasks, the procedures to accomplish them, project documentation, and project schedule. CH2M HILL will use its quality assurance/quality control (QA/QC) systems and procedures to assure that the Work Plan and other deliverables are of expected quality requiring only minor revisions. Specifically, the Work Plan includes the following:

- Identification of RI/FS project elements and the associated tasking including review of site documentation, previous field sampling and analysis activities, and treatability study activities. Output of this task is a detailed work breakdown structure of the RI/FS project.
- The technical approach to each task to be performed, including a detailed description of each task, the assumptions used, any information to be produced during and at the conclusion of each task, and a description of the work products that will be submitted to USEPA. Information is presented in a sequence consistent with the SOW.
- A schedule with specific dates for completion of each required activity and submission of each deliverable required by the SOW. This schedule also includes information regarding timing,

initiation, and completion of all critical path milestones for each activity and deliverable and the expected review time for USEPA.

- Resumes and an organization chart of key personnel providing support on the work assignment (WA).

The estimated LOE for this subtask is 284 hours.

1.1.4.2 Prepare Revised Work Plan (if necessary)

1.1.4.2.1 Attend Fact Finding/Negotiation Meeting. CH2M HILL attended a Work Plan fact finding/negotiation meeting with the WAM in Milwaukee. The final technical approach and costs required to accomplish the tasks outlined in the SOW were discussed and agreed upon. Three CH2M HILL personnel attended the meeting. The estimated LOE is 11 hours.

1.1.4.2.2 Prepare and Submit Revised Work Plan. CH2M HILL will prepare and submit a revised Work Plan incorporating the agreements made in the fact finding/negotiation meeting. The estimated LOE is 56 LOE hours.

1.2 Preparation of Site-specific Plans

1.2.1 Develop Site Management Plan. After USEPA approval of the RI/FS Work Plan, CH2M HILL will prepare a Site Management Plan (SMP) that provides USEPA with a written understanding of how access, security, contingency procedures, management responsibilities, and waste disposal are to be handled.

1.2.1.1 Develop Pollution Control and Mitigation Plan. CH2M HILL will prepare a Pollution Control and Mitigation Plan that outlines the process, procedures, and safeguards that will be used so contaminants or pollutants are not released offsite during the implementation of the RI/FS. A geotechnical engineer visited the site to determine if temporary measures could be implemented during the RI/FS to mitigate overland transport of contaminated soil from the lagoon area to the offsite wetland until permanent measures could be implemented during the RA. It was decided during the negotiation meeting not to pursue temporary measures.

The estimated LOE for this subtask is 60 hours.

1.2.1.2 Develop Transportation and Disposal Plan (Waste Management Plan). CH2M HILL will prepare a Transportation and Disposal Plan that outlines how wastes encountered during the RI will be managed and disposed of. CH2M HILL will specify the procedures that will be followed when wastes will be transported offsite for storage, treatment, and/or disposal, or stored onsite for incorporation into the RA. The estimated LOE for this subtask is 15 hours and assumes that

contaminated carbon generated during groundwater treatability testing may require disposal as hazardous waste.

1.2.2 **Develop Health and Safety Plan (HASP).** CH2M HILL will prepare a site-specific HASP that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan in accordance with 40 CFR 300.150 of the NCP and 29 CFR 1910.120 1(1) and (1)(2). The HASP will address task-specific health and safety requirements. The estimated LOE for this subtask is 40 hours.

1.2.3 **Develop Sampling and Analysis Plan**

1.2.3.1 **Quality Assurance Project Plan.** CH2M HILL will prepare a Quality Assurance Project Plan (QAPP) in accordance with USEPA QA/R-5 (latest draft or revision). The QAPP will describe the project objectives and organization, functional activities, and QA/QC protocols that will be used to achieve the desired Data Quality Objectives (DQOs). The DQOs will, at a minimum, reflect use of analytical methods for identifying contamination and addressing contamination consistent with the levels for remedial action objectives identified in the National Contingency Plan. Media to be investigated include surficial soil, subsurface soil, sediments, surface water, groundwater, and drinking water. It is assumed that samples will be nonCLP program as a result of DQOs of three, or the necessity for fast turn-around times and/or low detection limits so additional data can be collected during the same field event if needed. A Chemical Hygiene Plan will also be prepared as part of the QAPP for the onsite PCP immunoassay analyses. The estimated LOE for this subtask is 80 hours.

1.2.3.2 **Field Sampling Plan (FSP).** CH2M HILL will prepare a FSP that defines the sampling and data collection methods that will be used for the project. The FSP will include sampling objectives, sample locations and frequency, sampling equipment and procedures; sample handling and analysis, and the justification for analyzing samples through nonCLP sources. The FSP will not include samples where existing data meets the data quality objectives. Existing data consists of results from 20 monitoring wells, three lysimeters, over 200 soil boring locations and surficial soil locations, residential well sampling, and sediment and surface water sampling. The entirety of the existing data has not previously been consolidated and evaluated in any of the existing site reports. In addition, locations where soil was removed (and sampling data is no longer representative of current conditions) during removal actions is not well documented.

The FSP will include methods and procedures for treatability testing parameters and indicator parameters to determine if natural attenuation is occurring in the groundwater. The estimated LOE for this subtask is 190 hours.

1.2.3.3 **Data Management Plan**. CH2M HILL will prepare a Data Management Plan that outlines the procedures for storing, handling, accessing, and securing data collected during the RI. The estimated LOE for this subtask is 30 hours.

1.2.3.4 **Develop Other Plan(s).** CH2M HILL will develop other plans believed necessary to implement the RI. At this time, no LOE is budgeted for this subtask. The scope and budget for other plans will be provided in a WPRR, if necessary.

1.3 Project Management

CH2M HILL will perform general work assignment management including management and tracking of staff and costs, preparation of Monthly Progress Reports, attendance at project meetings, and preparation and submittal of invoices. It is anticipated that the period of performance for this project is from April, 1997 through September, 1998, as discussed in the fact finding/negotiation meeting.

1.3.1 **Prepare Monthly Status Reports**. CH2M HILL will prepare monthly progress reports in accordance with the requirements under the contract. CH2M HILL will document the technical progress and status of each task in the WBS for the reporting period in accordance with contract requirements. CH2M HILL will report costs and level of effort (by P-level) for the reporting period as well as cumulative amounts expended to date.

Additional project management activities included in this subtask are managing staff and resources, routine communication with the WAM, monitoring schedule and budget down to the lowest WBS level, and providing task management and quality control. It is assumed the SM will average 20 hours per month performing these activities; the RTL will provide 1 hour per month of project management support, and the RACs program manager or the RACs Quality Assurance Manager will expend 4 hours of LOE during the planning activities. An internal kickoff meeting with the project team will be held before field work begins, and the SM will prepare project instructions for the team. The total estimated LOE for this subtask is 383 hours.

1.3.2 **Meetings**. CH2M HILL will participate in progress meetings during the course of the WA. A 2-hour project scoping meeting was held in Milwaukee on May 7, 1997 with the WAM and four CH2M HILL personnel. For budgeting purposes, it is assumed two additional meetings will be held at the USEPA regional offices with two CH2M HILL personnel in attendance. The estimated LOE for this subtask is 48 hours.

1.4 Subcontract Procurement and Support Activities

1.4.1 **Identification and Procurement of Subcontractors.** The purpose of this subtask is to procure, evaluate, select, and award the necessary subcontracts to implement the RI/FS. CH2M HILL will procure and administer the following subcontracts:

1.4.1.1 **Drilling Subcontractor.** CH2M HILL anticipates procuring one drilling subcontractor, capable of CPT testing and LIF to delineate TPH distribution, and collecting groundwater grab samples. At the WAM's direction, CH2M HILL investigated using a government-owned Site Characterization Area Penetrometer (SCAP) rig to accomplish the same task as the cone penetrometer rig. After talking to the Waterways Experimental Station and the Kansas City Army Corps of Engineers, CH2M HILL was informed that the SCAP rig has 80 feet of cable and would not be able to reach the depth required at the PWP site.

One pre-bid meeting for all the interested site subcontractors is assumed. Such a meeting will be valuable to the drillers, and the surveyors who will bid on work to be done that includes wooded, hilly terrain. The estimated LOE to arrange and attend a pre-bid meeting is 14 hours.

It is estimated that identification and procurement of each drilling subcontractor will require 16 hours by a hydrogeologist, and 12 hours by the Contract Administrator. The total estimated LOE for this subtask is 70 hours.

1.4.1.2 **Surveying Subcontractor.** It is assumed a surveyor will be able to reestablish the sampling grid developed by ERT with a known control point. Horizontal and vertical control of new sampling locations will be established by surveying. The existing wells will be re-surveyed for vertical control. The use of a global positioning system (GPS) will be investigated for identification of sample locations collected in the woods. It is estimated that identification and procurement of a surveying subcontractor will require 24 hours by an engineer, and 24 hours by the Contract Administrator. The estimated LOE for this subtask is 48 hours.

1.4.1.3 **Geophysical Subcontractor—N/A**

1.4.1.4 **Site Preparation Subcontractor—N/A**

1.4.1.5 **Analytical Services Subcontractor**. It is assumed one analytical laboratory will be procured to analyze all parameters required during the remedial investigation and treatability testing that are not being analyzed onsite with field screening techniques. The procurement of the laboratory is estimated to require 32 hours by a chemist, and 24 hours by the Contract Administrator. The estimated LOE for this subtask is 56 hours.

1.4.1.6 **Waste Disposal Subcontractor.** Wastes generated during the RI/FS that will require disposal prior to a RA are expected to be minimal. Contaminated groundwater generated during well development or used for treatability testing will be treated with either ultraviolet degradation, fixed film biological remediation (biotrol unit), or carbon treatment. The carbon will require disposal, or regeneration.

Any LNAPL collected during treatability testing will be disposed of offsite. A limited amount of laboratory wastes will be generated with use of the PCP immunoassay kits. The costs associated with procuring a waste disposal subcontractor will be developed in the Treatability Test Work Plan when the nature and extent of wastes that will be generated during treatability testing is known. WPRR No. 1 will include the LOE and costs for this subtask.

1.4.1.7 **Treatability Subcontractor(s).** The need for treatability subcontractor(s) will be determined in the Treatability Testing Work Plan. WPRR No. 1 will include the LOE and costs to procure treatability subcontractor(s).

1.4.1.8 **Other(s).** None identified at this time.

Prior to award of the subcontract, CH2M HILL will submit a subcontract consent package to the Contracting Officer recommending the prospective awardee.

1.4.2 **Develop Subcontractor QA/QC Program.** CH2M HILL will review, approve, and monitor the analytical laboratory's QA/QC program. The estimated LOE for this subtask is 12 hours.

1.4.3 **Perform Subcontract Management.** CH2M HILL will perform the necessary management and oversight of the subcontractors needed to implement the RI/FS. CH2M HILL will institute procedures, monitor progress, and maintain systems and records to ensure that the work proceeds according to contract requirements. CH2M HILL will review and approve subcontractors' invoices and issue any necessary contract modifications. It is estimated the Contract Administrator will require 2 hours per contract, and 8 hours for contract modifications, assuming there will be two modifications. The laboratory subcontract will require 12 hours by a chemist, and the drilling subcontract will require 8 hours by a hydrogeologist. It is assumed the remaining subcontracts, excluding any waste disposal subcontracts, treatability subcontracts or pollution mitigation subcontracts, will require 4 hours each to manage the subcontract and approve invoices.

The estimated LOE for this subtask is 36 hours.

Task 2—Community Relations Technical Support

This task includes technical support provided by CH2M HILL during public/availability meeting(s) under the associated community relations WA. CH2M HILL will provide community relations support to USEPA throughout the RI/FS in accordance with *Community Relations in Superfund–A Handbook,* June 1988. For budgeting purposes, it is assumed one CH2M HILL person will provide technical support at two public/availability meeting(s), and each meeting will require an overnight stay. The estimated LOE is 30 hours.

Task 3—Data Acquisition

Data acquisition entails collecting environmental samples and information required to support the RI/FS. The planning for this task is accomplished in Task 1—Project Planning and Support, which results in the plans required to collect the field data. Data acquisition starts with USEPA's approval of the FSP and ends with the demobilization of field personnel and equipment from the site.

CH2M HILL will perform the following field activities for data acquisition in accordance with the USEPA-approved FSP and QAPP developed in Task 1.

3.1 **Mobilization and Demobilization.** CH2M HILL will provide the necessary personnel, equipment, and materials for mobilization and demobilization to and from the site for the purpose of conducting the sampling program under subtask 3.3.2, Field Investigation.

3.1.1 **Identify Field Support Equipment, Supplies, and Facilities.** LOE and costs for identifying, obtaining, and using field support equipment and supplies that are not specific to a discrete task are included in this subtask. It is assumed that one of the existing PWP buildings can be used for a field office, sample preparation area, and laboratory area for the PCP immunoassay kits, and that electrical power will be available by contacting the utility company to restore the connection. Identifying, obtaining, and mobilizing the equipment to the site is estimated to require 30 LOE hours. Setting up the support facility at the site is estimated to require 20 hours. Travel time to and from the site for the field team of four personnel will require 48 hours. (Although the field team will conduct various subtasks during a 9-day session, travel time is being allotted to the first task performed each session; see the project schedule).

Orientating team members to the site and conducting health and safety meetings is estimated to require 10 hours. The total estimated LOE for this subtask is 108 hours. The table below presents the anticipated major non-task-specific field equipment and supplies that will be needed and their estimated costs.

TABLE 3
Field Support Costs

Equipment	Unit Cost	Quantity	Total Cost
Field vehicles	$1,050 monthly	2	$2,100
photoionization detector	$80 weekly	2	$640
phone/fax	$70 monthly	1	$70
copier	$80 monthly	1	$80
mini-refrigerator for samples	Available	1	$0
personal protective equipment	$47.90/day	57	$1,365

TABLE 3
Field Support Costs

Equipment	Unit Cost	Quantity	Total Cost
solid waste disposal	$100 monthly		$100
porta-john	$70 monthly	1	$70
bottled water service	$45 monthly	1	$45
phone	$75 initial; $150 monthly	1	$225
electric	$100 monthly	1	$100
Estimated time in field excluding treatability testing is 1 month.			

3.1.2 **Mobilization.** Mobilize a field laboratory—N/A

3.1.3 **Demobilization.** Demobilize the field laboratory—N/A

3.2 **Field Investigation.** CH2M HILL will conduct environmental sampling including the following:

3.2.1 **Perform Site Reconnaissance.** CH2M HILL will use the base site map prepared by ERT and update it as applicable.

