PHASE III
SUBSURFACE INVESTIGATION REPORT

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE
BELOIT, WISCONSIN

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Beloit, Wisconsin

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1.0 INTRODUCTION

Presented in this report are the results of the Phase III Subsurface Investigation conducted at the Ursula Borgerding Estate Property, 433-437 Woodward Avenue, Beloit, Wisconsin. The property is currently owned by the Estate of Ursula Borgerding (Estate), represented by Mrs. Frances Borgerding Sheehy of Milwaukee, Wisconsin. The investigation described herein was performed in response to the March 15, 1991 letter from the Wisconsin Department of Natural Resources (WDNR), in which specific questions about the site characteristics, not addressed in previous investigations or requiring additional attention, were raised. The Scope of Work for the Phase III Subsurface Investigation (transmitted April 18, 1992) with Addenda, dated April 29, 1991 and May 6, 1991, was approved by Mr. Ron Curtis of the WDNR. Additional modifications to the schedule and scope of work, based on field conditions, were verbally approved by Mr. Curtis at the time of implementation and followed by written documentation.

1.1 Facility Definition

The Ursula Borgerding Estate Property (Estate) is located at 433-437 Woodward Avenue, Beloit, Wisconsin. The property occupies a portion of the northeast quarter of the northeast quarter of Section 35, Township 1 north, Range 12 east (NE ¼, NE ¼, Sec. 35, T. 1 N, R. 12 E - Figure 1). The site is bounded to the north by a City of Beloit green area, to the south by Woodward Avenue, to the east by the Chicago, Milwaukee, and St.Paul Chicago and Northwestern railroad line (railroad), and to the west by the Rock River. The north-south dimensions of the site are 200 feet from Woodward Avenue. East to west, the site is approximately 200 feet (south end) to 280 feet (north end). The total area of the Estate is slightly more than one acre (Figure 2, Figure 3).

At the request of the WDNR, and in order to define the "background" conditions of the area, soil borings and ground water monitoring wells were installed on the City of Beloit green area, located north of the Estate. For purposes of this report, the Estate Property, consisting of the land between Woodward Avenue and the City of Beloit green area and between the railroad and Rock River, will be referred to as the "Estate" or "South Parcel." The City of Beloit green area will be referred to as "North Parcel" (north portion of the property historically known as Branigan's Addition, Lot 3).

1.2 Purpose and Objectives

The purpose of the investigation was to respond to specific questions posed by the WDNR in their March 15, 1991 letter to the Estate representative. In order to address the specific issues in the WDNR letter, the goals of the investigation were defined as follows:

- Define ground water flow characteristics;
- Define chemical background conditions of the ground water and soil;
- Define horizontal and vertical contaminant concentration boundaries, including horizontal and vertical contaminant migration potential;
- Develop remedial alternatives for restoration of impacted soil and ground water at the site.

1.3 Scope of Work

The scope of the investigation required to achieve the objectives included the following tasks:

- Aerial photography and survey mapping of the site and surrounding area, to include approximately 40 acres around the property. The maps generated from the photography and survey are used to identify well locations, ground-elevation contours, ground water contours, ground water flow direction, and, if practical, distribution of impacted areas. All maps conform to National Map Accuracy Standards and reference USGS benchmarks and the state plane coordinate system.

- Historical aerial photography review and historical records review. The purpose of the reviews is to identify past uses of the property, including the surrounding areas. In particular, the location of the above-ground storage tanks and fill operations on or near the property are of significance.

- Identification of potential receptors of ground water down-gradient from the site. The identification of such receptors occurred during the mapping of the property and the historical records review.

- Installation of additional ground water monitoring wells. The purpose of the soil borings is to better define areas of impacted soil and potential sources of ground water impact. The purpose of the ground water monitoring wells is to aid in the definition of ground water characteristics, including flow direction, gradient and quality.

- Installation of shallow soil cores in the area of MW-10S, which was previously found to contain layers of paint near the surface. The shallow soil cores would be installed to characterize the lateral and vertical boundaries of paint disposed of on the ground.

- Collection and laboratory analysis of soil and ground water samples. Analyses include physical and chemical parameters, such as volatile organic compounds (VOCs), petroleum volatile organic compounds (PVOCs), metals associated with petroleum and waste oil investigations, and polynuclear aromatic hydrocarbons (PAHs). These parameters are required by the WDNR for leaking underground storage tank investigations. Additional analyses included grain size and total organic carbon (TOC), required for the determination of contaminant transport factors at the site.

- Ground water flow characteristics testing, including water level measurements, slug testing, and velocity and gradient estimates. The ground water information is necessary to determine flow rates and directions, to include contaminant transport factors.

- Identification of impacted areas, to include impact by gasoline, diesel fuel and other compounds.

- Collection and laboratory analysis of unidentified oily product previously found in the soils at the site.

- Proper on-site storage and eventual disposal of impacted soil and water, including drilling spoil, excavation material and purged ground water.

- Although not originally included in the scope of work, free petroleum, which was found in MW-3S, was pumped and disposed of, as described in the monthly progress reports to the WDNR.

2.0 REGIONAL SETTING

2.1 Location

The Ursula Borgerding Estate Property is located at 433-437 Woodward Avenue, which fronts the east bank of the Rock River. The property occupies a portion of the NE ¼, NE ¼, Sec. 35, T. 1 N, R. 12 E, Rock County, Wisconsin. The property comprises slightly more than one acre of land.

2.2 Meteorological Conditions

The Rock County area has the typical continental climate of interior North America, with a large annual temperature range and frequent short-period temperature changes (NOAA, 1986). Mean winter (December through February) temperatures range from approximately 19° F to 25° F. Mean summer (June through August) temperatures range from approximately 69° F to 74° F. The Rock County area lies in the path of frequent tornados, which move eastward during autumn, winter and spring.

The most frequent air masses are of polar origin, with occasional outbreaks of arctic air during the winter months. Although northward moving tropical air masses contribute considerable cloudiness and precipitation, the true gulf air mass does not reach this area in winter, and only occasionally during other seasons. Summers are pleasant, with only occasional periods of extreme heat or humidity. There are no particular dry or wet seasons, but approximately 60 percent of the annual precipitation falls during the five months of May through September. Cold season precipitation is lighter but generally lasts longer than that of the warmer months.

Soil moisture is usually adequate in the first part of the growing season. During July, August and September, the crops depend on rainfall, which is mostly from thunderstorm and tends to be erratic and variable in distribution and duration. Average occurrence of thunderstorms is less than seven days per month during the summer period. During an average winter, December, January and February, the ground is covered with an inch or more of snow. The soil is usually frozen from the first of December through most of March, with average frost penetration of 25 to 30 inches.

2.3 Topography

The area in the immediate vicinity of the Estate consists of the Rock River flood plain and river-cut outwash plains. The flood plain is identified by the City of Beloit Engineering to dissect the site (Figure 4), as indicated by the "River Fill Limit." However, topographic contours on the USGS Beloit Quadrangle (1976) indicate that the flood plain extends to U.S. Highway 51, although this may be the result of filling activities conducted during City development (Figure 1, Figure 5). East of U.S. Highway 51, is the Rock River Pleistocene river bank. The ridge consists of a 40-foot high ridge of outwash plain deposits (Alden, 1918).

2.4 Hydrology

The Rock River, the major water body in the area, is located adjacent to the west boundary of the Estate property. The River flows from north to south and is dammed approximately 925 feet south of the site, near the Blackhawk Power Station (Figure 5). Approximately one mile east of the site is Turtle Creek, which contributes to the Rock River approximately one mile south of the site, just south of the Wisconsin-Illinois border.

2.5 Surface Soils

The soils at the site consist of Alluvial Land, Wet (USDA Soil Conservation Service, 1974). Alluvial Land, Wet (Aw) consists of nearly level (zero to two percent slopes), poorly drained river sediments and are associated with flood plains. Ground water in Aw soils is found at or near the surface throughout the year, unless the land is drained. The texture of the Aw soil, near the surface and within the substratum, ranges from sandy loam to silt loam or muck. The soils that constitute the adjoining uplands, immediately east of the flood plain, consist of Lorenzo loam (LoD of the Lorenzo Series). LoD soils are considered moderately steep, maintaining 12 to 20 percent slopes, and is commonly found along drainages and on the edges of outwash plains.

2.6 Geology

Local geology is inferred from well and geologic logs obtained from the Wisconsin Geologic and Natural History Survey and from Wisconsin Power & Light Company for water-supply wells located in the vicinity of the Estate property. The details of formation thicknesses are from WP&L well #4, which is located approximately 350 feet east of the site, at the boundary of the flood plain deposits. In the vicinity of the Estate site, glacial deposits, consisting primarily of sand and gravel, are approximately 243 feet thick (Varner Well Drilling Company, 1926). Underlying the glacial material is approximately 32 feet of grey dolomite. Sandstone is encountered at depths of approximately 280 feet and extends to more than 960 feet. The upper 100 feet of sandstone contains layers of yellowish-grey and purple dolomite. Shale layers, ranging in thickness from 5 feet to 15 feet, are found interbedded with the sandstone at depths of 450 feet to 555 feet below ground surface.

Geologic formations in the southeastern area of the state include the Ordovician Sinnipee Group, consisting of the Galena, Decorah and Plattville Formations, overlying the Ordovician Ancell Group, consisting of the Glennwood and St. Peter Formations. Below the Ordovician Groups are the Cambrian Groups of Trempealeau, Tunnel City and Elk Mound (Le Roux, 1963 - Figure 6).

2.7 Ground Water

Ground water in the vicinity of the Estate is found in the near-surface soils of the flood plain, and in the underlying glacial deposits. The dolomite found under the glacial deposits is also water-bearing and appears to be in hydraulic connection with the glacial deposits. The sandstone aquifer is utilized as the primary source of industrial supply and municipal drinking water. The shale encountered may act as an aquitard in areas; however, the wells drilled to depths greater than that at which the shale is encountered are generally of open-hole construction, providing hydraulic connection of the sandstone aquifer located above and below the shale.

Ground water at the site was found at depths of three feet below the ground surface, near the Rock River, to nine feet below ground surface, 100 to 200 feet east of the river.

Shallow ground water flow within approximately 200 feet of the river is estimated to be from west to east, away from the Rock River, with a strong downward vertical gradient. However, there is evidence to support the existence of a deeper flow system that flows from east, presumably from the east highlands of the outwash plains, toward the west. The ground water flow system at the site is discussed in greater detail in Section 6.0.

3.0 SITE HISTORY

The history of the site has been compiled through a review of the property abstract, city building inspector and engineering department records, historical aerial photographs, historical plot maps, and interviews with surviving family members and local residents and merchants.

3.1 Site Ownership

Site ownership is traced back to the initial sale from the United States in 1838. The property, which at times has included the North Parcel (north portion of Branigan's Addition, Lot 3) and the property now occupied by the Blackhawk Power Station (historically known as Branigan's Addition, Lot 4), was owned by various private individuals until 1857, when the Beloit College Board of Trustees purchased the property from Jackson Bushsnell. The Beloit College Board of Trustees provided a Quit Claim deed for the property to Rock River Paper Manufacturing Company. This appears to indicate the first industrial activity at the site, although this cannot be confirmed based on available documentation. Other industrial owners of the property include Rock River Paper Mill Company, Beloit Water Power Company, Knickerbocker Ice Company, and City Ice Company (later known as City Ice & Fuel Company).

Edward Branigan, father of Ursula Borgerding, first purchased the property in 1913. In 1946, Edward Branigan bequeathed the property to his children, Robert Branigan and Ursula Borgerding. Robert Branigan provided a quit claim deed to Ursula Borgerding. A summary of the site ownership is provided as Table 1.

3.2 Site Tenancy

The facilities on the property have been leased to various companies throughout the site history. Following the close of the City Ice & Fuel Company, with the death of Edward Branigan in 1946, the Branigan/Borgerding family-owned and operated business was significantly reduced and the buildings and facilities were leased to other businesses. Tenancy records were compiled based on building inspector and city engineer records, citations, and historical photographs review. One tenant, identified in the Property Abstract, was Standard Oil Company (Indiana), which leased the property from Edward Branigan in 1931. The lease apparently terminated on May 31, 1933.

Additional tenancy records were found for the period from 1958 through the present. Tenants at the site included Woodward Oil Company, Finnegan Oil Company, Price-Rite Gas Station, Rem Frey Alignment (Brake) Service, Murmac Finishes (paint manufacturer) and The Press (printing shop). Based on a historical photograph, dated c. 1947, Miller High Life Beer was also a tenant at the property for a time. Other photographs, dated c. 1947, identify Deep Rock Petroleum Company as tenants or petroleum suppliers (identified by the presence of a Deep Rock fuel truck and above-ground storage tanks labeled "Deep Rock" in a historical site photograph). Most recently, the buildings were occupied by Drevdahl Automotive, Heritage Painting, and Superior Automotive Electric. All of the buildings are vacant at the present time.

A summary of the tenancy records is provided in Table 2. The tenancy documentation does not appear to be complete, and some of the references cite business locations at differing addresses on the property. However, it is believed that most of the tenants are represented.

3.3 Site Activities (Historical Photograph and Plat Review)

Historical aerial photographs of the site were obtained from the U.S Department of Agriculture, National Archives, and the Rock County Soil Conservation Service. Ground photographs were obtained from newspapers found in the Beloit Library historical collection and from the private collections of the Borgerding family. Plat maps of the site were obtained from the Beloit City Engineers office and from the Borgerding family's private collection of documents. A summary of the photographic references and plat maps is presented in Table 3.

Based on the aerial photographs, the area around the Estate was extensively developed by 1937. Residential development abounded on both sides of the Rock River, the Fairbanks-Morse facility was established, and the lagoon in Riverside Park is visible. In the 1940 photograph, the only significant change is the further development of residential properties around the site area. Due to the scale of the photographs (1:20,000), details of the site activities are difficult to determine; however, five coal bins, located immediately east of the railroad, coal piles on the North Parcel, and five buildings on the South Parcel are visible by 1940. This correlates with a plat map, dated October 26, 1946, on which the facilities associated with the Estate are identified. During this time, the North Parcel was also operated as part of the City Ice & Fuel Co. The North Parcel contains coal piles and a railroad line used to transport the coal and ice recovered from the Rock River during winter. Additionally, two frame sheds and an above-ground storage tank bunker are located on the North Parcel. This also correlates with information on the 1946 plat map. The plat map identifies a third frame shed, located along the river bank on the North Parcel, however, no photographic evidence was found to confirm the existence of the third building.

The property now occupied by Ace Hardware's parking lot (Branigan's Addition, Lots 1 and 2) was occupied by five vertical coal bins and seven buildings, in the 1937 and 1940 photographs. One of the buildings is identified as "cold storage." The property now occupied by the Blackhawk Power Station (Branigan's Addition, Lot 4) was also operated in conjunction with City Ice & Fuel until Edward Branigan sold Lot 4 to Wisconsin Power & Light Company in 1954. In the 1937 and 1940 photographs, one building is located on Lot 4.

With the death of Edward Branigan, in 1946, property uses began to change. In the 1950 photograph, the entire North Parcel is covered with coal, with the exception of the railroad tracks. On the South Parcel, only three buildings remain and an above-ground storage tank bunker, with nine storage tanks, is present. The storage tanks, three horizontal and the remainder vertical, are identified to contain regular gasoline, ethyl gas and diesel fuel oil, on a 1950 plat map of the South Parcel. Also identified on the plat map are four underground storage tanks in a concrete bunker adjacent to the 435 Woodward Avenue building (most recently occupied by Heritage Painting), then operated as a gas station. The dispenser islands can be seen in the aerial photograph. The plat also identifies the underground piping from the above-ground tanks to the underground tanks and to an unloading rack adjacent to the railroad. The plat, dated May 2, 1950 shows the existence of a fourth building, a frame garage, which was located adjacent to 437 Woodward Avenue (most recently occupied by Superior Automotive Electric) which was razed before the

October 10, 1950 aerial photograph was taken. Lots 1, 2 and 4 are relatively unchanged in the 1950 photograph.

In the 1956 photograph, coal storage is minimized on the North Parcel. Additionally, the frame buildings on the North Parcel were removed and there is no evidence of the above-ground storage tanks identified on the North Parcel in the 1940s. The South Parcel remaining lots are relatively unchanged.

No significant changes appear to have occurred on the properties until the 1969 photograph. In the 1969 photograph, the six vertical above-ground tanks are gone, as is the building on Lot 4, which was sold to Wisconsin Power & Light Co. in 1954. In the photograph from the City of Beloit (1970), there appears to be storage of large drums adjacent to one of the railroad tracks on the North Parcel. Also, high-voltage power line towers are present on the North Parcel.

By 1978, the coal bins, located immediately east of the railroad, had been removed. In the 1980 photograph, the locations where drums appeared to be stored in the 1970 photograph, appear to have storage sheds. There is evidence that the railroad lines into the North Parcel were being dismantled during this time.

During the time period from the mid 1950s to the early 1980s, the North Parcel, Lot 1 and Lot 2 were sold. Exact dates of sale are not certain; however, in a 1984 plat, the Estate is identified to consist only of the South Parcel.

3.4 Documented Events Potentially Impacting Environmental Quality

City and state records were reviewed to identify documented events that may have caused adverse impact to the environment at the Estate property. Only records for the Estate (South Parcel) were reviewed.

Several of the past tenants have been cited by the Wisconsin Department of Industry, Labor and Human Relations (DILHR) and/or the Beloit Fire Department for violations relating to storage of hazardous materials or faulty operation of petroleum dispensing and storage systems. A summary of identified citations is presented in Table 4.

Of particular note are the citations against Price-Rite Gas Station during the period from 1972 through 1984. Price-Rite received six citations during this period, three for leaking petroleum systems and two for inadequate petroleum system facilities. During the period from 1986 through 1989, Drevdahl Automotive Painting and Heritage Painting received two and three citations, respectively, for illegal storage of flammable materials.

The Estate property is listed in two Wisconsin Department of Natural Resources (WDNR) documents relating to environmental impairment. The first listing is in the Statewide Spills and Hazardous Incident Report (1989), identifying the Estate property as the site of a 1,000-gallon gasoline release. The release occurred on May 24, 1984 when Richards Brothers, hauling petroleum for U.S. Oil, failed to shut off the proper valve during fuel transfer. The Beloit Fire Department and WDNR were notified of the release. The fire department responded by diking and foaming the gasoline. The WDNR recommended that the remaining material be absorbed with sand. The exact location of the spilled gasoline was not documented in any of the reports filed by the Beloit Fire Department or the WDNR. However, the spill occurred in the vicinity of the above-ground storage tank area, with flow toward the UST location (immediately west of the 435 building) and the Rock River. There is no report of the gasoline discharging to the river.

The Wisconsin Department of Natural Resources has listed the Estate property in the Leaking Underground Storage Tank List (site unique identification number 301).

3.5 Summary of Previous Work

In November, 1989, Frances Borgerding Sheehy, representative for the Ursula Borgerding Estate, contracted Autoquip, Inc. to remove the six underground and three above-ground storage tanks located at the property. The field activities and laboratory results associated with the UST closure are presented in the December 11, 1989 CBC Environmental Services report. (At the time, closure assessments for above-ground storage tank closures were not required. Therefore, no assessment was performed). Upon removal of the tanks, significant gasoline contamination was identified in the soil and ground water in the tank area immediately west of 435 Woodward Avenue building (UST Location 1 - Figure 2). The tanks in UST Location 1 most recently contained gasoline and diesel fuel oil and were used to service the various gas stations operating out of the building since the late 1940s.

Low-level photoionization detector (PID) readings were recorded for the soils contained in a concrete vault located between 435 Woodward Avenue and 433 Woodward Avenue (UST Location 2). The soils were completely excavated from the vault, which was later filled with clean fill material and covered with concrete. Ground water was not encountered in the UST Location 2 excavation.

In response to the high PID readings and visual and olfactory observations that significant petroleum impact had occurred in UST Location 1, the UST closure assessment was abandoned in favor of performing a subsurface investigation with the objectives of defining the lateral and vertical boundaries of soil and ground water impact. The first phase of the subsurface investigation was initiated on March 14, 1990. Because the boundaries of impact could not be defined by the scope of work in the Phase I investigation, a second phase of work was initiated. The results of the Phase I/Phase II investigation are presented in the Dames & Moore report submitted October 15, 1990.

During the Phase I/Phase II investigation, five soil borings and six ground water monitoring wells were installed at the Estate property, including one monitoring well located on the south end of the North Parcel (Figure 7). Strong petroleum odors and in some cases, soils nearly saturated with oily materials were encountered in all of the sampling locations except MW-6. Dark brown, grey or black foundry-type sand and gravel fill material was encountered in all of the sampling locations except MW-8. Laboratory analyses indicated that the impacted soil and ground water was limited to the area of the dispenser islands, UST Location 1 and extending as far north and west as MW-2 (the area encompassing MW-2, MW-3, B-4 and B-5). Diesel fuel impacted soil and ground water was encountered on City of Beloit property (MW-7) and throughout the site, with the exception of the MW-6 vicinity.

Because data gathered during the Phase I/Phase II investigation did not identify all of the boundaries of impact, the WDNR requested that additional work be completed before remediation was initiated at the site. The WDNR prepared a letter to the Estate, dated March 15, 1991, detailing the additional issues for which they would require information before approving a remedial action plan. A work plan was developed to address the comments in the WDNR letter and work on the site, as described in this report, was initiated.

4.0 SITE DESCRIPTION

4.1 General Property Description

The total size of the Estate is approximately 1.1 acres and consists of the property from Woodward Avenue to 200 feet north of Woodward Avenue at a City of Beloit green area. The site is bounded by the Rock River to the west, and to the east by the Chicago, Milwaukee, and St.Paul Chicago and Northwestern railroad line. Beyond the railroad is the Ace Hardware parking lot (the Ace Hardware building is located east of the City of Beloit green area), U.S. Highway 51 and other commercial development. The property is bounded on the south by Woodward Avenue. Beyond Woodward Avenue is Wisconsin Power & Light Blackhawk Power Station.

There are currently three buildings on the site, designated from east to west, 433, 435, and 437 Woodward Avenue. Access to the property is unrestricted from Woodward Avenue, the Ace Hardware parking lot and the City of Beloit green area (North Parcel).

Until recently, portions of the site and all of the adjoining North Parcel were covered by sparse to dense grasses and brush. Mature and immature trees lined the boundary between the North Parcel and South Parcel, the railroad and the Rock River. Recently, however, Beloit 2000 Corporation has undertaken construction of the Riverfront Project, which, on the North Parcel, has consisted of removing most of the trees, removing the grasses and brush, grading the ground surface, installation of a storm water sewer system, and dredging and thin-spreading river sediments. The construction activities have also included removal of the above-ground storage tank bunker and pump house on the South Parcel.

4.2 Site Topography

Topography of the Estate Property varies from 746 feet above mean sea level at the edge of the Rock River to 750 feet at the south and east property boundaries. The ground is generally flat, with a gentle upward slope toward the east. The exception is on the south portion of the South Parcel, where the grade was artificially elevated to accommodate the elevation of Woodward Avenue and the Portland Avenue Bridge, which crosses the Rock

River. During drilling and excavation activities, foundry sand was encountered at depths from near the ground surface to more than 15 feet. (The fill material may extend deeper, however, due to the presence of ground water, deeper sampling was not possible.) The presence of the fill material indicates that the area used to be at lower elevations, possibly swamp or marshlands, and was filled to accommodate development. Filling was probably conducted in conjunction with construction of the Portland Avenue Bridge (1927) and/or construction of the Wisconsin Power & Light dam (1903), which may have artificially elevated river levels, making the land unsuitable for development without filling.

4.3 Site Geology

The geology at the site was investigated during drilling activities and excavation activities associated with the storm sewer installation conducted on the North Parcel and Riverside Park by Beloit 2000. The materials encountered during drilling/trenching indicate that significant filling has occurred at the site. Foundry sand fill was encountered in all of the sampling locations at thicknesses of up to eight feet. Other fill materials encountered included wood and brick. Underlying the foundry fill, in the saturated zone, was a black muck layer, indicating a swamp or marsh level before filling began. Geologic cross-sections of the site are shown on Figures 8, 8A, 8B, and 8C.

During installation of the soil boring at MW-3D, two soil samples were collected for grain-size analysis. The analyses were performed in accordance with the procedures in ASTM C136 and C117. The samples were selected to represent the typical fill material found at the site (G.S./1-3) and the interface of the fill material and the naturally-occurring, coarse sediments found under the organic mucks and clays (G.S./5-7). Sample G.S./1-3 was classified, based on the laboratory analysis, as "Silty Sand, fine to medium grained, black." Sample G.S./5-7 was classified as "Sand with Silt and Gravel, fine to medium to coarse grained, black." The USCS classification codes for the soil samples are *SM* (G.S./1-3) and *SM-SP* (G.S./5-7). The soils are classified as "sand" in accordance with the U.S.D.A. classification system. Copies of the laboratory reports are presented in Appendix G.

Although these classifications are more coarse than would be expected, based on the Rock County soil maps, they are representative of the fill material found at the site and the coarse river sediments found beneath the organic mucks and clays.

5.0 SOIL AND GROUND WATER QUALITY INVESTIGATION

5.1 Aerial Photography/Topographic Mapping

Aerial photographs of the site were taken on April 26, 1991 as part of the topographic base map requirements. Two base maps were developed from the photographs. A map of the study area, including both the North and South Parcels, was prepared at a scale of 1" = 30' (1:360) with a one-foot contour interval. The second map, which includes the WP&L water tower, east of U.S. Highway 51, and the WP&L dam, located downstream of the site, was prepared at a scale of 1" = 100' (1:1,200) with a five-foot contour interval. The aerial photographs and site maps were prepared by Aero-Metric Engineering, Inc. The maps conform to National Map Accuracy Standards and reference USGS benchmarks and the state plane coordinate system. The site maps are presented as Figures 3 and 5.

5.2 Soil Boring Installation Methodology

Prior to the investigation, Diggers Hotline was contacted by Dames & Moore personnel to have utilities at the site and on the adjacent city and Ace Hardware property to the north and east of the facility marked. Identified on-site utilities included a high-pressure gas line, from the north side of the 435 building north to the railroad; WP&L high-voltage, over-head power lines; and numerous utilities along the railroad, adjacent to the 433 building.

During June 4, 1991 through June 7, 1991, Twin City Testing Corporation, Milwaukee, Wisconsin, installed four soil borings at the Estate Property. In addition, two soil borings were installed on the North Parcel (MW-5 and MW-8) and one soil boring was installed in the Ace Hardware parking lot (MW-9). The locations are shown in Figure 9.

The boreholes were installed using 4¼-inch hollow stem augers, in accordance with ASTM method D-1586, section 5.1.3. Standard undisturbed soil sample collection procedures were used in conjunction with the installation of soil borings. A steel split barrel sampling tube was used for the collection and retrieval of the soil samples in accordance with ASTM method D-1586. Upon retrieval of the sampler, visual observations of the recovered materials were made in accordance with ASTM method D-2487 and with reference to method D-2488. Samples were described in the field with respect to the soil type (Unified Soil Classification System code), grain size distribution, color (or discoloration), odor, moisture content, consistency and photoionizable constituent content, as appropriate. The observations were recorded on soil boring logs (Appendix A).

5.3 Soil Coring Methodology

Shallow soil cores were collected from the area north and west of building 433 to define the boundaries of the paint previously found in the vicinity of MW-10S. The cores were advanced using a hand-auger. Soil samples were recovered and characterized at intervals of approximately six inches, to a maximum depth of approximately two feet. Soil characterization was performed as described in Section 5.2 above. The locations of the soil cores are shown in Figure 9.

