HEALTH ASSESSMENT
MOSS-AMERICAN
MILWAUKEE, WISCONSIN
CERCLIS NO. WID039052626
February 18, 1991

Prepared by:
Wisconsin Division of Health
Madison, Wisconsin

State of Wisconsin

PUBLIC COMMENT DRAFT

This Health Assessment will be available for public comment from February 25, 1991 to March 28, 1991. Persons who wish to comment or have questions about this report should contact the Division of Health, PO BOX 309, Madison Wi 53701-0309, or telephone (608) 267-6844.

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Health Assessments

Statement of Purpose

The federal "Superfund" law requires the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) to prepare a health assessment for all toxic waste sites that the U.S. Environmental Protection Agency (EPA) proposes for placement on the Superfund list (called the National Priorities List).* The Wisconsin Division of Health works with the ATSDR to prepare health assessments. The purposes of health assessments are:

1. to evaluate whether contaminants at the site pose a current or future threat to public health;

2. to recommend any steps needed to protect the public from exposure to toxic substances; and

3. to recommend long-term health studies, when appropriate.

For each site assessment health professionals look at the types of contamination present, including each substance's toxicity; ability to move through soil, air or water; persistence in the environment; and ability to accumulate in the food chain. They look at such ways that people could come in contact with the contaminants as ingestion, skin contact, or breathing. Investigators make conclusions about the types of illness that could result from exposure to the chemicals present. Finally, they recommend actions to protect public health now and in the future.

The EPA and the Wisconsin Department of Natural Resources provide much of the sampling data used for the assessment. This health assessment incorporates information from the remedial investigation that the EPA oversaw at this site.

* Officially, this section of the "Superfund" law is 42 U.S.C. §9604 (i).

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Agency for Toxic Substances and Disease Registry (ATSDR)

SUMMARY

The Moss-American site is a former wood-preserving plant on approximately 88 acres on the northwest side of Milwaukee, Wisconsin. Contaminants of concern include polyaromatic hydrocarbons (PAHs), phenolic compounds, chlorinated dioxins, arsenic, cadmium, chromium and lead. The western 23 acres of the property is currently owned by the Chicago and Northwestern Railroad. It is used for automobile storage. The remaining 65 acres are owned by the Milwaukee County Park System. The Little Menomonee River flows through the site and has become contaminated. Groundwater collected from shallow wells contained carcinogenic and noncarcinogenic PAHs and other organic contaminants, but water from intermediate and deep wells was free of contamination. The groundwater does not represent a health concern since there is no exposure potential. The soil on-site and river sediments which are heavily contaminated with creosote-related compounds pose a public health hazard. Among those likely to receive the greatest exposure to contaminants from this site are children who have been seen playing on the site and around the banks of the river. Public access to the site should be restricted until the contaminated soil and sediments can be removed or cleaned up.

BACKGROUND

Site Description

The Moss-American site, located in the northwestern part of the City of Milwaukee, consists of 88 acres of land which is bounded by the Chicago and Northwestern Railroad (C&NW) and Brown Deer Road to the north and the Wisconsin and Southern Railroad to the south. The site includes a 5-mile stretch of the Little Menomonee River which enters through the northern boundary and leaves through the eastern boundary (see appended map). The area is fairly flat with elevations ranging from 750 feet to 710 feet at the river's edge. The site contains low-lying wetland areas adjacent to the Little Menomonee River.

The site is located in an urban area and while the western 23 acres are fenced, the remaining 65 acres are easily accessible. The area near the river is heavily vegetated, undeveloped land that has unrestricted access. Although the unfenced area is posted, its park-like appearance may encourage children to use it as a play area.

Site History

Operations began at this site in 1921 when the Moss Tie Company began to treat railroad ties with creosote. The creosoting process used at the plant consisted of 50 percent No. 6 fuel oil and 50 percent coal-based creosote. Impregnation was done at high pressure (180 psi) and high temperature (200°F). Wood products were loaded in the processing area for treatment. Freshly treated wood was stacked on railcars parked on drip tracks and later transferred to the treated wood storage areas. The processing area consisted of the treatment building, vertical tanks for creosote and fuel oil storage, and several smaller support buildings.

Between 1921 and 1941, liquid wastes from the site were discharged directly to the Little Menomonee River. In 1941, a series of settling basins and a coke filter were installed for waste treatment; however, in 1954 a public health engineer noted that the coke filter was not in place. At that time the wastewater passed through an oil-water-sludge separator and was discharged to a 700-foot ditch that ultimately discharged to the river.

Between 1963 and 1965, the Kerr-McGee Chemical Corporation purchased the facility and formed the Moss-American Company. In 1966, the Milwaukee Metropolitan Sewerage District (MMSD) collected river samples near the plant. Based on analysis of these samples, MMSD advised Kerr-McGee to modify the creosote disposal facility to protect the river.

In 1971, following orders from the Wisconsin Department of Natural Resources (WDNR), Kerr-McGee began to pretreat its industrial waste and discharge it to a sanitary sewer. That year national attention was drawn to the site when several teenagers received chemical burns from wading in sediments more than 3 miles downstream. These burns were determined to have been caused by exposure to creosote-related chemicals. Subsequent studies identified the Moss-American facility as the source of the chemicals. As a result of this incident, warning signs were posted around the Moss-American site and Kerr-McGee dredged and filled eight waste ponds. Contaminated sediment along 1,700 feet of the river bed adjacent to the site was also excavated and landfilled near the northeastern corner of the site.

In 1973 the United States Environmental Protection Agency (EPA) provided $320,000 to remove and treat contaminated river sediments for about one mile of the river downstream of the site. The EPA filed suit against Kerr-McGee in 1974 seeking reimbursement for this cleanup. Milwaukee County also filed suit against Kerr-McGee for alleged damage to the Little Menomonee River.

In 1976 Kerr-McGee closed the Moss-American facility. The EPA continued to investigate the site and collect evidence for its suit. However the case was dismissed in 1978 because of erroneous field data. Milwaukee County dropped its impending law suit that same year in exchange for 65 acres of the site, which were added to the Milwaukee County park system. Kerr-McGee sold the remaining 23 acres to the Chicago and Northwestern Railroad Company in 1980. The railroad company now uses the parcel as an automobile loading and storage area. The site was added to the National Priority List (NPL) in 1983.