3.2.1.1 **Well Inventory**—N/A

3.2.1.2 **Residential Well Sampling.** The WDNR sampled five residential wells in 1993 and did not detect site contaminants; however, the risk evaluation prepared for the site by ATSDR recommended that nearby wells be sampled periodically. As the horizontal and vertical extent of the groundwater plume is not defined, CH2M HILL proposes to sample four of the five previously sampled wells. The well that will not be sampled is located the furthest from the site in a direction that is likely upgradient from the site.

The estimated LOE to contact the residents and collect the water samples is 10 hours.

3.2.1.3 **Land Survey.** At the initiation of the field effort, a surveying team will reestablish the site coordinate system that ERT used to collect soil samples on 200-foot grid nodes. A number of permanent markers will be installed that are intended to remain in place through the RA. The system will allow CH2M HILL to locate the contaminated areas defined by ERT and others. Existing wells will be surveyed for vertical control. This initial surveying effort is estimated to require five days by the subcontractor. It is estimated CH2M HILL personnel will require 4 hours over the week to guide the subcontractor.

At the end of the field effort all new sampling locations (borings, wells, soil, sediment, and surface water) will be surveyed. This effort is estimated to require five days for the subcontractor, and 4 CH2M HILL hours to guide the subcontractor.

The total estimated LOE for this subtask is 8 hours.

3.2.1.4 **Topographic Mapping.** During the initial land survey effort, the subcontractor will survey spot elevations to verify the topographic map produced by ERT and map changes caused by removal activities. Surface water elevations in the wetland will be measured at the same time initial water level measurements in the monitoring wells are being collected. No additional CH2M HILL effort is estimated for this subtask.

3.2.1.5 **Field Screening**—N/A

3.2.2 **Conduct Geological Investigations (Soils and Sediments).** CH2M HILL will conduct soil and sediment investigations.

3.2.2.1 **Collect Surface Soil Samples.** A limited number of surface soil samples will be collected and analyzed for PCP in some locations, and arsenic in others, to define the extent of contamination in areas where it appears removal activities have occurred and the remaining concentrations are unknown. Surficial soil samples may also be analyzed for PCP (with immunoassay field kits) in a few previously identified PCP hot spot areas to more closely define the amount of soil that may require remediation. Two samples of the biopile cement pad, and one sample of soil adjacent to the pad with evidence of cement chips nearby will be collected and analyzed for TCLP-arsenic to verify the pad's performance. The estimated LOE for this subtask is 10 hours.

3.2.2.2 **Collect Subsurface Soil Samples.** A subsurface soil investigation will be conducted to delineate the extent of contamination in two potential source areas of the site (See Figure 5). The rationale for the boring locations is as follows:

The majority of the subsurface soil contamination previously identified appears to be related to the lagoon and the gullies between the oil/water separator and the lagoon. A maximum of 11 borings will be advanced to a depth of about 130 feet to define the extent of the TPH/PCP contamination in this area. In addition, one boring will be conducted to the top of the till layer (about 125 feet below ground surface) to evaluate contamination beneath the former ACA Building. Previous surface soil sampling results from within the former ACA Building indicate high levels of PCP exist in the shallow soil. The data collected will be used to determine the potential volume of soil to be addressed by the soil remediation alternatives in the FS.

The other potential source area to be investigated is the Wood Chip Pile Area. Previous investigations, although of limited extent, indicate high levels of PCP (1,300 mg/kg) and TPH (24,000 mg/kg) exist in the wood chip pile. A maximum of 12 borings will be advanced along the perimeter and in central portion of the wood chip pile. All borings will be advanced to the top of the till layer (110 feet below ground surface). The data collected will be used to determine if contamination in the wood chip pile will need to be addressed in the development of remedial alternatives in the FS.

The borings will be advanced to the desired depth using CPT technology. The CPT is a direct-push technology, which will provide a continuous profile of the underlying site stratigraphy. The CPT borings will be performed in accordance with ASTM Standard D 3441. Combined with the CPT, LIF system will be used to rapidly delineate the distribution of petroleum hydrocarbons (i.e., TPH). Thus, the subsurface investigation relative to TPH will be conducted in situ, and TPH analysis of soil samples will not be performed in a laboratory.

The CPT also has the capability of providing soil and water samples at desired depth intervals. In the Wood Chip Pile Area, the CPT will be used to collect a soil sample at the wood chip/sand interface (about 20 feet below ground surface) to determine if contaminants have leached from the wood chips to the underlying sand. The soil samples will be analyzed for PCP using immunoassay test kits. Selected samples will be sent to an offsite laboratory for confirmation.

The CPT/LIF technology and sampling methods will be described in the FSP. Decontamination of CPT equipment will be an ongoing process. General decontamination procedures will be in accordance with the FSP and the QAPP. The management of decontamination fluids is discussed in Task 3.2.10 Dispose of Investigation-Derived Waste.

It is estimated the CPT investigation will require 10 12-hour days for a junior-level CH2M HILL geologist, and 12 hours travel time to and from the site. An estimated 40 hours is required for a senior-level hydrogeologist. The total estimated LOE for subtask 3.2.2.2 is 172 hours.

3.2.2.3 Soil Boring and Permeability Sampling—N/A

3.2.2.4 Collect Sediment Samples. A total of seven sediment samples is proposed to be collected from the two lobes of the wetlands located downgradient of the northeastern corner of the site. The northern wall of the lagoon failed in 1995, leaving a trail of sediment and wood bits down to the wetlands. A sediment sample collected in the wetland by the WDNR in 1993 detected PCP, arsenic, and copper (WDNR, 1993). Release of contaminants from the site to the nearby

wetland by overland flow or through groundwater discharge to surface water is a potential ecological threat.

The proposed placement of the sediment samples is shown in Figure 5. It is anticipated that sediment sampling will require a 4-hour effort by three personnel. Three people are anticipated for safety reasons because of the difficulty of sampling in wetlands. Three hours are estimated to contact the property owner and request permission to collect samples, and provide follow-up when results are available. The estimated LOE for this subtask is 15 hours.

3.2.2.5 **Survey Soil Gases**—N/A

3.2.2.6 **Test Pit**—N/A

3.2.3 **Conduct Air Investigations**—N/A

3.2.4 **Conduct Hydrogeological Investigations (Groundwater).** CH2M HILL will conduct hydrogeological investigations of groundwater.

3.2.4.1 **Install Well Systems.** None at this time.

3.2.4.2 **Collect Samples.** The objective of the groundwater sampling is to confirm the nature and extent of contamination at the site and along its perimeter. The analytical results will be used in the development of potential groundwater remedial alternatives in the FS. Specifically, the groundwater quality data will be used to assess the fate and transport of contaminants to determine if natural attenuation is a potentially acceptable remedial alternative.

Groundwater samples will be collected initially from the 23 existing wells. The resulting groundwater quality data will be used to refine the proposed boring locations conducted during the subsurface soil and hydrogeologic investigations.

The groundwater samples will be collected in accordance with the procedures specified in the FSP. The groundwater samples will be analyzed for PCP, arsenic, copper and zinc. In addition, selected wells will be sampled for analysis, per WDNR guidance, for natural attenuation/biodegradation indicator parameters. The analytical parameters and methods will be specified in the site-specific QAPP.

With the installation of dedicated submersible sampling pumps in the wells, the effort to purge the wells and collect samples is estimated to require two sampling teams of two people each two days to sample the existing wells. The total estimated LOE for this subtask is 96 hours.

3.2.4.3 **Collect Samples During Drilling.** Groundwater grab samples will be collected to evaluate groundwater flow directions and rates in the unconfined and semiconfined aquifers and to monitor groundwater contamination emanating from the site. The cone penetrometer will be used to obtain groundwater grab samples from various depths and

locations to assist in delineation of the potential groundwater plume. Samples will be collected using CPT, and analysis for PCP will be conducted onsite using an immunoassay kit. Confirmatory samples will analyzed using an offsite laboratory. Sample collection and analysis will follow the FSP and the QAPP procedures.

Approximately 19 CPT groundwater grab locations (Figure 4), and four shallow hand-pushed well point grab locations (Figure 5) are proposed as part of the hydrogeologic investigations. The rationale for the groundwater grab locations are as follows:

Based on the water levels measured in the unconfined aquifer, groundwater flowed radially outward from the lagoon. Groundwater grabs will be collected south of old Highway 70, and near the former production well to define the extent of contamination in the unconfined aquifer.

A potential exposure pathway for human and environmental receptors to site contaminants is through groundwater discharge into the wetland northeast of the site. Only one monitoring well (MW 13), screened in the unconfined aquifer, exists in the northeastern portion of the site. Additional monitoring points (two shallow and one deep boring) will be installed to provide horizontal and vertical hydraulic gradient information to determine if groundwater is discharging into the wetlands. One or two of the borings may be converted to piezometers to allow for water level measurements. In addition, shallow well points will be used to collect groundwater immediately adjacent to the wetland.

A potential source to groundwater contamination is the wood chip pile. Based on the results of the CPT/TPH mapping in the wood chip pile area, groundwater grab samples may be collected from these borings to monitor the impacts of contaminants leaching from the wood chip pile to the underlying groundwater. The data will be used to determine if remediation of the wood chip pile is necessary based on the contaminant migration to the groundwater.

As part of the hydrogeological investigation, CH2M HILL proposes to install a dedicated submersible bladder pump (QED or equivalent) in the existing wells (with the exception of those that are inaccessible by vehicle). The pumps would serve two purposes: over time they would save money as the time spent hand-bailing the 100-foot plus wells would be eliminated and the pumps are state-of-the-art for low flow sampling, which is important for metals and several of the natural attenuation indicator parameters. Any remedial action including a natural attenuation of groundwater component will require long-term groundwater monitoring.

The estimated LOE to collect the groundwater grab samples is 111 hours.

3.2.4.4 **Conduct Tidal Influence Study**—N/A

3.2.4.5 **Perform Hydraulic Tests (Pump Tests).** Not proposed at this time.

3.2.4.6 **Measure Groundwater Elevation.** Groundwater levels will be measured in all existing wells and any newly installed piezometers. The water level data will be used to determine site-specific groundwater flow directions and horizontal gradients within the unconfined and semiconfined aquifers.

The water levels will be collected, at a minimum, three times during the hydrogeological investigation. Because water levels have not been measured since November 1994, the water levels will be collected initially from the existing wells prior to the start of the field activities. The current water levels will be used to determine existing conditions and verify the conceptual model of groundwater flow direction and rates.

The later rounds of water level measurements will be collected in association with groundwater sampling.

The water levels will be collected in accordance with the procedures specified in the FSP and recorded in the field notebook. Groundwater elevations will be determined based on the surveyed elevation of a specified measurement point marked on the well casing and the measured depth to water from that point. The data evaluation is included under Task 6.2.

The estimated LOE for this subtask is 10 hours.

3.2.5 **Conduct Hydrogeological Investigations (Surface Water).** A surface water sample will be collected from each finger of the wetland located downgradient of the lagoon. The surface water samples will be collected in the same area of the sediments samples, and be analyzed for PCP, arsenic, copper, and zinc. One background surface water sample will be collected from the wetland in a location to be determined in the FSP. The estimated LOE for this subtask is 2 hours.

3.2.6 **Conduct Waste Investigation**—N/A

3.2.7 **Conduct Geophysical Investigation**—N/A

3.2.8 **Conduct Ecological Investigation.** A site visit will be conducted by an aquatic ecologist. Gaining permission from the property owner to access the wetland will be conducted under subtask 3.2.2.4. Activities to be conducted during the site visit include the following:

3.2.8.1 **Wetland and Habitat Delineation.** Existing aquatic, terrestrial, and wetland ecological habitat types (e.g., forest, cattail marsh) will be described, and the area covered by these habitats will be estimated. Potentially sensitive environments (e.g., migratory pathway, habitat known to be used by endangered or threatened species) will be noted.

The estimated LOE for this subtask is 12 hours, which includes travel time to the site.

3.2.8.2 **Wildlife Observations.** Casual observations of animal species or sign of a species while walking the area will be recorded. Studied observations will be made along a transect line in the early morning and evening hours by sitting still in one location for a period of time. The estimated LOE for this effort is 6 hours.

3.2.8.3 **Community Characterization.** Describe and, if possible, map soil and water types, land uses, and the dominant vegetation species present. The estimated LOE for this effort is 18 hours, which includes travel time from the site.

3.2.8.4 **Identification of Endangered Species.** The estimated LOE to request identification of threatened and endangered species in the site environs from the WDNR is 2 hours.

3.2.8.5 **Biota Sampling and Population Studies**—N/A

3.2.9 **Collect Contaminated Building Samples**—N/A

3.2.10 **Dispose of Investigation-Derived Waste.** CH2M HILL will characterize and dispose of investigation-derived wastes in accordance with local, state, and federal regulations as specified in the FSP. It is assumed that contaminated water will be treated and discharged onsite. The cost to treat the water will be assessed in the Treatability Study Work Plan, and the costs incorporated into WPRR No. 1. At this time the estimated LOE to handle and store the contaminated water for subsequent treatment during treatability testing is 15 hours.

Task 4—Sample Analysis

CH2M HILL will arrange for the analysis of environmental samples collected during the previous task. This task includes **ONLY** the cost of the sample analysis (including CH2M HILL's labor to analyze samples with the PCP immunoassay field kit). Efforts associated with sample collection are included in Task 3, efforts associated with shipment and validation are included in Task 5, and efforts associated with data evaluation are included in task 6. CH2M HILL will analyze the following samples:

4.1 **Screening-Type Laboratory Sample Analysis**

4.1.1 **Analyze Air and Gas Samples**—N/A

4.1.2 **Analyze Groundwater Samples.** An Ohmicron PCP immunoassay field test kit will be used to analyze groundwater grab samples (and soil samples) for PCP. The total cost for the calibration standards, extraction equipment, and rental of the spectrophotometer for one month is $3,540. The estimated LOE for a CH2M HILL chemist to perform the analysis of the groundwater grab samples is 48 hours, plus 12 hours travel time, and two hours of training. The training will be provided for free by the vendor. The total estimated LOE to analyze the samples is 62 hours.

4.1.3 Analyze Surface-Water Samples—N/A

4.1.4 Analyze Soil and Sediment Samples. The cost of the PCP field kit is included in subtask 4.1.2. The estimated LOE for a CH2M HILL chemist to analyze the soil samples for PCP is 35 hours.