5.4 Soil Sample Collection Methodology

Soil samples were collected from each sampling interval for laboratory analysis ("primary sample") and/or in-field analysis ("co-located sample"). Primary samples intended for laboratory analysis of lead (method 7421), RCRA metals (EPA 7000 series methods as appropriate), total organic carbon, or grain-size analysis were contained in laboratory-supplied 250-ml polypropylene bottles. The sample jars were filled but loosely packed. Primary samples intended for analysis of volatile organic compounds (VOCs, method 8021; total petroleum hydrocarbons, survey method) were collected in laboratory-supplied 4-oz. glass jars. The jars were tightly packed and securely capped with a teflon-lined lid to minimize head space in the jar (primary sample). Co-located samples were collected from each sampling interval for in-field screening with a photoionization detector (PID). The co-located samples were loosely packed 4-oz. glass jars to provide sufficient head space to optimize PID analysis.

After the sample jars were filled and closed, identification labeling was completed with respect to sampling location, identifier and depth of sample. The jar was placed in an insulated container to protect it from sunlight and temperature extremes. All sampling locations were documented in a bound field notebook used to record all daily activities performed at the site.

Between each sampling episode, the split spoon was washed in a TSP solution and double rinsed in clean tap water. All down-hole equipment was steam cleaned between borings. Soil collected during drilling was stored on the concrete loading pad, located north of the 433 building. The soil was placed on plastic and was covered with plastic, pending on-site soil treatment or disposal arrangements.

5.5 PID Screening

The co-located samples were allowed to warm to approximately 70° F., out of direct sunlight, and screened in the field using a MicroTip PID. The PID yields a semi-quantitative head-space analysis of the volatile compounds in the sample that have ionization potentials equal to or less than 10.6 eV. The PID was calibrated in the field, according to manufacturer's instructions, using 100-ppm isobutylene span gas, and checked between each screening event for proper response. The peak instrument readings were recorded on the soil boring logs. PID readings from the co-located samples were assumed to be similar to the primary samples. As such, the primary samples were not screened. This procedure reduces the escape of volatile components from the sample submitted for laboratory analysis. The PID screening results are provided in Table 5.

5.6 Monitoring Well Installation

All seven of the soil borings were converted into ground water monitoring wells. Monitoring wells MW-4, MW-5, MW-8 and MW-9 were constructed as monitoring wells, with the screened interval of the well intersecting the ground water table. Wells MW-2D, MW-3D and MW-10D were constructed as piezometers, nested with monitoring wells MW-2S, MW-3S and MW-10S, respectively. The wells were generally constructed, developed and sampled in accordance with chapter NR 141 of the Wisconsin Administrative Code. However, construction variances were required for aspects of all of the wells in response to field conditions and other restrictions:

- MW-9 required flush-mounted completion in order to comply with the property owner's requirements;

- MW-4, MW-5, MW-8 and MW-9 required reduced filter-packs, filter-pack seals and annular-space seals in order to allow the screened interval of the wells to intersect the ground water table;

- MW-2D, MW-3D and MW-10D required the use of collapsed formation around the screened interval due to the heaving material encountered at depth.

Well-construction variances were obtained from the WDNR during a June 7, 1991 telephone conversation and documented in the December, 1991 Status Report. The specific construction details are presented in the well construction reports (Appendix B). Details and discussions of the variances are provided below.

5.6.1 Flush-Mounted Well Completion

Flush-mounted completion of monitoring well MW-9 was required to comply with the conditions for installing a well on the property of Ace Hardware, as determined by the property owners. The well is located in the parking lot of Ace Hardware and was installed with a flush mount in order that it not interfere with facility parking. The flush mount is approximately eight inches in diameter and extends two feet below the ground surface. The annular space seal inside the flush mount is terminated approximately eight inches below the top of the well casing, which is sealed with an expandable locking plug. Access to the well is secured with a locking security bar. The surface of the flush mount is approximately one inch higher than the surrounding asphalt pavement, with a sloping concrete seal to channel water away from the well access.

5.6.2 Shallow-Well Construction

In order to intersect the water table, wells with maximum depths of 15 feet were installed at well locations MW-4, MW-5, MW-8 and MW-9. Shallow monitoring wells MW-1, MW-

2S, MW-3S and MW-10S were installed in 1990 with construction variance guidance from the WDNR. Shallow wells MW-4, MW-5, MW-8 and MW-9 were constructed using similar techniques. The specifics of construction of each well is documented in the well construction reports; however, the general construction consists of the following: 1) filter pack extending 1.5 feet above the top of the screened interval; 2) 0.5 feet of fine sand (filter pack seal); and 3) 5.5 feet of bentonite annular space seal.

5.6.3 Deep-Well Construction

Three deep wells were nested with existing shallow wells at well locations MW-2, MW-3 and MW-10. The shallow wells are identified with an "S" following the well number. The deep wells are identified with a "D" following the well number (Figure 9).

The deep wells are installed in the sand and gravel aquifer and have five-foot screens, placed at maximum depths of 35 to 40 feet. The sand and gravel at depths greater than approximately 25 feet are under significant hydrostatic pressure, causing heaving of the sand and gravel into the auger, making installation of a filter pack around the screen (at 35 to 40 feet) very difficult. Several techniques were implemented in an effort to reduce the amount of heaving material: 1) applying a positive pressure head in the auger by adding water from a known clean source[1]; 2) reaming and recleaning the hole[2]; and 3) and over-drilling with knock-out plugs[3]. None of the methods were successful in keeping the auger open long enough to install a filter pack around the screened interval of the well. The blow-back into the auger was three to five feet from the base of the screen. Additionally, the heaved material threatened to lock the augers in the ground. Therefore, the augers had to be pulled above the level of the heaved material, clearing the sand and gravel from the auger, before any material could be poured or tremied down the hole. However, as the augers were pulled up, the surrounding formation immediately heaved into the well casing.

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[1] Technique applied at MW-2D only. The water was obtained from City of Milwaukee tap and transported to the site in a stainless steel tank.

[2] Technique applied at MW-2D, MW-3D and MW-10D.

[3] Technique applied at MW-3D and MW-10D.

As the augers were pulled up, approximately one half to one foot at a time, the level of the heaved formation was measured. When the heaved material was finally forced out of the augers (at depths of 20 to 25 feet) the filter-pack seal and annular space seal were installed.

The construction of the deep wells is not thought to significantly impact the quality of water samples collected from the wells or to enhance vertical contaminant migration for the following reasons: 1) the greatest concentrations of chemical impact in the well locations was found in the soils at depths of 15 to 20 feet. The filter-pack seal and annular space seal were generally installed at 20 to 25 feet, minimizing the potential for the impacted section of the formation to affect the screened interval; 2) the material against the well screen and casing generally originated from deeper in the formation or from the same depth in the formation, thereby consisting of similar physical and chemical characteristics as the formation being investigated; and 3) the formation at depths greater than approximately 20 feet consisted of sand and gravel with very few fines. During development, the water in the wells was relatively free of silt before three well volumes were purged, indicating that the heaved material was appropriate for use as a filter pack.

5.7 Well Development and Ground Water Sample Collection Methodology

The wells were developed in accordance with NR 141. Details of development are provided in the well development logs (Appendix B). Purged well water collected during well development and well purging for sampling was containerized in well-dedicated, DOT-approved 55-gallon closed-head drums. The drums were labeled with the well number and identified as purge water. All drums were inspected for integrity each day of field activities.

Ground water samples were collected using well-dedicated, clear PVC bailers that had been previously washed in a TSP solution and triple rinsed with distilled water. Samples intended for VOC analysis (method 8021; method 8240) were collected in laboratory-supplied 40-ml vials with teflon septa. Sample vials were filled until a positive meniscus was formed, preserved with hydrochloric acid (HCl) and securely capped. Samples intended for semi-volatiles analysis (polynuclear aromatic hydrocarbon (PAH) by method 8270 or 610 HPLC) were collected in laboratory-supplied one-liter amber glass jars with teflon-lined lids without preservative. Samples intended for lead or RCRA metals analysis (EPA 7000 series methods as appropriate) were collected in laboratory-supplied 250-ml polypropylene jars with plastic lids. The water samples were pressure-filtered through 0.45 μm pore size cellulose acetate filters and preserved with laboratory-prepared nitric acid (HNO_3) in ampules.

After the sample jars were filled and closed, identification labeling was completed. Each jar was placed in an insulated container to protect it from sunlight and temperature extremes.

In addition to collection of the ground water samples from the well locations, quality control samples, consisting of one trip blank and one field blank, were submitted for analysis. The purpose of the trip blank is to identify if any volatile compounds, in detectible concentrations, contaminated the sample jars or samples during transportation from the laboratory, to the site, or on the return to the laboratory. The trip blank is to accompany the sample jars during the entire trip, including around the site during sampling activities, and is then returned to the laboratory, with the other ground water samples, for analysis. If contaminants are found in the trip blank, the actual ground water samples may also have been contaminated during the trip. The purpose of the field blank is to evaluate the potential for samples to be contaminated by use of common sampling equipment, water used for decontamination, exposure to the atmosphere, or sample-handling procedures.

The trip blank was prepared by the laboratory and was transported from the laboratory to the site with the sample jars. At the site the trip blank was carried to the sampling points during sampling activities. The trip blank was then processed, as if it was a ground water sample, and submitted to the laboratory for analysis.

The field blank consisted of unused decontamination water that was transported to the area of MW-3, exposed to the atmosphere and collected in a sample jar. Because none of the sampling equipment was used at more than one well (sampling equipment was dedicated to each well), the water was not poured through sampling equipment prior to collection in a sample jar. The field blank sample jar and sample was handled in the same manner as the ground water samples.

5.8 Soil and Ground Water Sample Custody

Sample custody procedures are designed to comply with U.S. EPA and National Enforcement Investigation Council (NEIC) requirements for sample control. Samples collected during the site investigation were the responsibility of identified persons from the time they were collected until they or their derived data were incorporated into the final report. Stringent chain-of-custody procedures were followed to maintain and document sample possession. A sample or evidence file is considered to be in custody if it is in your possession; is in your view, after being in your possession; was in your possession and was placed in a secured location; or is in a designated secure area.

Chain-of-custody forms were completed to the fullest extent possible prior to sample shipment. They included the following information: sample number, date collected, source of sample (including type of sample and site identification) and name of sampler. These forms were filled out in a legible manner using waterproof ink and were signed by the sampler. Similar information was provided on the sample tag, which was securely attached to the sample bottle.

Samples were always accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them signed, dated and noted the time on the record. The custody record documents sample custody transfer from the sampler, through the courier, to the laboratory.

Samples were packaged properly for shipment and dispatched to Ortek Environmental Laboratory, Green Bay, Wisconsin, for analysis, with a separate custody record accompanying each shipment. The original record accompanied the shipment and a copy was retained by the field sampler and filed immediately upon return to the office.

Samples requiring refrigeration were chilled with ice or "blue ice" and packaged in an insulated container/shuttle for transport to Ortek Environmental Laboratory. Only shipping containers that met all applicable state and federal standards for safe shipment were used. Copies of the chain-of-custody documents are presented in Appendix C.

5.9 Well-Elevation Survey

An elevation survey was conducted by Dames & Moore personnel on May 2, 1991, June 7, 1991 and August 27, 1991, using a Lietz/Sokkia automatic level, Model B1 (accurate to 0.0001 feet at 200 feet; the elevation readings have two significant figures; therefore, instrument error is negligible). The elevations were surveyed to several benchmark elevations, as identified on the Aero-Metric Engineering 1:360 site map. The raw survey data were recorded in a bound field notebook.

5.10 Laboratory Analyses

5.10.1 Soil Samples

Soil samples were transported on ice or "blue ice" to Ortek Environmental Laboratory for chemical and physical analysis. Two samples were to be analyzed from each soil boring; however, the high water table, minimal sample recovery due to the water, and heaving sands limited sampling to the top six to ten feet of the soil borings. Therefore, one sample was submitted to the laboratory from each soil boring. In the case of MW-4, MW-5 and MW-9, the soil samples collected throughout the boring were essentially similar; analysis of multiple samples would not have provided new information, and only one sample was submitted for analysis. Where soils throughout the boring were essentially similar, the deepest retrievable sample or the sample from the interval immediately above the saturated zone was selected for analysis. Soil samples from the piezometer nest wells (MW-2D, MW-3D and MW-10D) were not anticipated to be analyzed, as the soil encountered in the deep well borings is thought to be similar in characteristics and composition as the soil in the adjacent shallow borings. However, the soil encountered in MW-2D and MW-10D was significantly different from the soil that had been submitted for analysis from MW-2S and MW-10s. Therefore, one sample from each boring was submitted for laboratory analysis. The purpose of this analysis was to characterize the different types of fill and naturally-occurring soil encountered in the soils at the MW-2S/D and MW-10S/D sampling locations.

Each of the soil samples selected for laboratory analysis were analyzed for total petroleum hydrocarbons (TPH survey, to include gasoline and diesel range organics by the California

Method), petroleum volatile organics (VOCs by method 8021) and lead (EPA SW846 method 7421).

One additional soil sample was collected from immediately below the layer of paint found near the ground surface at MW-10S/D. The sample was analyzed for RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver), for later correlation to the metal content of the paint itself.

Soil samples from MW-3D were collected for analysis of total organic carbon (TOC) and grain-size analysis. The samples were collected from various intervals of the boring and were analyzed to determine parameters used in estimating contaminant transport rates.

The laboratory results are summarized in Table 6 and Figure 13. The laboratory reports are presented in Appendix D.

5.10.2 Ground Water Samples

Following development of the new wells and purging of the existing wells, in accordance with NR 141, ground water samples were collected for laboratory analysis. All 13 project wells were sampled in June, 1991 for analysis of volatile organic compounds (VOCs, method 8021[4].

Samples from MW-2S, MW-3S and MW-7 were collected in June, 1991 for analysis of polynuclear aromatic hydrocarbons (PAHs, method 8270). The samples were selected based on the previously-identified petroleum found at the sampling location: MW-2S was selected to identify PAHs where only gasoline fractions were identified. MW-3S was selected to identify PAHs where gasoline and diesel fuel (both dissolved fractions and free phases) were

[4] VOC analysis was to be performed by method 8021, per the requirements in the Wisconsin Department of Natural Resources (WDNR) Leaking Underground Storage Tank (LUST) Analytical Guidance. However, due to equipment malfunction at the laboratory, method 8021 could not be performed on all of the samples within the sample holding times. In response, some samples were analyzed by method 8260, which is the equivalent GC/MS method to 8021, which is by GC alone.

identified. MW-7 was selected to investigate whether PAHs would be found in ground water with low concentrations of petroleum fractions.

Six well locations were selected for ground water analysis of lead (per the WDNR LUST Analytical Guidance) and the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver, using appropriate U.S. EPA SW846 methodologies). The wells to be sampled for the lead and RCRA metals were selected somewhat randomly, to characterize the site as a whole, but with emphasis on the areas most likely to be impacted by lead or other metals. The areas most likely to be impacted were identified as MW-3S/D (due to the high concentrations of gasoline impact resulting from the 1984 gasoline release) and MW-10S/D (due to the spilled paint in this area). Both the shallow and deep wells were sampled for lead and the other metals at MW-3S/D and MW-10S/D in order to identify the degree to which the metals were migrating vertically. The random samples were collected from MW-2S and MW-7.

Also during the June, 1991 ground water sampling event, one duplicate sample (randomly selected as MW-2S) was collected for analysis of VOCs and metals. In addition, one trip blank and one field blank were submitted for analysis. The trip blank was analyzed for VOCs (method 8021). The field blank was analyzed for VOCs (method 8021), lead and RCRA metals.

Additional sampling was conducted in response to the results of the June, 1991 sample results and in order to achieve the objectives of the investigation. In September, 1991, ground water samples were collected form MW-6 and MW-10S. The sample from MW-6 was analyzed for PAHs. The sample from MW-6 was selected to represent background concentrations of those compounds because no detectible concentrations of any of the 8240 or 8021 volatiles had been found in the water at that location during the Phase I, Phase II or Phase III investigations.

The sample from MW-10S was analyzed for VOCs by method 8240 to investigate the presence of ketones in the ground water at that location. Ketones were identified in a ground water sample during the Phase I/Phase II investigation. The objective during the Phase III investigation was to identify which compounds were in the ground water and target those compounds for analysis in other wells in the immediate vicinity. Because none of the ketones previously identified in the ground water at MW-10S were found in the MW-10S September, 1991 sample, rationale for selecting specific compounds to analyze for in nearby wells could not be supported. Therefore, the wells in the immediate vicinity of MW-10S were analyzed for the complete 8240 scan. The 8240 scan was performed on water samples, collected during October, 1991, from MW-1, MW-5, MW-9 and MW-10D.

A summary of the sample locations, sampling dates and analytes is presented as Table 7. The ground water laboratory results are summarized in Table 8 and Figure 14. The laboratory reports, including laboratory blanks, are presented in Appendix E.

5.10.3 Paint Release Area

Samples of the paint, which was found on the ground on the north and west sides of the 433 building, were collected during installation of the MW-10D soil boring. The paint was analyzed for RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) to characterize the paint for later comparison to the metals results from the soil and ground water in the vicinity of the paint release area. The laboratory results are summarized in Table 9. The laboratory reports are presented in Appendix F.

5.10.4 Oily Product Special Investigation

During the Phase I/Phase II investigation, an oily substance was encountered in the soils at MW-1, MW-2S, MW-3S and B-5. One of the objectives of the Phase III investigation was to determine the composition of the oily substance. During the Phase III investigation, an oily substance was encountered floating on the ground water at MW-3S. Therefore, a sample of the material was collected and submitted to the laboratory for analysis. The analytical parameters included VOCs (method 8240), PAHs (method 8270), PCBs (preparation method 3510 and analytical method 8080), RCRA metals (SW846 methodologies as appropriate), and total petroleum hydrocarbons (TPH survey method).

Several compounds were identified in the PAH scan. However, because the sample had to be diluted by a factor of 100, the quantitation of the compound concentrations was unreliable. Subsequent sampling for analysis of PAHs and creosols (method 8270) in January, 1992 yielded better analytical results, which will be referred to in later discussions regarding the environmental quality of the site. The June, 1991 analytical results (with the exception of the PAH results) and the January, 1992 results are presented in Table 10. The laboratory reports are presented in Appendix F.

6.0 SITE HYDROGEOLOGY

The site hydrogeology was evaluated using data gathered during the Phase I/Phase II and Phase III investigations. Additional information was gathered during a pumping test conducted by Wisconsin Power & Light Company on WP&L well #4. Dames & Moore provided well monitoring at project wells MW-2S/D during the pumping test and the resulting data were exchanged between WP&L and Dames & Moore.

Hydrogeologic data were collected in order to characterize the shallow aquifer at the Estate Property. The foci of the characterization were:

- Ground water flow direction.
- Vertical and horizontal hydraulic gradient.
- Hydraulic conductivity of the aquifer.

The purpose of the characterization was to evaluate the potential contaminant migration pathways and the location of potential ground-water receptors.

6.1 Local Aquifer Characteristics

Well construction reports and geologic logs for Sec. 25, 35, and 36, T. 1 N., R. 12 E. were obtained from the Wisconsin Geological and Natural History Survey (WGNHS) and WP&L to determine the locations of private and municipal wells surrounding the Estate Property. The information was used to evaluate the subsurface stratigraphy of the area, as well as to locate potential ground water receptor wells.

The details of the geology and area ground water are discussed in Sections 2.5 and 2.6 above. In general, the geology in the vicinity of the site consists of approximately 243 feet of glacial deposits, consisting primarily of sand and gravel. Underlying the glacial material is approximately 32 feet of grey dolomite, which is underlain by sandstone. Ground water at the site is encountered at depths of three feet below the ground surface, near the Rock River, to depths of approximately nine feet below the ground surface 200 feet east of the river. The dolomite and sandstone are water-bearing units, which appear to have some hydraulic connection to the shallow glacial aquifer.

6.2 Ground Water Flow Patterns

Elevation surveys of the site and monitoring wells were conducted on May 2, 1991, June 7, 1991 and August 27, 1991 as described above. Ground water level data were collected in 1991, on May 2, June 4, August 27, September 30, October 2, October 7, and October 16. Ground water elevation data were also collected in 1992, on January 20 and January 31. The water levels were collected using a Keck oil-water interface probe (accuracy ±0.01 feet).

The data from the shallow wells were analyzed to evaluate the horizontal ground water gradient and horizontal expression of ground water flow direction. The data were analyzed using two geostatistical methods: kriging and least squares[5], and were cross-checked by hand plotting. Based on the ground water evaluations calculated from the data sets, the horizontal ground water flow direction is predominantly to the east, away from the Rock River, with a horizontal geometric mean gradient of 0.09. However, the measured ground water elevations at MW-9 and MW-10S are higher than would be expected if the ground water was continuing to flow east. Based on the least squares analysis, the water elevation measured at MW-9 is anomalously high and does not fit on the least-squares plane with the rest of the project wells. The water elevations measured at MW-10S are also anomalous, but to a lesser degree than those at MW-9. These data suggest that shallow ground water flow is from east to west, toward the Rock River, at distances greater than approximately 150 feet east of the river.

The data from the nested wells, at MW-2S/D, MW-3S/D and MW-10S/D, all indicate a downward vertical gradient. The presence of a downward vertical gradient suggests that water is flowing from the Rock River toward the east, as expressed by the shallow ground

[5] The least squares method is a way of analyzing the spatial distribution of the hydraulic heads by defining the trend surface, fitting a least squares plane to the water elevation data. The computer program also indicates the discrepancies between the trend surface and the actual measurements. The discrepancies can be used to analyze the broad range of phenomena that can interfere with the data, such as measurement errors, or heterogeneity.

water elevations within 150 feet of the river. The downward vertical gradient at MW-2S/D and MW-3S/D is significant (0.08 and 0.35, respectively), while the vertical gradient at MW-10S/D, approximately 210 feet east of the river, is 0.001. These data suggest that a change in the ground water flow patterns occurs at a location less than 200 feet east of the river.

The expression of two different shallow ground water flow directions and the differing magnitude of downward vertical gradient in the vicinity of the site suggests the possibility of two distinct ground water flow cells; a local, shallow flow cell that functions within approximately 150 to 200 feet of the surface water/ground water interface, and a regional flow system flowing from the outwash plains east of the river toward the west. The local flow cell appears to consist of surface water flowing out of the river bed in an easterly direction, with a strong downward vertical component. The local flow appears to discharge to the regional flow system approximately 150 to 200 feet east of the Rock River.

Based on the elevation of the water in the Rock River adjacent to the site, the regional ground water system does not appear to be discharging to the Rock River in the vicinity of the site (upstream of the Blackhawk station dam). However, data regarding the flow of ground water under and on the west side of the Rock River are not available for confirmation. An analysis of the ground water flow direction, utilizing data from the deep wells only, suggests that the deeper, regional ground water system is flowing in a south-southwesterly direction. Because river elevations downstream of the Blackhawk dam (shown in Figure 5) appear to be approximately five feet lower than the observed deep well water elevations, discharge to the Rock River downstream of the Blackhawk dam may be occurring. According to WP&L personnel, river elevations downstream of the Blackhawk dam were between 732 feet and 736 feet above mean sea level during the period for which ground water elevation data were collected. Additional discussion is provided below.

6.3 Ground Water-River Water Correlation

The water levels, both upstream and downstream of the Blackhawk dam, are monitored by Wisconsin Power & Light Company. WP&L provided the river water elevation data for the dates that ground water elevations were collected at the Estate property. A summary of the river water elevations is provided in Table 12.

Based on the reported river elevations, the water levels in the Rock River downstream of the Blackhawk dam are approximately five feet lower than the ground water elevations in the deep wells at the Estate property. This information, together with the south-southwest flow direction expressed by the deep wells, indicates that the ground water at the Estate property may be discharging to the Rock River at some location downstream of the Blackhawk dam.

The river elevations were plotted against the ground water elevations to evaluate whether river elevations correlated with observed ground water elevations. The resulting correlations are presented in Figure 11. The river levels upstream of the Blackhawk dam are maintained relatively constant to supply the Blackhawk power station with a constant source of water for hydroelectric power generation and non-contact cooling. The river elevations downstream of the dam fluctuate by as much as three feet, apparently in response to seasonal conditions. All three of the deep wells appear to correlate strongly with the fluctuations observed in the river level downstream of the dam. Additionally, shallow monitoring wells MW-1, MW-4, MW-5, MW-6, and MW-10S appear to strongly correlate with the observed river levels downstream of the dam. Ground water elevations in MW-2S, MW-7, and MW-8 appear to correlate with the downstream levels, but are less strongly correlated. MW-3S appears to correlate with the downstream levels, however, reliable ground water elevation data for MW-3S are limited to only three observation dates. The ground water elevations observed at MW-9 are relatively unchanged during the monitoring period. In that respect, they more closely reflect the upstream river levels, however, the distance between the river and MW-9 and the lack of correlation of other well levels with the upstream river levels suggest that this is not a significant correlation.

Because the river water elevations downstream of the Blackhawk dam and the ground water elevations observed at the Estate site correlate so closely, the lag time between the two is thought to be minimal. This suggests a strong hydraulic connection between the river and adjacent ground water system. For this reason, any seasonal fluctuations that are expressed in the water levels of the Rock River, will be expressed in the ground water elevations at the Estate property. Based on the available data (May, 1991 through January, 1992), the early spring of the year appears to have the highest water levels. The dry season is observed around August, with slight recovery through January (Figure 11).

6.4 Hydraulic Conductivity and Ground Water Velocity

Slug tests were conducted on each monitoring well to estimate the hydraulic conductivity of the aquifer at the well locations[6]. The tests were conducted and the data analyzed as described by Bouwer and Rice (1976). The estimated geometric mean hydraulic conductivity (K) in the shallow aquifer at the site is 1.4×10^{-5} cm/sec. During the Phase I/Phase II investigation, the hydraulic conductivity at the site was estimated to be 1.6×10^{-3} cm/sec. Although the instrumentation used during the Phase III investigation is more accurate, the data generated during the slug tests displayed numerous irregularities, which may have interfered with the analytical procedure. Based on the materials encountered during drilling and the response of the wells during development, the hydraulic conductivity of the shallow aquifer is estimated to be approximately 10^{-3} cm/sec.

Slug test data from the deep wells, which were screened in the sand and gravel portion of the glacial aquifer, could not be analyzed to estimate hydraulic conductivity because the aquifer response to the bail-down stress was too fast to collect recovery data. The estimated hydraulic conductivity of the sand and gravel region of the glacial aquifer is estimated in the range of 10^{-2} cm/sec or 10^{-1} cm/sec.

The pumping test, conducted by Wisconsin Power & Light Company, tested the characteristics of the sandstone aquifer. Monitoring well MW-2S was also monitored to evaluate the effect of pumping the sandstone aquifer on the water level of the shallow glacial aquifer. During the pumping phase of the test, water levels in MW-2S decreased by approximately 0.15 feet, indicating that there may be a limited hydraulic connection between the two aquifers. The hydraulic conductivity of the sandstone aquifer was estimated to be approximately 10^{-3} cm/sec.

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[6] Although slug tests are useful in assessing the hydraulic conductivity of an aquifer, the tests are only valid for the immediate area surrounding the well, in the screened interval of the well. In evaluating slug test data, significant assumptions must be made, which will reduce the reliability of the resulting data interpretation in areas beyond the immediate vicinity of the well screen. Slug tests may be accurate to within one to two orders of magnitude, especially under conditions of rapidly recharging wells or vertical and horizontal heterogeneity and anisotropy.

The average ground water linear velocity is estimated using the following equation:

$$V = \frac{K\,I}{n_e}$$

Where: V = Average linear velocity.
K = Hydraulic conductivity.
I = Ground water gradient.
n_e = Effective porosity of the aquifer material.

When data are available regarding the hydraulic conductivity, effective porosity, and ground water gradient in both the vertical and horizontal directions, velocity can be estimated by taking the vector sum of the velocities in both the vertical and horizontal directions. The average linear velocity for the site (in three dimensions) would be the sum of the array created by the individual vectors. However, because both the horizontal and vertical gradient and hydraulic conductivity vary significantly from well-location to well-location, quantitation of ground water velocity at the site is relatively meaningless. Instead, velocities at the different locations at the site can be inferred by the relative density of the ground water streamlines identified on Figure 10.