Site Visit

Two representatives of the Wisconsin Division of Health conducted a site visit on April 16, 1990 with representatives from Milwaukee County and the City of Milwaukee Health Department. Public access to the auto storage lot on the western 23 acres of the site is limited by an 8-foot high chainlink fence. This portion of the site is partially paved with grassy, and gravel-filled areas. The remaining 88 acres, owned by the Milwaukee Parks Division, was heavily vegetated with trees and waist-high grasses. Chemical contamination was not apparent. Wildlife in the form of birds and at least one snake was observed. Several dumping areas on the site were found to contain a variety of refuse including slag, old railroad ties, and scraps of wood and iron, which pose a physical hazard to children. The Milwaukee County Park representative indicated that homeless people are occasionally found living in huts constructed from these scrap materials. The park division routinely destroys these dwellings. The County Park representative also indicated that teenagers

frequently use dirt bikes on the site and that children have been observed fishing in the Little Menomonee River both on the property and downstream.

Low-lying areas of the site adjacent to the Little Menomonee River were inaccessible due to muddy conditions. It was therefore impossible to reach the banks of the river.

Demographics, Land Use, and Natural Resource Use

Land use of the area surrounding the site and the Little Menomonee River is a mix of agriculture, woodlands, industrial, residential and recreational park land (see map A). The site is bounded on the north by the C&NW railroad, and Brown Deer Road. A farm field lies between Brown Deer Road and the northwestern corner of the site. Undeveloped woodlands border the site on the east. A number of small businesses are located adjacent to the western boundary of the site, which is occupied by the automobile storage facility. The land immediately south of the Moss-American site contains a small residential section, a landfill, an auto junkyard, and farm fields.

In 1970, the population in this area was estimated to be between 3,500 and 10,000 persons per square mile. Increased residential development has occurred since that time, but current population data are not available. A wetland north of Brown Deer Road is surrounded by light industrial and commercial properties on the west and an apartment complex on the east. A wooded parkway, which is part of the Milwaukee County park system, borders the site on the south.

Current land use on the site includes an automobile transfer and storage lot on the western 23.3 acres. The automobile storage lot is leased from the C&NW railroad by the E&L Transport Company. New cars and trucks shipped by rail are unloaded at the lot, stored temporarily, and then shipped out by truck. The southwestern portion of this property is a paved parking and truck loading area. East of the paved area is a gravel parking area and grassy area used for overflow parking. The rail spurs on the northern part of the storage lot are used for parking and unloading train cars. Several feet of gravel fill was added to this area to construct the spurs. Access to the automobile storage lot is limited to employees of the E&L Transport Company, C&NW Railroad, and official visitors. The property is fenced and access is controlled by security police.

Access to the undeveloped county park property is not restricted, although it is limited by railroad tracks on the north and south, and the fenced automobile storage lot on the west. Access from the east is by an undeveloped lot and the property west of the river is posted "No Trespassing - Hazardous Chemicals May Be Present." Although the property is posted, it is used

occasionally as a short-cut for pedestrians. The area east of the river is used primarily by off-road motorcyclists and hikers.

State and Local Health Data

State and local health data for the community adjacent to the site are not available at this time.

COMMUNITY HEALTH CONCERNS

Milwaukee City health officials indicated that they were unaware of any community concerns regarding the health effects of exposure to site contaminants. Residents who attended the public meeting held by the EPA to discuss remediation procedures did not express any health concerns.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

On-Site Contamination

The EPA has investigated the entire site and 5 miles of the Little Menomonee River below the facility. The soil and groundwater investigation focused on identifying the horizontal and vertical extent of contamination in areas known or suspected to have been affected by site operations. The investigation of the river included the surface water, bottom sediment, and flood plain soils.

Soil.

Soil sampling began on May 18 and continued through May 31, 1988. Sampling in the paved area was performed on June 29. Confirmatory soil sampling was done on June 30. A total of 40 samples were analyzed, 30 from areas with high concentration of extractable organic compounds and 10 from areas with concentrations higher than 1000 ppm. Following receipt of laboratory results, 16 locations were resampled for submittal to Contract Laboratory Program (CLP) laboratories for more extensive analyses.

At the facility surface soil samples were collected at 100- to 200-foot intervals within suspected areas of contamination, and at random intervals in other areas. Subsurface samples were collected from boreholes to characterize deep contaminant migration and hydrogeologic conditions. All soil samples were visually screened by the field team and analyzed for extractable, organic compounds. Additional soil samples were then collected and analyzed for PAHs, other organic pollutants, and trace metals to quantify pollutant concentrations.

Contaminants detected in surface and subsurface soils are listed in Tables 1A and 1B. Elevated PAH concentrations were present at the facility in most of the surface soil west of the river and in a relatively small area east of the river where dredged material has been landfilled. In particular, the processing area and vicinity, the settling ponds, the treated storage areas, the northeast landfill, and the southeast landfill were identified as contaminated on the basis of the field screening results and analytical data. The most heavily contaminated areas are the processing area, the eastern edge of the treated storage area, the northeast landfill, and the southeast landfill (see maps B & C). The depth of soil contamination below the facility is limited by a dense silty-clay till 10-20 feet below ground.

Table 1A: Contaminants detected in surface soils.

Compound	No Samples Positive (Total=18)	Concentration Range (µg/kg) Minimum	Maximum
Polyaromatic hydrocarbons			
Benzo(a)anthracene*	14	79	420,000
Benzo(a)pyrene*	14	82	230,000
Benzo(b)fluoranthene*	14	130	270,000
Benzo(k)fluoranthene*	11	170	250,000
Chrysene*	14	110	510,000
Dibenzo(a,h)anthracene*	4	890	24,000
Indeno(1,2,3-cd)pyrene*	10	160	78,000
Benzo(g,h,i)perylene*	11	220	77,000
Fluoranthene*	12	800	2,200,000
Acenaphthene	11	290	2,000,000
Acenaphthylene	10	220	30,000
Anthracene	12	40	2,200,000
Fluorene	11	190	1,700,000
2-Methylnaphthalene	11	410	1,000,000
Naphthalene	13	110	1,800,000
Phenanthrene	13	350	2,700,000
Pyrene	12	600	2,000,000
Other Organic Compounds			
Benzene*	3	4	100
Toluene	18	2	1,300
Xylene(Total)	4	5	14,000
Ethylbenzene	5	1	1,600
1,1,1-Trichloroethane	1	19,000	19,000
1,1-Dichloroethane	1	210	210
Styrene*	2	380	2,600
Dibenzofuran	13	69	1,300,000
2,4-Dimethylphenol	1	280	280
N-Nitroso diphenylamine	1	270	270

Table 1A (continued):

Compound	No Samples Positive (Total=18)	Concentration Range (µg/kg) Minimum	Maximum
Other Organic Compounds (continued)			
2,4-Dinitrophenol	1	620,000	620,000
Heptachloro dioxin	3	0.46	1
Octachloro dioxin	3	1.4	4.4
Tetrachloro dioxin (Total)*	1	0.13	0.13
Tetrachloro dioxin (2,3,7,8)*	1	0.11	0.11
Trace Elements			
Arsenic*	17	1,800	110,000
Cadmium*	16	4,000	75,900
Chromium*	18	9,500	81,200
Cobalt	18	5,100	14,400
Copper	18	8,000	137,000
Lead*	16	4,700	519,000
Mercury	18	150	3,900
Nickel	18	11,200	30,900
Vanadium	18	12,200	38,200
Zinc	18	112,000	9,760,000
Other Analytes			
Cyanide	4	1,600	3,000

* These chemicals have been shown to cause cancer in laboratory animals.