4.1.5 Analyze Waste (Gas) Samples—N/A

4.1.6 Analyze Waste (Liquid) Samples—N/A

4.1.7 Analyze Waste (Solid) Samples—N/A

4.1.8 Analyze Biota Samples—N/A

4.1.9 Analyze Bioassay Samples—N/A

4.1.10 Perform Bioaccumulation Studies—N/A

4.2 CLP-Type Laboratory Sample Analysis

4.2.1 Analyze Air and Gas Samples—N/A

4.2.2 Analyze Groundwater Samples. Residential well samples will be analyzed for PCP. Monitoring wells samples will be analyzed for PCP, arsenic, copper, and zinc. The monitoring well samples will also be analyzed for natural attenuation parameters (see Table 4). The estimated cost of groundwater sample analysis is $23,095.

4.2.3 Analyze Surface-Water Samples. Three surface water samples and associated QA/QC samples will be analyzed for PCP, arsenic, copper, and zinc. The estimated analytical cost for the surface water samples is $1,875.

4.2.4 Analyze Soil and Sediment Samples. Soil samples to be analyzed at an offsite laboratory include a few confirmation samples for PCP, arsenic samples, and the sediment samples collected from the wetland that will be used for ecological risk characterization. The estimated analytical costs for the soil and sediment samples is $6,015.

4.2.5 Analyze Waste (Gas) Samples—N/A

4.2.6 Analyze Waste (Liquid) Samples—N/A

4.2.7 Analyze Waste (Solid) Samples—N/A

4.2.8 Analyze Biota Samples—N/A

4.2.9 Analyze Bioassay Samples—N/A

4.2.10 Perform Bioaccumulation Studies—N/A

Table 4 presents the analytical costs per type, parameter, matrix, and requested analysis time, and provides a total of all proposed analytical costs.

Table 4
Estimated Analytical Costs

Parameter	Task	Matrix	TAT	Method	No. of Samples (Units)	No. of QC Samples	Total No. of Samples (Units)	Cost per Sample (Unit)	TAT[1] Multiplier	Extended Cost
Delineation/Extent-Fixed Lab										
Pentachlorophenol	Residential Wells	water	STD	SW8270	4	4	8	$ 200.00	1.0	$ 1,600.00
Pentachlorophenol	Groundwater/Surface Water	water	7-day	SW8270	29	8	37	$ 200.00	1.5	$ 11,100.00
Pentachlorophenol	Soil Confirmation	soil	STD	SW8270	2	0	2	$ 225.00	1.0	$ 450.00
Pentachlorophenol	Sediment	soil	7-day	SW8270	8	4	12	$ 225.00	1.5	$ 4,050.00
Arsenic	Groundwater/Surface Water	water	7-day	SW7060	26	8	34	$ 20.00	1.5	$ 1,020.00
Arsenic	Surface Soil	soil	STD	SW7060	6	3	9	$ 25.00	1.0	$ 225.00
Arsenic	Sediment	soil	7-day	SW7060	7	4	11	$ 25.00	1.5	$ 412.50
Copper	Groundwater/Surface Water	water	7-day	SW6010	26	8	34	$ 20.00	1.5	$ 1,020.00
Copper	Sediment	soil	7-day	SW6010	7	4	11	$ 25.00	1.5	$ 412.50
Zinc	Groundwater/Surface Water	water	7-day	SW6010	26	8	34	$ 10.00	1.5	$ 510.00
Zinc	Sediment	soil	7-day	SW6010	7	4	11	$ 10.00	1.5	$ 165.00
TCLP-Arsenic	Concrete Pad	concrete	STD	SW1311/7060	3	0	3	$ 100.00	1.0	$ 300.00
									Subtotal	$ 21,265.00
Delineation/Extent-Immunoassay										
Pentachlorophenol	Groundwater	water	NA	Immunoassay	30	6	36	NA	NA	$ 1,770.00
Pentachlorophenol	Surface/Subsurface Soil	soil	NA	Immunoassay	22	4	26	NA	NA	$ 1,770.00
									Subtotal	$ 3,540.00
Natural Attenuation-Fixed Lab										
nitrate	Natural Attenuation	water	STD	IC-300(SW9056)	23	4	27	$ 25.00	1.0	$ 675.00
sulfate	Natural Attenuation	water	STD	IC-300(SW9056)	23	4	27	$ 20.00	1.0	$ 540.00
methane	Natural Attenuation	water	STD	SW8020/internal	23	4	27	$ 75.00	1.0	$ 2,025.00
manganese	Natural Attenuation	water	STD	SW6010	23	4	27	$ 20.00	1.0	$ 540.00
chloride	Natural Attenuation	water	STD	IC-300(SW9056)	23	4	27	$ 15.00	1.0	$ 405.00
carbon dioxide	Natural Attenuation	water	STD	SM4500-CO2D	23	4	27	$ 25.00	1.0	$ 675.00
TOC	Natural Attenuation	water	STD	SW9060/415.2	23	4	27	$ 25.00	1.0	$ 675.00
BTEX	Natural Attenuation	water	STD	SW8260/8020	23	4	27	$ 100.00	1.0	$ 2,700.00
alkalinity	Natural Attenuation	water	STD	EPA 310.1	23	4	27	$ 20.00	1.0	$ 540.00
soluble iron(FE2)	Natural Attenuation	water	STD	EPA 200.7(6010)	23	4	27	$ 35.00	1.0	$ 945.00
									Subtotal	$ 9,720.00
Field Parameters										
dissolved oxygen	Groundwater/Surface Water	water	NA	DO Meter	60	0	4 weeks	$ 75.00	1.0	$ 300.00
redox potential	Groundwater/Surface Water	water	NA	redox meter	60	0	4 weeks	$ 60.00	1.0	$ 240.00
pH	Groundwater/Surface Water	water	NA	pH meter	60	0	4 weeks	$ 60.00	1.0	$ 240.00
conductivity/temperature	Groundwater/Surface Water	water	NA	SCT meter	60	0	4 weeks	$ 60.00	1.0	$ 240.00
									Subtotal	$ 1,020.00
									TOTAL	$ 35,545.00

[1] TAT = Turnaround Time

Field Equipment rental	weekly rental
dissolved oxygen meter	$75
pH meter	$60
salinity/conductivity/temperature meter	$60
redox probe	$60

Task 5—Analytical Support and Data Validation

CH2M HILL will arrange for the analysis of environmental samples collected during the previous task. The sample support task begins with completion of the field sampling program and ends with the contractor validating the analytical data received from the laboratory.

CH2M HILL will perform the following activities:

5.1 **Prepare and Ship Environmental Samples**

5.1.1 **Groundwater Samples.** Approximately 37 groundwater samples will be collected during the RI and analyzed at an offsite laboratory for PCP, arsenic, copper, zinc, and several natural attenuation indicators, such as nitrate, sulfate, manganese, and others. The estimated LOE to prepare labels, sample tags, chain-of-custody, pack the samples on ice, and drive 2.5 hours round-trip to Federal Express in Duluth, Minnesota, is 45 hours.

5.1.2 **Surface and Subsurface Soil Samples.** Approximately 12 soil samples will be analyzed offsite either for PCP confirmation samples or for arsenic. It is assumed the samples will be shipped out with a shipment of groundwater samples. The estimated LOE to complete paperwork and pack the samples is 2 hours.

5.1.3 **Surface-Water and Sediment Samples.** Approximately 13 surface water and sediment samples will be analyzed offsite for PCP, arsenic, copper, and zinc. It is assumed the samples will be shipped the same day as the shipment of groundwater samples. The estimated LOE to complete paperwork and pack the samples is 10 hours.

5.1.4 **Air Samples**—N/A

5.1.5 **Biota Samples**—N/A

5.1.6 **Other Types of Media Sampling and Screening.** Two samples from the biopad cement pad, and one soil sample from adjacent to the pad will be analyzed offsite for TCLP-arsenic. The estimated LOE to complete paperwork and pack the sample is 1 hour.

5.2 **Coordinate with Appropriate Sample Management Personnel.** The estimated LOE for the field team to coordinate with the laboratory regarding sample arrival and for a chemist to resolve laboratory questions or problems is 28 hours.

5.3 **Implement USEPA-Approved Laboratory QA Program.** It is estimated a chemist will expend 4 hours per week while sampling is occurring to ensure the USEPA-approved laboratory QA program is followed. The total estimated LOE is 16 hours.

5.4 **Provide Sample Management (Chain-of-custody, sample retention, and data storage).** Two hours per day during sample collection are estimated to provide accurate chain-of-custody procedures for sample tracking, protective sample packing techniques, and proper sample-preservation techniques. The estimated LOE for this subtask is 14 hours.

5.5 **Validate Data - N/A.**

Task 6—Data Evaluation

CH2M HILL will organize and evaluate existing data and data gathered during the previous tasks that will be used later in the RI/FS effort. Data evaluation begins with the receipt of analytical data from the data acquisition task and ends with the completion of the Data Evaluation Summary Report. Specifically, CH2M HILL will perform the following activities or combination of activities during the data evaluation effort:

6.1 **Data Usability Evaluation and Field QA/QC.** CH2M HILL will evaluate the usability of the validated data, and evaluate the field data. The estimated LOE is 30 hours.

6.2 **Data Reduction, Tabulation, and Evaluation.** CH2M HILL will evaluate, interpret, and tabulate data in an appropriate presentation format for final data tables. CH2M HILL will design and set up an appropriate database for pertinent information collected that will be used during the RI/FS.

6.2.1 **Evaluate Geological Data (Soils and Sediments).** The soil data (stratigraphic and analytical) collected during the field investigation will be compiled with the data collected during the previous investigations. The geological data evaluation will include the following:

- Reducing analytical data and presenting it in a tabular format
- Preparing a technical memorandum documenting the data collection and sampling methods used in the geological investigations (soil and sediment)
- Examining the new and existing boring logs to determine the extent and continuity of the glacial till layer toward the northeast and northwestern portions of the site and updating the hydrogeologic cross sections
- Delineating the horizontal and vertical extent of soil contamination beneath former ACA building, the gullies from the oil-water separator and the lagoon, and in the wood chip pile area and presenting the results graphically
- Delineating the extent of site-related contamination in the sediment northeast of the site and presenting the results graphically
- Developing the conceptual model for the site stratigraphy and extent of soil and sediment contamination to be used in the contaminant transport modeling

The total LOE estimated for the geological data evaluation is 92 hours. The total LOE is based on the following:

- 12 hours to prepare the technical memorandum

- 20 hours to query and retrieve data from the database and to create summary tables
- 40 hours to evaluate the stratigraphic and analytical data
- 20 hours to produce the summary figures

6.2.2 **Evaluate Air Data.** CH2M HILL will evaluate the air data—N/A

6.2.3 **Evaluate Hydrogeological Data (Groundwater).** The hydrogeological data evaluation will include the following:

- Preparing a technical memorandum documenting the data collection and sampling methods used in the hydrogeological investigations
- Developing water level elevation maps, determining flow directions and rates for the unconfined and semiconfined aquifers
- Evaluating vertical groundwater gradients to determine if groundwater is discharging into the wetland area northeast of the site
- Evaluating the pump test data to determine the aquifer properties and developing distance-drawdown relationships
- Delineating the horizontal and vertical extent of groundwater contamination in the unconfined and semiconfined aquifers
- Evaluating the analytical groundwater data to determine if natural attenuation/biodegradation is currently occurring
- Developing the conceptual model for groundwater flow and extent of contamination to be used in the contaminant transport modeling and evaluation of remedial alternatives

The total LOE estimated for the hydrogeological data evaluation is 116 hours. The total LOE is based on the following:

- 12 hours to prepare the technical memorandum
- 36 hours to query and retrieve data from the database and create summary tables
- 56 hours to evaluate the water level and analytical data
- 12 hours to produce the summary figures

6.2.4 **Evaluate Hydrogeological Data (Surface Water).** The analytical data collected from the surface water samples will be summarized and compared with the groundwater results. The data will be evaluated to determine if contaminated groundwater is discharging to the wetland thereby providing an exposure pathway for humans and environmental receptors.

Based on the limited data to be evaluated, the estimated LOE to tabulate and complete the evaluation is 10 hours.

6.2.5 **Evaluate Waste Data**—N/A

6.2.6 **Evaluate Geophysical Data**—N/A

6.2.7 **Evaluate Ecological Data.** The estimated LOE to evaluate the ecological data is 8 hours.

6.3 **Modeling.** CH2M HILL will perform modeling as follows:

6.3.1 **Contaminant Fate and Transport.** Contaminant fate and transport modeling will be conducted based on the conceptual model of the site developed from the physical and analytical data collected during the field investigations. The transport modeling will focus on the leaching of contaminants through unsaturated zone followed by migration to the site boundary (or the wetland) via groundwater transport. The main objective of the modeling will be to estimate site-specific residual contaminant levels in the soil that are protective of groundwater (per the Wisconsin Administrative Code NR 720.19(3)). The results of the modeling will be used to determine the soil to cleanup criteria and the resulting volume of soil address in developing remedial alternatives for the contaminated soil.

The specific modeling software will be selected after reviewing the hydrogeological data and application of available software and discussions with USEPA and WDNR on an acceptable modeling approach. The results of the modeling will be presented in the Data Evaluation Report.

It is estimated that the contaminant fate and transport modeling will take 56 hours: 8 hours to review the data and select the best model, 40 hours to construct and run the model, and 8 hours to document and summarize the results.

6.3.2 **Water Quality**—N/A

6.3.3 **Groundwater.** CH2M HILL will evaluate the need to conduct groundwater modeling after the hydrogeologic investigation results are available to fill some of the data gaps mentioned previously, such as current groundwater gradients, continuity of the till layer northeast of MW 13, etc. If it is determined groundwater modeling is needed to support remedial alternatives discussions will be held with the WAM and the WDNR. The scope of work and costs would be addressed in a WPRR.

6.3.4 **Air**—N/A

6.3.5 **Other Modeling**—N/A

6.4 **Develop Data Evaluation Report**—N/A

Task 7—Risk Assessment

The Risk Assessment will determine whether site contaminants currently pose a potential risk to human health and the environment in the absence of any remedial action. The Human Health Risk Assessment (HHRA) is being prepared by others and will be made

available to CH2M HILL. The HHRA and Ecological Risk Assessment will be used to determine whether remediation is necessary at the site, provide justification for performing remedial action, and determine what exposure pathways need to be remediated.

If after review of the HHRA and the investigation results it is determined the HHRA should be updated with the new information collected during the RI, CH2M HILL will initiate discussions with the WAM.