6.5 Potential Ground Water Receptors

Potential ground-water receptors in the area surrounding the Estate Property include underground utilities, the Rock River, and industrial and municipal water wells.

6.5.1 Underground Utilities

Numerous underground utilities exist in the vicinity of the site. However, the utilities of primary concern, due to their relative location to the impacted areas of the site, consist of gas, water and storm sewer. A high-pressure gas line is located behind the 435 building and extends north-east, north of the 433 building, where it parallels the railroad track. The line intersects the impacted area of MW-10S/D. However, the line is located approximately three feet below ground surface, and ground water in the vicinity of MW-10S/D is found at depths of approximately 13 feet below ground surface. Therefore, the gas utility line is not a realistic ground water receptor. However, if the backfill around the gas line is sufficiently porous, contaminants in the vapor phase or washed through the soil by precipitation infiltration may be found adjacent to the line. In comparison, the backfill around the gas line is not likely to be more porous than the coarse fill material found throughout the site, this is not likely to provide a preferential path of migration.

Water and storm sewer lines are located south of the buildings and along the north side of Woodward Avenue. The water and sewer lines are located at depths of approximately five feet below the ground surface and are not deep enough to be of concern as ground water receptors, as ground water is located at depths of 8 to 13 feet below ground surface south of the buildings.

During Riverfront Project construction activities, a new storm sewer was installed on the North Parcel, which is owned by the City of Beloit. The storm sewer runs parallel to the Rock River, approximately 150 feet east of the river. The trench for the sewer was dug to a depth of approximately five feet below the ground surface. Ground water was encountered in the trench at a depth of approximately four feet. If the storm sewer is constructed of permeable material or is encased in a coarse gravel backfill, it may be a ground water receptor.

6.5.2 Rock River

The Rock River, which flows south, parallel to the Estate property, does not appear to be a potential ground water receptor in the vicinity of the site. Based on data gathered from the project monitoring wells, the shallow ground water is flowing away from the river, with the river discharging to the ground water. Based on the available data, the lower regional ground water flow is not discharging to the river in the area of the site, but is flowing under the river. It is possible that the regional ground water flow discharges to the Rock River at some location downstream of the dam. However, retardation of the contaminants in the shallow, organic-rich and fine-grained materials of the shallow ground water, coupled with natural degradation of the materials will significantly reduce the concentration of contaminants as the ground water migrates toward the regional flow system. Upon mixing with the regional flow system, further filtering and dilution (over nearly ¼ mile) with a significant volume of water will occur, further reducing any remaining contaminant concentrations.

6.5.3 Industrial and Municipal Water Wells

Well construction reports and geologic logs for Sec. 25, 35, and 36, T. 1 N., R. 12 E. were obtained from the Wisconsin Geological and Natural History Survey (WGNHS) and WP&L to determine the locations of municipal wells surrounding the Estate property. The information was used to evaluate the subsurface stratigraphy of the area, as well as to locate potential receptor wells.

Numerous wells were identified within one mile of the site. However, the majority of the wells were installed during the 1930s to 1950s for home use. According to City of Beloit personnel, all domestic-use water in the vicinity of the site is supplied by municipal wells and most of the residential wells have been abandoned. The remaining wells identified near the site consisted of industrial wells at the Fairbanks-Morse & Co. facility, north and east of the site, and municipal water wells owned by WP&L. The locations of active wells, including WP&L #4, are shown on Figure 12.

Beloit municipal well #2 is located within one mile of the site; however, the well is located west of the Rock River and north of the site, out of the apparent ground water flow path.

The Fairbanks-Morse wells are located north and east of the site, and are completed in the dolomite bedrock. These wells are out of the apparent ground water flow path from the Estate site and most likely receive ground water from the outwash plains east of the Fairbanks-Morse facility. Therefore, the wells are not of concern as potential receptors of ground water from the Estate property.

Wisconsin Power and Light Company has two wells in the vicinity of the Estate property. WP&L well #4 is located approximately 350 feet east of the site, on U.S. Highway 51. WP&L well #8 is located approximately ¼ mile south of the Estate property, on the east bank of the Rock River. Both wells are cased throughout the glacial and dolomite aquifers and open-hole construction in the underlying sandstone aquifer. The well at Blackhawk station is operating. WP&L #4 was abandoned, but has recently been evaluated for reconditioning. WP&L #8 is in operation. According to WP&L personnel, chemical analysis of water from WP&L #4, collected in 1991, yielded no detectible volatile compounds in the water. However, elevated lead and barium concentrations were identified.

Laboratory analysis of water collected from WP&L #8 during 1990 and 1991 contained trace concentrations (less than 5 $\mu g/l$) of various chlorinated compounds. The water samples did not contain any detectible concentrations of any of the compounds identified in the ground water at the Estate. Additionally, the compounds identified in WP&L #8 were not identified at the Estate. Based on this information, either the ground water at the Estate is not reaching WP&L #8 before discharging to the river, or the contaminants in the water at the Estate are being diluted or removed from the system by naturally-occurring chemical, physical or biological processes during the travel time to WP&L #8.

'89 result
1,1-DCA .64 ug/l
PCE 1.1 ug/l
1,1,1-TCA .38 ug/l
TCE 2.0 ug/l

7.0 NATURE AND EXTENT OF CONTAMINATION

7.1 Soil Quality

Total Petroleum Hydrocarbons

Total petroleum hydrocarbon (TPH) survey analyses were performed on soil samples to evaluate the soils for petroleum fractions as diesel fuel, gasoline, or kerosene. Kerosene was not detected in any of the samples. Because kerosene was stored in the tanks at UST Location 2, and kerosene was not identified in any of the soil samples, there is no reason to suspect that the tanks in UST Location 2 had adversely impacted the environment. The petroleum impact identified at the site appears to be located in two primary areas: 1) on the South Parcel in the vicinity of the AST and UST Location 1 systems, and 2) on the North Parcel in the vicinity of the AST system. Based on TPH analysis of a soil sample from MW-5, the two areas of petroleum impact do not appear to be connected.

Of the samples submitted for analysis during the Phase III investigation, diesel fuel was only found in the soil sample from MW-8. However, during previous phases of investigation, diesel fuel was also identified in the areas of MW-1, MW-7, B-8, B-9, MW-10S/D, and B-11. Based on these data, impact to the soil by diesel fuel fractions appears to be associated with the AST bunker, pump house and associated piping. The presence of diesel fractions in the soil near MW-10S/D may be the result of leaks from the piping or loading/unloading rack, which was located adjacent to the railroad tracks near MW-10S/D. The presence of diesel fuel in the vicinity of B-8 and B-9 is most likely the result of leaking dispenser islands. Although there is no documentation to verify which dispensers supplied diesel fuel, diesel fuel was stored in the USTs that supplied the dispensers.

The occurrence of diesel fuel on the North Parcel, near MW-8, is probably the result of releases from the above-ground storage tanks (discussed in Section 3.0). Although there is no documentation regarding the contents of the tanks on the North Parcel, the tanks are suspected to have contained diesel fuel, based on the presence of diesel fuel in piping encountered during installation of the new storm sewer (details in Section 4.1).

Gasoline fractions were identified in soil samples from MW-2D/S and MW-8. In previous phases of investigation, gasoline fractions were also identified at MW-3S/D, B-4, and B-5. Identification of gasoline fractions in the soil in the vicinity of MW-2S/D and MW-3S/D is likely the result, at least in part, of impact from the 1984 gasoline spill. Based on available documentation, the spilled gasoline traveled to those locations before being cleaned up. Impact found in MW-3S/D may also be the result of leaks from the USTs. Based on observations made during the UST closure assessment, releases from the USTs had occurred. Additionally, ground water was encountered in the concrete bunker in which the USTs were contained, indicating that if a release had occurred from the USTs, the release may not have been isolated from the environment. The occurrence of gasoline fractions in B-4 and B-5 may be the result of leaks from the dispensers or piping associated with the UST system in UST Location 1. Gasoline impact in the vicinity of MW-8 is probably the result of leaks or spills from the AST system previously identified.

Volatile Organic Compounds

Volatile organic compounds (VOCs) were identified in soil samples collected from MW-2S/D, MW-4, MW-5, MW-8, MW-9 and MW-10S/D. The compounds found in the soil include benzene; n-butylbenzene; tert-butylbenzene; chlorobenzene; p-isopropyltoluene; isopropylbenzene; naphthalene; n-propylbenzene; 1,1,2-trichloroethane (TCA); 1,3,5-trimethylbenzene; 1,2,4-trimethylbenzene; acetone; carbon disulfide; 2-butanone (MEK); vinyl acetate; and 2-methyl-4-butanone (MIBK)[7]. Of those compounds, TCA, acetone, carbon disulfide, MEK, vinyl acetate, and MIBK are compounds related to paint, varnish and resin manufacture. Concentrations of these compounds were identified in MW-2S/D, MW-4, MW-5, MW-8, and MW-9. The occurrence of the compounds at MW-9 was limited to trace concentrations of MIBK. The occurrence of the compounds at MW-5 was limited to trace concentrations of carbon disulfide. None of the concentrations of the paint-related compounds identified in MW-2D/S and MW-4 exceeded 100 $\mu g/kg$, with the exception of vinyl acetate (450 $\mu g/kg$ and 130 $\mu g/kg$, respectively). MW-2S/D was the only sampling

[7] Other compounds were also detected, but were also detected in the laboratory method blanks. Concentrations of compounds that were detected in the method blanks are only addressed if they exceed ten times the concentration in the method blank.

location tested that contained detectible concentrations of TCA. MW-4 was the only sampling location tested that contained detectible concentrations of acetone.

On the North Parcel, at MW-8, the soil contained high concentrations of vinyl acetate (8,300 μg/kg) and MIBK (5,300 μg/kg). MW-8 was also the only sampling location tested that contained detectible concentrations of chlorobenzene.

The occurrence of paint, varnish and resin manufacture-related compounds is probably the result of activities on the site by the various companies that manufactured paint or stored, mixed and used paint in their businesses. The occurrence of trace concentrations of MIBK at MW-9 may be related to the paint release area north of the 433 building. The occurrence of the compounds near the west property boundary coincides with the paint manufacturing operations that took place in the 437 building. The occurrence of the compounds on the North Parcel, at MW-8, suggests that the compounds may have been stored in the ASTs or in drums in the AST bunker area, previously located in the vicinity of MW-8.

Lead and Other Metals

Lead concentrations were analyzed in seven soil samples, per the WDNR LUST Analytical Guidance (June, 1991). In general, the concentrations were within common range values, as identified by the U.S. EPA, for natural soils (2 ppm to 200 ppm). Based on data from the site, the lead concentrations of 10 ppm to 20 ppm are considered within the range of the naturally occurring soils. Concentrations of 47 ppm and 60 ppm are considered acceptable for the fill material found throughout the site. A notable exception to this was found on the South Parcel at MW-10S/D in the soil immediately beneath the released paint. The concentration in this interval (1'-3') was 160 mg/kg (ppm). However, the concentration of lead in the soil returned to within those of the natural soils at a depth of eight to ten feet (10 ppm). On the North Parcel, soil at MW-8 exhibited high concentrations of lead (2,600 ppm). This may be the result of pigment from paint-related operations or the release of leaded petroleum products.

Additional heavy metal analysis was performed on soil from MW-10S/D. The purpose of the analysis was to correlate the concentrations of metals found in a sample of the paint waste with the concentrations in the soil immediately beneath the paint layers and at depth. The results of the three samples are presented in Table 9 for comparison. The elevated concentrations of lead in the paint sample correlate to the elevated concentrations in the soil sample from immediately beneath the paint. Lead does not appear to have impacted the soil in the deep sample (eight feet to ten feet). The same correlation can be made for concentrations of barium, cadmium, chromium and mercury in the paint waste and soil. However, the concentration of mercury found in the soils, even at depth, is greater than the concentration that the U.S. EPA has estimated as common for natural soils.

The arsenic concentration in the paint sample was considerable lower than the concentrations in the soil from the shallow and deep soil sample. The concentrations of arsenic in the soil samples are well within the common range concentrations that the U.S. EPA has identified for natural soils (1 ppm to 50 ppm).

7.2 Ground Water Quality

The ground water at the site is derived from three primary sources: 1) discharge from the Rock River bed (local flow system), 2) percolation of precipitation that falls in the immediate site area (local or regional flow systems, depending on location), and 3) ground water flow onto the site via the regional flow system. Ground water entering the site from the regional flow should be relatively free from contamination (up-gradient sources not withstanding)[8], as is demonstrated by the lack of significant contaminant concentrations in ground water from MW-6 and MW-9. Likewise, the ground water entering the site from the Rock River should be relatively clean[8]. However, contaminants may be washed into the site subsurface from this flow if the river water is contaminated or if the sediments through which the water flows are contaminated. Although the river-bottom sediments will retain and filter contaminants, it is possible that contaminants are being washed onto the property through the sediments, given the condition of the sediments dredged during construction for the boat landing, north of the North Parcel. However, the majority of the contaminants

[8] As this is an industrial area, river and up-gradient ground water could be expected to contain detectible concentrations of contaminants.

found in the ground water are likely mobilized to the ground water by precipitation percolating through the impacted soils.

Volatile Organic Compounds

Volatile compounds were detected in ground water samples collected from MW-1, MW-2S, MW-2D, MW-3S, MW-3D, MW-4, MW-7, MW-8, MW-9, MW-10S, and MW-10D[9]. The ground water collected from MW-5 and MW-6 contained no detectible concentrations of the volatile compounds analyzed. The concentrations of volatile compounds found in the ground water at MW-4, MW-7, MW-8, MW-9, and MW-10D do not exceed the enforcement standards, found in Wisconsin Administrative Code NR 140, for any of the compounds detected, and do not exceed the NR 140 preventive action limits for any of the compounds with the exception of benzene in MW-7 and MW-8.

The NR 140 enforcement standard is exceeded for benzene at MW-1, MW-2S, MW-2D, MW-3S, MW-3D, and marginally at MW-10S. Other compounds in concentrations that exceed the NR 140 enforcement standards include toluene (MW-3S) and xylenes (MW-3D). NR 140 preventive action limits were exceeded for ethylbenzene and toluene at MW-3D.

The highest concentrations of VOC impact were identified in the vicinity of MW-1, MW-2S/D, and MW-3S/D. The types of volatiles detected in this area are primarily associated with petroleum products. This is consistent with observed site conditions and historical use of these areas of the site for storage and distribution of petroleum products. The occurrence of petroleum fractions in the ground water at MW-10S, and to a lesser degree at MW-10D, is expected, based on the relative location of petroleum storage and distribution systems. The only compounds not associated with petroleum products that were identified in the ground water are carbon disulfide, detected in the ground water sample at MW-1, and 2-butanone (MEK), detected at MW-10S.

Compounds associated with paints were detected in low concentrations in the ground water at MW-10S (MEK, 6 μg/l). During previous phases of work at the site, other compounds

[9] Concentrations of compounds that were detected in the method blanks are only addressed if they exceed ten times the concentration in the method blank. Method blank reports are presented in Appendix E.

associated with paints, MIBK and 2-hexanone (MBK), were detected in MW-10S. However, these compounds could not be detected in the ground water during the sampling events of the Phase III investigation. Possible explanations for the non-reproducibility of detection of MIBK and MBK are laboratory carry-over in instrumentation by another sample or contaminant volatilization due to the presence of the well (a path for introduction of additional oxygen and volatile escape). Sampling error is not considered a likely explanation because the only significant difference in sampling procedures was the HCl preservation of the most recent sample. Preservation of the sample would be expected to increase the identified concentration.

Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) are semi-volatile compounds associated with coals, creosols, heavy petroleum fractions, or incomplete or inefficient hydrocarbon combustion. PAHs can be produced as part of automobile exhaust, refuse burning, or power generation (Sittig, 1985). PAHs are generally low-mobility or immobile compounds in the subsurface environment, because the compounds will readily sorb to particulate and organic matter in the aquifer.

PAHs are also found to occur as a result of dissolution in petroleum compounds. McKay (1978) found that complex petroleum mixtures are soluble as long as the ratio of low and high molecular weight compounds is maintained. If low-molecular weight compounds are added to a solution, the heavier compounds (PAHs) will precipitate. At the Estate property, this phenomenon could have occurred as the result of the interaction of petroleum (gasoline and diesel fuel) with asphalt or coal. The addition of gasoline or diesel fuel to asphalt will dissolve asphalt. The resulting solution, with the addition of the low-weight compounds found in gasoline, could result in the precipitation of PAHs. Conditions such as this exist at the Estate property in the vicinity of MW-3, where old asphalt surfaces were encountered during drilling and free petroleum has been identified on the ground water. A more detailed discussion of PAH formation, toxicity and environmental fate is presented as Appendix H.

The greatest concentrations of PAHs were identified in the oily product identified in MW-3S and in the ground water at MW-3S. None of the compounds identified in the ground water sample exceeded 40 $\mu g/l$, with the exception of naphthalene (120 $\mu g/l$). PAH analysis was also conducted on ground water samples collected from MW-7 and MW-6. No detectible concentrations of PAHs were identified in either MW-6 or MW-7, with the exception of trace concentrations (2.03 $\mu g/l$) of naphthalene in MW-6.

Lead and Other Metals

Lead concentrations were analyzed in ground water samples collected from six monitoring wells, per the WDNR LUST Analytical Guidance (June, 1991). Detectible concentrations of lead were found in the ground water from MW-3S and MW-10S. The concentration found in MW-3S did not exceed the enforcement standard in NR 140, but did exceed the preventive action limit. The lead concentration in MW-10S exceeded the enforcement standard. The lead found in MW-3S is probably related to the occurrence of gasoline and gasoline fractions in the ground water. The lead concentration found in the ground water at MW-10S may be from the paint waste or may be the result of leaks from the AST system. No detectible concentrations of lead were found in the ground water samples collected from MW-2S, MW-3D, MW-7, or MW-10D.

Additional heavy metal analyses were performed on ground water samples collected from MW-2S, MW-3S, MW-3D, MW-7, MW-10S, and MW-10D. None of the arsenic concentrations in the water exceeded the NR 140 enforcement standards. The NR 140 preventive action limit was exceeded for arsenic in ground water collected from MW-3D and MW-10S. However, as discussed in Section 7.1, arsenic concentrations at the site appear to be naturally-occurring.

Barium was detected in all of the ground water samples tested. The concentrations of barium in the ground water did not exceed the enforcement standard but did exceed the preventive action limit at MW-3S and MW-7. However, if the barium was a contaminant resulting from the paint waste, the concentrations at MW-10S would be expected to be the highest at the site. Because the concentrations at MW-10S do not exceed the preventive action limit and are not the highest at the site, there is no reason to believe that the barium in the ground water is not naturally occurring.

What is the concentration of Ba in foundry sand?

Cadmium was identified in detectible concentrations in ground water samples from MW-2S, MW-3D, MW-10S, and MW-10D. The concentrations of cadmium in the samples were all less than the preventive action limit of 1 mg/l. The remainder of the heavy metals analyzed, chromium, mercury, silver and selenium, were not detected in any of the ground water samples.

7.3 Quality Control Samples

To evaluate the potential for sampling error or cross contamination during sample handling, transportation and analysis, quality control samples were analyzed. One sample, randomly selected, was collected from MW-2S as a duplicate sample. Additionally, one trip blank and one field blank were analyzed.

The duplicate was analyzed for VOCs, lead and other heavy metals. All of the parameters identified in the duplicate sample were within the acceptable limits of quantitation.

The trip blank was analyzed for VOCs. None of the compounds analyzed were detected in the trip blank.

The field blank was analyzed for VOCs, lead and other metals. Toluene was detected in the field blank at a concentration of 1.3 μg/l. Because the concentration is so near the practical quantitation limit for the method, it is not thought to impact the quality of the samples. Chloroform was also detected in the sample, at a concentration of 0.4 μg/l; however, chloroform was not detected in any of the other samples and is therefore, not a concern from a quality assurance standpoint.

7.4 Contaminant Transport Mechanisms

Contaminants will mobilize in the environment by means of advection, dispersion, and diffusion. Advection is the process by which the contaminants are transported in solution with the flow of ground water (gravity). Dispersion is the process by which contaminants are mechanically mixed, spread out over a larger area than by advection alone and become diluted away from the source. Diffusion is the process by which aqueous-phase contaminants migrate from areas of higher concentration to areas of lower concentration (kinetic). Diffusion is the process that is largely responsible for radial distribution of contaminants around a source area, which is most apparent under conditions of minimal ground water flow.

Contaminant movement will be retarded by several factors: adsorption/desorption, cation exchange, precipitation/dilution, and oxidation/reduction. These factors will affect different compounds to differing degrees. Additional influences on the retardation of compounds in the aquifer include the particle size distribution and total organic carbon content of the aquifer material. Organic content of soil is an important factor in the adsorption/desorption of compounds. Generally, the greater the organic content, the greater the adsorptive capacity of the material. However, the organic content of the material diminishes in importance in fine-grained material (silt and clay). At the Estate property, fine-grained materials are encountered at depths of approximately five to ten feet below the ground surface. The soils are also characterized by high organic content. At depths greater than 10 or 15 feet, the soils are characterized by coarse sand and gravel. However, the organic content remains relatively constant to depths of 25 feet below the ground surface.

The character of the contaminant is also a factor in the retardation of that compound. Organic compounds that are hydrophobic, such as many found in petroleum products, will readily adsorb to organics and fines. The heavier compounds, such as PAHs, will also readily adsorb to solids.

The retardation of a compound is often estimated based on the octonol/water partitioning coefficient, K_{oc}. K_{oc} values for many compounds are available and can be used to estimate the partitioning or distribution of a compound between solid and aqueous phases. The higher the K_{oc} value of a compound, the greater the retardation effect. Compounds with K_{oc} values less than 150 are considered highly mobile. Moderately mobile compounds are those with K_{oc} values up to approximately 500. K_{oc} values over 2000 indicate that a compound is slightly mobile and K_{oc} values greater than 20,000 indicate that a compound is essentially immobile in the subsurface environment. Fetter (1988) provides a series of tables of K_{oc} values. For many compounds, the distribution coefficient of the compound can then be estimated by multiplying the percent organic matter in soil times the K_{oc}. The retardation of a compound is then:

$$R = (V_{GW} / V_c) = 1 + (\rho / n_e)K_d$$

Where:

R	=	Retardation coefficient.
V_{GW}	=	Velocity of the ground water.
V_c	=	Velocity of the contaminant.
ρ	=	Bulk density of the soil.
n_e	=	Effective porosity of the soil.
K_d	=	Distribution coefficient.

Because V_{GW} is an array, retardation coefficients are difficult to estimate. Without accurate retardation coefficients, reliable contaminant migration modeling cannot be performed. Additionally, the ages of the releases of compounds found at the site are not known, and therefore, modeling to determine the maximum potential extent of contaminant transport is meaningless. However, relative comparisons of the potential migration of contaminants can be made by evaluating the K_{oc} and K_d values for each of the compounds of concern. The K_{oc} and K_d values for compounds of interest are presented in Table 11.

8.0 SUMMARY AND CONCLUSIONS

A third phase of subsurface investigation was conducted at the Ursula Borgerding Estate Property, 433-437 Woodward Avenue, Beloit, Wisconsin in response to the March 15, 1991 letter from the Wisconsin Department of Natural Resources, in which specific questions about the site characteristics, not addressed in previous investigations or requiring additional attention, were raised. The scope of the Phase III investigation included preparation of a detailed site topographic map of the site and surrounding properties, installation of additional soil borings and ground water monitoring wells, laboratory analysis of soil and ground water samples, definition of the characteristics of waste products at the site, estimations of the hydrogeologic conditions and ground water flow, and identification of potential ground water receptors.

Soil borings and ground water monitoring wells were installed during the period of June 4, 1991 through June 7, 1991. The soil borings were installed on the Estate property (MW-4); on the property owned by the City of Beloit, immediately north of the Estate (MW-5, MW-8); and in the Ace Hardware parking lot, east of the Estate property (MW-9). All of the soil borings were converted to ground water monitoring wells. Additionally, three deep wells were installed in nested locations (MW-2S/D, MW-3S/D, and MW-10S/D).

Six soil samples were submitted to Ortek Environmental Laboratory for analysis of total petroleum hydrocarbons, survey method, to determine the concentrations and character of petroleum fractions found in the soil. The samples were also analyzed for volatile organic compounds (method 8021), as required under the WDNR LUST Analytical Guidance (June, 1991). Seven soil samples were analyzed for lead, as required. Two additional samples, from MW-10S/D, where waste paint was identified, were analyzed for heavy metals to evaluate if metals were leaching from the waste paint into the adjacent soil.

Ground water samples were collected and analyzed from all of the monitoring wells and deep wells. All of the samples were analyzed for VOCs (method 8021, per the WDNR LUST Analytical Guidance). Four additional samples were analyzed for PAHs (method 8270, per WDNR LUST Analytical Guidance). The PAH samples were selected from wells identified as containing fractions of 1) gasoline, 2) diesel fuel, 3) both gasoline and diesel fuel, and 4) containing no detectible concentrations of gasoline or diesel fuel, to serve as background. Five samples, collected from wells in the vicinity of the waste paint area, were analyzed for VOCs (method 8240). Six samples were analyzed for lead and other heavy metals. The samples were selected from the well locations most likely to be impacted and at random to characterize the site ground water for lead and other heavy metal concentrations.

Three water samples, a trip blank, a field blank, and a randomly-selected duplicate, were analyzed for appropriate parameters as quality control samples.

An additional investigation was performed on the waste paint found behind the 433 building and on the oily product found in MW-3S. A sample of the waste paint was analyzed for heavy metals. The oily product was analyzed for VOCs (method 8240), PAHs (method 8270 to include creosols), PCBs, RCRA metals, and TPH survey. The paint was found to contain relatively high concentrations of lead, mercury and chromium. Lesser concentrations of barium, cadmium and arsenic were also identified. The oily product in MW-3S was found to consist primarily of gasoline and diesel fuel fractions. The material also contained detectible concentrations of lead, arsenic, and various PAHs. No PCBs or creosols were identified in the product.

Diesel fuel fractions were found in the soil on the Estate Property in the vicinity of the AST bunker, AST piping, UST Location 1, and abandoned dispenser islands. On the North Parcel, diesel fractions were found in the soil in the vicinity of MW-8. Gasoline fractions were found in the soil in the vicinity of UST Location 1, the abandoned dispensers, and near the Rock River. This is consistent with the location of gasoline facilities and the 1984 gasoline release.

VOCs were found in the soil throughout the Estate site. VOCs usually associated with paints were found in the soil in the western half of the site. This is consistent with the location of former paint manufacturing operations.

Lead concentrations in the soils were generally within the concentrations expected for the soils and fill material found at the site. The exception is the shallow soil at MW-10S/D, which appears to be impacted by the waste paint found at that location. Elevated concentrations of barium, cadmium, chromium and mercury were also identified in the shallow soil at MW-10S/D; however, the elevated metal concentrations in the shallow soils appear to return to normal in soils from eight feet below the ground surface.

Ground water at the site is impacted with petroleum fractions in the vicinity of the AST locations and UST Location 1. Petroleum fractions were not found in the ground water in the south portion of the Estate property. On the North Parcel, petroleum fractions were found in the ground water in the vicinity of MW-8.

VOCs usually associated with paints were found in the ground water at MW-1 and MW-10S. These are likely the result of the presence of paint waste on the ground in these areas. Semi-volatiles (PAHs) were identified in three of the four wells tested. However, two of the three wells, MW-7 and MW-6, contained only trace concentrations of naphthalene, which may be associated with the petroleum found at the site. In MW-3S, several PAH compounds were found in the ground water. The presence of these compounds is thought to be the result of dissolution of the heavy fractions found in coal and asphalt in the presence of lighter fractions in gasoline and diesel fuel. The presence of free gasoline and diesel fuel in MW-3S could result in such phenomena.