Table 1B: Contaminants detected in subsurface soils.

Compound	Number of Samples Positive (Total = 34)	Concentration Range (µg/kg) Minimum	Maximum
Polyaromatic hydrocarbons			
Benzo(a)anthracene*	6	69	190,000
Benzo(a)pyrene*	6	40	34,000
Benzo(b)fluorathene*	10	10	87,000
Benzo(k)fluoranthene*	9	14	20,000
Chrysene*	9	38	120,000
Dibenzo(a,h)anthracene*	2	51	1,800
Indeno(1,2,3-cd)pyrene*	4	29	9,900
Benzo(g,h,i)perylene*	5	44	10,000
Fluoranthene*	14	16	2,300,000
Acenaphthene	12	9	2,700,000
Acenaphthylene	3	24	47,000
Anthracene	11	11	1,800,000

Table 1B (continued):

Compound	Number of Samples Positive (Total = 34)	Concentration Range (µg/kg) Minimum	Maximum
Polyaromatic hydrocarbons (continued)			
Fluorene	11	17	2,100,000
2-Methylnaphthalene	9	8	1,300,000
Naphthalene	11	19	2,600,000
Phenanthrene	13	60	4,600,000
Pyrene	13	16	1,600,000
Other Organic Compounds			
Toluene	26	2	2,000
Ethylbenzene	6	3	4,100
Xylene	8	2	17,000
1,1,1-Trichloroethane	2	6	11
Methylene Chloride	2	33	10,000
Styrene*	4	1	9,300
Dibenzofuran	11	11	1,600,000
4-Nitrophenol	1	240	240
Phenol	2	46	78
Pentachlorophenol*	2	110	700
Di-n-butyl phthalate	10	25	2,800
Di-n-octyl phthalate	2	12	5,800
bis(2-Ethylhexyl) phthalate*	9	42	5,800
Dimethyl phthalate	2	700	1,300
Diethyl phthalate	3	31	6,000
Hexachloro dioxin	1	7	7
Trace elements			
Arsenic*	29	1,300	7,800
Cadmium*	29	1,600	6,900
Chromium*	32	4,600	24,000
Cobalt	32	2,800	14,000
Copper	32	5,600	87,500
Lead*	31	2,300	31,000
Manganese	32	95,700	841,000
Mercury	18	100	4,500
Nickel	29	7,100	28,000
Vanadium	29	5,800	37,000
Zinc	32	36,000	1,740,000

* These chemicals have been shown to cause cancer in laboratory animals.

Groundwater.

The depth to groundwater varies from zero feet in the wetlands near the river to about 20 feet in the northwestern section of the site. The shallow groundwater system consists of a thin zone of saturated soils above a dense silty-clay till confining layer. The saturated zone above the confining layer is between 5 and 15 feet thick.

Groundwater monitoring wells at the Moss-American site were sampled by CH2M HILL personnel on July 11, 12, and 13, 1988. Four-foot-long, stainless steel, bottom-loading bailers were used to purge and sample each well. Following collection the sample was taken to the field trailer for measurement of sample temperature, pH and conductivity. The samples were sent to CLP Laboratories for biological oxygen demand, chemical oxygen demand, total organic carbon, total dissolved solids, total suspended solids, acidity, total phenols, sulfate, organic compounds, and inorganic chemical analysis.

Contaminants detected in groundwater are listed in Table 2. The shallow groundwater underlying the central portion of the site was found to contain high levels of naphthalene, acenaphthene and phenanthrene (5.5, 1.4 and 2.0 ppm, respectively). Several other PAHs and VOCs were detected at concentrations ranging from 8 to 630 ppb. No inorganic contamination was detected in the filtered groundwater samples. Groundwater contamination extends from the processing area to the river in a band that could be up to 400 feet wide. The contaminated plume generally follows the groundwater gradient at the site, which is northeasterly toward the river.

Groundwater contamination extends to a maximum depth of 20 feet below ground. No contaminants were detected in intermediate and deep wells at the facility. The lower extent of groundwater contamination is limited by the dense silty-clay till. No groundwater contamination was detected in samples taken from three wells located at the site boundary. These include two wells, one shallow and one intermediate depth, located just outside the extreme southwest corner of the site, and one shallow well located due south of the former processing area.

Table 2: Contaminants detected in groundwater.

Compounds	Number of Samples Positive (Total = 25)	Concentration Range (µg/L) Minimum	Maximum
Polyaromatic hydrocarbons			
Benzo(a)anthracene*	1	81	81
Benzo(a)pyrene*	1	23	23
Benzo(b)fluoranthene*	1	23	23
Benzo(k)fluoranthene*	1	25	25
Chrysene*	1	69	69
Fluoranthene*	3	13	460
Acenaphthene	3	11	1,400
Acenaphthylene	1	22	22
Anthracene	2	8	110
Fluorene	2	20	630
2-Methylnaphthalene	1	520	520
Naphthalene	3	3,120	5,500
Phenanthrene	2	28	2,000
Pyrene	3	11	300
Other Organic Compounds			
Benzene*	2	5	6
Ethylbenzene	1	27	27
Dibenzofuran	2	9	560
Phenol	1	8	8
2,4-Dimethylphenol	1	14	14
Bis(2-ethylhexyl)phthalate*	3	9	11
Trace Elements			
Arsenic*	13	1.3	7.8
Chromium*	2	6.7	7.8
Vanadium	5	4.7	6.9

* These chemicals have been shown to cause cancer in laboratory animals.

Surface water.

Eight surface water samples were taken on the Little Menomonee River on May 2, 1988. Water was collected at points located 350 feet upstream of the site, on-site near the entrance of the Little Menomonee River, near the center of the site, near the southern border of the site, approximately 1 and 3 miles downstream from the site, and 40 feet upstream of the confluence of the Little Menomonee River and the Menomonee Rivers. Samples were taken at the approximate midpoint of the river or ditches at mid-depth. Filtering and sample preservation were performed at the site trailer. Samples were labeled and shipped the same day to designated EPA CLP laboratories.

No visible evidence of surface water contamination was noted during the sampling except for oil sheens produced in several areas when sediments were disturbed during the collection process.