7.1 **Human Health Risk Assessment**—N/A

7.2 **Ecological Risk Assessment.** An ecological risk assessment will be conducted for the PWP Superfund site to evaluate potential existing and future threats to the environment in the absence of any remedial action (USEPA, 1989). The risk assessment process for the PWP site will follow procedures as described in this Work Plan and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments Final* (USEPA, 1997). Under this guidance, a screening-level risk assessment will be conducted first.

Screening-level risk assessments are "simplified risk assessments that can be conducted with limited data by assuming values for parameters where data are lacking. " The screening-level assessment will be developed from the following format:

- Site visit (Task 3.2.8)
- Screening-level problem Formulation and Ecological Effects Evaluation
- Screening-level exposure estimate and risk calculation

7.2.1 **Draft Ecological Risk Assessment Report.** CH2M HILL will prepare a draft Ecological Risk Assessment Report that addresses the following:

Screening-Level Problem Formulation

The screening-level problem formulation will focus on the following five issues:

- Environmental setting and contaminants known or suspected to exist at the site
- Contaminant fate and transport mechanisms that might exist at the site
- The mechanisms of ecotoxicity associated with contaminants and likely categories of receptors that could be affected
- Identification of complete exposure pathways that might exist at the site
- Selection of endpoints for ecological risk

Characterization of the site and hazard identification. This first step will compile information that already exists from site history and reports related to the site. The environmental setting, including natural areas (e.g., upland forest, nearby wildlife refuge), as well as disturbed/man-made areas will be described. Part of the description of the environmental setting will be to describe existing aquatic, terrestrial and wetland ecological habitat types,

and estimate the area covered by these habitats. Likewise, any potentially sensitive habitats will be noted.

Contaminant fate and transport. During the problem formulation, pathways for migration of a contaminant (e.g., surface water runoff, erosion) will be identified. The highest contaminant concentrations measured on the site will be documented for each medium.

Mechanisms of ecotoxicity associated with contaminants and likely categories of potential receptors. Toxic mechanisms of each potential contaminant will be identified to evaluate the importance of potential exposure pathways and to focus the selection of assessment endpoints. The risk assessment team ecologists will determine what plants, animals, and habitats might exist or could be expected in the area of the site.

Identification of complete exposure pathways that might exist at the site. Potential exposure pathways will be evaluated. For an exposure pathway to be complete, a contaminant must be able to travel from the source to ecological receptors and to be taken up by the receptors via one or more exposure route. An ecological exposure pathways model will be constructed for the site. Most likely exposure pathways and exposures routes for particular receptors will be evaluated.

Selection of assessment and measurement endpoints. For this screening-level risk assessment, assessment endpoints are any adverse effects on ecological receptors, where receptors are plants and animal populations and communities, habitats, and sensitive environments. Adverse effects on populations will be inferred from measures related to impaired reproduction, growth, and survival. Adverse effects on communities will be inferred from changes in community structure or function. Adverse effects on habitat will be inferred from changes in composition and characteristics that reduce the habitats' ability to support the plant and animal populations and communities. The following preliminary assessment endpoints will be considered for the PWP site and potential "offsite area" adjacent to the site that may have received site contamination:

- soil quality (COPC content) that does not interfere with soil invertebrate and plant survival
- soil quality (COPC content) that does not interfere with small mammal survival, growth, and reproduction
- food source that does not interfere with large mammal, bird (including raptor) survival, growth, and reproduction.
- soil quality (COPC content) such that erosional run off from the site into adjacent wetlands and surface water (including sediment) resources does not interfere with growth, reproduction, and survival of aquatic life, wetland plants, birds, amphibians, and reptiles.

- sediment and surface water quality (COPC content) in downgradient wetlands such that does not interfere with growth, reproduction, and survival of aquatic life, wetland plants, birds, amphibians, and reptiles.

Screening-Level Ecological Effects Evaluation

The next step in the screening-level risk assessment will be the preliminary ecological effects evaluation and the establishment of contaminant exposure levels that represent conservative thresholds for adverse ecological effects (Toxicity Assessment/Ecological Effects Assessment). For this assessment a screening-level ecotoxicity value will be developed for each contaminant and complete exposure pathway/route. If possible, screening ecotoxicity values will represent a no-observed-adverse-effect-level (NOAEL) for long-term (chronic) exposures to a contaminant. If NOAELs (preferred) are not available then lowest -observed-adverse-effect-level (LOAELs) will be used with a correction factor of 0.1 applied. If LOAELs are not available then LC_{50} or EC_{50} values will be reviewed for appropriate application to this risk assessment.

Screening-Level Exposure Estimate

For this screening-level risk assessment the highest measured onsite contamination for each environmental medium will be used to estimate exposure (Exposure Assessment). In the absence of site-specific information, the following conservative assumptions will be used to develop an estimate of exposure:

- Area use factor—for the screening-level exposure estimate for terrestrial animals, invertebrates, plants, aquatic organisms, it will be assumed that the home range is within the contaminated area (includes adjacent "offsite" areas), and thus the organisms are exposed 100 percent of the time.

- Bioavailability—for this screening-level exposure estimate, it will be assumed that bioavailability of contaminants at the site is 100 present.

- Life stage—for this screening level assessment, it will be assumed that the most sensitive life stages are present.

- Body and food ingestion rates—estimates of body weight and food ingestion rates of receptor animals will be obtained from USEPA's *Wildlife Exposure Factors Handbook* (USEPA, 1993a,b) as a preferred source.

- Bioaccumulation—The most conservative BCF values identified in the literature will be used to estimate bioaccumulation.

- Dietary composition—for species that feed on more than one type of food, the assumption will be that the organisms diet is composed entirely of whichever type of food is most contaminated.

Screening-Level Risk Calculation

For screening-level risk calculation, the hazard quotient (HQ) approach , which compares point estimates of screening ecotoxicity values and exposures values will be used (Risk Characterization). The screening ecotoxicity value will be equivalent to a documented and/or best conservative estimated chronic NOAEL (preferred). Thus, for each contaminant and environmental medium, the hazard quotient will be expressed as the ratio of a potential exposure level to the NOAEL.

An HQ less than one (unity) indicates that the contaminant alone is unlikely to cause adverse ecological effects. If multiple contaminants of potential ecological concern exist at the site, HQs that produce effects by the same toxic mechanisms will be summed into a hazard index (HI). An HI less than one indicates that the group of contaminants is unlikely to cause adverse ecological effects.

Uncertainty Assessment

In each stage of the screening-level risk assessment, limitations to information produce degrees of uncertainty (identification of limitations and uncertainty). Professional judgment will be used to determine the uncertainty associated with information taken from the literature and any extrapolations used in the development of screening ecotoxicity values. Limitations in the use of the values will be discussed in the context of this site assessment. Likewise, uncertainty associated with the assumptions used in the estimate of exposure will also be discussed.

Scientific/Management Decision Point (SMDP)

The results of the screening-level ecological risk assessment will be communicated to the risk manager. The risk manager will need to decide whether the information available is adequate to make a risk management decision. Possible decision points will be the following:

- There is adequate information to conclude that ecological risks are negligible and, therefore, no need for remediation in the basis of ecological risk
- The information is not adequate to make a decision at this point, and the ecological risk assessment process will continue
- The information indicates a potential for adverse ecological effects, and a more through assessment is warranted

Under the SMDP, if the information indicates a potential for adverse ecological effects, discussions will be initiated with the WAM to determine if a more thorough assessment is warranted.

It is estimated literature analysis will require 4 hours; and report preparation will require 80 hours by the author, 8 hours each for a graphics artist and an editor, and 4 hours for senior review. The total estimated LOE for this subtask is 96 hours.

7.2.2 **Final Ecological Risk Assessment Report.** After the draft Ecological Risk Assessment Report has been reviewed and commented on by USEPA, the contractor will incorporate USEPA comments and submit the final Ecological Risk Assessment Report. The estimated LOE for this subtask is 38 hours.

Task 8—Treatability Study and Pilot Testing

Based on review of the previous treatability studies conducted at the site, and technical direction from the WAM, some of the technologies that may be suitable as site remedies have been identified during the planning stage for this Work Plan. At present it is expected that an in situ bioventing pilot study will be conducted for soil remediation, and ultraviolet dechlorination by sunlight pilot study will be conducted for extracted groundwater. Bench-scale tests involving laboratory testing of undisturbed core soil samples collected during the in situ bioventing pilot test are also anticipated. Other potential studies may include investigating the use of a Biotrol Fixed Film Biological Water Treatment System, and sending water samples to a carbon vendor, and possibly an ultraviolet-oxidation vendor for batch testing. CH2M HILL will submit a testing plan identifying the types and goals of the studies. The treatability studies will determine the suitability of remedial technologies to site conditions and problems.

In accordance with the schedule established in the approved RI/FS Work Plan, CH2M HILL will perform the following activities:

8.1 **Literature Search.** CH2M HILL will conduct a literature search and contact applicable vendors. CH2M HILL also plans to attend a free seminar being held in Milwaukee on remediation at wood treatment sites at which ERT will present their treatability results from the PWP site. The estimated LOE for this subtask is 50 hours.

8.2 **Develop Treatability and Pilot Work Plan.** CH2M HILL will prepare the Treatability Study Work Plan, and associated costs to perform the treatability tests, and submit the plan to the USEPA for review and approval. The Treatability Study Work Plan will describe the technology to be tested, test objectives, test equipment or systems, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety procedures, and residual waste management. The DQOs for the treatability study will also be documented. The Treatability Study Work Plan will also describe pilot plant installation and startup, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed offsite, permitting requirements will be addressed. A schedule for performing the treatability study will be included with specific dates for each task and subtask, including USEPA review periods. Key milestones that will have completion dates specified include the procurement of contractors, the completion of sample collection, the performance period, sample analysis, and report preparation.

The Treatability Study Work Plan will describe in detail the treatment process and how the proposed vendor or technology will meet the performance standards for the site. It will address how the subcontractor will meet all discharge or disposal

requirements for any and all treated material, air, water, and expected effluents. Additionally, the Work Plan will explain the proposed final treatment and disposal of all material generated by the proposed treatment system. During the development of the Treatability Study Work Plan, the costs associated with performing the tests will be developed and presented as WPRR No. 1. Preparation of the Treatabilty Study Work Plan is estimated to require 170 hours, and preparation of WPRR No. 1 is estimated to require 50 hours. The total estimated LOE for Subtask 8.2 is 220 hours.

Treatability studies will be conducted as described in the USEPA-approved Final Treatability Study Work Plan. In accordance with the SOW, this RI/FS Work Plan estimates 0 LOE and $0 for conducting the treatability studies/pilot tests. The following activities may be required during the performance of the treatability study and pilot testing:

8.3 **Bench Test**

8.3.1 **Procure Test Facility and Equipment.** CH2M HILL will procure test facility and equipment, including the procurement procedures necessary to acquire the vendor, equipment, or facility to execute the tests.

8.3.2 **Provide Vendor and Analytical Service.**

8.3.3 **Test and Operate Equipment.** CH2M HILL will test equipment to ensure operation, then start up and operate the equipment.

8.3.4 **Retrieve Sample for Testing.** CH2M HILL will obtain samples for testing as specified in the Treatability Study Work Plan.

8.3.5 **Perform Laboratory Analysis.** CH2M HILL will establish a field laboratory to facilitate fast-turnaround analysis of test samples, or, if necessary, will procure outside laboratory services to analyze the test samples and evaluate test results.

8.3.6 **Characterize and Dispose of Residuals.**

8.4 **Pilot-Scale Test**

8.4.1 **Procure Test Facility and Equipment.** CH2M HILL will procure test facility and equipment, including the procurement procedures necessary to acquire the vendor, equipment, or facility to execute the tests.

8.4.2 **Provide Vendor and Analytical Service.**

8.4.3 **Test and Operate Equipment.** CH2M HILL will test equipment to ensure operation, then start up and operate the equipment.

8.4.4 **Retrieve Sample for Testing.** CH2M HILL will obtain samples for testing as specified in the Treatability Study Work Plan.

8.4.5 **Perform Laboratory Analysis.** CH2M HILL will establish a field laboratory to facilitate fast-turnaround analysis of test samples, or, if necessary, will procure outside laboratory services to analyze the test samples and evaluate test results.

8.4.6 **Characterize and Dispose of Residuals.**

8.5 **Field Test**

8.5.1 **Procure Test Facility and Equipment.** CH2M HILL will procure test facility and equipment, including the procurement procedures necessary to acquire the vendor, equipment, or facility to execute the tests.

8.5.2 **Provide Vendor and Analytical Service**

8.5.3 **Test and Operate Equipment.** CH2M HILL will test equipment to ensure operation, then start up and operate the equipment.

8.5.4 **Retrieve Sample for Testing.** CH2M HILL will obtain samples for testing as specified in the Treatability Study Work Plan.

8.5.5 **Perform Laboratory Analysis.** CH2M HILL will establish a field laboratory to facilitate fast-turnaround analysis of test samples, or, if necessary, will procure outside laboratory services to analyze the test samples and evaluate test results.

8.5.6 **Characterize and Dispose of Residuals.**

8.6 **Develop Treatability Study Report.** Thirty days after completion of the Treatability Study, CH2M HILL will prepare and submit the Treatability Study Evaluation Report that describes the performance of the technology. The study results will clearly indicate the performance of the technology or vendor compared with the performance standards established for the site. The report will also evaluate the treatment technology's effectiveness, implementability, cost, and final results compared with the predicted results. The report will also evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

Task 9—Remedial Investigation Report

CH2M HILL will develop and deliver a Remedial Investigation (RI) report that establishes the site characteristics such as media contaminated, extent of contamination, and the physical boundaries of the contamination. Pursuant to this objective, CH2M HILL will obtain only the minimally essential amount of detailed data necessary to determine the key movement and extent of contamination. The key contaminants will be selected based on persistence and mobility in the environment and the degree of hazard. The key contaminants identified in the RI will be evaluated for receptor exposure, and an estimate of the key contaminants level reaching human or environmental receptors will be made. It is assumed the Human Health Risk Assessment prepared by others will be available to CH2M HILL prior to initiation of the RI Report. CH2M HILL will use existing standards and guidelines such as drinking-water standards, water-quality criteria, and other criteria accepted by the USEPA as appropriate for the situation to evaluate effects on receptors who may be exposed to the key contaminants above appropriate standards or guidelines.

9.1 **Draft RI Report.** In accordance with the schedule developed in the RI/FS Work Plan, CH2M HILL will submit a draft RI Report which includes the following.

- Site Background. CH2M HILL will assemble and review available facts about the regional conditions and conditions specific to the site under investigation.