The ground water flow at the site is characterized by two different flow systems. The local flow system, the "local system," consists of the shallow water within approximately 150 feet of the Rock River. In this cell, water is flowing from the river, predominantly to the east. This cell is characterized by a strong downward vertical gradient. The second flow system, the "regional system," consists of ground water flowing, presumably from the highlands east of the site, toward the river. The local system appears to discharge to the regional system, which appears to discharge to the Rock River at some location downstream of the dam at the Blackhawk power station.

Potential ground water receptors include underground utilities located on the property, the Rock River downstream of the dam, and an active municipal water well located downstream of the dam. Underground utilities are not likely potential ground water receptors, based

on the proximity of the utilities to areas of impacted ground water. The exception to this is the new storm water sewer located on the North Parcel.

The potential for detectible concentrations to be discharged to the river are limited because of retardation of the contaminants in the shallow soils at the site, natural degradation and physical filtering of contaminants, and dilution upon mixing with the regional flow system.

One municipal water well, WP&L #8, is located within one mile, downstream of the Estate. The well is not thought to be a significant concern as a potential ground water receptor because the well is cased throughout the glacial aquifer. Additionally, ground water quality results for the water in WP&L #8 indicate that none of the contaminants found at the Estate property are found in the ground water from WP&L #8.

1) PAH were never sampled
2) This is a gravel pack well only — in depth mostly draws from shallow aquifer.

9.0 RECOMMENDATIONS

9.1 Summary of Potential Remedial Alternatives

The adverse environmental impact at the Estate property site can be divided into three broad categories: soil contamination, ground water contamination, surface debris, and product. Surface debris includes the paint waste found in the vicinity of the 433 building, contaminated construction debris, and the piping associated with the AST and UST systems. Product refers to the petroleum on ground water in MW-3S. The various remedial alternatives may be divided into the categories of removal or inoculation. Removal may consist of in-situ or ex-situ removal. Inoculation may consist of rendering the contaminant immobile, isolating the contaminant to protect against potential human exposure, or altering the contaminant to a form that does not provide a significant risk to human health or the environment.

Because of the significant amount of water entering the site, removal or inoculation technologies may be coupled with ground water gradient control. Ground water gradient control may consist of a physical barrier that extends down to regions of lower hydraulic head in the aquifer. This would control both the amount of water entering the site and the ground water elevations.

Prior to discussing particular remedial actions as they may apply to the site conditions, a brief overview of the various potentially feasible remedial actions is presented.

Impacted Medium	Potential Solution	Technique
Soil	Removal (ex-situ)	Excavation and off-site disposal
		Excavation and on-site treatment
	Removal (in-situ)	Soil washing
		Vacuum extraction
		Vegetative uptake

Impacted Medium	Potential Solution	Technique
Soil (continued)	Inoculation	Cap
		Vitrification
		Solidification/stabilization
		Bioremediation
Ground Water	Removal	Pump, treat and discharge (carbon adsorption/air stripping, UV oxidation, or POTW treatment)
		Vitrification
		Vegetative uptake
		Chemical precipitation, ion exchange, evaporation, filtration, floatation, electrolysis
	Inoculation	Cap
		Bioremediation (ex-situ or in-situ)
Surface Debris	Removal	Excavation and off-site disposal
	Inoculation	Cap
Product	Removal	Pump and off-site disposal
	Inoculation	Pump and on-site treatment

9.1.1 Excavation and Off-Site Disposal

Excavation and off-site disposal of the impacted materials found at the site could be implemented to address the impacted soil and surface debris. Excavation of the impacted soil and surface debris would remove the contaminants from the site, eliminating the potential for those materials to cause future impact to the ground water at the site. The materials can be disposed of in a sanitary landfill. However, excavation and disposal of contaminated soil is only appropriate if the material can be completely removed. In the case of the Estate Property, excavation is not appropriate as a remedy for the soil because, impacted soils exist within the saturated zone. The saturated soils cannot be effectively excavated, and off-site disposal of saturated soils is not allowed at most landfills. Additionally, excavation and landfill disposal is only cost-effective if the volume of the material to be disposed of is less than 1,000 cubic yards. Beyond 1,000 cubic yards, on-site treatment becomes more cost-effective. The estimated volume of soil to be remediated at the Estate is approximately 15,000 cubic yards.

For the surface debris, excavation and off-site disposal may be an appropriate alternative. The surface debris will consist of significantly less material, making excavation and disposal cost-effective. Additionally, the surface debris to be addressed is located in areas with lower ground water, making excavation practical.

9.1.2 Excavation and On-Site Treatment

On-site treatment of excavated materials could consist of biotreatment or thermal destruction. Excavation and on-site treatment of impacted soil is not appropriate due to the constraints of excavation, described above. On-site treatment of the surface debris may be appropriate only to the extent that contaminated debris may be rendered uncontaminated during a treatment process, and therefore, disposed of as solid waste instead of contaminated waste. However, the cost of on-site treatment may easily exceed the cost of disposal of contaminated surface debris as contaminated waste.

9.1.3 Soil Washing

In-situ soil washing has three primary components: extraction wells, injection wells or trenches, and waste water treatment system. (Disposal or untreated discharge are not likely options, and therefore, will not be addressed here.) During in-situ soil washing, a solvent, surfactant solution or water is injected as a flushing fluid into the soil through injection wells or trenches, which are located in the area of contamination, and up-gradient from the extraction wells. The purpose of the flushing fluid is to increase the solubility of the contaminants within the soil and ground water, thus the contaminants are carried in solution. The flushing fluid travels through the contaminated zone to the extraction wills, where it is collected. The flushing fluid is then processed in the waste water treatment system, where contaminants are removed. After treatment, the purified solution is re-injected into the system or discharged (Holden, *et al.*, 1989).

The effectiveness of soil washing is primarily dependent on the types of contaminants to be remediated and the porosity of the soil. If metals and organics occur together in the zone of contamination, the selection of the type of flushing fluid becomes difficult. In this case, pre- or post-treatment may be necessary. Cleaning soils and ground water at a typical site can take three to four years.

Difficulties associated with this technology, as it would apply to the Estate property, include ensuring that all of the injected flushing material, and the contaminants in solution, are recovered by the extraction wells. Detailed knowledge of the hydrogeology of the site is necessary. Additionally, because of the potential added risk to ground water quality, the WDNR is reluctant to allow injection of any fluids into the subsurface environment.

9.1.4 <u>Vacuum Extraction</u>

Soil vacuum extraction (VE) is the process by which an active vacuum is applied to a well or wells in order to extract volatile compounds in the vapor phase. VE technology is applicable to the removal of a wide variety of volatile compounds and is most effective in permeable soils. Conventional VE technology cannot, however, be used to remediate ground water. If conventional VE technology is applied at the Estate property, it will have to be coupled with pump and treat technology to address the ground water.

Two-phase vacuum extraction is an advance on conventional vacuum extraction technology in that it is capable of removing volatile contaminants from the ground in both the liquid and vapor phases. Subsequently, the two-phase VE system is more appropriate for sites with high or fluctuating ground water tables.

At the Estate property, both the soil and ground water require remediation of volatile compounds. Given the high ground water table, the two-phase system would be the more appropriate of the VE technologies available. However, the disadvantage of any VE technology with respect to the Estate site conditions, is that VE will not effectively address heavy metals or semi-volatile compounds. Another disadvantage of VE technology arises when the affected soil is heterogeneous. In this case, flow may bypass the finer soils, moving in the path of least resistance. Although the technology to correct this inefficiency has not been developed, careful planning can reduce the affects in some cases.

Off-gas permitting may be required, as well as discharge of recovered water. Additionally, recovered water is likely to require pre-treatment prior to discharge.

Although VE may be applicable as a remedial technique for addressing the volatile compounds in soil and ground water, VE will not address metals, solids (surface debris), or semi-volatiles compounds effectively. Therefore, if VE was selected to remediate the site, it would have to be coupled with other technologies.

9.1.5 Vegetative Uptake

Vegetative uptake of contaminants may be applicable, to some degree, to the remediation of soil and ground water. The process includes the absorption of contaminants through the root system of plants and the translocation and storage of the contaminants in the plant tissue. The efficiency of uptake of contaminants in plants is dependent on the availability of the contaminant in the soil and the movement of the element to the root and the form of the element in the soil (only ionic forms of an element are absorbed by plant roots)(Smith, 1985).

In vegetative uptake, the process by which the contaminants are removed is translocation. Therefore, once the plants have completed the growth cycle, they must be harvested and removed from the site. This is to prevent the reentering of the contaminant into the soil when the plants die and decompose. After the plants have been harvested, they must be disposed of in an environmentally safe manner.

The potential for a vegetative uptake system is good if the following limitations of the system are realized: The vegetative uptake system will take a considerable amount of time, it must be determined if there are plant species available that can accomplish the desired contaminant extractions, and if the soil conditions are able to produce, or can be modified to produce optimal growth for the selected plants. Once the species of plant and the soil type is decided on, uptake trial tests are necessary (Smith, 1985).

Plants have been documented to absorb inorganic compounds, such as heavy metals; however, there is little documentation on the ability of plants to absorb organic compounds. Plants have been demonstrated to absorb organic herbicides, leading some researchers to draw parallels between absorption of herbicides and absorption of other organic pollutants. Additional research is necessary to verify or disprove this parallel (Smith, 1985). Another limitation of vegetative uptake is the limited depth from which contaminants will be absorbed; the depth of the root system.

9.1.6 Surficial Capping

Capping is a means of isolating the soil from the elements and reducing or eliminating precipitation infiltration to the impacted subsurface. As previously discussed, the primary source of contamination at the site is the releases to the surface soil. Infiltration of precipitation washes the contaminants from the soil and mobilized them to the ground water. The strong downward vertical gradient in the most heavily impacted areas of the site enhance the mobilization of contaminants transported to the ground water table by infiltration. A non-permeable cap would reduce or eliminate the infiltration of precipitation through the impacted soils, and thus reduce the mobilization of contaminants to the ground water. With the reduction of water input to the impacted zone, the natural chemical, physical and biological processes can act on the contaminants in the soil and ground water.

Generally, a cap consists of a clay liner, two to four feet thick, covered by soil and shallow-rooted vegetation (deep-rooted vegetation can penetrate the liner, allowing a path for water to migrate). The clay liner can be replaced by or used in conjunction with a synthetic liner.

Factors influencing the effectiveness of a cap are the nature and concentration of contaminants in the soil and ground water, ground water flow through the impacted zone, and the natural processes operating in a system that would decay or retain contaminants. However, the most significant factor influencing the effectiveness of a cap is controlled land use. If the land is zoned as a green area and will not be further developed, capping would be an effective remedial technique for the site. However, if buildings are located on the capped area, the building footings will provide a path for water migration into and through the cap, destroying the integrity of the cap. Even as a green area, the type of vegetation at the site will have to be monitored to ensure that no deep-rooted plants or trees grow to sized that would threaten the integrity of the cap.

While capping would be an appropriate technique to reduce the migration of contaminants and provide a barrier between the contaminants and the public, additional measures would have to be taken to address the petroleum in MW-3S. Although the product in MW-3S is not likely to migrate to any significant degree, it should be recovered from the subsurface by means of a pumping system and properly disposed.

9.1.7 <u>In-Situ Vitrification</u>

The basic concept of in-situ vitrification (ISV) is to prevent contaminants in the soil from mobilization by entombing the contaminated soil in a glass-like medium, formed by melting the surrounding soils. ISV is applicable to soils as a form of inoculation. ISV will also address ground water in the treated area, essentially by vaporizing the water, which will escape with other gases during the cooling phase of the ISV process.

The process of ISV uses electrodes, each installed in the contaminated soil and extending the entire depth of the contaminated zone. A conductive starter mixture of graphite and glass frit is placed in the soil around the electrodes to made the initial conduction easier. A strong current is passed through the electrodes. The current is transferred to the graphite-glass mixture, which is destroyed by oxidation. Once the graphite-glass mixture completely oxidizes, the current is transferred to the soil surrounding the mixture, causing it to melt. Once the current ceases to be transferred, the melt cools and solidifies, incorporating the nonvolatile contaminants into the solid matrix. The organic contaminants are not incorporated in the solid matrix, but are destroyed by the current. The byproducts of the destroyed organics migrate to the surface, combusting when in the presence of oxygen (Holden, *et al.*, 1989).

Gases are given off during the cooling phase of the ISV process. Because of the escaping gases, a hood must be placed over the processing area to collect the escaping gases until they can be analyzed. If the volatile concentrations being released are determined to be within state and federal regulations, the gases may be released to the atmosphere (Hansen, verbal communication)(Holden, *et al.*, 1989).

Factors affecting the effectiveness of ISV include soil moisture, depth to ground water, soil permeability, the nature of the contaminants and buried metals. Soils will not melt until all of the water is evaporated. Generally, if ground water is present and the soils have a permeability in excess of 10^{-3} cm/sec, the ISV process becomes uneconomical (Hansen, verbal communication). The sheer volume of ground water at the site, being located adjacent to the Rock River, would make ISV impractical if not technically infeasible. The rate of incorporation of volatile metals into the melt is reduced near the surface. If combustibles are present, heavy metal oxides can be produced (Holden, *et al.*, 1989).

If buried metals are present, a short circuit can occur between the electrodes. Buried metal can be a factor if the buried metal is 90 percent of the linear distance between electrodes (Holden, *et al.*, 1989). Much of the Estate Property is covered by steel-reinforced concrete. Additionally, buried concrete was encountered at numerous drilling locations. It is unknown if the buried concrete contained steel reinforcement. A geophysical survey of the site would have to be performed to identify the amount and location of buried metal before the applicability of this technology to this site could be determined.

9.1.8 Solidification/Stabilization

The stabilization/solidification and ISV processes are similar in their basic concepts. Each process reduces the mobility of the contaminants in the soil be encapsulating the contaminants within a matrix that has a low permeability. In the stabilization method, the matrix used is introduced into the soil environment. In contrast, the ISV process creates the matrix from the soil.

To entomb the contaminated soil within a matrix, two different technologies are currently being used in the solidification process. The technologies are the Detoxifier and the Geo-Con/DSM system. Both systems inject stabilizing agents into the soil through various methods; however, the Geo-Con/DSM system also blends the agents with the soil at depth. Various stabilization agents are used for the matrix in the solidification process. The agents are categorized as follows: cement-based, silicate-based, thermoplastic-based, or organic polymer-based materials. To give the matrix specific characteristics, an additive will often be added to the primary stabilizing agent. An example is the addition of silicate to cement that will stabilize a wider range of material than a cement-based stabilizing agent. When selecting the stabilizing agents, the additives, and determining the waste-to-additive ratio and mixing and curing conditions, it is essential that the chemical and physical characteristics of the waste be known. This is to ensure that the integrity of the end product can be predicted (Holden, *et al.*, 1989).

The long-term effects of the solidification are not known and are predicted to vary according to the site. Because of this unknown factor, it is necessary to monitor the gases and leachate from the solidification product. According to Holden, *et al.* (1989), in the presence of leachable metals, the effectiveness of certain stabilization methods will vary. The presence of certain listed chemicals in the soil that is solidified will retard the setting, curing and strength of the final product. Additionally, the presence of soluble salts of manganese, tin, zinc, copper, and lead will reduce the strength of the final product, cause variations in setting time and reduce the dimensional stability of the cured matrix, which could increase the leachability potential of the final product. Lead was identified in the soil at the site, however, it is not known if the lead is in the form of a soluble salt. The presence of the other soluble salts has not been investigated, but is possible, given the nature of the fill material at the site.

9.1.9 Bioremediation

Bioremediation is the process by which micro-organisms are utilized to metabolize contaminants in the soil and ground water. Bioremediation technology can consist of several levels of technology, from monitoring the naturally-occurring microbial activity at a site through a system that includes development of a specific microbial population, introduction and maintenance of the species, and use of a bio-surfactant to render the contaminants available. Because the use of low-technology bioremediation as a sole-remediation technology has proven to be less predictable and reliable, only the high-technology bioremediation systems will be addressed here.

A bioremediation system utilizes essentially similar equipment to a vacuum extraction (VE) system with the addition of microbacteria to enhance the cleanup process. The bioremediation system distributes a biosurfactant throughout the unsaturated treatment area, releasing the adsorbed compounds for recovery and metabolism. Because bioremediation uses both the physical process of vacuum extraction and microbial action, the system can, in some cases, clean a site to within regulatory criteria in as little as 60% to 80% of the time required by VE alone. Additionally, because the bioremediation system is a closed loop, air discharge is minimized. As with the VE system, the bioremediation method could effectively clean the soil to within WDNR cleanup criteria, could address contaminants under buildings and around buried utilities.

The system utilizes vapor extraction-type wells to perform active extraction of contaminant vapors and injection of heated, oxygenated air to enhance biodegradation of contaminants. Preparation of a site for the operation of a bioremediation system involves the installation of soil vapor extraction wells, soil vapor injection wells, and pressure-gradient monitoring wells. In addition to the installation of the system's plumbing network, soil samples must be collected for biological analysis. Samples collected for biological analysis are used to culture a site-specific inoculum for enhancement of biodegradation.

The process of inoculum preparation consists of screening site soil samples for bacteria capable of degrading the contaminants found at the site and then culturing those bacteria into a dense microbial broth for later application to the site's soil. The purpose of the bacterial inoculum is to reduce the time required for site restoration through rapid biotreatment. Once the bacterial population is developed, the bacteria are applied to the subsurface through shallow surface trenches. Once inoculated, the subsurface environment can be enhanced through the injection of warm, moist, oxygenated air into the core of the impacted area. This process maintains an optimal environment for degradation of organic compounds throughout the soil column.

Following the inoculation of the site soils, active site restoration commences. This closed-loop process will involve the extraction of contaminant vapors from the vapor-extraction wells. Once the contaminant vapors are extracted from the subsurface, they are condensed on media within the system, with the condensate directed to a bioreactor for degradation. There is no discharge from the bioreactor. After the contaminants are removed from the extracted vapor, the vapor is heated, moistened, oxygenated and returned to the subsurface through a vapor injection well. The re-injection process, eliminating atmospheric discharge, maintains a viable subsurface environment for effective biotreatment. Because the injected air is warmed, the system maintains active bacterial colonies throughout the year.

Factors affecting the effectiveness of a bioremediation system include the type of compounds to be remediated, soil permeability, ground water elevations, ground water fluctuations, and natural microbial populations. Bioremediation is most applicable to sites contaminated with organic compounds, although heavy metals can be fixed to some degree.

Soil permeability is a factor in bioremediation as it relates to the mobility of the contaminants and bacteria. The presence of shallow ground water or fluctuating ground water levels may develop anaerobic conditions in the impacted soil, which could damage the bacterial population.

9.1.10 Pump, Treat and Discharge

Impacted ground water could be extracted from the subsurface through a series of recovery wells or recovery trenches. The water could then be discharged directly to a POTW system or treated on-site prior to discharge. If the water is treated on site, discharge may be to a sanitary sewer system or to the Rock River may be an option, depending on the post-treatment water quality (discharge to the storm sewer system is not specifically addressed as the storm sewer system discharges to the Rock River).

Pump systems could be designed to address both impacted ground water and the product found in MW-3S. Recovery wells generally are constructed of four- or six-inch PVC or stainless steel, and are equipped with pumps specifically calibrated to the hydrogeologic parameters of the aquifer. Recovered ground water (and product) can be treated off site at a POTW, if contaminant concentrations are within acceptable limits. On-site treatment could include carbon adsorption/air stripping or UV oxidation for organics. If treatment of metals in ground water is required, on site treatment could be performed by chemical precipitation, ion exchange, evaporation, filtration, floatation, or electrolysis.

The effectiveness of a pump and treat system is influenced by the pumping rate and duration of the program. The contaminants in the ground water will also adsorb to the organic carbon in the subsurface. This is a reversible process, however, and the contaminants trapped in the soil will eventually desorb and become mobile in the ground water system. The pumping rate of the system must be slow enough to allow for reentry of the contaminants into the ground water for recovery, yet fast enough to create and maintain an effective radius of influence. The latter will be the most difficult to control because of the site's proximity to the Rock River and the observed rapid recharge rates of the aquifer to pumping stress.

Carbon Adsorption/Air Stripping

Carbon adsorption is the process by which ground water may be treated by filtering the water through activated carbon. Activated carbon can also be used to treat ground water in the vapor phase through air stripping. Certain organic contaminants adsorb readily to carbon, thus effectively removing the compounds from the water. The majority of the volatile and semi-volatile compounds found in the ground water at the site are easily adsorbed to carbon.

The equipment necessary for the operation of liquid-phase carbon adsorption systems includes a ground water pumping system and carbon canisters or vats designed to allow appropriate water retention times and manage the flow rates required to maintain a radius of influence in the aquifer. An effluent containment tank would also be necessary to contain the treated water until laboratory analyses and discharge permitting could be obtained.

The equipment necessary for the operation of vapor-phase carbon adsorption systems includes the equipment identified above plus an air stripping tower. In the air stripping process, recovered water is pumped into the system through the top of the site stripping tower at a controlled flow rate. Clean air is blown from the base of the system, counter-current to the water flow, to increase the area of contact and allow volatilization of organic compounds into the air stream. The air stream is then passed through a de-mister to remove additional moisture. The organics, as well as some water vapor, are released to an off-gas treatment system which utilized activated carbon to filter out the organics. Options for disposal of spent carbon, from either liquid-phase or vapor-phase treatments, include regeneration, landfilling or incineration.

An issue that must be addressed regarding the appropriateness of air stripping is the potential to develop explosive conditions within the system due to high concentrations of volatile compounds, especially if treating the petroleum product found in MW-3S. Pretreatment of the water containing the petroleum product, by use of an oil-water separator system, may be necessary to avoid damage to the system.

UV Oxidation

Ultraviolet oxidation (UV Ox) is the process by which ultraviolet light is combined with ozone or peroxide to create a highly oxidative environment in which organic compounds are broken down into non-hazardous constituents, including CO_2 and H_2O. U.S. EPA demonstration studies (1989) indicate that the process has been effective in reducing concentration of chlorinated solvents, pesticides, aromatics to levels below practical quantitation limits.

A typical UV Ox system consists of an oxygen source, an ozone generator or hydrogen peroxide feed system, a UV oxidation reactor, and an ozone decomposer (Fletcher, 1987). The reactor provides controlled, simultaneous UV-oxidant contact, which can be operated on a continuous flow basis or in batch mode. Flow rates can vary from 1 gpm to 1,000 gpm.

The UV Ox process has been proven effective on a variety of organic compounds. Past applications have included the reduction of petroleum fractions from 14,000 $\mu g/l$ to less than 2 $\mu g/l$. Additionally, the U.S. EPA has recognized UV Ox as an alternative to activated carbon where the effluent discharge requirement is less than one $\mu g/l$.

The effectiveness of UV Ox is dependent on several factors. The presence of free product on the water can interfere with the oxidation process by consuming oxidant, coating the UV lamp sheaths, and interfering with the diffusion of ozone. Pretreatment of the water, including removal of free product and pH adjustments, may be required.

Chemical Precipitation, Ion Exchange, Evaporation, Filtration, Floatation, Electrolysis

Metal concentrations in the ground water are generally below the NR 140 enforcement standards, with the exception of lead in MW-10S. The preventive action limits are exceeded in MW-3S for barium and lead, MW-8 for barium, and MW-4 and MW-10S for arsenic. If ground water treatment for metals is required, remedial options may include:

- Chemical precipitation, including coagulation, neutralization, precipitation, flocculation, and coprecipitation;
- Ion exchange;
- Evaporation;
- Filtration, including ultrafiltration and reverse osmosis;
- Floatation, in combination with precipitation or flocculation;
- Electrolysis.

Of the treatments listed above, only evaporation, ultrafiltration and chemical precipitation have had full-scale field application. Additionally, some of the others not only have not had full-scale applications, but also have identified constraints on applicability. For example, floatation requires significant capital outlay, requires large amounts of chemicals and energy to operate, and has not been proven in full-scale operations.

Implementation of a remediation system for the removal of the identified heavy metals may not be required. Further ground water investigation and sampling must be conducted to verify actual levels of metal contaminants. In addition, if a two-phase VE system is used, remediation of metals may not be required. Generally, during the operation of a two-phase VE system, low levels of metals tend to fixate in the surrounding soils. Assuming that such a situation occurs at the Estate property, the additional expense of metals recovery remediation would be eliminated.

9.2 Recommended Remedial Actions

The varied contaminants and media to be remediated at the site make the design of a remediation system difficult. No single technology will address all of the impacts at the site effectively. Of the technologies listed above, only soil washing, vacuum extraction, bioremediation, pump and treat, and capping offer feasible alternatives. Each has disadvantages and none could be applied to address the site as a whole. Soil washing would require pump and treat technology to collect the wash and to address the free petroleum separately. Pump and treat technology is only applicable to the ground water and does not address the soil. Additionally, the treatment methodology may require pretreatment or separate treatment of the free petroleum. Vacuum extraction, bioremediation and capping could address both soil and ground water contamination, but a separate system to address the free petroleum would likely be required. In all cases, excavation of the piping associated with the AST and UST systems is recommended. Additionally, excavation and off-site disposal of the waste paint is advisable.

Because the majority of the impact is the result of above-ground and underground petroleum storage tank releases, under the PECFA program, the least expensive alternative that the WDNR will accept must be implemented. If zoning controls can be implemented to restrict use of the Estate property, capping, coupled with excavation and disposal of surface debris and pumping and disposal of free petroleum is the recommended alternative. Capping is the least costly of the options and, although actual remediation of the contaminants in the soil and ground water would occur by natural processes over a longer period of time, the issue of potential public health would be addressed quickly.

If zoning restrictions cannot be achieved and enforced, a remediation program including either bioremediation or VE in conjunction with pumping and disposal of free petroleum

and excavation and disposal of surface debris is recommended. The determination of whether to use bioremediation or VE may be based on cost, as the end result is expected to be similar. Implementation of any of the recommended site remedies should be coupled with a ground water gradient control facility.

10.0 LIMITATIONS

Dames & Moore and its subcontractors for this project certify to the best of their knowledge and belief that the information contained herein is accurate and complete. The subsurface investigation was conducted in accordance with accepted practices for the environmental consulting profession. Information provided by others was accepted as true and complete and the on-site inspection process was limited to only those activities that were immediately visible and obvious.

Due to the limitations of the inspections and investigative process and the necessary use of unverified data furnished by others, users of this report relying on information contained herein are cautioned that Dames & Moore and its subcontractors cannot assume liability if the actual conditions vary from the information contained in this report.

The information, conclusions and recommendations provided in this report apply only to the Ursula Borgerding Estate property as it existed at the time of the investigation. If site uses, conditions, regulations or laws change, conclusions and recommendations may no longer apply.

Respectfully submitted,

DAMES & MOORE

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TABLE 5
PID READINGS

URSULA BORGERDING ESTATE
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Sample Id	PID (IU)	Sample Id	PID (IU)	Sample Id	PID (IU)	Sample Id	PID (IU)
MW-2D/1*	59	MW-3D/1	1758	MW-4/1	12.4	MW-5/1	2.5
/2	244	/2	1247	/2	3.1	/2	2.0
		/3	982	/3*	4.8		
		/4	1138				
		/5	1532				
MW-8/1	3.9	MW-9/1	N.D.	MW-10D/1	145		
/2	243	/2*	N.D.	/2	58.9		
/3	99	/3	2.0				
		/4	2.1				
		/5	2.7				

N.D. - Not detected.
PID readings are peak values.
IU - Instrument units, ppm, based on 100 ppm isobutylene calibration.
* Sample submitted for laboratory analysis.