No carcinogenic PAHs were detected in any of the surface water samples. Noncarcinogenic PAHs and dibenzofuran were detected in the sample collected from the ditch draining the north side of the site and west of the river. The total concentration of noncarcinogenic PAHs was 31 µg/L. Methylene chloride was detected at 1 µg/L in a sample taken about 5 miles downstream from the site. No other VOCs were detected in the other surface water samples. Inorganic analytes observed in the downstream surface water samples were found in concentrations similar to those in the background samples (see Table 3).

Table 3: Contaminants detected in surface water.

Compound	Number of Samples Positive (Total = 9)	Concentration Range (µg/L) Minimum	Maximum
Polyaromatic hydrocarbons			
Acenaphthene	1	11	11
Fluorene	1	5	5
2-Methylnaphthalene	1	2	2
Naphthalene	1	11	11
Phenanthrene	1	2	2
Other Organic Compounds			
Methylene Chloride	1	1	1
Dibenzofuran	1	6	6
Di-N-butylphthalate	2	2	4

River Sediments.

The Little Menomonee River was sampled in three stages from downstream to upstream. Sampling was performed by CH2M Hill from May 4 to May 19, 1988. The first stage of sampling consisted of the collection of samples at 300-foot intervals for the 5-mile length of the river from the confluence with the Menomonee River to the C&NW Railroad bridge from May 4 to 10, 1988. Cross-section and inlet sampling were completed in the second stage from May 11 to 18. Flood plain and bank sampling were performed in the final stage of sampling on May 18 and 19.

More than 250 screening samples were analyzed for concentrations of extractable organic compounds. Sixty were selected for PAH and phenolic compound analysis. Sixteen sites were subsequently resampled on June 16 and 17 and sent to CLP laboratories for analysis of Target Compound List compounds, dioxin and selected treatment parameters. Sample selection was based on extractable organic screening results.

Fourteen background samples were collected - north (upstream) of the facility, from the tributaries of the Little Menomonee River, and upstream and downstream in the Menomonee River from its confluence with the Little Menomonee.

Contaminants typical of creosote constituents were detected over the entire 5-mile length of the Little Menomonee River, which extends from the site to its confluence with the Menomonee River. Levels of contamination in the sediments of the Little Menomonee, from the time it enters the site to the confluence with the Menomonee River, significantly exceeded background levels.

The major contaminants found were PAHs. All six samples from the 1-mile segment nearest and including the property contained PAH compounds which are known to cause cancer. One sample contained extremely high levels of PAH compounds. Dibenzofuran was also detected at concentrations as high as 520,000 µg/kg. Ethylbenzene was detected in two samples at 410 µg/kg and 730 µg/kg and toluene was detected at 950 µg/kg.

Chlorinated VOCs were found in four samples. Methylene chloride was detected in three samples at a concentration as high as 33,000 µg/kg. Chloroform was found at concentrations as high as 990 µg/kg in two samples. Arsenic, lead, and zinc were also found to be above background levels. The maximum levels detected were 8 mg/kg, 117 mg/kg and 2,200 mg/kg, respectively.

Sediment samples collected 1-2 miles downstream contained PAHs, dibenzofuran and VOCs. Contamination was not evenly distributed along the length of the river, across its width, or with depth. No significant decrease in contaminant concentrations was observed at increasing distances from the property.

Table 4: Contaminants detected in sediment.

Compound	Number of Samples Positive (Total = 18)	Concentration Range (µg/kg) Minimum	Maximum
Polyaromatic hydrocarbons			
Benzo(a)anthracene*	18	260	140,000
Benzo(a)pyrene*	17	320	54,000
Benzo(b)fluroanthene*	18	340	64,000
Benzo(k)fluoranthene*	17	66	35,000
Chrysene*	18	390	150,000
Dibenzo(a,h)anthracene*	8	180	2,400
Indeno(1,2,3-c,d)pyrene*	14	180	15,000
Benzo(g,h,i)perylene*	13	150	13,000
Fluoranthene*	16	750	830,000
Acenaphthene	17	160	800,000
Acenaphthylene	4	97	1,400
Anthracene	17	71	710,000
Fluorene	17	200	630,000
Naphthalene	9	1,300	350,000
Phenanthrene	18	280	1,500,000
Pyrene	18	700	800,000
Other Organic Compounds			
4-Chloroaniline	1	60,000	60,000
Chloroform	6	340	990
Ethylbenzene	8	3	730
Methylene Chloride	9	630	33,000
N-Nitrosodiphenylamine	1	3,100	3,100
Toluene	4	44	950
Heptachloro dioxin	3	0.14	11
Hexachloro dioxin	1	8.7	8.7
Octachloro dioxin	8	0.48	5.5
Pentachloro dioxin	1	0.45	0.45
Dibenzo furan	16	130	520,000
Heptachloro furan	2	0.75	22
Hexachloro furan	2	0.23	8.4
Octachloro furan	1	8.8	8.8
Pentachloro furan	1	0.55	0.55
Butylbenzyl phthalate	1	720	720
Di-n-butyl phthalate	1	210,000	210,000
Di-n-octyl phthalate	3	25	90

Table 4 (continued):

Compound	Number of Samples Positive (Total = 18)	Concentration Range (µg/kg) Minimum	Maximum
Trace Elements			
Arsenic*	18	3,500	10,100
Cadmium*	18	4,100	14,100
Chromium*	18	10,600	32,600
Cobalt	18	5,100	11,500
Copper	18	13,500	45,500
Lead*	18	18,400	213,000
Manganese	18	296,000	945,000
Mercury	10	210	430
Nickel	8	16,400	24,400
Vanadium	18	16,500	30,900
Zinc	18	230,000	2,200,000

* These chemicals have been shown to cause cancer in laboratory animals.

Off-Site Contamination

No off-site contamination was identified in the remedial investigation report. Off-site monitoring was conducted in the Menomonee River.

Quality Assurance and Quality Control

In preparing this health assessment the Wisconsin Department of Health and Social Services, Division of Health, relies on the information in the referenced documents and assumes that adequate quality assurance and quality control measures were followed with regard to chain of custody, laboratory procedures, and data reporting. The validity of the analysis and conclusions drawn for this health assessment is determined by the completeness and reliability of the referenced information.

Physical and Other Hazards

During the site visit several dumping areas on the site were found. These contained a variety of refuse including slag, old railroad ties and scraps of wood and iron. Some of the rusty iron scraps appeared to have sharp edges. These objects pose a physical hazard to site trespassers who could stumble over these objects or could receive cuts or abrasions from these items.

PATHWAYS ANALYSIS

Environmental Pathways

The existing sources of contamination at the site include the surface soil and subsurface soil in the process area, the treated tie storage area, the northeast and southwest landfills, and the sediments in the Little Menomonee River. The behavior of the chemicals at the Moss-American site are influenced by the physical and chemical conditions at the site and in the surrounding area. Their form, transport, and fate depend upon such factors as pH, temperature, soil moisture, oxidation-reduction potential, physicochemical properties of the surface and subsurface strata, water chemistry and the macro- and micro-organisms present.