- Investigation
  - field investigation and technical approach
  - chemical analysis and analytical methods
  - field methodologies
    - biological
    - surface water
    - sediment
    - soil boring
    - soil sampling
    - groundwater
    - hydrogeological assessment

- Site characteristics
  - Geology
  - Hydrogeology
  - Meteorology
  - Demographics and land use
  - Ecological assessment

- Nature and extent of contamination
  - contaminant sources
  - contaminant distribution and trends

- Fate and transport
  - contaminant characteristics
  - transport processes
  - contaminant migration trends

- Summary and conclusions.

The tabulated data and data evaluation report prepared under Task 6 will be incorporated into the RI Report. Field procedures prepared for the FS will be modified as needed if deviations were required, and incorporated into the RI Report. It is assumed approximately 20 figures will be generated, requiring 60 hours. Compiling and summarizing previous site investigation data is estimated to require 100 hours. Refining the conceptual site model and evaluating the key contaminants extent, fate and transport, and potential receptor exposure is estimated to require 120 hours. Writing the site background section, the site investigation section, the conclusions and executive summary, and coordinating the production of the report and appendixes is estimated to require 240 hours. The total estimated LOE for this subtask is 520 hours.

9.2 **Final RI Report.** After USEPA and WDNR review of the draft RI Report, CH2M HILL will incorporate comments as directed by USEPA and submit the final RI Report. It is assumed 24 hours will be required to respond to comments in writing, 30 hours will be required for figure modifications, and 50 hours will be required for report revisions. The total estimated LOE for this subtask is 104 hours.

Task 10—Remedial Alternatives Screening

CH2M HILL will investigate only those hazardous waste management alternatives that will remediate or control contaminated media (soil, surface water, groundwater, sediments) remaining at the site, as deemed necessary in the RI, to provide adequate protection of human health and the environment. The potential alternatives will encompass, as specified in the NCP, a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of hazardous substances but vary in the degree to which long-term management of residuals or untreated waste is required, with one or more alternatives involving containment with little or no treatment; and a no-action alternative. Alternatives that involve minimal efforts to reduce potential exposures (e.g., site fencing, deed restrictions) will be presented as "limited action" alternatives.

10.1 **Prepare Draft Technical Memorandum.** CH2M HILL will prepare a draft technical memorandum presenting the potential alternatives and including the following information:

- Establish Remedial Action Objectives. Based on existing information, CH2M HILL will identify site-specific remedial action objectives which should be developed to protect human health and the environment. The objectives will specify the contaminants and media of concern, the exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals). CH2M HILL assumes the Human Health Risk Assessment Report being prepared by others will be available to CH2M HILL prior to the start of this task. A groundwater leaching model may be used to develop soil PRGs. It is estimated development of the RA objectives will require 80 hours. A letter summarizing the objectives will be sent to the USEPA for discussion and eventual agreement. It is assumed that concurrence on the objectives can be achieved before this subtask is complete.

- Establish General Response Actions. CH2M HILL will develop general response actions for each medium of interest by defining contaminant, treatment, excavation, pumping, or other actions, singly or in combination to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characteristics of the site. Development of the representative response options is estimated to require 65 hours.

- Identify and Screen Applicable Remedial Technologies. CH2M HILL will identify and screen technologies based on the developed general response actions. Treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other site characteristics will be considered. The presumptive guidance for wood treater sites will be followed as applicable. It is anticipated that treatment technologies considered will be bioremediation, low temperature thermal desorption, and groundwater extraction and treatment. Representative process options will be selected to carry forward into alternative development. Treatability testing for those technologies that are probable candidates for consideration during the detailed analysis will have been identified in the

Treatability Study Work Plan. Identifying and screening the applicable technologies is estimated to require 125 hours.

- Develop Remedial Alternatives in accordance with NCP. The development of the alternatives is estimated to require 200 hours. The effort will include combining representative response actions into alternatives, brainstorming the appropriateness of suggested alternatives, and developing the alternatives in sufficient detail for the technical memorandum and the identification of action-specific ARARs. An additional 70 hours is estimated to write and internally review the technical memorandum.

- Screen Remedial Alternatives for Effectiveness, Implementability, and Cost. CH2M HILL proposes to eliminate this step in the FS process in accordance with presumptive remedy guidance. Because of the limited options for remediation of pentachlorophenol-contaminated soils, it is anticipated that sufficient reasonable alternatives will be developed without the need for this initial alternative screening step.

The total estimated LOE for subtask 10.1 is 540 hours.

10.2 **Prepare Final Technical Memorandum.** After USEPA review of the draft technical memorandum, CH2M HILL will incorporate USEPA comments and submit the final technical memorandum. The estimated LOE for this subtask is 70 hours, which includes 20 hours for figure revisions.

Task 11—Remedial Alternatives Evaluation

CH2M HILL will perform a Remedial Alternatives Evaluation. The alternatives evaluation task is the analysis of the alternatives that were developed in Task 10. The evaluation consists of four steps: (1) defining the alternative sufficiently to support a +50/-30 percent cost estimate and identify the key ARARs associated with the alternative; (2) developing capital costs, operation and maintenance costs, and present worth calculations for each alternative; (3) analyzing the alternatives individually with respect to the nine evaluation criteria; and (4) comparing and contrasting the alternatives to one another with respect to the nine evaluation criteria (the last two criteria can not be evaluated before a public meeting is held). A table will be provided summarizing the results of this analysis. The purpose of this task is to develop information that will help decisionmakers select the appropriate alternative for implementation at the site.

Because presumptive remedies for wood treating sites have been established by USEPA, it is assumed that no more than five base alternatives for soil and four base alternatives for groundwater will be evaluated. Base alternatives may have up to two contingent actions. Disciplines such as hydrogeologists and wastewater engineers (for groundwater pump and treat), chemists and process engineers (for soil bioremediation), and geotechnical engineers (for slope stabilization and soil covers) will support the definition of the alternatives. It is anticipated that 120 hours will be used to develop the initial conceptual design on the alternatives. About 40 hours will be needed by a regulatory specialist to define ARARs for the alternatives. It is estimated that 50 hours will be required to guide the effort and support the disciplines. The individual analysis of the alternatives will involve 100 hours supported

by 20 industrial hygienist hours to assess short-term effectiveness. The comparative analysis of alternatives is estimated to require 40 hours.

To develop the +50/-30 percent relative cost estimate for alternative comparison, a schedule for implementing the RA will be developed. It is anticipated that 80 hours will be required to estimate the implementation schedule for five remedial actions. Conducting the cost estimate will require 150 hours. Coordination and documentation of the cost estimating effort will involve 60 hours.

The total estimated LOE for Task 11 is 640 hours.

Task 12—FS Report and RI/FS Report

CH2M HILL will develop a FS Report consisting of a detailed analysis of alternatives and cost-effectiveness analysis in accordance with NCP 300.68(h)(3)(I)(2), and 300.430(e) and (f). The report will contain a summary of alternative remedial actions, cost analysis, institutional analysis, public-health analysis, and environmental analysis.

12.1 **Prepare Draft FS Report.** CH2M HILL will prepare a draft FS and submit to USEPA according to the schedule in the RI/FS Work Plan. The FS Report will contain the following:

- Summary of feasibility study objectives
- Summary of remedial objectives
- General Response Actions
- Identification and screening of remedial technologies
- Remedial alternatives description
- Detailed analysis of remedial alternatives. The technical feasibility considerations will include the careful study of any problems that may prevent a remedial alternative from mitigating site problems. The site characteristics will be kept in mind as technical feasibility of each alternative is studied. Specific items that will be addressed are reliability (operation over time), safety, operation and maintenance, ease with which the alternative can be implemented, and time needed for implementation.
- Summary and conclusions

The report is estimated to be about 500 pages, including appendices. Included in the appendices will be details of the cost estimates and details of worker exposure calculations for the short-term effectiveness evaluation, and the ARARs evaluation. An estimate of 50 hours will be used to produce figures, and 140 hours to organize the information produced during the FS and oversee production of the report. Internal review of the report and revisions are estimated to require 20 hours. The estimated LOE for this subtask is 210 hours.

12.2 **Prepare Final FS Report.** After USEPA review of the draft FS Report, CH2M HILL will incorporate USEPA comments and submit the final FS Report. The estimated LOE for this subtask is 40 hours.

Task 13—Post RI/FS Support

CH2M HILL will provide technical support required for preparation of the proposed plan and ROD for the site. The support may include the following activities: attendance at public meetings, briefings, and technical meetings; review of presentation materials; technical assistance on review of the Responsiveness Summary and Proposed Plan and ROD; and any review of a Feasibility Study Addendum. In accordance with the SOW 100 LOE are assumed for this task.

CH2M HILL will provide post RI/FS support as directed by the WAM and within the limitations of the budget. CH2M HILL will monitor the expenditures on this task and advise the WAM of budget status and the need for a WPRR, if needed.

Task 14—Negotiation Support—N/A

Task 15—Administrative Record—N/A

Task 16—Work Assignment Closeout

CH2M HILL will perform the necessary activities to close out the WA in accordance with contract requirements.

16.1 **Package and Return Documents to Government.** CH2M HILL will sort, package and return all documents to USEPA. The estimated LOE for this subtask is 12 hours.

16.2 **Prepare Closeout Report.** CH2M HILL will prepare a Work Assignment Closeout Report (WACR). The WACR will include all LOE by P-level and costs in accordance with the WBS. The estimated LOE for this subtask is 12 hours.

Project Management

Project Organization

The WA will be managed out of CH2M HILL's Milwaukee office. Technical personnel used on this WA will also be from the Milwaukee office, with the exception of the Treatability Test Manager, who is in the Chicago office. Specialized technical expertise may also be brought in from other offices as needed. Gina Bayer will serve as the SM and will work directly with the Region V WAM. She will have primary responsibility for execution of this WA. Dong-Son Pham will serve as the Assistant SM.

The project organization is shown in Figure 6. A site team has been selected to support Ms. Bayer based on each member's qualifications and experience with the technical issues to be addressed at this site. Resumes of key team members are presented in Attachment A. Table 6 is a comparison of CH2M HILL E-grades to USEPA P-levels for the key personnel. Currently, the following individuals have been identified: Joe Sandrin will serve as the Review Team Leader (RTL) and Phil Smith as Senior Reviewer, as described later; Jewelle Keiser will serve as lead hydrogeologist, Eric White will lead the treatability testing, and Dong-Son Pham will serve as the Assistant Site Manager and Field Task Manager. The functions of each will be coordinated by the SM.

TABLE 5
Comparison of P-Level to E-Grade for Key Personnel

Personnel	USEPA P-Level	CH2M HILL E-Grade	Education	Years of Experience
Al Sloan-Program Manager	P4	ES6	BS	24
Gina Bayer-Site Manager	P3	ES4	BS	13
Dong-Son Pham-Asst. Site Manager	P1	ES2	MS	7
Joe Sandrin-Review Team Leader	P4	ES6	BA	19
Phil Smith-Senior Review	P4	EN6	BS	20

Schedule Control

As the project progresses, the SM will monitor the progress of the project against the task schedules and due dates for deliverables. The SM will be responsible for maintaining and updating, as appropriate, the project schedule.

The SM will keep the WAM informed of known or anticipated slippage or acceleration of the project elements. If slippage of tasks within the control of CH2M HILL occurs or is

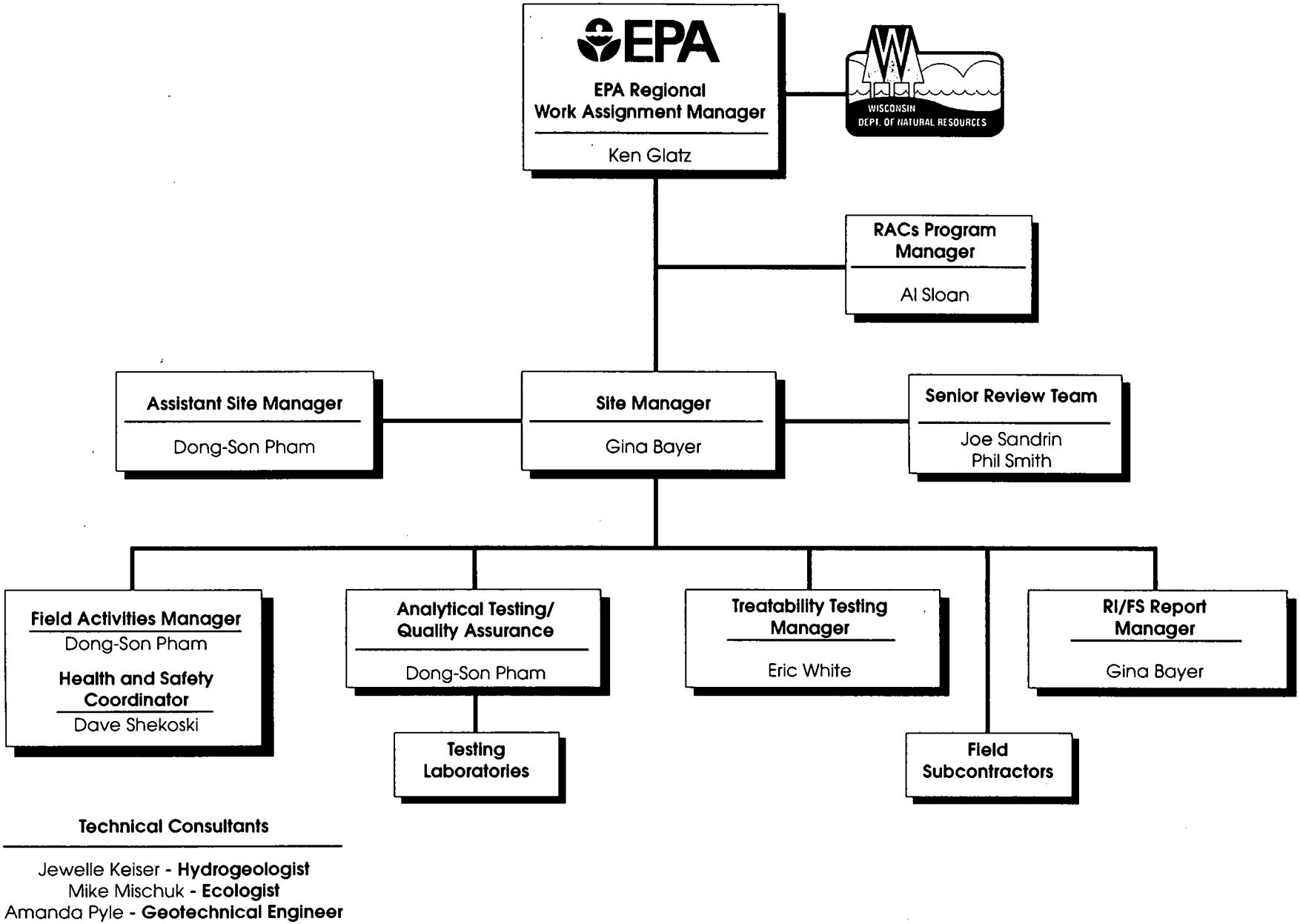

FIGURE 6
CH2M HILL Project Organization
Penta Wood Products RI/FS Work Plan

anticipated, the SM will develop and outline available methods to maintain the overall project schedule. If slippage occurs as a result of actions outside the control of CH2M HILL, the SM will inform the WAM and will assist in determining if the slippage involves a modification to the WA as a result of a schedule modification.