TABLE 12
ROCK RIVER WATER ELEVATION DATA

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Date	Upstream of Blackhawk Dam	Downstream of Blackhawk Dam
May 2, 1991	744.6	736.0
June 4, 1991	744.6	734.0
August 27, 1991	745.0	732.9
September 30, 1991	744.6	733.4
October 7, 1991	744.6	733.9
October 16, 1991	744.8	733.8
January 20, 1992	744.9	(river iced over)
January 31, 1992	744.7	734.6

River water elevations obtained from Wisconsin Power & Light Company.
River elevations based on correlation to USGS benchmark; reported in feet above mean sea level.

TABLE 1
PROPERTY OWNERSHIP (PROPERTY ABSTRACT) SUMMARY

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

DATE	GRANTOR	GRANTEE	TYPE
11/22/1838	United States	Otis P. Bicknell	Government Entry
4/21/1842	United States	Otis P. Bicknell	Patent
6/26/1837	William Jones & Wife	Chas. Walker	Warranty Deed
4/11/1840	Otis P. Bicknell	Horace White	Quit Claim Deed
12/6/1843	Horace White & Wife	Phillip Kearney	Quit Claim Deed
4/28/1852	Philip Kearney	Timothy Higgins	Warranty Deed
9/21/1854	O.P. Bicknell & Wife	Paul Dillingham	Quit Claim Deed
4/25/1855	Paul Dillingham & Wife	Jackson Bushnell	Quit Claim Deed
8/24/1857	Timothy Higgins	Jackson Bushnell	Quit Claim Deed
9/17/1857	Jackson J. Bushnell	Beloit College Board of Trustees	Warranty Deed
4/1858	Diana M. Kearney	Philip Kearney	Quit Claim Deed
4/14/1858	Rock County & State of Wisconsin	Jacob D. Woodruff	Tax Deed
9/13/1867	Beloit College Board of Trustees	Rock River Paper Mfg. Co.	Quit Claim Deed
1/2/1885	Rock River Paper Mill Co.	Beloit Water Power Co.	Deed
4/1/1885	Rock River Pater Co.	Booth M. Malone	Deed
6/20/1885	Booth M. Malone & Wife	Moses R. Doyon	Quit Claim Deed
7/24/1885	Moses R.Doyon & Wife	Rock River Paper Mill Co.	Quit Claim Deed
1/31/1895	Rock River Paper Mill Co.	Hugh McGavock	Warranty Deed
4//22/1898	Hugh McGavock & Wife	Knickerbocker Ice Co.	Warranty Deed
7/18/1902	Knickerbocker Ice Co.	Joseph A. Janvrin	Quit Claim Deed
4/26/1911	Joseph A. Janvrin	City Ice Co.	Warranty Deed
5/14/1913	City Ice Co.	Edward Branigan	Warranty Deed
4/4/1931	Edward Branigan	Standard Oil Co. (Indiana)	Lease
10/25/1935	Edward Branigan	City Ice & Fuel Co,	Quit Claim Deed
12/31/1940	City Ice & Fuel Co.	Edward Branigan	Warranty Deed
1/5/1946	Edward Branigan Estate	Robert Branigan, Ursula Borgerding	Will
11/7/1946	Robert & Evelyn Branigan	Ursula Borgerding	Quit Claim Deed
8/25/1954	Ursula Borgerding	Wisconsin Power & Light	Warranty Deed

TABLE 2
PROPERTY TENANCY SUMMARY

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Tenancy Dates	433 Woodward	435 Woodward	437 Woodward	Source
1958			Woodward Oil Co.	9/4/58 Electrical Permit
1960		Osborn's (435B)		2/26/60 Electrical Permit
1960		Murmac Finishes, Inc. (435 B)		2/5/60 State of Wisconsin Industrial Commission 2/22/60 Electrical Permit 12/4/78 DILHR TAG. Flash Report (no address)
1961			Finnegan Oil Co.	11/21/61 Electrical Permit
1964		Rem Frey Alignment (Brake) Service		3/9/64 Electrical Permit 6/18/64 Building Permit Application
1972			Price-Rite Oil Company/Gas Station	8/7/72 DILHR citation 9/19/72 Beloit Fire Dept. correspondence 11/22/72 Beloit Fire Dept. report 1/31/73 Beloit Fire Dept. correspondence 9/8/74 DILHR citation
1972		Price-Rite Gas Station		9/4/72 City of Beloit Report of Alarm 6/21/84 Beloit Fire Dept. correspondence
1973			Ken Wagner Locksmith (bldg?)	9/27/73 Beloit Fire Dept. Inspection Report 6/11/74 Beloit Fire Dept. Inspection Report 6/23/75 Beloit Fire Dept. Inspection Report 8/10/84 Arthur R. Moss & Co., Inc. correspondence
1982	D&S Gun Shop (bldg?)			4/5/82 City of Beloit zoning commission ordinance no. 1770 7/13/82 City of Beloit signage violation
1984	James Moriarty			1/3/84 Resolution authorizing conditional use on property
1986	The Press			10/6/86 Beloit Fire Dept. Official Notice
1986	Drevdahl Automotive			10/5/86 Beloit Fire Dept. Official Notice 11/8/88 Beloit Fire Dept. Official Notice
1988		Heritage Painting		11/8/88 Beloit Fire Dept. Official Notice 6/22/89 Beloit Fire Dept. Official Notice 11/30/89 Beloit Fire Dept. Official Notice
1989			Superior Automotive Elect.	10/1989 On-site observation

TABLE 4
CITATIONS

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

DATE	TENANT	AUTHORITY	OFFENCE
8-7-72	Price-Rite Gas Station	Beloit Fire Department	Valve and pipe joints leaking near diked area; pipes from AST to UST are not closed connection with valve controls; pump propped up on cement.
9-4-72	Price-Rite Gas Station	Beloit Fire Department	Open valve in west dispenser leaking gasoline to pavement; leaks in piping near main valve.
11-22-72	Price-Rite Gas Station	Beloit Fire Department	Leaking gasoline from improperly sealed conduit at pump house.
1-31-73	Price-Rite Gas Station	Beloit Fire Department	Illegal flood lamp wiring near west dispenser resulting in fire.
9-18-74	Price-Rite Gas Station	DILHR	Pipeline connections without emergency internal valves; tanks have leaks; no check valve for automatic backflow protection.
6-21-84	Price-Rite Gas Station	Beloit Fire Department	Ordered to secure all valves in response to May 24, 1984 gasoline release.
10-6-86	The Press	Beloit Fire Department	Improper storage of flammable waste (oily rags).
10-15-86	Drevdahl Automotive Painting	Beloit Fire Department	Storage of flammable liquid not meeting code.
11-8-88	Drevdahl Automotive Painting	Beloit Fire Department	Illegal storage of flammable liquid in building.
11-8-88	Heritage Painting	Beloit Fire Department	Illegal storage of flammable liquid in building.
6-22-89	Heritage Painting	Beloit Fire Department	Illegal storage of 55 gallons flammable liquid outside.
11-30-89	Heritage Painting	Beloit Fire Department	Flammable liquid stored inside building in exceedence of fire prevention standards.

TABLE 6
LABORATORY RESULTS (SOIL)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

	Analytical Parameter	MW-2D 1'-3'	MW-3D (various)	MW-4 8'-10'	MW-5 8'-10'	MW-8 4'-6'	MW-9 4'-6'	MW-10D 1'-3'	MW-10D 8'-10'
VOCs	Benzene (µg/kg)	12	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	N.D.
	n-Butylbenzene (µg/kg)	N.D.	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	1,200
	tert-Butylbenzene (µg/kg)	N.D.	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	160
	Chlorobenzene (µg/kg)	N.D.	N.T.	N.D.	N.D.	59	N.D.	N.T.	N.D.
	p-Isopropyltoluene (µg/kg)	N.D.	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	140
	Isopropylbenzene (µg/kg	N.D.	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	150
	Naphthalene (µg/kg)	74	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	1,400
	n-Propylbenzene (µg/kg)	300	N.T.	6	N.D.	N.D.	N.D.	N.T.	N.D.
	1,1,2-TCA (µg/kg)	26	N.T.	N.D.	N.D.	N.D.	N.D.	N.T.	N.D.
	1,3,5-Trimethylbenzene (µg/kg)	370	N.T.	19	N.D.	N.D.	N.D.	N.T.	210
	1,2,4-Trimethylbenzene (µg/kg)	130	N.T.	39	N.D.	N.D.	N.D.	N.T.	N.D.
	Acetone (µg/kg)	N.D.	N.T.	72	N.D.	N.D.	N.D.	N.T.	N.T.
	Carbon Disulfide (µg/kg)	N.D.	N.T.	7	22	N.D.	N.D.	N.T.	N.T.
	2-Butanone (µg/kg)	13	N.T.	N.D.	N.D.	70	N.D.	N.T.	N.T.
	Vinyl Acetate (µg/kg)	450	N.T.	130	N.D.	8,300	N.D.	N.T.	N.T.
	4-Methyl-2-Pentanone (µg/kg)	69	N.T.	N.D.	N.D.	5,300	26	N.T.	N.T.
TPH	as Gasoline (mg/kg)	18.5	N.T.	N.D.	N.D.	282.6	N.D.	N.T.	N.T.
	as Diesel (mg/kg)	N.D.	N.T.	N.D.	N.D.	237.1	N.D.	N.T.	N.T.
METALS	Lead (mg/kg)	19	N.T.	60	21	2,600	47	160	10
	Arsenic (mg/kg)	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	4.1	2.0
	Barium (mg/kg)	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	42	33
	Cadmium (mg/kg)	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	0.7	N.D.
	Chromium (mg/kg)	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	11	6.8
	Mercury (mg/kg)	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	7.4	0.4

DAMES & MOORE

TABLE 6
LABORATORY RESULTS (SOIL)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Analytical Parameter	MW-2D 1'-3'	MW-3D (various)	MW-4 8'-10'	MW-5 8'-10'	MW-8 4'-6'	MW-9 4'-6'	MW-10D 1'-3'	MW-10D 8'-10'
TOC (mg/kg)	N.T.		N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
3'-5'		11,700						
7'-9'		29,800						
10'-16'		10,500						
20'-25'		33,300						
Grain Size	N.T.		N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
1'-3'		*SM*						
5'-7'		*SM-SP*						

N.D. - Not detected
N.T. - Not tested.

TABLE 7
GROUND WATER LABORATORY ANALYSES

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Method	MW-1	MW-2S	MW-2S DUP	MW-2D	MW-3S	MW-3D	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10S	MW-10D	TRIP BLANK	FIELD BLANK
VOC (8021)						6/91	6/91				6/91	6/91	6/91	6/91		
VOC (8240)	10/91							10/91				10/91	9/91	10/91		
VOC (8260)	6/91	6/91	6/91	6/91	6/91			6/91	6/91	6/91					6/91	6/91
PAH (8270)		6/91			6/91				9/91	6/91						
Lead		6/91	6/91		6/91	6/91				6/91			6/91	6/91		6/91
RCRA Metals		6/91	6/91		6/91	6/91				6/91			6/91	6/91		6/91

6/91 - Date of sample collection for corresponding analysis.

TABLE 8
LABORATORY RESULTS (GROUND WATER)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

	Analytical Parameter	MW-1*	MW-2S	MW-2S DUP	MW-2D	MW-3S	MW-3D	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10S*	MW-10D	Trip Blank	Field Blank
VOCs	Benzene (μg/kg)	1,200	241	253	390	2,430	8,600	N.D.	N.D.	N.D.	4.6	1.4	N.D.	8	N.D.	N.D.	N.D.
	n-Butylbenzene (μg/l)	N.D.	N.D.	N.D.	N.D.	N.D.	340	N.D.	N.D.	N.D.	N.D.	1.9	N.D.	5.4	N.D.	N.D.	N.D.
	tert-Butylbenzene (μg/l)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.4	N.D.	2.2	N.D.	N.D.	N.D.
	sec-Butylbenzene (μg/kg)	N.D.	1.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.8	N.D.	6.1	1.3	N.D.	N.D.
	Chloroform (μg/kg)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.4
	Ethylbenzene (μg/kg)	N.D.	20.1	17.1	2.6	164	760	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.1	16	N.D.	N.D.
	p-Isopropyltoluene (μg/l)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.5	N.D.	N.D.	N.D.
	Isopropylbenzene (μg/kg)	N.D.	3.6	2.8	N.D.	N.D.	180	N.D.	N.D.	N.D.	N.D.	1.7	N.D.	12	N.D.	N.D.	N.D.
	Naphthalene (μg/l)	N.D.	N.D.	N.D.	N.D.	N.D.	480	N.D.	N.D.	N.D.	N.D.	2.2	N.D.	130	N.D.	N.D.	N.D.
	n-Propylbenzene (μg/kg)	N.D.	5.4	3.4	N.D.	N.D.	280	N.D.	N.D.	N.D.	N.D.	1.2	N.D.	29	N.D.	N.D.	N.D.
	1,3,5-Trimethylbenzene (μg/kg)	N.D.	28.9	15.3	N.D.	N.D.	300	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.6	N.D.	N.D.	N.D.
	1,2,4-Trimethylbenzene (μg/kg)	N.D.	67.6	47.4	N.D.	N.D.	690	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.9	N.D.	N.D.	N.D.
	Toluene (μg/kg)	N.D.	4.4	5.3	2.6	378	220	N.D.	N.D.	N.D.	N.D.	N.D.	6.7	3.2	6.7	N.D.	1.3
	Xylenes (μg/kg)	N.D.	34.1	22.4	3.4	N.D.	1,900	N.D.	N.D.	N.D.	N.D.	N.D.	13	N.D.	13	N.D.	N.D.
	MTBE (μg/kg)	N.D.	5.9	9.6	129	N.D.	660	4.0	N.D.	N.D.	4.8	N.D.	N.D.	4.5	4.2	N.D.	N.D.
	2-Butanone (μg/l)	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.D.	6	N.D.	N.T.	N.T.
	Carbon Disulfide (μg/l)	150	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.	N.D.	N.D.	N.D.	N.T.	N.T.

detection limits ? — highly elevated — close — close — close — highly elevated — highly elevated — ok — close — ok — ok — ok — ok — ok — ok

detection limit of 500 ug/l

TABLE 8
LABORATORY RESULTS (GROUND WATER)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

	Analytical Parameter	MW-1*	MW-2S	MW-2S DUP	MW-2D	MW-3S	MW-3D	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10S*	MW-10D	Trip Blank	Field Blank
PAHs	Naphthalene (µg/l)	N.T.	14.0	N.T.	N.T.	120	N.T.	N.T.	N.T.	2.03	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Acenaphthalene (µg/l)	N.T.	N.D.	N.T.	N.T.	37	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Fluorene (µg/l)	N.T.	N.D.	N.T.	N.T.	24	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Phenanthrene (µg/l)	N.T.	N.D.	N.T.	N.T.	42	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Fluoranthene (µg/l)	N.T.	N.D.	N.T.	N.T.	28	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Pyrene (µg/l)	N.T.	N.D.	N.T.	N.T.	20	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Benzo(a)Anthracene (µg/l)	N.T.	N.D.	N.T.	N.T.	12	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Chrysene (µg/l)	N.T.	N.D.	N.T.	N.T.	14	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Benzo(b)Fluoranthene (µg/l)	N.T.	N.D.	N.T.	N.T.	25	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
	Benzo(a)Pyrene (µg/l)	N.T.	N.D.	N.T.	N.T.	11	N.T.	N.T.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.T.	N.T.	N.T.
METALS	Lead (µg/l)	N.T.	N.D.	N.D.	N.T.	6.4	N.D.	N.T.	N.T.	N.T.	N.D.	N.T.	N.T.	51	N.D.	N.T.	N.D.
	Arsenic (µg/l)	N.T.	3.9	5.7	N.T.	3.8	5.8	N.T.	N.T.	N.T.	3.4	N.T.	N.T.	9.2	N.D.	N.T.	N.D.
	Barium (µg/l)	N.T.	180	170	N.T.	240	99	N.T.	N.T.	N.T.	260	N.T.	N.T.	180	120	N.T.	N.D.
	Cadmium (µg/l)	N.T.	0.3	N.D.	N.T.	N.D.	0.7	N.T.	N.T.	N.T.	N.D.	N.T.	N.T.	0.4	0.3	N.T.	N.D.
	Chromium (µg/l)	N.T.	N.D.	N.D.	N.T.	N.D.	N.D.	N.T.	N.T.	N.T.	N.D.	N.T.	N.T.	N.D.	N.D.	N.T.	N.D.

* Highest concentrations of all analyses reported, where analytes were analyzed on more than one occasion.
N.D. - Not detected.
N.T. - Not analyzed.
Shaded areas denote exceedence of NR 140 enforcement standard.
Shaded cells indicate an exceedence of the NR 140 enforcement standard. Proposed standards are not addressed.

TABLE 9
LABORATORY RESULTS (PAINT WASTE)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

	Analytical Parameter	Paint Waste	Soil 1'-3' (Beneath Paint Waste)	Soil 8'-10'
METALS	Arsenic (mg/kg)	0.5	4.1	2.0
	Barium (mg/kg)	64	42	33
	Cadmium (mg/kg)	2.1	0.7	N.D.
	Chromium (mg/kg)	180	11	6.8
	Lead (mg/kg)	2100	160	10
	Mercury (mg/kg)	180	7.4	0.4

TABLE 10
LABORATORY RESULTS (OILY PRODUCT)

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

	Analytical Parameter	June, 1991 Sampling	January, 1992 Sampling
TPH	as Gasoline (mg/kg)	828,000	N.T.
	as Diesel Fuel (mg/kg)	306,000	N.T.
VOCs	Toluene (μg/l)	5.1	N.T.
	Ethylbenzene (μg/l)	10	N.T.
	m & p-Xylenes (μg/l)	54	N.T.
PAHs	Naphthalene (μg/l)	N.R.	20,000
	2-Methylnaphthalene (μg/l)	N.R.	N.D.
	Acenaphthalene (μg/l)	N.R.	1,800
	Dibenzofuran (μg/l)	N.R.	1,300
	Fluorene (μg/l)	N.R.	2,400
	Phenanthrene	N.R.	6,400
	Anthracene (μg/l)	N.R.	850
	Fluoranthene (μg/l)	N.R.	2,800
	Pyrene (μg/l)	N.R.	2,600
	Benzo(a)Anthracene (μg/l)	N.R.	2,100
	Chrysene (μg/l)	N.R.	1,600
	bis(2-Ethylhexyl)Phthalate (μg/l)	N.R.	N.D.
	Benzo(b)Fluoranthene (μg/l)	N.D.	3,500
	Benzo(k)Fluoranthene (μg/l)	N.R.	N.D.
	Benzo(a)Pyrene (μg/l)	N.R.	1,700
	Indeno(1,2,3-cd)Pyrene (μg/l)	N.R.	660
	Benzo(g,h,i)Perylene (μg/l)	N.R.	530
METALS	Arsenic (mg/kg)	0.7	N.T.
	Lead (mg/kg)	110	N.T.
PCBs	(Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260)	N.D.	N.T.

N.D. - Not detected.
N.T. - Not tested.
N.R. - Not reliable concentration estimates due to dilution factor.

TABLE 11
K_{oc} AND K_d ESTIMATES

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

Compound	K_{oc}	K_d
Acetone	1	0.019
MIBK (2-methyl-4-butanone)	20	0.38
1,1,2-TCA	49	0.93
Benzene	97	1.84
MEK (2 butanone)	235	4.46
Toluene	242	4.60
o-Xylene	363	6.90
p-Xylene	552	10.49
m-Xylene	588	11.17
Ethylbenzene	622	11.82
Naphthalene	1300	24.70
Dibenzofuran	2140	40.66
Acenaphthalene	2450	46.55
Phenanthrene	23000	437
Anthracene	26000	494
Pyrene	63400	1205
Benzo(a)Pyrene	282185	5362
Chrysene	420108	7982
Benzo(b)Fluoranthene	1148497	21821

K_{oc} estimates from Fetter (1988).
K_d estimates derived using Fetter K_{oc} estimates and ρ is estimated at 2.65 g/cm^3.

TABLE 3
PHOTOGRAPHIC AND PLOT MAP REFERENCES SUMMARY

URSULA BORGERDING ESTATE PROPERTY
433-437 WOODWARD AVENUE, BELOIT, WISCONSIN

YEAR	SOURCE	PHOTO ID	SCALE
AERIAL PHOTOGRAPHS			
7-24-37	National Archives/ASCS	Can 725,XA-5-421	1:20,000
11-2-40	National Archives/ASCS	Can 778, XA-8A-A7	1:20,000
10-21-50	U.S. Department of Agriculture	XA-2G-141X	≃1:1,200
5-16-56	U.S. Department of Agriculture	XA-1B-125X	≃1:1,200
8-20-63	U.S. Department of Agriculture	XA-2DD-81X	≃1:1,200
7-12-69	U.S. Department of Agriculture	XA-1KK-188X	≃1:1,200
1969	Rock County Soil Conservation Service	(no identification number)	≃1:7,700
1970	City of Beloit	1351	1:960
1978	Rock County Soil Conservation Service	(no identification number)	≃1:7,700
11/1980	City of Beloit	1351	1:960
1986	Rock County Soil Conservation Service	Beloit 86 F9 35 T1N R12E	≃1:7,700
GROUND PHOTOGRAPHS			
1930s or 1940s	Book of Beloit (Beloit Library historical document)	City Ice & Fuel and coal bins	N.A.
12-10-38	Borgerding Family	City Ice & Fuel Co.	N.A.
c. 1950 (previously reported as c. 1940)	Borgerding Family	Pump House and Deep Rock tank	N.A.
c. 1947	Borgerding Family	Gas Station with Deep Rock fuel truck	N.A.
c. 1947	Borgerding Family	Gas Station with Deep Rock fuel truck and tank.	N.A.
PLAT MAPS			
2-4-46	Borgerding Family	Track Servicing City Ice & Fuel Co.	1:1,200
10-26-46	Beloit City Engineer	Branigan's Addition Survey	1:492
5-2-50	Borgerding Family	Proposed Bulk Plant	1:192
11-1984	Beloit City Engineer	River Fill Limits	1:960

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ______

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 04 / 91 (MM DD YY)	06 / 04 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-2D	______ Feet MSL	747.44 Feet MSL	8 1/4 inches

Boring Location
State Plane ______ N. ______ E S/C/N | Lat 89° 1' 57" | Long 42° 31' 1"

NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W

Local Grid Location (If Applicable) ______ Feet ☐ N ☐ S ______ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK	5 4	CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
*2-1	12	9		1-3 SAND; clayey, pebbles, black	SM			59						moist diesel odor
2-2	4	5		4-6 Same as above with gravel	SP			244						wet, moist sediment poured out, odor, sheen on sediment:
				Sampling terminated at 40'										
				*Sample submitted for analysis										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm DAMES & MOORE

This form is authorized by Chapters 144.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a seperate offense, pursuant to ss 144.99 and 162.06, Wis. Stats

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ____________

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started (MM/DD/YY)	Date Drilling Completed (MM/DD/YY)	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 06 / 91	06 / 06 / 91	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-3D	____ Feet MSL	748.91 Feet MSL	8 1/4 inches

Boring Location
State Plane ________ N. ________ E S/C/N | Lat 89° 1' 57"
NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W | Long 42° 31' 1"

Local Grid Location (If Applicable) ☐ N ☐ E ____ Feet ☐ S ____ Feet ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK	5 4	CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
3-1	grab sample		1-3	SAND; fine to medium, black	SM			1758						petroleum odor
3-2	10	18	3-5	Same as above, cinder block at tip	SM			1247						moist, odor
3-3	8	20	5-7	SAND; gravel, coarse, black, foundry	SP			982						wet, odor
3-4	1	-	7-9	SAND; medium, black	SM			1138						oily sheen on water, odor
3-5	Auger sample		14-16	No classification				1532						wet, odor
				Sampling terminated at 34' well set										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	DAMES & MOORE

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State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ____

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 06 / 91 (MM DD YY)	06 / 06 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-4	____ Feet MSL	750.29 Feet MSL	$8^1/_4$ inches

Boring Location
State Plane ____ N. ____ E S/C/N | Lat 89° 1' 57"
NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W | Long 42° 31' 1"

Local Grid Location (If Applicable)
____ Feet ☐ N ☐ S ____ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK	5 4	CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
4-1	Auger sample		1-3	Sample refusal at 3.1', concrete slab, offset				12.4						
4-2	8	13	5-7	SAND; foundry,coarse, black and brown	SM			3.1						dry, no odor
*4-3	18	6	8-10	Fill; foundry, sand, medium to fine, black	SM			4.8						wet, no odor
				Sampling terminated at										
				*Sample submitted for analysis										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature | Firm DAMES & MOORE

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State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ______

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 05 / 91 (MM DD YY)	06 / 05 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-5	______ Feet MSL	748.63 Feet MSL	8 1/4 inches

Boring Location
State Plane ______ N. ______ E S/C/N | Lat 89° 1' 57"
NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W | Long 42° 31' 1"

Local Grid Location (If Applicable)
______ Feet ☐ N ☐ S ______ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK		CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
5-1	10	11	5-7	FILL; foundry, fine to coarse, some clay, black	SM			25						drove rock bottom 6" wet no odor
*5-2		1	8-10	Fill; Top 2", foundry, coarse, black Next 6" SILT; organic muck, black Bottom 10" CLAY; organic, rich, some fine sand, grey Sampling terminated at 15' *Sample submitted for analysis	SM Pt OL			2.0						wet, sheen on water

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	DAMES & MOORE

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State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ____________

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 05 / 91 (MM DD YY)	06 / 05 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-8	____ Feet MSL	746.16 Feet MSL	8 1/4 inches

Boring Location
State Plane ________ N. ________ E S/C/N | Lat 89° 1' 57"
NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W | Long 42° 31' 1"

Local Grid Location (If Applicable)
____ Feet ☐ N ☐ S ____ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK	5 4	CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
8-1	10	12	1-3	SAND; Top 2", foundry, black Bottom 6" Sand, clayey, gravel, brown	SM			3.9						dry, no odor
*8-2	10	2	4-6	FILL; Top 4", foundry, coarse, black Bottom ORGANIC MUCK; clayey, few pebbles, some sand, black	SM Pt			243						wet, odor, sheen on water
8-3	1	3	7-9	SAND, coarse, pebbles, grey	SM			99						wet
8-4	Auger sample			Auger spoil from 10-13' CLAY; sandy, coarse, grey, sand below	CL									
8-5	Auger sample													
				Sampling terminated at 15'										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	DAMES & MOORE

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ______

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Page 1 of 1

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
URSULA BORGERDING ESTATE		

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP. GARY WELLNER	06 / 05 / 91 (MM DD YY)	06 / 05 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-9	______ Feet MSL	750.12 Feet MSL	$8^{1}/_{4}$ inches

Boring Location
State Plane ______ N. ______ E S/C/N | Lat 89° 1' 57" | Long 42° 31' 1"

NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W

Local Grid Location (If Applicable): ______ Feet ☐ N ☐ S ______ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK	5 4	CITY OF BELOIT

Sample Number	Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
9-1	10	2	1-3	FILL; foundry ash, pebbles, black	SM			ND						dry, no odor
*9-2	16	8	4-6	Same as above, some glass pieces in fill	SM			ND						
9-3	2	11	7-9	Same as above, very coarse	SP			2.0						wet
				(Encountered cobble, threw auger off Abandoned at 6', offset for 10-13' sample and well)										
9-4	1	wt.	10-12	FILL; coarse, metal and foundry, red-brown	SP			2.1						wet
9-5	2	10	13-15	FILL; foundry, coarse, black	SP			2.7						wet
				Sampling terminated at 15', well set										
				*Sample submitted for analysis										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	DAMES & MOORE

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State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Wastewater
☐ Emergency Response
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ________

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
URSULA BORGERDING ESTATE			

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
TWIN CITY TESTING CORP.	06 / 04 / 91 (MM DD YY)	06 / 04 / 91 (MM DD YY)	H.S. AUGER

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
		MW-10D	____ Feet MSL	750.12 Feet MSL	8 1/4 inches

Boring Location
State Plane ________ N. ________ E S/C/N | Lat 89° 1' 57" | Long 42° 31' 1"
NE 1/4 of NE 1/4 of Section 35 T 1 N, R 12 E/W

Local Grid Location (If Applicable)
____ Feet ☐ N ☐ S ____ Feet ☐ E ☐ W

County	DNR County Code	Civil Town/City/ or Village
ROCK		CITY OF BELOIT

Sample: Number	Sample: Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
				No Log										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ________

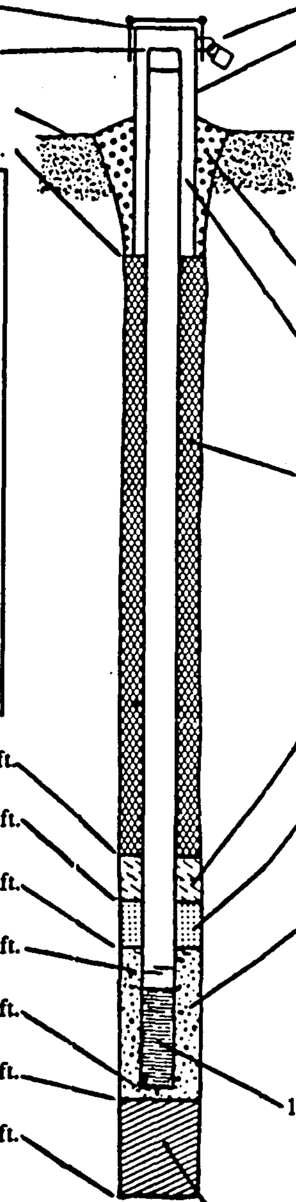
MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: [redacted]URSULA BORGERDING ESTATE
[redacted]cility License, Permit or Monitoring Number: ________

Local Grid Location of Well: ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.
Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or
St. Plane ______ ft. N, ______ ft. E.
Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35, T. 1 N, R. 12 ☒E. ☐W.
Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Well Name: MW 2D
Wis. Unique Well Number ______ DNR Well Number ______
Date Well Installed: 6/4/91 (mm/dd/yy)
Well Installed By: (Person's Name and Firm)
Gary Wellner
Twin City Testing Corp.