Potential mechanisms for release and migration of contaminants at the site are dependent on chemical characteristics. Volatile contaminants, i.e. benzenes, phenols and phthalates, can vaporize from soil to the atmosphere and be transported by the wind. Such movement of contaminants from this site is likely given the volatile nature of aromatic hydrocarbons, but this has not been documented.

This pathway may be especially important during remediation when heavily contaminated soil is being excavated. Wind erosion can also move hydrophobic organic compounds which tend to bind to soil particles. This may be important during the remediation, but is probably not a major existing pathway because the land is heavily vegetated.

Water soluble compounds, including phenols and inorganic salts, can leach into the groundwater which discharges to the Little Menomonee River. Polyaromatic hydrocarbons, which are virtually insoluble in water, may be carried into the groundwater in micelles or attached to silt particles. Detection of these compounds in the groundwater indicates that this is an important pathway at Moss-American. However, because groundwater contamination has not penetrated the clay-confining layer and does not extend to the site boundary, public wells located more than a mile from the site are not at risk of contamination.

Surface runoff of water-soluble or soil-bound contaminants from the site into the Little Menomonee River may also occur, particularly in times of heavy rainfall. Such runoff is limited by vegetation at the site.

Contaminants bound to the sediments of the Little Menomonee River may slowly diffuse into the surface water providing a constant source of low-level contamination. Hydrophobic organic chemicals found in the sediments can bioaccumulate in aquatic biota and become concentrated in the food chain. Ingestion of fish from the Little Menomonee River could pose a potential risk to health.

However, the importance of this route of exposure is minimized by the Wisconsin Department of Natural Resources' observation that fish do not frequent this area in significant numbers. This situation is thought to be due to the effects of the contaminated sediments on the aquatic invertebrates needed to support fish life.

Human Exposure Pathways

Based on existing patterns of contamination and a review of current and possible future land uses, the most likely exposure pathways for the Moss-American site include:

1) Exposure of recreational users through dermal contact with and/or ingestion of contaminated sediments and surface water in the Little Menomonee River. Levels of contamination in the surface water do not pose a significant risk, however the sediments are heavily contaminated with PAHs, many of which are suspected human carcinogens.

2) Exposure of site visitors to a variety of carcinogenic and noncarcinogenic creosote-related compounds which can be released from soil to the air by erosion or volatilization. Visitors to the site could be exposed to air contaminants via inhalation, ingestion or dermal absorption.

3) Exposure of site visitors by direct contact with surface soil containing high levels of creosote-related compounds. The soil also contains low levels of a variety of carcinogens including styrene, benzene and arsenic. Routes of exposure include dermal absorption and soil ingestion.

4) Exposure of remediation contractors to surface and subsurface-soil and sediments contaminated with a variety of creosote-related compounds. These workers will also be exposed to vapors and aerosols during excavation of contaminated soils, thus dermal absorption, soil ingestion and inhalation exposures are all possible.

5) Exposure of construction workers or future site users by direct contact with subsurface soil during site development. More than 30 creosote-related compounds and 11 trace elements were detected in the subsurface soils. The creosote-related compounds occurred at concentrations up to 2.3 parts per thousand. These workers will also be exposed to vapors and aerosols during excavation of these soils, thus dermal absorption, soil ingestion and inhalation exposures are all possible.

Sediment and Surface Water.

People engaging in activities such as swimming and wading in the river or walking along its banks could have contact with contaminated sediments. This contact could result in exposure through ingestion of sediment, dermal absorption of contaminants in the sediment, or inhalation of volatilized organic substances. The river level declines in dry seasons, exposing contaminated sediments.

Inadvertent ingestion or direct contact with surface water by people swimming or wading in the river, playing along its banks, or fishing along it could result in exposure to contaminants in the water. However, very few contaminants were detected in the surface water of the river, and those detected were at relatively low concentrations.

Fish Consumption.

Many of the chemicals detected in the sediments of the Little Menomonee River have high octanol-water partition coefficients and may have a tendency to bioaccumulate in aquatic animals and to pose a danger to people who consume fish from the river. Fishing has not been restricted in the river adjacent to or downstream from the property. However, this portion of the river contains very few fish, and few, if any, are thought to be caught by the children who fish along its banks.

Soil and Ambient Air.

Exposures could occur as a result of direct contact with contaminated soils or the inhalation of contaminants released to the ambient air. The site is easily accessible and located in an urban area. Teenagers frequently use dirt bike trails on the site. The area near the river is heavily vegetated, undeveloped land that has unrestricted access. Its park-like appearance may encourage children to use it as a play area. They could be exposed to soil contaminants via inadvertent ingestion of contaminated soil, dermal absorption of organic compounds from soil or standing water, or via inhalation of volatile organic compounds or contaminated dust.

An automobile storage and loading facility is located on the far western section of the site where the original processing area was located. This area is now covered with a gravel parking lot. Because the area is covered, the workers at the facility are not expected to be exposed.

PUBLIC HEALTH IMPLICATIONS

As discussed in the Environmental Contamination and Other Hazards and Pathways Analysis Sections, trespassers or workers on the site may be exposed to a variety of creosote-related compounds, some of which are carcinogenic, via dermal contact with the soils, accidental ingestion of soil, or inhalation of aerosols, dust or vapors.

Individuals who are on-site may be exposed to a variety of polyaromatic hydrocarbons. The most likely consequence of contact with these compounds is an increased risk of cancer. Some 4- to 5-ring PAHs have been associated with lung, stomach and skin cancers in experimental animals.

No community health concerns have been identified relative to this site. Communication with the Milwaukee City Health Department has failed to identify any local health concerns or evaluation. State and federal agencies have not yet conducted any investigation into possible increases in cancer or adverse birth outcomes in the community surrounding the Moss-American site. Such an expensive undertaking is probably not warranted since significant exposures have not been established.

Groundwater

The shallow groundwater underlying the site was found to contain high levels of several noncarcinogenic PAHs and low levels of several carcinogenic compounds including benzo(a)anthracene, benzo(a)pyrene, benzo(a)- and (k)fluoranthene, chrysene and benzene. The maximum depth of groundwater contamination was determined to be 20 feet. The extent of contamination is limited by a dense silty-clay till confining layer.

This contamination has not resulted in human exposure since the groundwater underlying the site is not used.

Surface Water and Sediments

The most likely consequence of direct (dermal absorption, ingestion of sediment) and indirect (inhalation of vaporized compounds) contact with surface water and sediments is an increased risk of cancer due to exposure to carcinogenic PAHs, primary components of creosote. Some 4- to 5-ring PAHs have been associated with lung, stomach and skin cancers. It is unclear whether ingestion of fish from this river is occurring or whether ingestion of fish caught from the river poses a health threat. Direct contact with sediments may also result in irritation of skin and mucous membranes.