Cost Control

Attached to this Work Plan is a detailed summary of projected labor and expense costs broken down by individual activities and tasks (Detailed Task Cost Table). The cost monitoring system for this project will provide the SM with a monthly report of current and cumulative site costs, down to the subtask level. This monitoring system will be used to track budget versus actual expenditures on individual site activities and will give the SM a clear indication of deviations in project delivery costs.

The SM will keep the WAM informed of the status of the budget. If the costs of tasks within the SOW are anticipated to exceed the established budget, the SM will alert the WAM before a change in costs occurs and will work with the WAM to realign costs. Project management methods available include shifting funds from other tasks, and if technically feasible, reducing the LOE on individual tasks and reducing the scope of individual tasks. Additional funds will be requested only as a last resort. Changes in the SOW or in the assumptions made in this scope that will result in a change in costs will be identified early so appropriate actions can be taken.

The SM will monitor expenditures and travel costs, encourage the site team to maximize use of government travel discounts, and check subcontractor invoices for reasonableness and for compliance with the terms of their contracts. No subcontractor charges in excess of contracted budgets will be authorized or paid without clear documentation of their validity. Should the subcontractor costs exceed the amount approved by the USEPA, reapproval will be obtained.

Coordination with the USEPA and Other Parties

CH2M HILL anticipates interacting with only the USEPA unless directed otherwise by the WAM. The WAM for the USEPA is Ken Glatz. All questions, comments, and communications from CH2M HILL will be to the USEPA and will be coordinated through the SM. Outside questions and comments to CH2M HILL will be directed to the USEPA. CH2M HILL will have contact with other involved parties only after USEPA approval.

Quality Control

The key to quality control of this project is the RTL, Joe Sandrin, and senior reviewer, Phil Smith. The RTL's role will be to support the SM in project management activities and to act as the coordinator of CH2M HILL internal reviews. All deliverables to the USEPA will be reviewed. The reviews ensure technical quality, as well as readability of deliverables.

Phil Smith's role will be to guide the technical and regulatory aspects of the presumptive remedies. Phil has extensive experience with site characterization and remedial evaluation and was on WDNR's NR 700 series advisory board during rule development.

The RTL and senior reviewer will also be involved in the planning activities conducted at the beginning and during the project. This allows them to better understand the project and to provide initial direction to the project.

Project Schedule

The schedule for completing this WA is presented in Figure 7. The project schedule incorporates the following assumptions:

- USEPA approval of the revised Work Plan no later than July 25, 1997, and approval of the Site Plans no later than September 8, 1997
- USEPA and WDNR reviews of deliverables is completed within the specified times
- Analytical data will be analyzed within 7 days, and CH2M HILL will receive a copy of the data within seven days
- CH2M HILL will receive the Human Health Risk Assessment (draft) by June 26
- WPRR No. 1 will be submitted concurrently with the Treatability Study Work Plan
- Pilot test results of in situ-bioremediation may not be available prior to the ROD, thus necessitating a contingency ROD.

Table 6 summarizes the major project deliverables. In coordination with the WAM, CH2M HILL will seek to shorten the project schedule by use of teleconferences and other methods to expedite decisions and to communicate progress during the RI/FS.

TABLE 6
Summary of CH2M HILL Deliverables

Deliverable	Due Date
Work Plan	May 23, 1997
Revised Work Plan	July 9, 1997
Site Plans	August 11, 1997
Treatability Study WP with WPRR No. 1	August 18, 1997
Remedial Alternatives Memorandum	September 6, 1997
Draft RI Report	January 9, 1998
Draft FS Report	March 12, 1998
Final RI Report	March 12, 1998
Treatability Study Report	January 23, 1998
Final FS Report	April 30, 1998

Figure 7
Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Task 1 Project Planning**	394d	4/10/97	9/30/98
2	1.1.1 Kickoff Meeting	0d	4/24/97	4/24/97
3	1.1.2 Conduct Site Visit	0d	5/1/97	5/1/97
4	1.1.3 Evaluate Information	16d	4/18/97	5/9/97
5	1.1.4 RI/FS Work Plan	21d	4/24/97	5/23/97
6	EPA review work plan	23d	5/27/97	6/26/97
7	1.1.4.2.1 Negotiation Meeting	0d	6/18/97	6/18/97
8	1.1.4.2.2 Prepare Revised Work Plan	7d	7/1/97	7/9/97
9	EPA review revised Work Plan	12d	7/10/97	7/25/97
10	1.2 Prepare Site Plans	11d	7/28/97	8/11/97
11	EPA review plans	24d	8/12/97	9/8/97
12	1.3 Project Management	394d	4/10/97	9/30/98
13	1.4 Procure Subcontractors	27d	7/28/97	8/29/97
14	**Task 2 Comm. Relations Technical Support**	254d	4/10/97	3/18/98
15	**Task 3 Fieldwork**	21d	9/9/97	9/29/97
16	3.1.1 Set up Support Facilities	2d	9/9/97	9/10/97
17	3.2.4.2 Collect existing mw samples & water levels	3d	9/11/97	9/13/97
18	3.2.1.3 Survey prior coordinate system	5d	9/9/97	9/13/97
19	3.2.1.2 & 3.2.2.1 Collect res. wells and surficial soils	1d	9/14/97	9/14/97
20	3.2.2.4 & 3.2.5 Collect surface water and sediments	1d	9/15/97	9/15/97
21	3.2.8 Conduct ecological visit	2d	9/15/97	9/16/97
22	3.2.4.3 Cone Penetrometry Testing and gw grabs	15d	9/15/97	9/29/97
23	3.2.1 Survey new sample locations	5d	9/25/97	9/29/97
24	**Task 4 Sample Analysis**	37d	9/13/97	10/27/97
25	4.1.2 & 4.1.4 Conduct PCP kit testing	15d	9/15/97	9/29/97
26	4.2 Off-site lab analysis	37d	9/13/97	10/27/97
27	**Task 5 Analytical Support and Data Validation**	62d	9/14/97	12/2/97
28	**Task 6 Data Evaluation**	10d	12/3/97	12/16/97
29	6.2 Data Reduction, Tabulation, & Evaluation	5d	12/3/97	12/9/97
30	6.3 Modeling	5d	12/10/97	12/16/97
31	**Task 7 Ecological Risk Assessment**	81d	10/14/97	2/3/98
32	7.2.1 Draft Ecological Risk Assessment Report	47d	10/14/97	12/17/97
33	EPA Review of Draft Eco Report	22d	12/18/97	1/16/98
34	7.2.2 Final Ecological Risk Assessment Report	12d	1/19/98	2/3/98

Figure 7
Project Schedule

ID	Task Name	Duration	Start	Finish
35	**Task 8 Treatability Study and Pilot Testing**	164d	6/24/97	1/23/98
36	8.1 Literature Search	32d	6/24/97	8/6/97
37	8.2 Treatability Study Work Plan & WPRR No. 1	10d	8/7/97	8/18/97
38	EPA Review Treat. Work Plan & WPRR No. 1	17d	8/19/97	9/8/97
39	8.5 Perform Bench and Field Tests	90d	9/9/97	1/2/98
40	8.6 Treatability Study Report	15d	1/5/98	1/23/98
41	**Task 9 RI Report**	67d	12/10/97	3/12/98
42	9.1 Draft RI Report	23d	12/10/97	1/9/98
43	EPA Review of Draft RI Report	23d	1/12/98	2/11/98
44	9.2 Final RI Report	21d	2/12/98	3/12/98
45	**Task 10 Remedial Alternatives Screening**	69d	7/28/97	10/16/97
46	10.1 Draft Remedial Alternatives Memorandum	33d	7/28/97	9/6/97
47	EPA Review Remedial Alternatives Memorandum	24d	9/7/97	9/30/97
48	10.2 Final Remedial Alternatives Memorandum	12d	10/1/97	10/16/97
49	**Task 11 Remedial Alternatives Evaluation**	77d	10/17/97	2/2/98
50	**Task 12 FS Report and RI/FS Report**	56d	2/12/98	4/30/98
51	12.1 Draft FS Report	21d	2/12/98	3/12/98
52	EPA Review Draft FS Report	21d	3/13/98	4/10/98
53	12.2 Final FS Report	14d	4/13/98	4/30/98
54	**Task 13 Post RI/FS Support**	26d	5/1/98	7/31/98
55	**Task 16 Work Assignment Closeout**	43d	8/3/98	9/30/98

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Appendix A

Resumes

Regina C. Bayer

Certified Hazardous Materials Manager

Education

B.S., Water Chemistry, University of Wisconsin-Stevens Point

Professional Registration

Certified Hazardous Materials Manager, Master's Level

Experience

Ms. Bayer is a water chemist specializing in hazardous waste management. She has over 13 years of experience in the environmental field, including 11 years of experience working primarily with CERCLA sites. Her work has entailed environmental field sampling and laboratory analysis, site evaluations, remedial investigation, and design. Her experience also includes the construction, development, and application of the USEPA's Superfund Hazard Ranking System, project management, and supervision of staff.

She recently served as project manager for the Arrowhead Refinery site RD/RA, which was completed in 2 years and under budget despite funding delays. This site was the first mixed-fund settlement case in the USEPA Region V, with PRPs, USEPA, and the State responsible for the separate but interrelated aspects of the cleanup. The remedial action included chemical extraction, residual stabilization, excavation, and disposal.

She is currently project manager for Fields Brook Oversight RI/FS–RD/RA project in Ohio. She served as project manager for an oversight RI/FS project at a U.S. DOE Superfund site in Ohio from 1992 to March 1997. Prior to 1993 she served as the assistant project manager for several oversight RD/RA projects at the Arrowhead Refinery site including incineration, bioremediation , and soil washing. Other responsibilities with CH2M HILL have included preparation of environmental impact statements and environmental assessments for highways and hazardous waste landfills; preparation of a remedial investigation report and a feasibility study report for a site with hexavalent chromium contamination and a landfill site; and analytical support in close support laboratories.

As a state coordinator for a large consulting firm responsible for the preremedial assessment of potential hazardous waste sites in USEPA Region 5, Ms. Bayer provided technical and administrative oversight of 20 staff members and provided liaison with the Wisconsin Department of Natural Resources, Illinois EPA, Minnesota Pollution Control Agency, and the USEPA.

She has participated in hundreds of Superfund site inspections, through which she has gained experience in sampling groundwater, surface water, sediment, soil and soil gas, and low-level mixed waste. She has also performed ambient air monitoring at Superfund sites. The sites she has evaluated have included steel foundries, asphalt pavers, wood preservation facilities, electronic component manufacturing facilities, hazardous and mixed waste landfills, chrome and zinc plating facilities, iron ore mining operations, and pesticide formulation facilities. Activities she has participated in have included literature and title searches; obtaining rights of entry; interviews with persons knowledgeable of the site and its environs; development of Work Plans, quality assurance/quality control plans, and site

safety plans; site inspections; data validation and interpretation; and report and hazard ranking score generation. In addition, Ms. Bayer has completed a 40-hour radiation training course for Superfund work.

Ms. Bayer was a project manager for an expanded "test case" Superfund site design to evaluate the draft revised Hazard Ranking System. Groundwater sampling activities at the site had documented a release of tetrachloroethane to drinking water supplies. Air, surface water, soil, and sediment sampling and fish collection were used to determine the extent of contamination and assess pathways and targets of contamination. Ms. Bayer tested the Hazard Ranking System model with several scenarios and presented her conclusions to the MITRE Corporation and the USEPA.

She has monitored the work of onsite contractors at drilling sites to ensure cost-effectiveness and compliance with applicable permits and regulations. She has also supported field laboratory efforts at various U.S. Air Force bases and Federal Aviation Authority sites, performing soil vapor analyses with a Photovac, herbicide/pesticide analyses using a gas chromatograph/HPLC, volatile organics analyses with a purge and trap gas chromatograph, and metals analyses with a furnace atomic absorption instrument.

For a project funded by the U.S. Navy, Ms. Bayer participated in sampling activities and data interpretation to determine the effects of extremely low frequency radiation on bog plants. For that project, she operated atomic absorption instruments.

At a laboratory certified by the USEPA's Contract Laboratory Program, Ms. Bayer determined the hazardous constituent content of industrial products using gas chromatography and various extraction methods.

Ms. Bayer was involved in a University of Georgia project at the U.S. Department of Energy's Savannah River Plant in Aiken, South Carolina. She analyzed surface water samples for nutrients and mercury to assess the thermal and water quality impacts of the plant's cooling water on the Savannah River watershed.

Ms. Bayer has taken continuing education classes at Northern Illinois University and Marquette University in environmental geochemistry, statics and dynamics, and fluid mechanics.

Ms. Bayer participated in timber stand improvement, estimating timber volume, and firefighting with the U.S. Forest Service in Wyoming. She has participated in the trapping of mammals and aquatic organisms for population estimates.

While completing her bachelor's degree, Ms. Bayer designed and conducted a nitrates/pesticides survey of private wells located in the sand plains of central Wisconsin.

Joseph A Sandrin

QA/QC Specialist

Education

Graduate Work, Organic Chemistry, University of Wisconsin—Milwaukee
B.A., Chemistry, Ripon College

Distinguishing Qualifications

- Strong working relationships with EPA Region V and IDEM QA staff, and continued demonstrated success at executing planning documents that are fully acceptable to both IDEM and Region V.
- Senior project chemist and QA/QC manager experience on four large multi-SWMU RFI/corrective measure study (CMS) projects for S.C. Johnson & Son, Vulcan Chemical, and Chevron Chemical.
- Managed procurement of analytical services for more than 10 projects, involving more than $2 million in analytical costs.