Type of Well: Water Table Observation Well ☐ 11; Piezometer ☒ 12
Distance Well Is From Waste/Source Boundary ______ ft.
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No



A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 750.44 ft. MSL
C. Land surface elevation 747.44 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 4 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐
13. Sieve analysis attached? ☐ Yes ☐ No
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99
[redacted]6. Drilling additives used? ☐ Yes ☒ No
Describe ________
17. Source of water (attach analysis): ________

E. Bentonite seal, top ______ ft. MSL or 17 ft.
F. Fine sand, top ______ ft. MSL or 20 ft.
G. Filter pack, top ______ ft. MSL or 22 ft.
H. Screen joint, top ______ ft. MSL or 24 ft.
I. Well bottom ______ ft. MSL or 28 ft.
J. Filter pack, bottom ______ ft. MSL or 38 ft.
K. Borehole, bottom ______ ft. MSL or 38 ft.
L. Borehole, diameter 8 in.
M. O.D. well casing 2.25 in.
N. I.D. well casing 2 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4 in.
b. Length: 7 ft.
c. Material: Steel ☒ 04; Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ________
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐; Other ☐
5. Annular space seal: a. ~~Granular~~ Bentonite ☒ 33 (chips)
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . . Bentonite-cement grout ☐ 50
e. 2.55 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☐ 33
b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☒ 32
c. ________ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. #4555 RF
b. Volume added 0.5 ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. #30 RF
b. Volume added 1.5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐
10. Screen material: FJTPVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
b. Manufacturer Mono Flex
c. Slot size: 0.010 in.
d. Slotted length: 5 ft.
11. Backfill material (below filter pack): None ☐ 14; Other ☒ Natural

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature ________ Firm: Twin City Testing Corp.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
Ursula Borgwirtig Estate	Rock	MW-21	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
_ _ _ _ _ _ _	54	_ _ _ _ _	_ _ _

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐

3. Time spent developing well ≥120 min. ?

4. Depth of well (from top of well casisng) 28. ft. (Because part of filter pack?)

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 8.1 gal.

7. Volume of water removed from well 50. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 15.7 ft.	15.2 ft.
Date	b. 06/05/91 (mm dd yy)	06/05/91 (mm dd yy)
Time	c. 8:30 ☒ a.m. ☐ p.m.	~5:30 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)		Cleared by 40 gals.

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stehr

Firm: Dames + Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristine M. Stehr

Print Initials: KMS

Firm: Dames + Moore

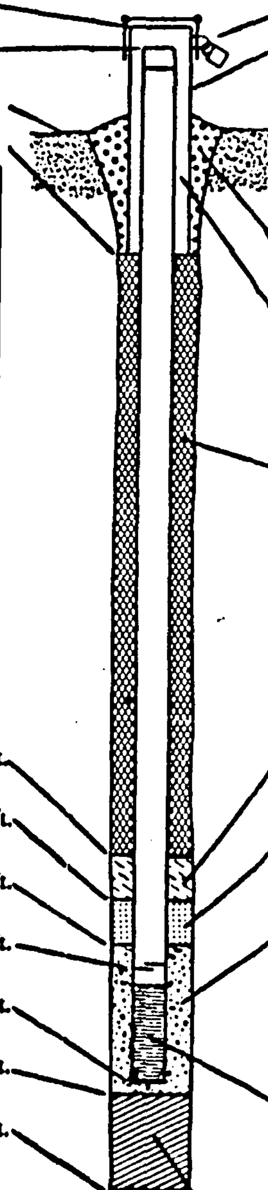
NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: URSULA BORGERDING ESTATE	Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name: MW 3D
Facility License, Permit or Monitoring Number: ________	Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or St. Plane ______ ft. N, ______ ft. E.	Wis. Unique Well Number ____ DNR Well Number ____
Type of Well: Water Table Observation Well ☐ 11; Piezometer ☒ 12	Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N, R. 12 ☒ E. ☐ W.	Date Well Installed: 6 / 7 / 91 (m m d d y y)
Distance Well Is From Waste/Source Boundary ____ ft.	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known	Well Installed By: (Person's Name and Firm) Gary Wellner, Twin City Testing Corp.
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No		



A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 751.54 ft. MSL
C. Land surface elevation 748.91 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
Other ☐ ______

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis): ______

E. Bentonite seal, top ______ ft. MSL or 17 ft.
F. Fine sand, top ______ ft. MSL or 19 ft.
G. Filter pack, top ______ ft. MSL or 21 ft.
H. Screen joint, top ______ ft. MSL or 23 ft.
I. Well bottom ______ ft. MSL or 28 ft.
J. Filter pack, bottom ______ ft. MSL or 35 ft.
K. Borehole, bottom ______ ft. MSL or 35 ft.
L. Borehole, diameter 8 in.
M. O.D. well casing 2.25 in.
N. I.D. well casing 2 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4 in.
b. Length: 7 ft.
c. Material: Steel ☒ 04; Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ______

3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐
None — Other ☐

5. Annular space seal: a. ~~Granular Bentonite~~ Chips ☒ 33
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . . Bentonite-cement grout ☐ 50
e. 4.25 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. 4555 RF
b. Volume added 0.5 ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. #30 RF
b. Volume added 1.5 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ 23
Flush threaded PVC schedule 80 ☐ 24
Other ☐

10. Screen material: FJT PVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
b. Manufacturer Mono Flex
c. Slot size: 0.010 in.
d. Slotted length: 5 ft.

11. Backfill material (below filter pack): None ☒ 14
Natural — Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	Twin City Testing Corp.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name
Upzelle Berganding Estate	Rock	MW-3D
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number / DNR Well Number
________	54	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
- surged with bailer and bailed ☒ 41
- surged with bailer and pumped ☐ 61
- surged with block and bailed ☐ 42
- surged with block and pumped ☐ 62
- surged with block, bailed and pumped ☐ 70
- compressed air ☐ 20
- bailed only ☐ 10
- pumped only ☐ 51
- pumped slowly ☐ 50
- Other ________ ☐

3. Time spent developing well ≥120 min.

4. Depth of well (from top of well casisng) 35. ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 8.1 gal.

7. Volume of water removed from well 110. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 13.01 ft.	13.0 ft.
Date	b. 06/05/91 (mm dd yy)	__/__/__ (mm dd yy)
Time	c. ~9:00 ☒ a.m. ☐ p.m.	~5:30 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe) Cleared @ ~95 gals

Fill in if drilling fluids were used and well is at solid waste facility:

	Before	After
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stehr

Firm: Dames + Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristi M. Stehr

Print Initials: KMS

Firm: Dames & Moore

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ________

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: URSULA BORGERDING ESTATE

Local Grid Location of Well: ________ ft. ☐ N. ☐ S. ________ ft. ☐ E. ☐ W.

Well Name: MW 4

Facility License, Permit or Monitoring Number: ________

Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or

Wis. Unique Well Number / DNR Well Number

St. Plane ________ ft. N. ________ ft. E.

Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12

Date Well Installed: 6/5/91 (m m d d y y)

Distance Well Is From Waste/Source Boundary: ____ ft.

Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N, R. 12 ☒ E. ☐ W.

Well Installed By: (Person's Name and Firm): Gary Wellner, Twin City Testing Corp.

Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No

Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known

A. Protective pipe, top elevation ______ ft. MSL

B. Well casing, top elevation 752.75 ft. MSL

C. Land surface elevation 750.29 ft. MSL

D. Surface seal, bottom ______ ft. MSL or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ________

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ________

17. Source of water (attach analysis): ________

E. Bentonite seal, top ______ ft. MSL or 2 ft.

F. Fine sand, top ______ ft. MSL or 3 ft.

G. Filter pack, top ______ ft. MSL or 4 ft.

H. Screen joint, top ______ ft. MSL or 5 ft.

I. Well bottom ______ ft. MSL or 15 ft.

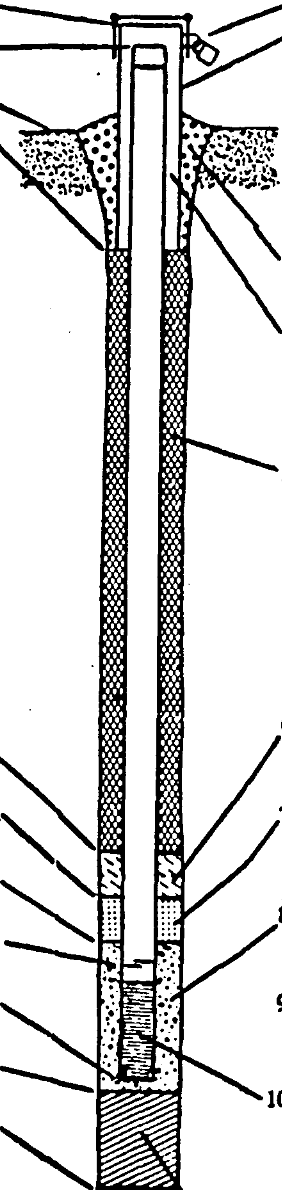
J. Filter pack, bottom ______ ft. MSL or 15 ft.

K. Borehole, bottom ______ ft. MSL or 15 ft.

L. Borehole, diameter 8 in.

M. O.D. well casing 2.25 in.

N. I.D. well casing 2 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4 in.
b. Length: 4 ft.
c. Material: Steel ☒ 04; Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ________

3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐; None — Other ☐

5. Annular space seal: a. Granular Bentonite ☒ 33
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . Bentonite-cement grout ☐ 50
e. 0.85 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ________ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. 4555 RF
b. Volume added 0.5 ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. #30 RF
b. Volume added 3 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐

10. Screen material: FJTPVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
b. Manufacturer: Mono Flex
c. Slot size: 0.010 in.
d. Slotted length: 10 ft.

11. Backfill material (below filter pack): None ☒ 14; Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	Twin City Testing Corp.

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State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
Ursula Dreibelbis Estate	Rock	MW-4	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	54	________	____

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
- surged with bailer and bailed ☒ 41
- surged with bailer and pumped ☐ 61
- surged with block and bailed ☐ 42
- surged with block and pumped ☐ 62
- surged with block, bailed and pumped ☐ 70
- compressed air ☐ 20
- bailed only ☐ 10
- pumped only ☐ 51
- pumped slowly ☐ 50
- Other ______ ☐

3. Time spent developing well 80 min.

4. Depth of well (from top of well casisng) 15. ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 5.1 gal.

7. Volume of water removed from well 30. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.7 ft.	8.2 ft.
Date	b. 06/06/91 (mm dd yy)	06/06/91 (mm dd yy)
Time	c. ~7:30 ☒ a.m. ☐ p.m.	~2:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe) Clearing @ 25 gals.

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____._ mg/l	_____._ mg/l
15. COD	_____._ mg/l	_____._ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stoler

Firm: Dames + Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristine M. Stoler

Print Initials: KMS

Firm: Dames + Moore

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: URSULA BORGERDING ESTATE

Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.

Well Name: MW 5

Facility License, Permit or Monitoring Number: ______

Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or

Wis. Unique Well Number: ______ DNR Well Number: ______

Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12

St. Plane ______ ft. N, ______ ft. E.

Date Well Installed: 6/7/91 (m m d d y y)

Distance Well Is From Waste/Source Boundary ______ ft.

Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N, R. 12 ☒ E. ☐ W.

Well Installed By: (Person's Name and Firm) Gary Wellner, Twin City Testing Corp.

Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No

Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known

A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 751.26 ft. MSL
C. Land surface elevation 748.63 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 2. ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ______

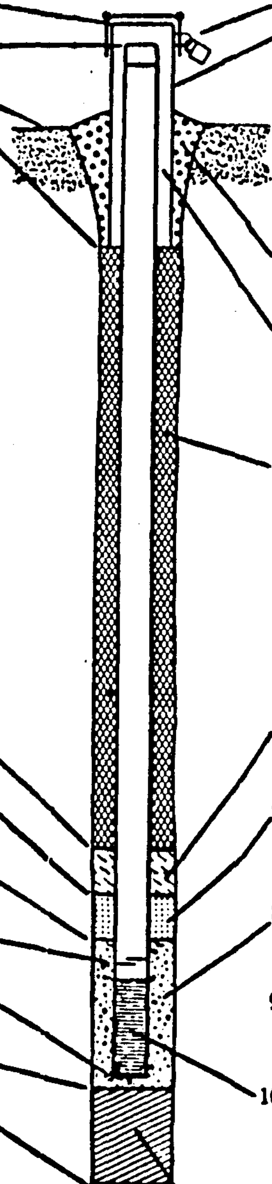
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis): ______

E. Bentonite seal, top ______ ft. MSL or 2. ft.
F. Fine sand, top ______ ft. MSL or 2.5 ft.
G. Filter pack, top ______ ft. MSL or 3. ft.
H. Screen joint, top ______ ft. MSL or 4. ft.
I. Well bottom ______ ft. MSL or 14. ft.
J. Filter pack, bottom ______ ft. MSL or 15. ft.
K. Borehole, bottom ______ ft. MSL or 15. ft.
L. Borehole, diameter 8. in.
M. O.D. well casing 2.25 in.
N. I.D. well casing 2. in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4. in.
   b. Length: 4. ft.
   c. Material: Steel ☒ 04; Other ☐ ______
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ______
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐ ___; Other ☐ ______
5. Annular space seal: a. Granular Bentonite ☒ 33
   b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
   c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
   d. ______ % Bentonite . . . . . Bentonite-cement grout ☐ 50
   e. 0.85 Ft³ volume added for any of the above
   f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
   b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
   c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. 4555 RF
   b. Volume added 0.5 ft³
8. Filter pack material: Manufacturer, product name and mesh size
   a. #30 RF
   b. Volume added 3 ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ______
10. Screen material: FJTPVC
   a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ______
   b. Manufacturer MonoFlex
   c. Slot size: 0.010 in.
   d. Slotted length: 10. ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ ______

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: ______ Firm: Twin City Testing Corp.

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State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
[illegible]	Rock	MW-5	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
	54		

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐

3. Time spent developing well: 4:00 min.

4. Depth of well (from top of well casisng): 15. ft.

5. Inside diameter of well: 2. in.

6. Volume of water in filter pack and well casing: 5.1 gal.

7. Volume of water removed from well: 55. gal.

8. Volume of water added (if any): 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
    (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.28 ft.	8.6 ft.
Date (mm dd yy)	b. 06/08/91	06/08/91
Time	c. 8:00 ☒ a.m. ☐ p.m.	12:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

	Before	After
14. Total suspended solids	______.__ mg/l	______.__ mg/l
15. COD	______.__ mg/l	______.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stehr

Firm: Dames + Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature]

Print Initials: KMS

Firm: Dames + Moore

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

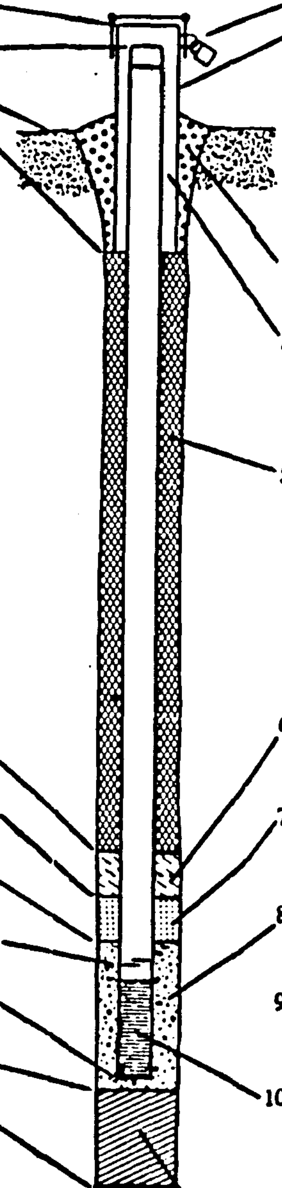
Facility/Project Name: URSULA BORGERDING ESTATE
Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.
Well Name: MW-8

Facility License, Permit or Monitoring Number: ________
Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or
Wis. Unique Well Number: ______ DNR Well Number: ______

Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12
St. Plane ______ ft. N, ______ ft. E.
Date Well Installed: 6 / 5 / 91 (m m / d d / y y)

Distance Well Is From Waste/Source Boundary: ______ ft.
Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N, R. 12 ☒ E. ☐ W.
Well Installed By: (Person's Name and Firm) GARY WELLNER, TWIN CITY TESTING CORP.

Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No
Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known



A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 750.16 ft. MSL
C. Land surface elevation 746.16 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 2 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ______

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe ______

17. Source of water (attach analysis): ______

E. Bentonite seal, top ______ ft. MSL or 2 ft.
F. Fine sand, top ______ ft. MSL or 3 ft.
G. Filter pack, top ______ ft. MSL or 4 ft.
H. Screen joint, top ______ ft. MSL or 5 ft.
I. Well bottom ______ ft. MSL or 15 ft.
J. Filter pack, bottom ______ ft. MSL or 15 ft.
K. Borehole, bottom ______ ft. MSL or 15 ft.
L. Borehole, diameter 8 in.
M. O.D. well casing 2.25 in.
N. I.D. well casing 2 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4 in.
b. Length: 4 ft.
c. Material: Steel ☒ 04; Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ 30; Annular space seal ☐; Other ☐
5. Annular space seal: a. Granular Bentonite ☒ 33
b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ______ % Bentonite . . . . . Bentonite-cement grout ☐ 50
e. 0.85 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. 4555 RF
b. Volume added 0.5 ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. #30 RF
b. Volume added 3 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐
10. Screen material: FJTPVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
b. Manufacturer MonoFlex
c. Slot size: 0.010 in.
d. Slotted length: 10 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: ______ Firm: Twin City Testing Corp.

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State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
Ursula Borgwardt Estate	Rock	MW-8	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☒ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐

3. Time spent developing well ~80 min.

4. Depth of well (from top of well casisng) 15. ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 5.1 gal.

7. Volume of water removed from well 47. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
   (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.67 ft.	8.7 ft.
Date	b. 06/06/91 (mm dd yy)	06/06/91 (mm dd yy)
Time	c. ~9:00 ☒ a.m. ☐ p.m.	~2:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe) Clearing @ 35 gals

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____.__ mg/l	_____.__ mg/l
15. COD	_____.__ mg/l	_____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stahl

Firm: Dames + Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristine M. Stahl

Print Initials: KMS

Firm: Dames + Moore

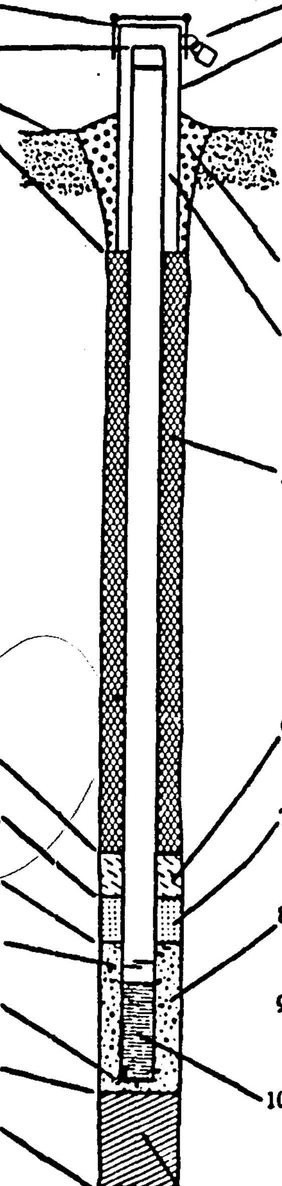
NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4 90

Facility/Project Name: URSULA BORGERDING ESTATE	Local Grid Location of Well: ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name: MW-9
Facility License, Permit or Monitoring Number: ________	Grid Origin Location: Lat. 89 1' 57" Long. 42 31' 1" or	Wis. Unique Well Number ______ DNR Well Number ______
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	St. Plane ______ ft. N, ______ ft. E.	Date Well Installed: 6 / 5 / 91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ______ ft.	Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N, R. 12 ☒ E. ☐ W.	Well Installed By: (Person's Name and Firm) Gary Wellner, Twin City Testing Corp.
Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known	



A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 750.40 ft. MSL
C. Land surface elevation 750.12 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 1 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ______

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis): ______

E. Bentonite seal, top ______ ft. MSL or 1 ft.
F. Fine sand, top ______ ft. MSL or 2 ft.
G. Filter pack, top ______ ft. MSL or 3 ft.
H. Screen joint, top ______ ft. MSL or 5 ft.
I. Well bottom ______ ft. MSL or 15 ft.
J. Filter pack, bottom ______ ft. MSL or 15 ft.
K. Borehole, bottom ______ ft. MSL or 15 ft.
L. Borehole, diameter 8 in.
M. O.D. well casing 2.25 in.
N. I.D. well casing 2 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 8 in.
b. Length: 7 ft.
c. Material: Steel ☐ 04; Other ☐ Cast
d. Additional protection? ☒ Yes ☐ No
If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ______
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐; Other ☐ sand
5. Annular space seal: a. Granular Bentonite ☒ 33
b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ______ % Bentonite . . . . . . Bentonite-cement grout ☐ 50
e. 0.85 Ft³ volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. 4555 RF
b. Volume added 1 ft³
8. Filter pack material: Manufacturer, product name and mesh size
a. #30 RF
b. Volume added 1.5 ft³
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐
10. Screen material: FJTPVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
b. Manufacturer MonoFlex
c. Slot size: 0.010 in.
d. Slotted length: 10 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
	Twin City Testing Corp.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
Ursula Bergerding Estate	Rock	MW-9	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
- surged with bailer and bailed ☒ 41
- surged with bailer and pumped ☒ 61
- surged with block and bailed ☐ 42
- surged with block and pumped ☐ 62
- surged with block, bailed and pumped ☐ 70
- compressed air ☐ 20
- bailed only ☐ 10
- pumped only ☐ 51
- pumped slowly ☐ 50
- Other ______ ☐

3. Time spent developing well 120 min.

4. Depth of well (from top of well casisng) 15. ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 5.6 gal.

7. Volume of water removed from well 55. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.1 ft.	7.9 ft.
Date	b. 06/04/91 (mm dd yy)	06/09/91 (mm dd yy)
Time	c. 2:00 ☐ a.m. ☒ p.m.	5:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe) Clearing @ 40 gals.

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stehr

Firm: Dames & Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristine M. Stehr

Print Initials: KMS

Firm: Dames & Moore

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

[redacted]ility/Project Name: URSULA BORGERDING ESTATE

Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.

Well Name: MW 10-D

Facility License, Permit or Monitoring Number: ________

Grid Origin Location: Lat. 89° 1' 57" Long. 42° 31' 1" or

Wis. Unique Well Number: ______ DNR Well Number: ______

Type of Well: Water Table Observation Well ☐ 11 Piezometer ☒ 12

St. Plane ______ ft. N. ______ ft. E.

Date Well Installed: 6 / 6 / 91 (m m / d d / y y)

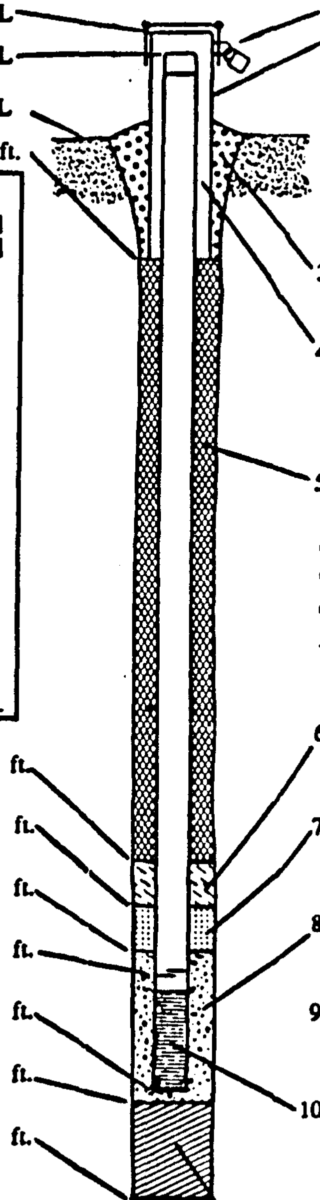
Distance Well Is From Waste/Source Boundary: ______ ft.

Section Location of Waste/Source: NE 1/4 of NE 1/4 of Sec. 35 T. 1 N. R. 12 ☒ E. ☐ W.

Well Installed By: (Person's Name and Firm) Gary Wellner, Twin City Testing Corp.

Is Well A Point of Enforcement Std. Application? ☐ Yes ☐ No

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known



A. Protective pipe, top elevation ______ ft. MSL
B. Well casing, top elevation 752.22 ft. MSL
C. Land surface elevation ______ ft. MSL
D. Surface seal, bottom ______ ft. MSL or 3 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ____

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis): ______

E. Bentonite seal, top ______ ft. MSL or 3 ft.
F. Fine sand, top ______ ft. MSL or 8 ft.
G. Filter pack, top ______ ft. MSL or 8 ft.
H. Screen joint, top ______ ft. MSL or 25 ft.
I. Well bottom ______ ft. MSL or 30 ft.
J. Filter pack, bottom ______ ft. MSL or 30 ft.
K. Borehole, bottom ______ ft. MSL or 30 ft.
L. Borehole, diameter 8 in.
M. O.D. well casing 2.25 in.
[redacted] I.D. well casing ______ in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
 a. Inside diameter: 4 in.
 b. Length: 7 ft.
 c. Material: Steel ☒ 04; Other ☐ ____
 d. Additional protection? ☐ Yes ☒ No
 If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐ ____; None — Other ☐ ____
5. Annular space seal: a. ~~Granular~~ Bentonite Chips ☒ 33
 b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
 c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
 d. ____ % Bentonite . . . . . Bentonite-cement grout ☐ 50
 e. 5 Ft^3 volume added for any of the above
 f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite ~~XXXX~~ chips ☒ 33
 b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
 c. ______ Other ☐ ____
7. Fine sand material: Manufacturer, product name & mesh size
 a. None ____
 b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
 a. None ____
 b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____
10. Screen material: FJTPVC
 a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
 b. Manufacturer: Mono Flex
 c. Slot size: 0.010 in.
 d. Slotted length: 5 ft.
11. Backfill material (below filter pack): None ☐ 14; Natural — Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: ______ Firm: Twin City Testing Corp.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
Ursula Dergandic Estate	Rock	MW-10D	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	__	_______	___

1. Can this well be purged dry? ☐ Yes ☑ No

2. Well development method
   - surged with bailer and bailed ☑ 41
   - surged with bailer and pumped ☐ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐

3. Time spent developing well ~180 min.

4. Depth of well (from top of well casisng) 30. ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing 7.2 gal.

7. Volume of water removed from well 65. gal.

8. Volume of water added (if any) 0. gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☐ No
    (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 13.7 ft.	13.5 ft.
Date	b. 06/07/91 (mm dd yy)	06/07/91 (mm dd yy)
Time	c. 8:30 ☑ a.m. ☐ p.m.	3:00 ☐ a.m. ☑ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 / Turbid ☑ 15	Clear ☑ 20 / Turbid ☐ 25
(Describe)		clearing @ 55 gals.