Soil

The soil on-site is heavily contaminated with creosote-related chemicals, many of which are potential carcinogens. In addition, high levels of arsenic, cadmium, chromium, nickel, lead and zinc were found. Arsenic and hexavalent-chromium are known to cause cancer in humans; and cadmium and lead are suspected human carcinogens. People trespassing on the site could contact these contaminants through inadvertent ingestion, dermal absorption and inhalation pathways. Exposures via these routes could increase lifetime cancer risks.

Lead is a central nervous system toxin and also inhibits hemoglobin synthesis, causing anemia. Exposure to high levels of cadmium can result in kidney changes. Cadmium is also a probable human carcinogen when inhaled. Dinitrophenol uncouples oxidative-phosphorylation, reducing cellular ATP levels. Dinitrophenol causes weight loss and can adversely affect the heart. Exposure of experimental animals to minute quantities of 2,3,7,8-TCDD induces a life-threatening wasting phenomenon. The physiological mechanism of this effect is not understood. TCDD causes a variety of tumors in experimental animals and is a probable human carcinogen. This substance causes a disfiguring form of cystic acne in humans. Exposure of pregnant monkeys to 2,3,7,8-TCDD during days 20-40 of gestation significantly increased the rate of spontaneous abortion.

Food Chain

It is impossible to evaluate the possibility of adverse health effects resulting from consumption of potentially contaminated fish and wildlife without further information.

CONCLUSIONS

The Moss-American site is contaminated with toxic and hazardous chemicals and poses a health hazard to anyone entering the property or frequenting a stretch of the Little Menomonee River extending from the site to its confluence with the Menomonee River 5 miles downstream. Direct contact with soil on-site or with river sediments may increase lifetime cancer risk and poses a special danger to young children who may be drawn to the site by its park-like appearance. The remedial investigation report indicates that incidental ingestion of sediments from the Little Menomonee River by a 70-kg adult who was exposed 2 days per week, 20 weeks per year for 10 years could increase lifetime cancer risk by as much as 1 in 10,000.

People, usually children, have been observed fishing in the Little Menomonee River. Bottom-dwelling fish from this river could contain cancer-causing PAHs, and may pose a health hazard to anyone eating them. It is believed that fish from the Little Menomonee River are not being caught in significant numbers.

Remedial activities involving soil removal will temporarily increase the risk of worker and neighboring residential exposures via inhalation, ingestion and dermal absorption. These exposures can be minimized by appropriate use of worker protection apparatus and by various work techniques aimed at reducing release of toxins to the atmosphere via soil erosion and volatilization.

This site does not qualify for a disease-prevalence and symptom-prevalence study because there is not a significant exposure route to community residents under current land use conditions. There is little community concern regarding the public health impacts of this site, which apparently reflects the lack of off-site contamination.

RECOMMENDATIONS

1) Public access to unfenced portions of the site should be restricted.

2) People should be discouraged from swimming or wading in the Little Menomonee River between the site and the confluence of the Little Menomonee with the Menomonee River.

3) During remedial activities, optimal dust control measures should be used and appropriate monitoring should be conducted at the work-site periphery to ensure the safety of nearby residents and employees of the automobile storage facility which will be in operation during remediation.

4) Appropriate safety measures should be taken to protect workers from skin contact with heavily contaminated soils and sediments and inhalation of vapors and aerosols during soil excavations at the site.

6) Nearby residents should be informed of possible hazards associated with the remediation and the area should be made inaccessible during this time.

Need for Follow-up Health Activities

The Moss-American site has been evaluated for appropriate follow-up with respect to health activities. The evaluations performed during this health assessment indicate that persons in the surrounding area have been exposed to site contaminants. However, it is unlikely that the low level of exposure caused illness that could be documented. Therefore, this site is not being considered for additional health activities at this time. If environmental monitoring during the site clean-up detects the release of contaminants or if new information is discovered concerning greater than expected fish consumption from the Little Menomonee River or frequent trespassing, then the site will be reevaluated for possible follow-up health activities.

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Personal communication with representatives of the Department of Natural Resources-Southeastern District.

APPENDICES

Maps of site illustrating site location, historical land use, extent of soil contamination and location of monitoring wells and soil borings.