Relevant Experience

Mr. Sandrin is an environmental chemist specializing in hazardous waste management. His experience includes quality assurance, chemist, and data management roles for a variety of industrial and military projects.

He is the CH2M HILL Great Lakes regional office coordinator working with EPA Region V on issues related to QAPP preparation and review and analytical data quality review and validation. He has prepared and reviewed numerous QAPPs for RCRA facility investigations (RFIs) remedial investigations, remedial designs (treatability studies), and remedial actions (long-term monitoring and performance monitoring during remediation) in Region V under RCRA and CERCLA.

Mr. Sandrin also serves as project manager for oversight of base closure activities at two DOD facilities in Indiana. This work is performed under the Region V ARCS contract. Mr. Sandrin is involved in USEPA RCRA, CERCLA and IDEM issues related to investigation, remediation, and base closure activities at these facilities. Work includes review of QAPPs, analytical data, and interactions with Region V and IDEM QA staff.

Mr. Sandrin has extensive experience in the planning and delivery of onsite laboratory and analytical support to projects in the field. He has managed multiple projects where onsite laboratories have been used to provide real time rapid turnaround for analysis of groundwater and soil samples. Onsite laboratories have been used for analysis of metals, volatiles, PCBs, PAHs, and other parameters. The onsite laboratories have significantly improved project performance and assisted the project team in completing fieldwork in a rapid manner.

Mr. Sandrin is serving as task manager for analytical services and data management for the RCRA Corrective Action project for a large steel manufacturer. He is responsible for managing development and implementation of an Oracle database system that will be used to support future investigation and remediation work. The database is being developed to

support multiple ongoing projects and will be set up and documented so that the facility can operate, maintain, and manage the database over the life of the project.

He also is developing a scope of services and contracting approach for analytical support to best meet project requirements, maximize efficiency, and control costs for analytical services, data management, and data validation. An approach is being developed to integrate lab services, data validation, and data management to minimize project costs, speed the availability of validated data to the project team, and provide a quality product.

Mr. Sandrin has served as senior project chemist for RFIs for private clients in EPA Region V. He has worked on multi-SWMU RI/CMS assignments as senior project chemist or QA/QC manager for S.C. Johnson & Son, Vulcan Chemical, and Chevron Chemical. He negotiated with EPA Region V Quality Assurance staff, developed the analytical approach, selected target compounds for analysis, selected appropriate analytical methods for the study, prepared the QAPP, managed laboratory support, and validated and reviewed data from laboratory analyses. The efforts have also included obtaining Region V approval for use of an onsite lab in lieu of offsite analysis for metals analysis at one facility. As project chemist, Mr. Sandrin has been responsible for developing data management systems and approaches to data management for these projects. He was responsible for establishing the initial programs for receipt of electronic deliverables from laboratories for RCRA projects. He currently serves as a senior consultant and reviewer for data management projects in the Milwaukee environmental data management group.

Mr. Sandrin managed and participated in development of a sitewide QAPP covering multiple operable units and media for a DOE facility in Ohio. This work included development of a sitewide data validation plan and processes for developing data quality objectives for investigation work.

He developed, managed, and participated in a large-scale project to review and perform data validation in support of the RI work at a Department of Energy (DOE) facility in Ohio. The project delivered more than 30,000 hours of services in 6 months to meet project schedule and budget requirements. Mr. Sandrin also was responsible for quality control review of data validation work performed by project staff.

Philip R Smith

Hazardous Waste Specialist

Education

B.S., Civil Engineering, Marquette University

Professional Registrations

Professional Engineer: Wisconsin, Ohio

Distinguishing Qualifications

- Extensive experience in performing hazardous waste investigation and remediation studies, preparing wastewater system facility plans, and conducting environmental assessments
- In-depth knowledge of requirements of CERCLA and RCRA, the USEPA RI/FS and RCRA guidance documents, ARAR issues, and the scientific and engineering aspects of corrective measures

Relevant Experience

Mr. Smith is a senior environmental engineer who has more than 20 years' experience in performing hazardous waste remediation studies, preparing wastewater system facility plans, conducting environmental assessments (EAs), and investigating potentially leaking underground storage tanks (USTs). He has conducted site inspections or performed environmental sampling at more than 20 sites. The studies he has participated in have included the analyses of waste characteristics, geohydrology, geochemistry, hydrology, and air quality.

As both a team member and project manager, Mr. Smith has been involved in remedial investigations and feasibility studies (RIs/FSs) at Superfund sites and for private clients. In addition, he has served as a senior reviewer for numerous other RIs/FSs.

Some of his more recent work has been at U.S. Air Force bases (AFB) across the country. He serves as senior reviewer for investigation and remediation work at many of the Installation Restoration Program sites at Wright-Patterson AFB (WPAFB) in Dayton, Ohio. He also was the project manager and primary author of the WPAFB Management Action Plan (MAP), which presented comprehensive remediation strategies for the 66 sites at the base. The MAP includes estimates of the most probable remedial actions and the associated investigation, design, and construction costs for each site.

He also serves as senior technical advisor for two operable units at Hill AFB in Salt Lake City, Utah. Each unit includes complex geology and remedial approaches that focus on control of LNAPL and DNAPL and the downgradient dissolved phase groundwater plumes. A variety of in situ treatment option treatability studies for remediation of the pure phase contamination are underway at these sites. In addition, existing data has been developed and evaluated for documentation and prediction of natural attenuation of chlorinated solvents.

At the K.I. Sawyer AFB, he conducted RIs/FSs at seven sites including fire training areas, USTs, disposal sites, and JP-4 spill sites. The investigations and remedial alternative development included a focus on natural attenuation approaches for many of the sites.

Mr. Smith was the task leader for a private client interim action, which included design and construction of a groundwater collection and treatment system to prevent discharges to a nearby creek. For the Muskegon Chemical Company NPL site in Muskegon, Michigan, he was the task leader for a FS that considered a range of soil and groundwater actions. Special emphasis was placed on development of risk-based cleanup goals, treatability studies, and methods to reduce the duration of groundwater cleanup during the project.

Mr. Smith's technical expertise has been sought over the years for development of USEPA guidance documents and State of Wisconsin hazardous waste regulations. He was a senior technical consultant for and the author of two of the more important USEPA guidance documents, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* and *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*. For the State of Wisconsin, he served on the Technical Advisory Committee for the development of the Department of Natural Resources (DNR) hazardous waste regulations (NR700 series). Over the course of 2 years, Mr. Smith advised the DNR on how the regulations could be written to achieve the best balance of promoting remediation that is protective, yet cost-effective relative to the risks posed.

Mr. Smith was a senior reviewer of RI and RCRA facility investigation activities and technical manager of treatability testing, FSs, and corrective measures (CMs) for Robins AFB in Macon, Georgia. The base has more than 30 solid waste management units (SWMUs) and one CERCLA National Priorities List (NPL) site either being cleaned up or investigated. Mr. Mr. Smith has supported the base in the resolution of ARAR issues with the Georgia EPA and the USEPA. His in-depth knowledge of the requirements of CERCLA and RCRA, the USEPA RI/FS and RCRA guidance documents, ARAR issues, and the scientific and engineering aspects of CMs allows him to serve as the focal point for coordination of the many complex issues relating to cleanup of multiple sites. Mr. Smith was also the primary author of the first Record of Decision for the base and the Remedial Action Strategy Plan, which integrated CMs for soils and groundwater at the base.

Mr. Smith served as a senior reviewer for USEPA oversight of cleanup efforts at the Reilly Industries Superfund site in Indianapolis, Indiana. This facility occupies more than 100 acres and is both an NPL and a RCRA corrective action site, with more than 20 SWMUs. Mr. Smith's input has enabled the potentially responsible parties (PRPs) to focus on more cost-effective and protective CMs that comply with both CERCLA and RCRA requirements. Mr. Smith also served as FS and CMs study task manager at other NPL and RCRA CA sites owned by private-sector clients.

Mr. Smith completed a fast-track FS for a contaminated drinking water source in Des Moines, Iowa. Tasks included a major pump test, groundwater modeling, technology screening, alternatives development, detailed analysis of alternatives, and air dispersion modeling of air stripper trichloroethene emissions. All work was performed in close coordination with state and federal agencies and the PRPs over the course of 2.5 months.

Philip R. Smith

Mr. Smith was project manager for a CERCLA FS for the McCormick and Baxter wood preserving facility in Stockton, California. Several remedial actions focusing on capping and bioremediation of soil contaminated with pentachlorophenol and polynuclear aromatic hydrocarbons were developed for the 29-acre site. Of particular concern was the development of remedial actions at the site that would allow the client to maintain existing operations.

On a project for DuPont, Mr. Smith was FS task leader for a CERCLA NPL landfill site in Clinton, Iowa. Because impacts on public health and the environment were minimal at the site, the FS, with concurrence from the State of Iowa, focused only on containment alternatives. Following completion of the FS, an alternative was selected that upgrades the existing cap and provides for groundwater monitoring. The selected remedy includes a clause that would allow for implementation of a more rigorous containment alternative if negotiated groundwater contaminant levels are exceeded at the site boundary.

Mr. Smith was project manager of the CERCLA RI/FS for the 11-acre Onalaska Landfill site near La Crosse, Wisconsin. The remedial investigation of the landfill was completed in one phase of field work and focused on identification of the extent of groundwater contamination and the location and extent of a solvent disposal area within the landfill. A field laboratory was used for same-day sample analysis and aided in judiciously selecting monitoring well placement and soil sample collection. The remedy selected by the USEPA included an NR 504 cap, groundwater interception, groundwater treatment using aeration for iron precipitation followed by clarification and sludge dewatering, and in situ biological treatment of heavily contaminated soil outside the landfill.

Mr. Smith managed the CERCLA remedial investigation of the Morris Arsenic site in Minnesota. RIs were successful in identifying the extent of contamination at the site. Analysis of results and the resulting risk assessment indicated that no action was necessary for cleanup at the site and the site was deleted from the NPL. USEPA Region V gave CH2M HILL the highest possible performance rating for this project.

Dong-Son V. Pham

Project Chemist

Education

M.S., Water Chemistry, University of Wisconsin
B.S., Mathematics/Chemistry, University of Wisconsin

Experience

Mr. Pham is a project chemist for CH2M HILL who has participated in laboratory setup, laboratory data management and data validation, sample collection and analysis, quality assurance/quality control, and report writing. He has been involved in writing quality assurance project plans and field sampling plans, developing cost proposals, and conducting environmental assessments.

Mr. Pham has participated in a variety of data validation activities, including the remedial investigation/ feasibility study (RI/FS) at Wright-Patterson Air Force Base (Ohio) and K.I. Sawyer Air Force Base (Michigan). He has also served as the project chemist for setup, management, and operation of the close support laboratory for the RI/FS at Wright-Patterson. Soil and groundwater samples were analyzed at the onsite laboratory for select contaminants.

For the Arrowhead Superfund site in Minnesota, Mr. Pham served as the assistant site manager. His responsibilities included coordination of field oversite and air monitoring activities, budget management, laboratory and data management, and assisted in report writing.

Mr. Pham has served as the field team leader for long-term monitoring activities at the Master Disposal Service Landfill site in Wisconsin. His responsibilities included laboratory procurement and setup, coordination of field activities, laboratory and data management, and report writing.

For a Vulcan Chemical (Wisconsin) RCRA site contaminated with mercury, Mr. Pham helped prepare procurement documents, reviewed data, and assisted in setting up the close support laboratory.

Mr. Pham was involved in CH2M HILL's work at the Onalaska Landfill Superfund site in Wisconsin. His responsibilities included procuring laboratories and managing the analytical portion of the project.

Mr. Pham has served as the project chemist for setup and operation of the close support laboratories for the Boarhead Farms and Paoli Railyard Superfund sites in Pennsylvania.

Before joining CH2M HILL, Mr. Pham served as a research specialist in the Water Chemistry Program at the University of Wisconsin. He was in charge of a project funded by the U.S. Environmental Protection Agency to determine PCB concentrations in Green Bay. He was responsible for all aspects of analytical chemistry for determining the PCB concentrations, gas chromatograph analyses, and quality assurance/quality control measures. As a research assistant in the same program, Mr. Pham conducted research on the fate and transport of PCBs in the environment. He also gained experience with wet

extractions and atomic absorption spectroscopy while involved in the Water Chemistry Program.

Membership in Professional Organizations

American Chemical Society
International Association of Great Lakes Research

Publications

Physical, Chemical, and Biological Factors Contributing to the Fate and Transport of PCB Congeners in Green Bay Sediments. Master's thesis. University of Wisconsin. 1993.

With A. Andren et al. *Application of the Mass Balance Approach to Green Bay: Sediment Loading, Fluxes and Redistribution of PCBs, Dieldrin and Other Chlorinated Hydrocarbons*. EPA Report. 1993.

Mass, Distribution, and Sedimentation Rates of Total and Individual Congeners in Green Bay. Presented at the EPA Conference: Green Bay Mass Balance Study Meeting, Chicago. December 1992.

PCB Congener Distribution in Green Bay. Presented at the Midwest Environmental Chemistry Conference, Madison, Wisconsin. October 16–17, 1992.

Jewelle Imada Keiser

Senior Hydrogeologist

Education

M.S., Geology and Geophysics/Hydrogeology, University of Hawaii
B.S., Geology, Michigan State University

Professional Registrations

Certified Professional Geologist: AIPG (CPG 8409)
Certified Professional Geologist: Indiana, Wisconsin, Pennsylvania
Certified Hazardous Materials Manager: The Institute of Hazardous Materials Management (CHMM No. 3189)

Experience

Ms. Keiser is a senior hydrogeologist and the Group Leader of CH2M HILL's Groundwater Resources Group in the Great Lakes Region. She has over 10 year of experience as a hydrogeologist in the environmental field. Her professional experience demonstrates an extensive background as a site manager, lead hydrogeologist and project reviewer. Her responsibilities have included managing and conducting remedial investigations/feasibility studies (RI/FSs) and writing the associated reports; developing and managing a health and safety program and a quality assurance/quality control program; preparing critical reviews; and preparing environmental management plans, Work Plans, field sampling plans (FSPs), quality assurance project plans (QAPPs), and other technical documents. She is familiar with state and federal regulations and in working with and negotiating with regulatory agency personnel.