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_____._ mg/l	_____._ mg/l
15. COD	_____._ mg/l	_____._ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: Kristine M. Stehr

Firm: Dennis & Moore

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Kristine M. Stehr

Print Initials: KMS

Firm: Dennis & Moore

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

ORTEK CHAIN OF CUSTODY/ANALYSIS REQUEST FORM

Company Name: Dames & Moore

Project No./Client 20255-003

Sampling Location: 20255-003

Sampler [illegible]

No.: 1663

ORTEK Batch No. 9106089

Bottle Size/Preservative

ANALYSIS REQUESTED: 8021; TPH; Pb

Date	Time	Sample I.D./Description	No. of Bottles						Total	*Sample Type	ANALYSIS REQUESTED										Remarks	Lab Use Only ID Number
6/4/91		MW-2D/1/1'-3'	1	1					2	S	X	X	X	X								113525
6/5/91		MW-4/3/8'-10'	1	1					2	S	X	X	X	X								113526
"		MW-3/2/4'-6'	1	1					2	S	X	X	X	X								113527
"		MW-9/2/4'-6'	1	1					2	S	X	X	X	X								113528
"		MW-5/2/8'-10'	1	1					2	S	X	X		X								113529

COMMENTS/SPECIAL INSTRUCTIONS:

☐ If Pb > 5ppm do TCLP

*Sample Type		
S - Soil	SW - Surface Water	H - Hazardous Liquid
SE - Sediment	DW - Drinking Water	A - Air
SO - Solid	WW - Wastewater	O - Oil
	GW - Groundwater	X - Other

Date Received: 6/6/91

Date Due: 7/1/91 ☐RUSH (approved by lab)

Quotation #:

Purchase Order #:

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No

Packed By:

Sealed For Shipping By: Seal #

Results To: Dames & Moore
250 E. Wisconsin Ave, Ste 1500
Milwaukee, WI 53202

Attention: Kristine Steby

Billing Address: Same

Phone: 414/347-0800 FAX 414/347-0288

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	[signature]	6/5/91	5:20	[signature]	6/5/91	5:20
2.	[signature]	6/6/91	3:30	[signature]	6-6-91	3:30

Received for Laboratory: [signature] 6/10/91 09:19

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☐Yes ☐No

Method of Shipment: LAWTEK

Contents Temperature °C Refrig. # 240 MH-6

ORTEK 2496 West Mason Street
Green Bay, WI 54307-2435
(414) 498-2222

ORTEK CHAIN OF CUSTODY/ANALYSIS REQUEST FORM

1 of 2

No.: 1167

Company Name: Dames + Moore

Project No./Client: 20255-003

Sampling Location: 20255-003

Sampler: Kristine M Stehr

ORTEK Batch No. 9106124

Bottle Size/Preservative: 40 ml gl. / 4 oz gl. / 500 ml plastic / 1 qt. plastic

Analysis: 8021 / 8240 / RCRA Metals / MTBE

Date	Time	Sample I.D./Description	No. of Bottles				Total	*Sample Type	8021	8240	RCRA Metals	MTBE	Remarks	Lab Use Only ID Number
6/7/91		MW-4	3				3	GW	X			X		113608
		MW-8	3				3	GW	X			X		113609
		MW-10S	6			1	7	GW	X	X	X	X	Added 1 mL HNO3	113610
		MW-9	3				3	GW	X			X		113611
		MW-10D	3			1	4	GW	X		X	X	Added 2 mL HNO3	113612
↓		MW-3D	3			1	4	GW	X		X	X		113613
6/4/91		MW-10D/8-10		1	1		2	S	X		X			113614
		MW-10D/Paint			1		1	X			X			113615
↓		MW-10D/PSoil			1		1	S			X			113616

COMMENTS/SPECIAL INSTRUCTIONS:

Pricing Per Contract - Glen Moore

☐ If Pb > 5ppm do TCLP

*Sample Type: S - Soil, SE - Sediment, SO - Solid, SW - Surface Water, DW - Drinking Water, WW - Wastewater, GW - Groundwater, H - Hazardous Liquid, A - Air, O - Oil, X - Other Paint

Date Received: 6/12/91

Date Due: 7/3/91 ☐RUSH (approved by lab)

Quotation #:

Purchase Order #:

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No

Packed By: K. Stehr

Sealed For Shipping By: K. Stehr Seal #

Results To: Dames & Moore
250 E. Wisconsin Ave, Ste 1500
Milw., WI 53202

Attention: Kristine Stehr

Billing Address: Same

Phone: 414/347-0800 FAX 414/347-0288

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	Kristine M Stehr	6/11/91	2:15p	D Guest	6/11/91	3:35p
2.						

Received for Laboratory: Denise Dietsche 6/12/91 11:29

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☐Yes ☒No

Method of Shipment: LAUTER

Contents Temperature 8 °C Refrig. # 32, M-2, MA-5, 100

ORTEK 2496 West Mason Street Green Bay, WI 54307-2435 (414) 498-2222

ORTEK CHAIN OF CUSTODY/ANALYSIS REQUEST FORM

No.: 1895

Company Name: Dames & Moore

Project No./Client: 20255-003

Sampling Location: 20255-003

Sampler: Kristin McStela

Bottle Size/Preservative: 40 ml glass; 1 gt amber; 1 gt H2SO4; ... plastic; ... glass

Analysis: 8021; MTBE; RCRA Metals; PAH

ORTEK Batch No. 9106090

Date	Time	Sample I.D./Description	No. of Bottles						Total	*Sample Type	8021	MTBE	RCRA Metals	PAH							Remarks	Lab Use Only ID Number
6/5/91		MW-1	3							GW	X	X										113530
"		MW-2S	3	1	1					GW	X	X	X	X								113531
"		MW-2D	3							"	X	X										113532
"		MW-2S/Dup	3		1					"	X	X	X									113533
"		MW-3S	3	1	1					"	X	X	X	X								113534
"		MW-6	3							"	X	X										113535
"		MW-7	3	1	1					"	X	X	X	X								113536
"		Trip Blank	3							"	X	X										113537
"		Field Blank	3		1					"	X	X	X									113538

COMMENTS/SPECIAL INSTRUCTIONS:

Prices per contract

☐ If Pb > 5ppm do TCLP

*Sample Type: S - Soil; SE - Sediment; SO - Solid; SW - Surface Water; DW - Drinking Water; WW - Wastewater; GW - Groundwater; H - Hazardous Liquid; A - Air; O - Oil; X - Other ______

Date Received: 6/10/91

Date Due: 7/1/91 ☐RUSH (approved by lab)

Quotation #:

Purchase Order #:

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No

Packed By: ______

Sealed For Shipping By: ______ Seal # ______

Results To: Dames & Moore
250 E. Wisconsin Ave, Ste 1500
Milwaukee WI 53202

Attention: Kristin Stela

Billing Address: SAME

Phone: 414/347-0... FAX 414/347-0288

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	[signature]	6/5/91	5:00	[signature]	6/5/91	5:00
2.	[signature]	6/6/91	3:30	[signature]	6-6-91	3:30

Received for Laboratory: [signature] 6/10/91 10:18

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☑Yes ☐No

Method of Shipment: LAUTER

Contents Temperature 11 °C Refrig. # M-3, 240

ORTEK
2490 West Mason Street
Green Bay, WI 54307-2435
(414) 438-2222

ORTEK CHAIN OF CUSTODY/ANALYSIS REQUEST FORM

No.: 1160

Company Name: Dames & Moore

Project No./Client: 20255-003

Sampling Location: ~~[illegible]~~, 20255-003

Sampler: Jennifer Trapp

Bottle Size/Preservative: 40 ml glass; 500 ml [illegible]

ORTEK Batch No.: 9106140

Date	Time	Sample I.D./Description	No. of Bottles						Total	*Sample Type	ANALYSIS REQUESTED: 8021	MTBE	TOC	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~				Remarks	Lab Use Only ID Number
~~[illegible]~~		~~[illegible]~~																				113655
6/11/91		MW5	3						3	GW	X	X										↓
6/11/91		TOC/20-25		1					1	S			X									113656

COMMENTS/SPECIAL INSTRUCTIONS:
Pricing per contract - Glenn Moses

☐ If Pb > 5ppm do TCLP

*Sample Type
S - Soil
SE - Sediment
SO - Solid
SW - Surface Water
DW - Drinking Water
WW - Wastewater
GW - Groundwater
H - Hazardous Liquid
A - Air
O - Oil
X - Other ______

Date Received: 6/13/91
Date Due: 7/4/91 ☐RUSH (approved by lab)
Quotation #:
Purchase Order #:

Results To: Dames & Moore
250 E. Wisconsin #1500
Milwaukee, WI 53202
Attention: Kristine Stehr

Billing Address: Same

Phone: (414) 347-0800 FAX (414) 347-0258

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No
Packed By: Jennifer Trapp
Sealed For Shipping By: Jennifer Trapp Seal # ______

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	Jennifer Trapp	6/11/91	3:55 pm			
2.						

Received for Laboratory: [signature] 6-13-91 12:36

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☑Yes ☐No
Method of Shipment: Lab Courier
Contents Temperature 11.8 °C Refrig. # 32,100

ORTEK
2496 West Mason Street
Green Bay, WI 54307-2435
(414) 498-2222

—1

4574558

DAMES & MOORE, Ltd.

250 East Wisconsin Ave, Suite 1500
Milwaukee, Wisconsin 53202
(414) 347-0800 FAX:(414) 347-0288

Turnaround Time

☐ Rush (preapproved by Lab)
☒ Normal 9/27/91

SHIPPING DETAILS:
Method of Shipment: Courier
Contents Temperature: 0.8 C
Comments: COOLER NOT SECURE

PROJECT NAME:

PROJECT #: 20255-003

Send Results To:
PROJECT MANAGER: Cristine Stehl

9109043

LAB USE ONLY	DATE	CONTAINERS	No.	SAMPLE ID	SAMPLE TYPE	ANALYSIS REQUESTED: 8240	610 HPLC								REMARKS/PRESERVATIVES
	9/4/91	40ml gl	4	MW-105	GW	X									HCl 116772
	9/4/91	1qt amber	2	MW-6	GW		X								none 116773
															Date Due: 9/27/91

CHAIN OF CUSTODY RECORD

SAMPLER: (SIGNATURE)	DATE
D. Kerr	9/4/91

COMMENTS
NC for 8240 – exceeded hold on last samples
Report dibenzofuran on 610 HPLC – call if questions.

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
D. Kerr	9-5-91 3:10pm	L. Just			

32.90

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY: BY (SIGNATURE)	DATE/TIME
					Gloria Doftater	9/6/91 8:08

DAMES & MOORE, Ltd.
250 East Wisconsin Ave, Suite 1500
Milwaukee, Wisconsin 53202
(414) 347-0800 FAX:(414) 347-0288

Turnaround Time

☐ Rush (preapproved by Lab)
☒ Normal

SHIPPING DETAILS:
Method of Shipment
Contents Temperature ____ C
Comments

PROJECT NAME:
PROJECT #: 20355-003
Send Results To:
PROJECT MANAGER: K. Stehr

ANALYSIS REQUESTED columns (handwritten): 8240; 8240; VOCs (Full); TPH Survey

LAB USE ONLY	DATE	CONTAINERS	No.	SAMPLE ID	SAMPLE TYPE	8240			VOCs (Full)	TPH Survey					REMARKS/PRESERVATIVES
	10/2/91	4 oz. gl	1	RS1	S				X	X					
	10/2/91	40 ml. gl	3	MW-1	GW	X									
	"	"	3	MW-5	GW	X									HCl pres
	"	"	3	MW-9	GW	X									HCl pres
	"	"	3	MW-10D	GW	X									HCl pres

CHAIN OF CUSTODY RECORD

SAMPLER: (SIGNATURE)	DATE
[signature]	10/2/91

COMMENTS Analyte list changed (from 4 cmpds to 8240) by K. Stehr

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature]	10/3 | 1:00	[signature]
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME

ORTEK **CHAIN OF CUSTODY/ANALYSIS REQUEST FORM**

Company Name: Dames & Moore

Project No./Client 20255-003

Sampling Location: 20255-003

Sampler Kristin McStelter

Bottle Size/Preservative: 500 ml plastic

No.: ~~1159~~ 1167 2 of 2

ORTEK Batch No. 9106124

Date	Time	Sample I.D./Description	No. of Bottles	Total	*Sample Type	TOC	Grain Size	Remarks	Lab Use Only ID Number
6/11/91		TOC/3-5	1	1	S	X		may have strong odors	113617
		TOC/7-9	1	1	S	X			113618
		TOC/14-16	1	1	S	X			113619
		GS/1-3	1	1	S		X		113620
		GS/5-7	1	1	S		X		113621

COMMENTS/SPECIAL INSTRUCTIONS:
Pricing per contract - Glen Moore

☐ If Pb > 5ppm do TCLP

*Sample Type: S - Soil; SE - Sediment; SO - Solid; SW - Surface Water; DW - Drinking Water; WW - Wastewater; GW - Groundwater; H - Hazardous Liquid; A - Air; O - Oil; X - Other ______

Date Received: 6/12/91
Date Due: 7/3/91 ☐RUSH (approved by lab)
Quotation #:
Purchase Order #:

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No
Packed By: K. Stelter
Sealed For Shipping By: K. Stelter Seal # ______

Results To: Dames & Moore
250 E. Wisconsin Ave, Ste 1500
Milw WI 53202
Attention: Kristin Stelter

Billing Address: Same

Phone: 414/347-0800 FAX 414/347-0288

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	Kristin McStelter	6/11/91	2:15 pm	[illegible]	6/11/91	3:34
2.						

Received for Laboratory: [signature] 6/12 [illegible] 11:29

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☐Yes ☐No
Method of Shipment: Ortek
Contents Temperature 8 °C Refrig. # ~~32, M2, MA5~~, 100

ORTEK
2496 West Mason Street
Green Bay, WI 54307-2435
(414) 499-2222

ORTEK

CHAIN OF CUSTODY/ANALYSIS REQUEST FORM

No.: 1161

Company Name: Dames & Moore

Project No./Client: 20255-003

Sampling Location: 20255-003

Sampler: [signature]

ORTEK Batch No. 9106140

Bottle Size/Preservative: 4 oz. gl.

Analysis columns: 8240 ✓, 8270 ✓, PCBs ✓, RCRA Metals ✓, TPH - Survey ✓

Date	Time	Sample I.D./Description	No. of Bottles	Total	*Sample Type	8240	8270	PCBs	RCRA Metals	TPH - Survey	Remarks	Lab Use Only ID Number
6/7/91		Product/MW-3S	1	1	X	X	X	X	X	X		113657

COMMENTS/SPECIAL INSTRUCTIONS:
Characterize Product only
See Dave Schumacher for details

☐ If Pb > 5ppm do TCLP

*Sample Type: S - Soil; SE - Sediment; SO - Solid; SW - Surface Water; DW - Drinking Water; WW - Wastewater; GW - Groundwater; H - Hazardous Liquid; A - Air; O - Oil; X - Other Free Product

Date Received: 6-13-91
Date Due: 7/4/91 ☐RUSH (approved by lab)
Quotation #:
Purchase Order #:

Results To: Dames + Moore
250 E. Wisconsin Ave #1500
Milwaukee, WI 53202
Attention: Kristine Stehr

Billing Address: Same

Phone: 414/347-0800 FAX 414/347-0256

To Be Completed by Client

Seal Intact Upon Receipt by Sampling Co.: ☐Yes ☐No
Packed By:
Sealed For Shipping By: Seal #

CUSTODY TRANSFERS

	Relinquished by:	Date:	Time:	Received by:	Date:	Time:
1.	[signature]	6/12/91	sealed 8:35A			
2.						

Received for Laboratory: Chris Wahinkiewicz 6-13-91 12:36

Shipping Details - To Be Completed By ORTEK

Seal Intact Upon Receipt by Laboratory ☑Yes ☐No
Method of Shipment: Carrier
Contents Temperature 1.8 °C Refrig. # 100

ORTEK
2496 West Mason Street
Green Bay, WI 54307-2435
(414) 498-2222

459[illegible]

DAMES & MOORE, Ltd.

250 East Wisconsin Ave, Suite 1500
Milwaukee, Wisconsin 53202
(414) 347-0800 FAX:(414) 347-0288

ORTEK
Via UPS

Turnaround Time
☒ Rush (preapproved by Lab)
☐ Normal 1/24/92

SHIPPING DETAILS:
Method of Shipment: UPS
Contents Temperature: ON ICE
Comments: COOLER SECURE

PROJECT NAME:
PROJECT #: 20255-003
Send Results To:
PROJECT MANAGER: Kristine Stoler
9201130

LAB USE ONLY	DATE	CONTAINERS	No.	SAMPLE ID	SAMPLE TYPE	ANALYSIS REQUESTED: Creosols by 8270									REMARKS/PRESERVATIVES
133098	1/20/92	1 glass amber liter	1	MW-35	groundwater	X									None

54

CHAIN OF CUSTODY RECORD

SAMPLER: (SIGNATURE)	DATE
[signature]	1/20/92

COMMENTS
Rush per Glen Moses.
→ Sample is almost pure product! ←

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	
[signature]	1/20/92 3:15	[signature]				
RELINQUISHED BY: (SIGNATURE)	**DATE/TIME**	**RECEIVED BY: (SIGNATURE)**	**RELINQUISHED BY: (SIGNATURE)**	**DATE/TIME**	**RECEIVED FOR LABORATORY BY: (SIGNATURE)**	**DATE/TIME**
					[signature]	1-21-92 9:30

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307
414-498-2222
FAX: 414-498-4067

LABORATORY ANALYSIS RESULTS

Wisconsin Certification No.
405099530

Client: DAMES & MOORE
Address: 250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE, WI 53202
Attn: KRISTINE STEHR
Telephone No.: (414) 347-0800

Sample ID: MW-2D/1 1-3'
Date Collected: 06/04/91
Date Received: 06/10/91
Location:

CALIFORNIA METHOD TPH ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	* UNITS
Kerosene	5.0	ND	mg/kg
Gasoline	5.0	18.5	mg/kg
Diesel	5.0	ND	mg/kg

ND = Not detected
* = Dry Weight Basis

Comments Lab Sample ID: 9106089:113525
Date Analyzed: 06/14/91
Analyzed by GC/FID on a DB-5 Capillary column

Signed: [signature] Date: 6-20-91

ORTEK
ENVIRONMENTAL LABORATORY

2496 West Mason Street P.O. Box 12435 Green Bay, [illegible]
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-2D
Sample Desc: SOIL
Date Collected: 06/04/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC SOIL ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
BENZENE*	6.0	12
BROMOCHLOROMETHANE	6.0	ND
BROMODICHLOROMETHANE*	6.0	ND
BROMOFORM*	6.0	ND
BROMOBENZENE	6.0	ND
BROMOMETHANE*	11	ND
n-BUTYLBENZENE	6.0	ND
tert-BUTYLBENZENE	6.0	ND
sec-BUTYLBENZENE	6.0	ND
CARBON TETRACHLORIDE	6.0	ND
CHLOROETHANE*	11	ND
CHLOROMETHANE*	11	ND
4-CHLOROTOLUENE	6.0	ND
2-CHLOROTOLUENE	6.0	ND
CHLOROBENZENE*	6.0	ND
CHLOROFORM*	6.0	ND
DIBROMOCHLOROMETHANE*	6.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	6.0	ND
1,2-DIBROMOETHANE (EDB)	6.0	ND
DIBROMOMETHANE	6.0	ND
DICHLORODIFLUOROMETHANE	6.0	ND
1,4-DICHLOROBENZENE	6.0	ND
1,2-DICHLOROBENZENE	6.0	ND
1,3-DICHLOROBENZENE	6.0	ND
1,3-DICHLOROPROPANE	6.0	ND
1,2-DICHLOROPROPANE*	6.0	ND
2,2-DICHLOROPROPANE	6.0	ND
1,1-DICHLOROETHANE*	6.0	ND
1,1-DICHLOROPROPENE	6.0	ND
1,2-DICHLOROETHANE*	6.0	ND
cis-1,3-DICHLOROPROPENE*	6.0	ND
trans-1,3-DICHLOROPROPENE*	6.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
trans-1,2-DICHLOROETHENE*	6.0	ND
cis-1,2-DICHLOROETHENE*	6.0	ND
1,1-DICHLOROETHENE*	6.0	ND
ETHYLBENZENE*	6.0	13
HEXACHLOROBUTADIENE	6.0	ND
p-ISOPROPYLTOLUENE	6.0	ND
ISOPROPYLBENZENE	6.0	ND
METHYLENE CHLORIDE*	6.0	7
NAPHTHALENE	6.0	74
n-PROPYLBENZENE	6.0	300
1,1,2,2-TETRACHLOROETHANE*	6.0	ND
1,1,1,2-TETRACHLOROETHANE	6.0	ND
TETRACHLOROETHENE*	6.0	ND
TRICHLOROFLUOROMETHANE	6.0	ND
1,2,3-TRICHLOROBENZENE	6.0	ND
1,2,4-TRICHLOROBENZENE	6.0	ND
1,1,1-TRICHLOROETHANE*	6.0	ND
TRICHLOROETHENE*	6.0	ND
1,1,2-TRICHLOROETHANE*	6.0	26
1,2,3-TRICHLOROPROPANE	6.0	ND
1,3,5-TRIMETHYLBENZENE	6.0	370
1,2,4-TRIMETHYLBENZENE	6.0	130
TOLUENE*	6.0	4
VINYL CHLORIDE*	11	ND
STYRENES*	6.0	ND
XYLENES (TOTAL)*	6.0	42
ACETONE*	11	ND
CARBON DISULFIDE*	6.0	5
2-BUTANONE*	11	13
VINYL ACETATE*	11	450
4-METHYL-2-PENTANONE*	11	69
2-HEXANONE*	11	ND

ND = Not Detected
 * = Analyzed by EPA Method 8240
** = Dry Weight Basis
COMMENTS: Lab Sample ID: 9106089 - 113525
Date Analyzed: 06/17/91
All Non-8240 Compounds quantitated as TICS.

Signed: *Maria A. Kuehl* Date: 3/12/92

ORTEK
ENVIRONMENTAL LABORATORY

414-498-2222
FAX: 414-498-4067
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435

LABORATORY ANALYSIS RESULTS

Wisconsin Certification No.
405099530

Client: DAMES & MOORE
Address: 250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE, WI 53202
Attn: KRISTINE STEHR
Telephone No.: (414) 347-0800

Sample ID: MW-4/3 8-10'
Date Collected: 06/05/91
Date Received: 06/10/91
Location:

CALIFORNIA METHOD TPH ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	* UNITS
Kerosene	5.0	ND	mg/kg
Gasoline	5.0	ND	mg/kg
Diesel	5.0	ND	mg/kg

ND = Not detected
* = Dry Weight Basis

Comments Lab Sample ID: 9106089:113526
Date Analyzed: 06/14/91
Analyzed by GC/FID on a DB-5 Capillary column

Signed: [signature]

Date: 6-20-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, [illegible]
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-4
Sample Desc: SOIL
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC SOIL ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *	PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
BENZENE*	5.0	ND	trans-1,2-DICHLOROETHENE*	5.0	ND
BROMOCHLOROMETHANE	5.0	ND	cis-1,2-DICHLOROETHENE*	5.0	ND
BROMODICHLOROMETHANE*	5.0	ND	1,1-DICHLOROETHENE*	5.0	ND
BROMOFORM*	5.0	ND	ETHYLBENZENE*	5.0	6
BROMOBENZENE	5.0	ND	HEXACHLOROBUTADIENE	5.0	ND
BROMOMETHANE*	10	ND	p-ISOPROPYLTOLUENE	5.0	ND
n-BUTYLBENZENE	5.0	ND	ISOPROPYLBENZENE	5.0	ND
tert-BUTYLBENZENE	5.0	ND	METHYLENE CHLORIDE*	5.0	ND
sec-BUTYLBENZENE	5.0	ND	NAPHTHALENE	5.0	ND
CARBON TETRACHLORIDE	5.0	ND	n-PROPYLBENZENE	5.0	6
CHLOROETHANE*	10	ND	1,1,2,2-TETRACHLOROETHANE*	5.0	ND
CHLOROMETHANE*	10	ND	1,1,1,2-TETRACHLOROETHANE	5.0	ND
4-CHLOROTOLUENE	5.0	ND	TETRACHLOROETHENE*	5.0	ND
2-CHLOROTOLUENE	5.0	ND	TRICHLOROFLUOROMETHANE	5.0	ND
CHLOROBENZENE*	5.0	ND	1,2,3-TRICHLOROBENZENE	5.0	ND
CHLOROFORM*	5.0	ND	1,2,4-TRICHLOROBENZENE	5.0	ND
DIBROMOCHLOROMETHANE*	5.0	ND	1,1,1-TRICHLOROETHANE*	5.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	5.0	ND	TRICHLOROETHENE*	5.0	ND
1,2-DIBROMOETHANE (EDB)	5.0	ND	1,1,2-TRICHLOROETHANE*	5.0	ND
DIBROMOMETHANE	5.0	ND	1,2,3-TRICHLOROPROPANE	5.0	ND
DICHLORODIFLUOROMETHANE	5.0	ND	1,3,5-TRIMETHYLBENZENE	5.0	19
1,4-DICHLOROBENZENE	5.0	ND	1,2,4-TRIMETHYLBENZENE	5.0	39
1,2-DICHLOROBENZENE	5.0	ND	TOLUENE*	5.0	5
1,3-DICHLOROBENZENE	5.0	ND	VINYL CHLORIDE*	10	ND
1,3-DICHLOROPROPANE	5.0	ND	STYRENES*	5.0	ND
1,2-DICHLOROPROPANE*	5.0	ND	XYLENES (TOTAL)*	5.0	25
2,2-DICHLOROPROPANE	5.0	ND	ACETONE*	10	72
1,1-DICHLOROETHANE*	5.0	ND	CARBON DISULFIDE*	5.0	7
1,1-DICHLOROPROPENE	5.0	ND	2-BUTANONE*	10	ND
1,2-DICHLOROETHANE*	5.0	ND	VINYL ACETATE*	10	130
cis-1,3-DICHLOROPROPENE*	5.0	ND	4-METHYL-2-PENTANONE*	10	ND
trans-1,3-DICHLOROPROPENE*	5.0	ND	2-HEXANONE*	10	ND

ND = Not Detected
* = Analyzed by EPA Method 8240
** = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106089 - 113526
Date Analyzed: 06/17/91
All Non-8240 Compounds quantitated as TICS.