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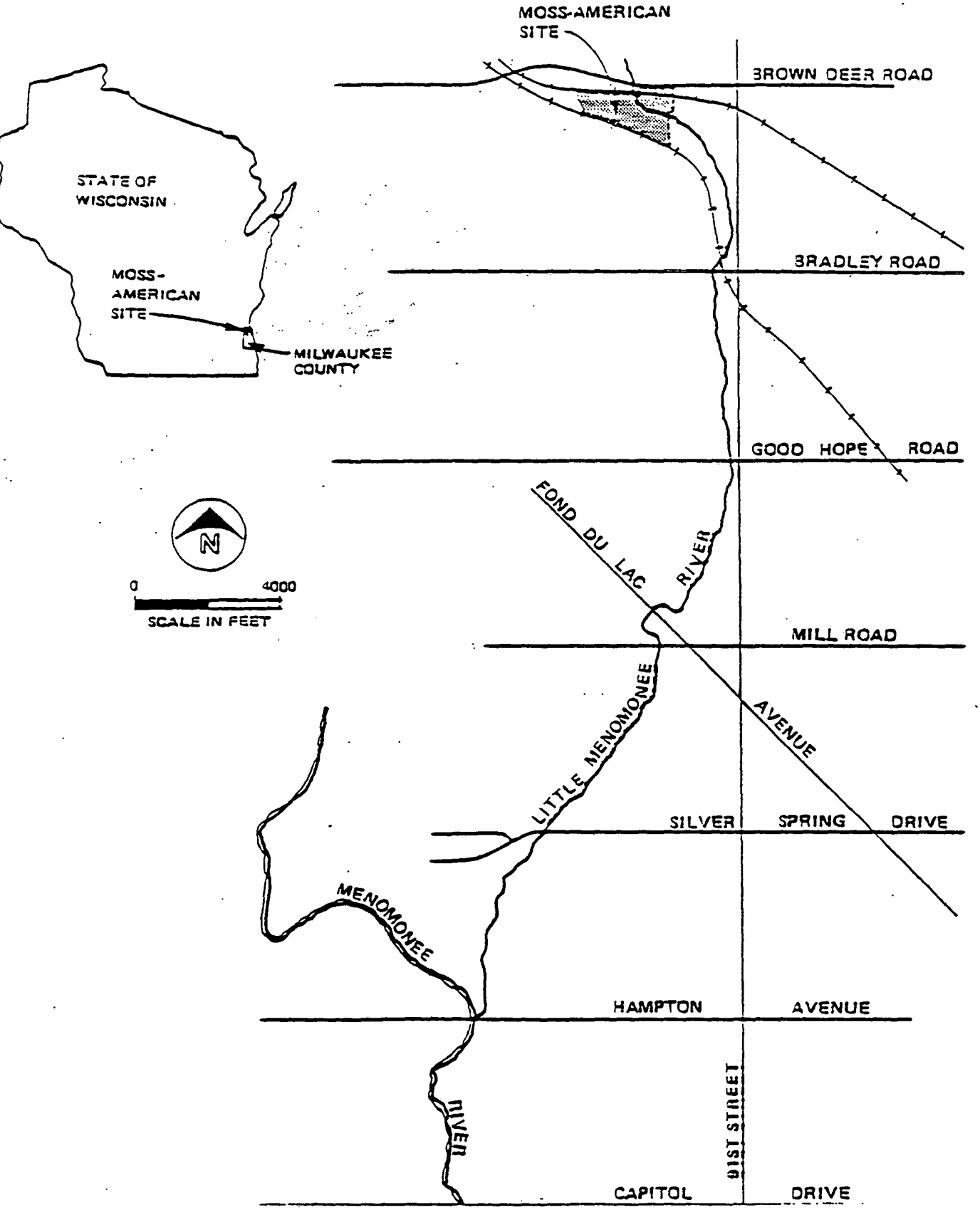
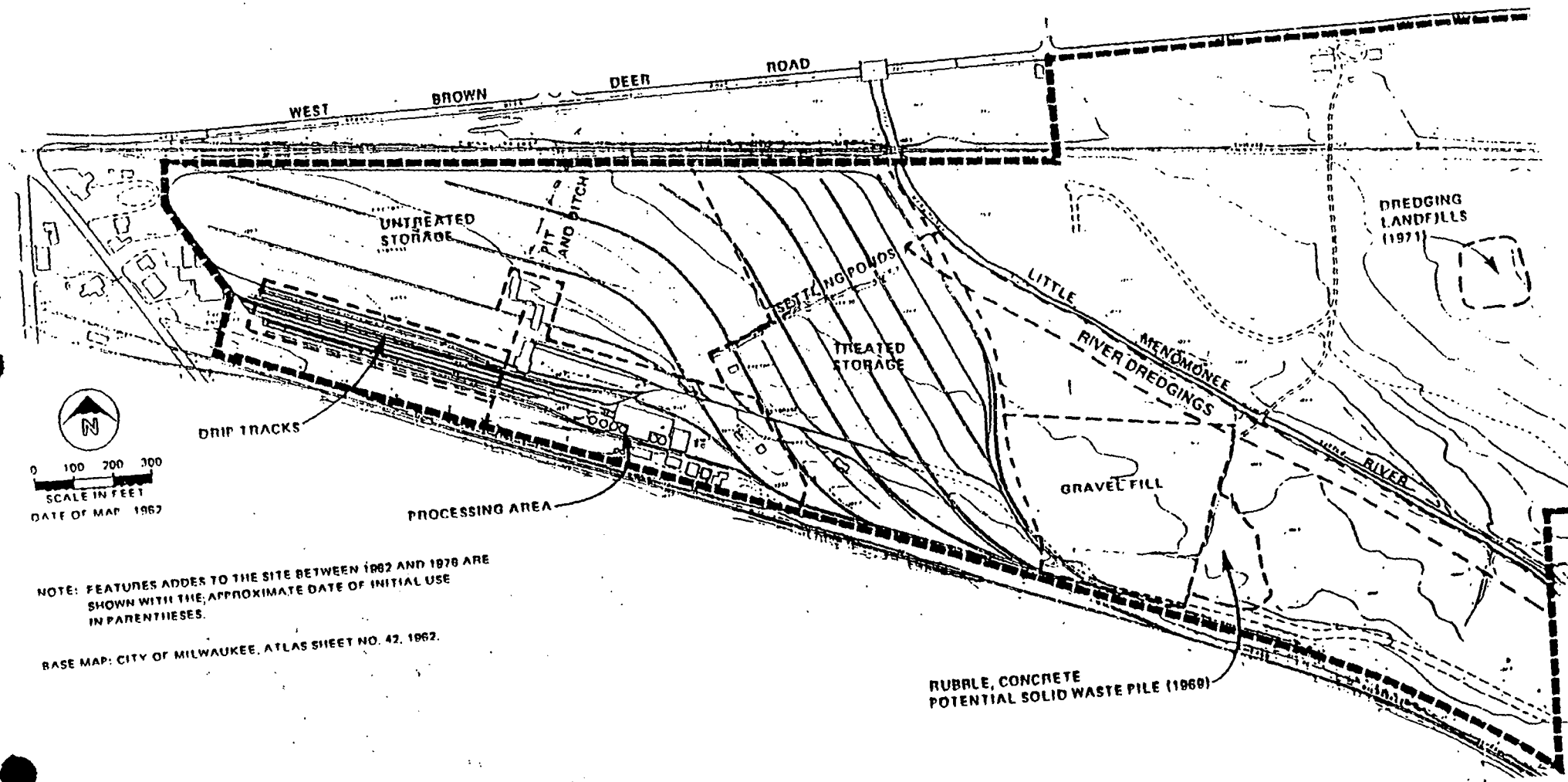
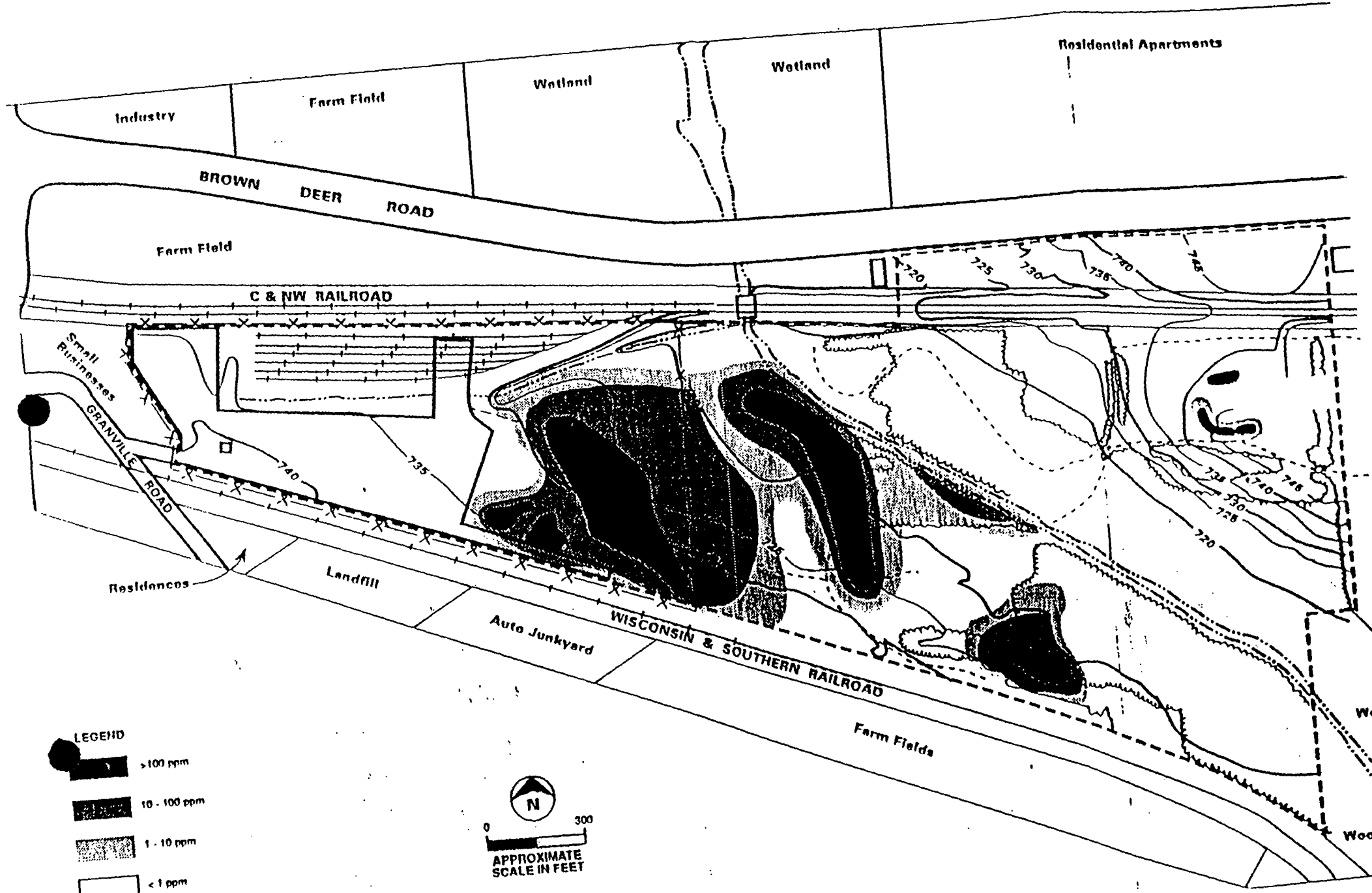