Ms. Keiser has provided technical assistance on remedial investigations and feasibility studies for hazardous waste sites in the Midwest. She is currently the site manager for one PRP oversight project and has been the site manager for two other completed Superfund sites in Region 5. In addition, she has provided technical assistance as project hydrogeologist or reviewer for 20 other Superfund sites in Region 5. Her experience includes evaluation and interpretation of hydrogeologic data for sites in Minnesota, Michigan, Indiana, and Wisconsin. She has also designed and evaluated effectiveness of groundwater contamination or extraction systems for the purpose of aquifer restoration for sites in Ohio, Indiana and Minnesota

Ms. Keiser is the Site Manager (SM) for the RI/FS oversight and risk assessment at the Tomah Sanitary Municipal Landfill Superfund site, Tomah, Wisconsin. The City of Tomah owns and operated a landfill into which unknown quantities of residential, commercial and industrial wastes were disposed. The Source Control RI has been completed by the PRPs. The investigation identified the major contaminants in the groundwater to be vinyl chloride (maximum concentration of 370 μg/L) and benzene (maximum concentration of 33 μg/L). The human health and ecological risk assessment was developed by CH2M HILL and the draft risk assessment was completed in three months. The PRPs are currently finalizing the Source Control Feasibility Study. Ms Keiser's responsibilities for this project include technical assistance to EPA, review of the PRP documents, coordination of field oversight personnel and managing the risk assessment activities.

Ms. Keiser's was the SM for an RI/FS and risk assessment at the Tomah Fairgrounds Landfill Superfund site in Tomah, WI. The project involved working with the EPA, Wisconsin Department of Natural Resources (WDNR) and the City of Tomah (the PRPs) to conduct a very streamlined RI/FS. Based on the existing data and using the presumptive remedy approach for the landfill, the approved field effort consisted of a limited and focused groundwater (5 monitoring wells) and surface soil (12 sampling locations) investigation. Based on the preliminary results of the RI, the City of Tomah agreed to place institutional controls such that the site use remains nonresidential and the installation and use of private wells on the site and directly downgradient is prohibited; and to develop a limited groundwater monitoring program. Thus, potential future risk from the site could be minimized and further action for the site was not considered warranted under the current land use. The EPA decided that an FS was not necessary to move forward on a no-action Record of Decision (ROD) and the ROD was signed in September 1996. The entire Work Assignment was completed in a year and a half for about 69 percent of the approved LOE and 64 percent of the approved budget.

Ms. Keiser is the project manager and lead hydrogeologist for the decommissioning and closure of a metal finishing facility in Kenosha, Wisconsin. Based on reconnaissance of the surface soils upon the building removal, a groundwater collection system was installed simultaneously with the subsurface soil investigation. The investigation discovered VOC contamination in the groundwater unrelated to site activities. Ms. Keiser was involved in negotiating with the WDNR to not chase the VOC plume and to limit the remedial action to the groundwater collection with disposal to the local water treatment plant and using the site as a parking lot.

Ms. Keiser is involved as a senior hydrogeologist for the Corrective Measures Study for the Vulcan Chemicals site in Port Edwards, Wisconsin. Her responsibilities included developing the conceptual model and evaluation of potential soil and groundwater corrective action alternatives. As part of this task, contaminant transport and migration from the potential source areas to the Wisconsin River (and its associated wetlands) were evaluated to support natural attenuation/biodegradation as the recommended corrective action for groundwater. The CMS Report is currently being reviewed by WDNR.

In addition, to knowledge of general hydrogeology, Ms. Keiser provides expertise in numerical modeling of groundwater flow and contaminant transport. With focus on groundwater flow assessments and contaminant transport modeling, she has modeled the groundwater impacts from leachate at several landfill sites; at downgradient receptors from SWMUs at K.I. Sawyer and Wright-Patterson Air Force Bases to determine the need for soil and/or groundwater remediation; and on water levels due to surface application of treated effluent by the Landis Sewerage Authority, New Jersey. She was also support computer modeler for the Miami Wellfield study for the City of Dayton.

In another position, she was the lead reviewer of Superfund projects for the Office of Inspector General's evaluation of the USEPA's remedial planning process. Her reviews focused on the technical soundness, and procedural, investigative and decision making processes used in the completion of projects from initial assessments phases through the RI/FS, ROD and RD/RA phases. The reviews included projects in Region 5 (Bofors-Nobel site, Muskegon, MI), Region 6 (Koppers Texarkana site, Texarkana, TX), Region 4 (North

Hollywood Dump site, Memphis, Tennessee), and Region 9 (Purity Oil Sales, Inc. site, Fresno, CA).

Membership in Professional Organizations

American Institute of Professional Geologists (AIPG)
American Geophysical Union (AGU)
Association of Groundwater Scientists and Engineers (a Division of NWWA)
Association for the Environmental Health of Soils
Institute of Hazardous Materials Management

Erik White

Industrial Process Engineer

Education

M.S., Environmental Engineering, University of Michigan, Ann Arbor, MI
B.S., Civil Engineering, University of Massachusetts, Amherst, MA

Distinguishing Qualifications

- Experience in hazardous waste site assessment and remediation projects
- Project engineer for industrial gas and physiochemical and biological wastewater treatment system evaluation projects
- Experience in preparation of SPCC and FRP plans pursuant to EPA regulations

Relevant Experience

Mr. White took part in a feasibility study for operating a full-scale, 2-stage Activated Sludge Plant (ASP) at a refinery industrial wastewater treatment plant. The study was initiated in response recently passed NESHAP regulations and consisted of both laboratory and field work. The field study included installing, implementing, and operating a 2-stage ASP pilot unit onsite. Study results indicated that operating a full-scale, 2-stage ASP would not work, thus saving millions of dollars that would have been spent in the design and installation of a full-scale system.

Mr. White took part in preparing piping and instrumentation diagrams for a light oil recovery facility at a coke byproducts plant to meet OSHA Process Safety Management (PSM) regulations. Duties included reviews of existing drawings, in-field verification of actual piping and instrumentation layouts, and creation of a database file that contains a list of instrumentation and equipment at the light oil recovery facility. The completed drawings served as a necessary first step to meet the complete OSHA PSM regulations.

Mr. White was the project engineer for updating existing SPCC and FRP Plans, for an integrated steel mill along Lake Michigan, to meet July 1, 1994, EPA regulations for preparation of SPCC and FRP Plans. The project was initiated by an EPA letter that contained comments regarding the FRP Plan previously submitted. The letter requested that some items be addressed within 30 days and others within 60 days. Both deadlines were met.

Erik performed a feasibility study on the addition of a finishing mill oily waste stream into an existing physical-chemical wastewater treatment process. Duties included in-field laboratory studies, cost comparison calculations for transporting the waste stream to the existing process, and report generation.

Mr. White was involved in several hazardous waste site assessment and remediation projects. Duties included researching state and county files, overseeing the installation of both overburden and bedrock monitoring wells, conducting soil and groundwater sampling, interpreting data, conducting soil gas surveys to further delineate extent of contaminant plumes, supervising the installation of recovery wells, conducting soil vapor extraction pilot tests, supervising the excavation of various underground storage tanks, and

preparing various groundwater elevation maps and NPDES permit applications. Other duties included the implementation, operation, and maintenance of remediation systems consisting of separate phase petroleum recovery in conjunction with activated carbon treatment for the dissolved constituents, soil vapor extraction, and free-phase petroleum recovery in conjunction with air stripping and catalytic incineration.

Mr. White performed a treatability study to test the effectiveness of removing light nonaqueous phase liquid (LNAPL), groundwater containing dissolved constituents of LNAPL, and soil vapor under vacuum-enhanced extraction. Duties included preparing specifications and drawings for bidding, obtaining vendor quotations, working with the vendor during design, and implementing the system. The system is operating and exceeding client expectations.

Mr. White was involved in the evaluation of an existing gas cleaning system for a plasma arc cupola for a foundry in Ohio. The project was initiated because the client was not able to meet the Ohio EPA emission limits for the plasma arc cupola, which was considered a new source. Onsite duties included observation of system operation, inspection of system internals, and collection of data. In-house duties included preparation of a spreadsheet program that predicts air temperature and velocities at different points within the gas cleaning system and interaction with vendors for upgrading of certain components that would improve overall gas cleaning system performance. The project resulted in the recommendation that relatively inexpensive modifications would improve the system efficiency to reliably pass the emission limits set forth by the Ohio EPA.

Michael W. Mischuk

Aquatic Biologist

Education

M.A., Biology, St. Cloud State University
B.A., Biology, St. Cloud State University

Distinguishing Qualifications

- Broad experience in site safety coordination
- Experience at nuclear processing plant and Superfund sites

Relevant Experience

Mr. Mischuk is an aquatic biologist who specializes in freshwater ecology, biomonitoring of aquatic ecosystems, bioassessments of waterways receiving point source contaminant discharges, evaluation of impacts of Superfund and construction sites on freshwater resources, restoration of freshwater habitat, and site safety coordination. He has performed bioassessments of streams, rivers, and lakes, receiving point source discharges and evaluated freshwater resources associated with hazardous waste sites and construction sites. He is also involved in freshwater habitat restoration.

Mr. Mischuk was site safety coordinator and field team leader for the aquatic sampling effort at the Rocky Flats nuclear processing plant in Colorado. The types of samples collected included fish tissue, benthic invertebrate, sediment, and water samples.

At the Boarhead Farms Superfund site in Pennsylvania, Mr. Mischuk served as site safety coordinator and field team leader for the collection of sediment, surface water, and benthic invertebrate samples. This work was conducted as part of the eco-risk assessment for the remedial investigation (RI) at the site.

For the Fieldsbrook Superfund site in Ohio, Mr. Mischuk oversaw and reviewed an ecologic risk assessment to evaluate the affects of inorganic, organic, and radiological contamination on the environment.

Under the Region III ARCs contract, Mr. Mischuk characterized stream sediment deposits from PCBs as part of the RA for the Paoli Rail Yard Superfund Site in Pennsylvania.

Under the Region III ARCS contract, Mr. Mischuk conducted ecological fieldwork for an RI/FS at Halby Chemical Superfund Site in Delaware. This former industrial site is polluted with petroleum hydrocarbons and heavy metals. The fieldwork included collecting fish tissue and sampling sediment.

Mr. Mischuk conducted an ecological risk assessment from radiological contamination for the RI/FS at the Kerr Magee Superfund site in Illinois.

For Elmendorf Air Force Base in Alaska, Mr. Mischuk conducted a field investigation and participated in ecological risk assessment of heavy metals and petroleum hydrocarbons on Ship Creek and associated ponds and streams.

He was a senior biologist for Integrated Paper Services, Inc., of Appleton, Wisconsin. His responsibilities there included design and implementation of research to investigate and evaluate the effects of effluent discharges on receiving stream water quality.

As an associate scientist at the Institute of Paper Chemistry, Mr. Mischuk spent 12 years conducting investigations aimed at assessing the effects of pulp and paper wastewater discharges on freshwater ecosystems. His work included instream bioassessments with macroinvertebrates and algae as indicators of biological integrity. He also used bioassays to perform compliance monitoring for NPDES permits and conducted eutrophication assessments using algal bioassays and nutrient loading models.

While working for the Minnesota Department of Natural Resources as an aquatic biologist, Mr. Mischuk served as field operations coordinator and principal investigator for the design and implementation of a study to characterize periphyton populations in rivers and streams proximate to a proposed copper/nickel mine. The work included obtaining technical information for development of public policy and regulation for a new mineral industry in Minnesota.

Mr. Mischuk conducted research on algal populations in the Mississippi River near Monticello, Minnesota. His efforts were in support of an ecological monitoring program for a nuclear power plant owned by Northern States Power Company.

Membership in Professional Organizations

Phycological Society of America
North American Benthological Society

Publications

With D. L. Rades. *Use of Filter-feeding Caddisfly Larvae to Assess Instream Reductions of 2,3,7,8-TCDD and TCDF.* Monograph No. 90-001M. 1990. Integrated Paper Services Inc.

With J. R. Weber, Jr. A Synopsis of 25 years of Instream Biomonitoring in the Vicinity of a Bleached Kraft Mill. *Proceedings, Environmental Aspects of Pulping Operations and Their Wastewater Implications.* Edmonton, Alberta. July 27–28, 1989.

With D. L. Rades. A Stable Artificial Substrate Device (Tri-Basket Sampler) for Collecting Macroinvertebrate Samples from Streams and Rivers. *Wisconsin Academy of Science, Arts and Letters* 137(1985): 186–188.

With M. Tesmer and J. Teed. *A Modified Approach to Community Comparison in Aquatic Systems.* Institute of Paper Chemistry Technical Series No. 137. 1984.

Use of the Algal Assay Bottle Test in Assessing Nutrient Effects of Pulp and Paper Effluents on Receiving Streams. *Proceedings of the Technical Association of the Pulp and Paper Industry, Environmental Conference.* 1983.

Heated Water Effects Upon Primary Production. Master's thesis. St. Cloud State University. 1976.

Amanda M. Pyle

Civil Engineer

Education

M.S., Civil and Environmental Engineering, University of Wisconsin–Madison
B.S., Civil Engineering, University of Washington

Professional Registrations

PECFA Consultant Registration No. 247012

Relevant Experience

Ms. Pyle is a civil engineer specializing in compiling and interpreting water well logs for landfill hydrologic studies; calculating landfill gas headloss through an LFG collection system for flare replacement; and collecting sediment samples for multi-spectrum contaminant analysis. Ms. Pyle has experience in pilot scale studies of in situ bioventing at Superfund sites. She is currently researching the feasibility of a unique field screen technique for low levels of hydrocarbon contamination in soils.

Ms. Pyle acted as field engineer at Wyckoff EPA Superfund site. Her responsibilities included collecting split spoon continuous soil borings for geologic logging; organizing, proofing, and interpreting soil boring lab test results for groundwater extraction well design; assisting in extraction well screen design; overseeing drilling, installation, and development of groundwater extraction well screens; collecting groundwater samples for multi-spectrum contaminant analysis; gathering groundwater elevations and producing groundwater contour maps; assisting in project management and planning; and preparing scheduling and man-hour planning.

As a student intern for a geotechnical consultant in Alaska, Ms. Pyle researched and compilated existing federal and state regulation pertaining to erosion control structures and methods. She wrote and edited documents including erosion control field reference guides and office manuals for major Alaskan oil companies' engineering staff. Ms. Pyle also served as the lab technician and was responsible for soil sample preparation and analysis to determine physical parameters for use in engineering design.

Ms. Pyle was a student intern for the State of Alaska's Department of Natural Resources where she worked on the State's Geographic Information System; annotated cultural features; verified the position accuracy on the Sun Microsystems Workstation; and mapped and quantified environmental contamination areas in the Prince William Sound resulting from the Exxon Valdez oil spill.

Membership in Professional Organizations

Member of the American Society of Civil Engineering and Women in Engineering