Map A - Location of Moss-American site



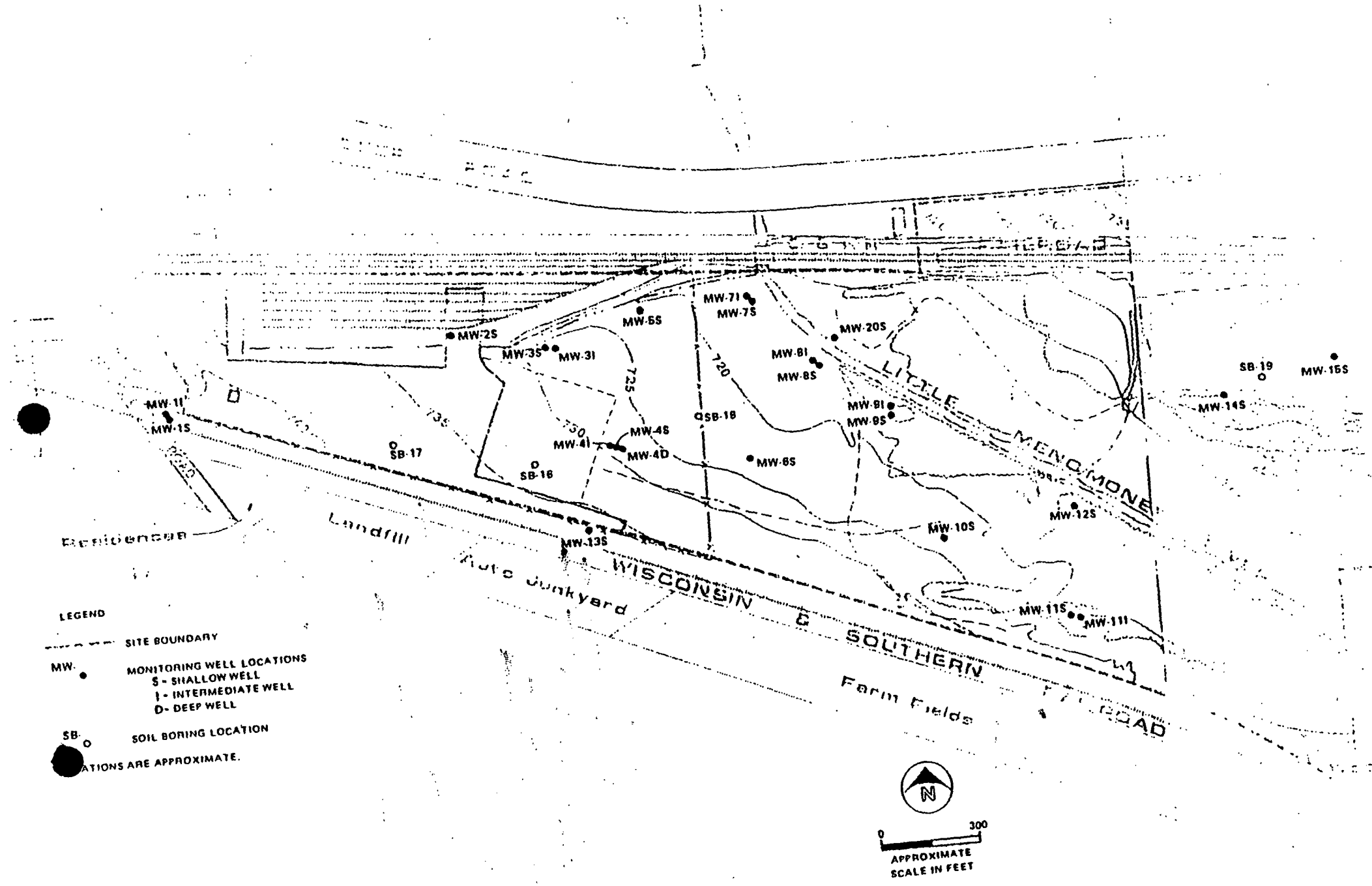
Map B - Historical Land Uses.

From January 9, 1990 Remedial Investigation Report, CH2M Hill



Map C - Extent of Soil Contamination
Based on Carcinogenic PAHs
and Field Data

From January 9, 1990 Remedial Investigation Report, CH2M Hill



Map D - Monitoring Well and Soil Boring Locations

From January 9, 1990 Remedial Investigation Report