Signed: Marcia G. Kuehl Date: 3/27/92

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

LABORATORY ANALYSIS RESULTS

Wisconsin Certification No.
405099530

Client: DAMES & MOORE
Address: 250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE, WI 53202
Attn: KRISTINE STEHR
Telephone No.: (414) 347-0800

Sample ID: MW-5/2 8-10'
Date Collected: 06/05/91
Date Received: 06/10/91
Location:

CALIFORNIA METHOD TPH ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	UNITS *
Kerosene	5.0	ND	mg/kg
Gasoline	5.0	ND	mg/kg
Diesel	5.0	ND	mg/kg

ND = Not detected
* = Dry Weight Basis

Comments Lab Sample ID: 9106089:113529
Date Analyzed: 06/14/91
Analyzed by GC/FID on a DB-5 Capillary column

Signed: [signature]

Date: 6·20·91

ORTEK
ENVIRONMENTAL LABORATORY

2496 West Mason Street · P.O. Box 12435 · Green Bay, WI
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-5
Sample Desc: SOIL
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC SOIL ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
BENZENE*	7.0	ND
BROMOCHLOROMETHANE	7.0	ND
BROMODICHLOROMETHANE*	7.0	ND
BROMOFORM*	7.0	ND
BROMOBENZENE	7.0	ND
BROMOMETHANE*	13	ND
n-BUTYLBENZENE	7.0	ND
tert-BUTYLBENZENE	7.0	ND
sec-BUTYLBENZENE	7.0	ND
CARBON TETRACHLORIDE	7.0	ND
CHLOROETHANE*	13	ND
CHLOROMETHANE*	13	ND
4-CHLOROTOLUENE	7.0	ND
2-CHLOROTOLUENE	7.0	ND
CHLOROBENZENE*	7.0	ND
CHLOROFORM*	7.0	ND
DIBROMOCHLOROMETHANE*	7.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	7.0	ND
1,2-DIBROMOETHANE (EDB)	7.0	ND
DIBROMOMETHANE	7.0	ND
DICHLORODIFLUOROMETHANE	7.0	ND
1,4-DICHLOROBENZENE	7.0	ND
1,2-DICHLOROBENZENE	7.0	ND
1,3-DICHLOROBENZENE	7.0	ND
1,3-DICHLOROPROPANE	7.0	ND
1,2-DICHLOROPROPANE*	7.0	ND
2,2-DICHLOROPROPANE	7.0	ND
1,1-DICHLOROETHANE*	7.0	ND
1,1-DICHLOROPROPENE	7.0	ND
1,2-DICHLOROETHANE*	7.0	ND
cis-1,3-DICHLOROPROPENE*	7.0	ND
trans-1,3-DICHLOROPROPENE*	7.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
trans-1,2-DICHLOROETHENE*	7.0	ND
cis-1,2-DICHLOROETHENE*	7.0	ND
1,1-DICHLOROETHENE*	7.0	ND
ETHYLBENZENE*	7.0	4
HEXACHLOROBUTADIENE	7.0	ND
p-ISOPROPYLTOLUENE	7.0	ND
ISOPROPYLBENZENE	7.0	ND
METHYLENE CHLORIDE*	7.0	8
NAPHTHALENE	7.0	ND
n-PROPYLBENZENE	7.0	ND
1,1,2,2-TETRACHLOROETHANE*	7.0	ND
1,1,1,2-TETRACHLOROETHANE	7.0	ND
TETRACHLOROETHENE*	7.0	ND
TRICHLOROFLUOROMETHANE	7.0	ND
1,2,3-TRICHLOROBENZENE	7.0	ND
1,2,4-TRICHLOROBENZENE	7.0	ND
1,1,1-TRICHLOROETHANE*	7.0	ND
TRICHLOROETHENE*	7.0	ND
1,1,2-TRICHLOROETHANE*	7.0	ND
1,2,3-TRICHLOROPROPANE	7.0	ND
1,3,5-TRIMETHYLBENZENE	7.0	ND
1,2,4-TRIMETHYLBENZENE	7.0	ND
TOLUENE*	7.0	3
VINYL CHLORIDE*	13	ND
STYRENES*	7.0	ND
XYLENES (TOTAL)*	7.0	6
ACETONE*	13	ND
CARBON DISULFIDE*	7.0	22
2-BUTANONE*	13	ND
VINYL ACETATE*	13	ND
4-METHYL-2-PENTANONE*	13	ND
2-HEXANONE*	13	ND

ND = Not Detected
* = Analyzed by EPA Method 8240
** = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106089 - 113529
Date Analyzed: 06/17/91
All Non-8240 Compounds quantitated as TICS.

Signed: Marcia A. Kuehl Date: 3/12/92

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

LABORATORY ANALYSIS RESULTS

Wisconsin Certification No.
405099530

Client: DAMES & MOORE
Address: 250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE, WI 53202
Attn: KRISTINE STEHR
Telephone No.: (414) 347-0800

Sample ID: MW-8/2 4-6'
Date Collected: 06/05/91
Date Received: 06/10/91
Location:

CALIFORNIA METHOD TPH ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	* UNITS
Kerosene	5.0	ND	mg/kg
Gasoline	5.0	282.6	mg/kg
Diesel	5.0	237.1	mg/kg

ND = Not detected
* = Dry Weight Basis

Comments Lab Sample ID: 9106089:113527
Date Analyzed: 06/19/91
Analyzed by GC/FID on a DB-5 Capillary column

Signed: [signature]

Date: 6-20-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI [illegible]
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-8
Sample Desc: SOIL
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC SOIL ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg *
BENZENE*	24	ND
BROMOCHLOROMETHANE	24	ND
BROMODICHLOROMETHANE*	24	ND
BROMOFORM*	24	ND
BROMOBENZENE	24	ND
BROMOMETHANE*	47	ND
n-BUTYLBENZENE	24	ND
tert-BUTYLBENZENE	24	ND
sec-BUTYLBENZENE	24	ND
CARBON TETRACHLORIDE	24	ND
CHLOROETHANE*	47	ND
CHLOROMETHANE*	47	ND
4-CHLOROTOLUENE	24	ND
2-CHLOROTOLUENE	24	ND
CHLOROBENZENE*	24	ND
CHLOROFORM*	24	ND
DIBROMOCHLOROMETHANE*	24	ND
1,2-DIBROMO-3-CHLOROPROPANE	24	ND
1,2-DIBROMOETHANE (EDB)	24	ND
DIBROMOMETHANE	24	ND
DICHLORODIFLUOROMETHANE	24	ND
1,4-DICHLOROBENZENE	24	ND
1,2-DICHLOROBENZENE	24	ND
1,3-DICHLOROBENZENE	24	ND
1,3-DICHLOROPROPANE	24	ND
1,2-DICHLOROPROPANE*	24	ND
2,2-DICHLOROPROPANE	24	ND
1,1-DICHLOROETHANE*	24	ND
1,1-DICHLOROPROPENE	24	ND
1,2-DICHLOROETHANE*	24	ND
cis-1,3-DICHLOROPROPENE*	24	ND
trans-1,3-DICHLOROPROPENE*	24	ND
trans-1,2-DICHLOROETHENE*	24	ND
cis-1,2-DICHLOROETHENE*	24	ND
1,1-DICHLOROETHENE*	24	ND
ETHYLBENZENE*	24	8
HEXACHLOROBUTADIENE	24	ND
p-ISOPROPYLTOLUENE	24	ND
ISOPROPYLBENZENE	24	ND
METHYLENE CHLORIDE*	24	27
NAPHTHALENE	24	ND
n-PROPYLBENZENE	24	ND
1,1,2,2-TETRACHLOROETHANE*	24	ND
1,1,1,2-TETRACHLOROETHANE	24	ND
TETRACHLOROETHENE*	24	ND
TRICHLOROFLUOROMETHANE	24	ND
1,2,3-TRICHLOROBENZENE	24	ND
1,2,4-TRICHLOROBENZENE	24	ND
1,1,1-TRICHLOROETHANE*	24	ND
TRICHLOROETHENE*	24	ND
1,1,2-TRICHLOROETHANE*	24	ND
1,2,3-TRICHLOROPROPANE	24	ND
1,3,5-TRIMETHYLBENZENE	24	ND
1,2,4-TRIMETHYLBENZENE	24	ND
TOLUENE*	24	13
VINYL CHLORIDE*	47	ND
STYRENES*	24	ND
XYLENES (TOTAL)*	24	32
ACETONE*	47	ND
CARBON DISULFIDE*	24	ND
2-BUTANONE*	47	70
VINYL ACETATE*	47	8300
4-METHYL-2-PENTANONE*	47	5300
2-HEXANONE*	47	ND

ND = Not Detected
* = Analyzed by EPA Method 8240
** = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106089 - 113527
Date Analyzed: 06/17/91
All Non-8240 Compounds quantitated as TICS.

Signed: Marcia G. Kuehl Date: 3/12/92

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

LABORATORY ANALYSIS RESULTS

Wisconsin Certification No.
405099530

Client: DAMES & MOORE
Address: 250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE, WI 53202
Attn: KRISTINE STEHR
Telephone No.: (414) 347-0800

Sample ID: MW-9/2 4-6'
Date Collected: 06/05/91
Date Received: 06/10/91
Location:

CALIFORNIA METHOD TPH ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	* UNITS
Kerosene	5.0	ND	mg/kg
Gasoline	5.0	ND	mg/kg
Diesel	5.0	ND	mg/kg

ND = Not detected
* = Dry Weight Basis

Comments Lab Sample ID: 9106089:113528
Date Analyzed: 06/14/91
Analyzed by GC/FID on a DB-5 Capillary column

Signed: D. [signature]

Date: 6-20-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street — P.O. Box 12435 — Green Bay, Wi [illegible]
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-9
Sample Desc: SOIL
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC SOIL ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg**
*BENZENE	6.0	4
BROMOCHLOROMETHANE	6.0	ND
*BROMODICHLOROMETHANE	6.0	ND
*BROMOFORM	6.0	ND
BROMOBENZENE	6.0	ND
*BROMOMETHANE	11	ND
n-BUTYLBENZENE	6.0	ND
tert-BUTYLBENZENE	6.0	ND
sec-BUTYLBENZENE	6.0	ND
CARBON TETRACHLORIDE	6.0	ND
*CHLOROETHANE	11	ND
*CHLOROMETHANE	11	ND
4-CHLOROTOLUENE	6.0	ND
2-CHLOROTOLUENE	6.0	ND
*CHLOROBENZENE	6.0	ND
*CHLOROFORM	6.0	ND
*DIBROMOCHLOROMETHANE	6.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	6.0	ND
1,2-DIBROMOETHANE (EDB)	6.0	ND
DIBROMOMETHANE	6.0	ND
DICHLORODIFLUOROMETHANE	6.0	ND
1,4-DICHLOROBENZENE	6.0	ND
1,2-DICHLOROBENZENE	6.0	ND
1,3-DICHLOROBENZENE	6.0	ND
1,3-DICHLOROPROPANE	6.0	ND
*1,2-DICHLOROPROPANE	6.0	ND
2,2-DICHLOROPROPANE	6.0	ND
*1,1-DICHLOROETHANE	6.0	ND
1,1-DICHLOROPROPENE	6.0	ND
*1,2-DICHLOROETHANE	6.0	ND
*cis-1,3-DICHLOROPROPENE	6.0	ND
*trans-1,3-DICHLOROPROPENE	6.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/kg**
*trans-1,2-DICHLOROETHENE	6.0	ND
*cis-1,2-DICHLOROETHENE	6.0	ND
*1,1-DICHLOROETHENE	6.0	ND
*ETHYLBENZENE	6.0	10
HEXACHLOROBUTADIENE	6.0	ND
p-ISOPROPYLTOLUENE	6.0	ND
ISOPROPYLBENZENE	6.0	ND
*METHYLENE CHLORIDE	6.0	11
NAPHTHALENE	6.0	ND
n-PROPYLBENZENE	6.0	ND
*1,1,2,2-TETRACHLOROETHANE	6.0	ND
1,1,1,2-TETRACHLOROETHANE	6.0	ND
*TETRACHLOROETHENE	6.0	ND
TRICHLOROFLUOROMETHANE	6.0	ND
1,2,3-TRICHLOROBENZENE	6.0	ND
1,2,4-TRICHLOROBENZENE	6.0	ND
*1,1,1-TRICHLOROETHANE	6.0	ND
*TRICHLOROETHENE	6.0	ND
*1,1,2-TRICHLOROETHANE	6.0	ND
1,2,3-TRICHLOROPROPANE	6.0	ND
1,3,5-TRIMETHYLBENZENE	6.0	ND
1,2,4-TRIMETHYLBENZENE	6.0	ND
*TOLUENE	6.0	11
*VINYL CHLORIDE	11	ND
*STYRENES	6.0	ND
*XYLENES (TOTAL)	6.0	17
*ACETONE	11	ND
*CARBON DISULFIDE	6.0	ND
*2-BUTANONE	11	ND
*VINYL ACETATE	11	ND
*4-METHYL-2-PENTANONE	11	26
*2-HEXANONE	11	ND

ND = Not Detected
* = Analyzed by EPA Method 8240.
** = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106089 - 113528
Date Analyzed: 06/17/91
All Non-8240 Compounds quantitated as TICS.

Signed: [signature] Date: 12-7-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-10D/8-10
Sample Desc: SOIL
Date Collected: 06/06/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	140	ND
BROMOCHLOROMETHANE	140	ND
BROMODICHLOROMETHANE	140	ND
BROMOFORM	140	ND
BROMOBENZENE	140	ND
BROMOMETHANE	140	ND
n-BUTYLBENZENE	140	1200
tert-BUTYLBENZENE	140	160
sec-BUTYLBENZENE	140	ND
CARBON TETRACHLORIDE	140	ND
CHLOROETHANE	140	ND
CHLOROMETHANE	140	ND
4-CHLOROTOLUENE	140	ND
2-CHLOROTOLUENE	140	ND
CHLOROBENZENE	140	ND
CHLOROFORM	140	ND
DIBROMOCHLOROMETHANE	140	ND
1,2-DIBROMO-3-CHLOROPROPANE	140	ND
1,2-DIBROMOETHANE (EDB)	140	ND
DIBROMOMETHANE	140	ND
DICHLORODIFLUOROMETHANE	140	ND
1,4-DICHLOROBENZENE	140	ND
1,2-DICHLOROBENZENE	140	ND
1,3-DICHLOROBENZENE	140	ND
1,3-DICHLOROPROPANE	140	ND
1,2-DICHLOROPROPANE	140	ND
2,2-DICHLOROPROPANE	140	ND
1,1-DICHLOROETHANE	140	ND
1,1-DICHLOROPROPENE	140	ND
1,2-DICHLOROETHANE	140	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	140	ND
cis-1,2-DICHLOROETHENE	140	ND
1,1-DICHLOROETHENE	140	ND
ETHYLBENZENE	140	ND
HEXACHLOROBUTADIENE	140	ND
p-ISOPROPYLTOLUENE	140	140
ISOPROPYLBENZENE	140	150
METHYLENE CHLORIDE	140	ND
NAPHTHALENE	140	1400
n-PROPYLBENZENE	140	ND
1,1,2,2-TETRACHLOROETHANE	140	ND
1,1,1,2-TETRACHLOROETHANE	140	ND
TETRACHLOROETHENE	140	ND
TRICHLOROFLUOROMETHANE	140	ND
1,2,3-TRICHLOROBENZENE	140	ND
1,2,4-TRICHLOROBENZENE	140	ND
1,1,1-TRICHLOROETHANE	140	ND
TRICHLOROETHENE	140	ND
1,1,2-TRICHLOROETHANE	140	ND
1,2,3-TRICHLOROPROPANE	140	ND
1,3,5-TRIMETHYLBENZENE	140	210
1,2,4-TRIMETHYLBENZENE	140	ND
TOLUENE	140	ND
VINYL CHLORIDE	140	ND
STYRENES + o-XYLENES	280	ND
m & p-XYLENES	280	ND
METHYL-T-BUTYLETHER	140	ND

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113614
Date Analyzed: 07/31/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: D. [signature] Date: 8-14-91

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLK

Lab Name: ORTEK **Contract:**

Lab Code: ORTEK **Case No.:** DON002 **SAS No.:** **SDG No.:** FTJ-DW01

Matrix: (soil/water) SOIL **Lab Sample ID:** 8240CK50

Sample wt/vol: 5 **(g/mL)** g **Lab File ID:** 617B1

Level: (low/med) LOW **Date Received:** 06/10/91

% Moisture: not dec. 0 **Date Analyzed:** 06/17/91

Column: (pack/cap) CAP **Dilution Factor:** 1

CONCENTRATION UNITS: ug/Kg (ug/L or ug/Kg)

CAS NO.	COMPOUND	(ug/L or ug/Kg)	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	4	J
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-pentanone	1	J
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	2	J
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	2	J
100-42-5	Styrene	5	U
1330-02-7	Xylene (total)	6	

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106089
Our lab # : 113525 Report Date: 07/17/91
Your sample ID: MW-2D/1 1-3'
Sample Matrix : SOIL

COLLECTION INFORMATION

Date/Time/By: 06/04/91 K S
Location :

Lab#	Test	Result	Units
113525	Lead	19	MG/KG
	Total Solids	84.9	%

Signed D. [signature] Date 8-15-91

Signed ________ Date ________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106089
Our lab # : 113526
Your sample ID: MW-4/3 8-10'
Sample Matrix : SOIL

Report Date: 07/17/91

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test	Result	Units
113526	Lead	60	MG/KG
	Total Solids	77.9	%

Signed D. [signature] Date 8-15-91

Signed ____________________ Date ____________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106089
Our lab # : 113529
Your sample ID: MW-5/2 8-10'
Sample Matrix : SOIL

Report Date: 07/17/91

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test	Result	Units
113529	Lead	21	MG/KG
	Total Solids	73.4	%

Signed________________ Date________

Signed________________ Date________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12495 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106089
Our lab # : 113527 Report Date: 07/17/91
Your sample ID: MW-8/2 4-6'
Sample Matrix : SOIL

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test	Result	Units
113527	Lead	2600	MG/KG
	Total Solids	81.4	%

Signed [signature] Date 8-15-91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106089
Our lab # : 113528 Report Date: 07/17/91
Your sample ID: MW-9/2 4-6'
Sample Matrix : SOIL

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test	Result	Units
113528	Lead	47	MG/KG
	Total Solids	83.7	%

Signed (signature) Date 8-15-91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our Lab # : 113616 Report Date: 07/08/91
Your Sample ID: MW-10D/P SOIL
Sample Matrix : SOIL

COLLECTION INFORMATION
Date/Time/By: 06/06/91 K S
Location :

Lab#	test		Result	Units
113616	Silver	<	1.0	MG/KG
	Arsenic		4.1	MG/KG
	Barium		42	MG/KG
	Cadmium		0.7	MG/KG
	Chromium		11	MG/KG
	Mercury		7.4	MG/KG
	Lead		160	MG/KG
	Selenium	<	0.3	MG/KG

Signed *Mark Melby* Date *7-25-91*

Signed __________ Date __________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our lab # : 113614
Your sample ID: MW-10D/8-10
Sample Matrix : SOIL

Report Date: 07/17/91

COLLECTION INFORMATION

Date/Time/By: 06/06/91 K S
Location :

Lab#	Test		Result	Units
113614	Arsenic		2.0 *	MG/KG
	Barium		33	MG/KG
	Cadmium	<	0.5	MG/KG
	Chromium		6.8	MG/KG
	Mercury		0.4	MG/KG
	Selenium	<	0.3	MG/KG
	Silver	<	1.0	MG/KG
	Lead		10 *	MG/KG

Signed Nick Mulcahy (signature) Date 7-25-91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-1
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	75	828
BROMOCHLOROMETHANE	50	ND
BROMODICHLOROMETHANE	50	ND
BROMOFORM	75	ND
BROMOBENZENE	100	ND
BROMOMETHANE	75	ND
n-BUTYLBENZENE	170	ND
tert-BUTYLBENZENE	75	ND
sec-BUTYLBENZENE	100	ND
CARBON TETRACHLORIDE	50	ND
CHLOROETHANE	75	ND
CHLOROMETHANE	100	ND
4-CHLOROTOLUENE	125	ND
2-CHLOROTOLUENE	50	ND
CHLOROBENZENE	50	ND
CHLOROFORM	50	ND
DIBROMOCHLOROMETHANE	50	ND
1,2-DIBROMO-3-CHLOROPROPANE	100	ND
1,2-DIBROMOETHANE	75	ND
DIBROMOMETHANE	100	ND
DICHLOROFIFLUOROMETHANE	50	ND
1,4-DICHLOROBENZENE	100	ND
1,2-DICHLOROBENZENE	100	ND
1,3-DICHLOROBENZENE	150	ND
1,3-DICHLOROPROPANE	50	ND
1,2-DICHLOROPROPANE	50	ND
2,2-DICHLOROPROPANE	75	ND
1,1-DICHLOROETHANE	75	ND
1,1-DICHLOROPROPENE	50	ND
1,2-DICHLOROETHANE	50	ND
trans-1,2-DICHLOROETHENE	100	ND
cis-1,2-DICHLOROETHENE	275	ND
1,1-DICHLOROETHENE	100	ND
ETHYLBENZENE	75	ND
HEXACHLOROBUTADIENE	250	ND
p-ISOPROPYLTOLUENE	75	ND
ISOPROPYLBENZENE	75	ND
METHYLENE CHLORIDE	150	ND
NAPHTHALENE	250	ND
n-PROPYLBENZENE	50	ND
STYRENE	75	ND
1,1,2,2-TETRACHLOROETHANE	100	ND
1,1,1,2-TETRACHLOROETHANE	50	ND
TETRACHLOROETHENE	50	ND
TRICHLOROFLUOROMETHANE	150	ND
1,2,3-TRICHLOROBENZENE	250	ND
1,2,4-TRICHLOROBENZENE	250	ND
1,1,1-TRICHLOROETHANE	75	ND
TRICHLOROETHENE	50	ND
1,1,2-TRICHLOROETHANE	75	ND
1,2,3-TRICHLOROPROPANE	75	ND
1,3,5-TRIMETHYLBENZENE	75	ND
1,2,4-TRIMETHYLBENZENE	150	ND
TOLUENE	50	ND
VINYL CHLORIDE	75	ND
XYLENES (TOTAL)	150	ND
METHYL-T-BUTYLETHER	250	ND

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113530
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-15-91

ORTEK
ENVIRONMENTAL LABORATORY
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ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-2S
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.5	241
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.5	ND
BROMOBENZENE	2.0	ND
BROMOMETHANE	1.5	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	1.5	ND
sec-BUTYLBENZENE	1.5	1.6
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.5	ND
CHLOROMETHANE	2.0	ND
4-CHLOROTOLUENE	2.5	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	2.0	ND
1,2-DIBROMOETHANE	1.5	ND
DIBROMOMETHANE	2.0	ND
DICHLORODIFLUOROMETHANE	1.5	ND
1,4-DICHLOROBENZENE	2.0	ND
1,2-DICHLOROBENZENE	2.0	ND
1,3-DICHLOROBENZENE	3.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.5	ND
1,1-DICHLOROETHANE	1.5	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	2.0	ND
cis-1,2-DICHLOROETHENE	5.5	ND
1,1-DICHLOROETHENE	2.0	ND
ETHYLBENZENE	1.5	20.1
HEXACHLOROBUTADIENE	5.0	ND
p-ISOPROPYLTOLUENE	1.5	ND
ISOPROPYLBENZENE	1.5	3.6
METHYLENE CHLORIDE	3.0	ND
NAPHTHALENE	5.0	ND
n-PROPYLBENZENE	1.0	5.4
1,1,2,2-TETRACHLOROETHANE	2.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	3.0	ND
1,2,3-TRICHLOROBENZENE	5.0	ND
1,2,4-TRICHLOROBENZENE	5.0	ND
1,1,1-TRICHLOROETHANE	1.5	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.5	ND
1,2,3-TRICHLOROPROPANE	1.5	ND
1,3,5-TRIMETHYLBENZENE	1.5	28.9
1,2,4-TRIMETHYLBENZENE	3.0	67.6
TOLUENE	1.0	4.4
VINYL CHLORIDE	1.5	ND
STYRENES	1.5	ND
XYLENES (TOTAL)	3.0	34.1
METHYL-T-BUTYLETHER	5.0	5.9

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113531
Analyzed by EPA Method 8260.

Signed: marcia a. Kuehl Date: 3/12/92

ORTEK
ENVIRONMENTAL LABORATORY

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2496 West Mason Street P.O. Box 12635

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MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-2S/DUP
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.5	253
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.5	ND
BROMOBENZENE	2.0	ND
BROMOMETHANE	1.5	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	1.5	ND
sec-BUTYLBENZENE	1.5	ND
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.5	ND
CHLOROMETHANE	2.0	ND
4-CHLOROTOLUENE	2.5	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	2.0	ND
1,2-DIBROMOETHANE	1.5	ND
DIBROMOMETHANE	2.0	ND
DICHLORODIFLUOROMETHANE	1.5	ND
1,4-DICHLOROBENZENE	2.0	ND
1,2-DICHLOROBENZENE	2.0	ND
1,3-DICHLOROBENZENE	3.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.5	ND
1,1-DICHLOROETHANE	1.5	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	2.0	ND
cis-1,2-DICHLOROETHENE	5.5	ND
1,1-DICHLOROETHENE	2.0	ND
ETHYLBENZENE	1.5	17.1
HEXACHLOROBUTADIENE	5.0	ND
p-ISOPROPYLTOLUENE	1.5	ND
ISOPROPYLBENZENE	1.5	2.8
METHYLENE CHLORIDE	3.0	ND
NAPHTHALENE	5.0	ND
n-PROPYLBENZENE	1.0	3.4
1,1,2,2-TETRACHLOROETHANE	2.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	3.0	ND
1,2,3-TRICHLOROBENZENE	5.0	ND
1,2,4-TRICHLOROBENZENE	5.0	ND
1,1,1-TRICHLOROETHANE	1.5	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.5	ND
1,2,3-TRICHLOROPROPANE	1.5	ND
1,3,5-TRIMETHYLBENZENE	1.5	15.3
1,2,4-TRIMETHYLBENZENE	3.0	47.4
TOLUENE	1.0	5.3
VINYL CHLORIDE	1.5	ND
STYRENES	1.5	ND
XYLENES (TOTAL)	3.0	22.4
METHYL-T-BUTYLETHER	5.0	9.6

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113533
Analyzed by EPA Method 8260.

Signed: marcia a. kuehl Date: 3/12/92

ORTEK
—NVIRONMENTAL LABORATORY

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MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-2D
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.5	390
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.5	ND
BROMOBENZENE	2.0	ND
BROMOMETHANE	1.5	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	1.5	ND
sec-BUTYLBENZENE	1.5	ND
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.5	ND
CHLOROMETHANE	2.0	ND
4-CHLOROTOLUENE	2.5	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	2.0	ND
1,2-DIBROMOETHANE	1.5	ND
DIBROMOMETHANE	2.0	ND
DICHLOROFIFLUOROMETHANE	1.5	ND
1,4-DICHLOROBENZENE	2.0	ND
1,2-DICHLOROBENZENE	2.0	ND
1,3-DICHLOROBENZENE	3.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.5	ND
1,1-DICHLOROETHANE	1.5	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	2.0	ND
cis-1,2-DICHLOROETHENE	5.5	ND
1,1-DICHLOROETHENE	2.0	ND
ETHYLBENZENE	1.5	2.6
HEXACHLOROBUTADIENE	5.0	ND
p-ISOPROPYLTOLUENE	1.5	ND
ISOPROPYLBENZENE	1.5	ND
METHYLENE CHLORIDE	3.0	ND
NAPHTHALENE	5.0	ND
n-PROPYLBENZENE	1.0	ND
STYRENE	1.5	ND
1,1,2,2-TETRACHLOROETHANE	2.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	3.0	ND
1,2,3-TRICHLOROBENZENE	5.0	ND
1,2,4-TRICHLOROBENZENE	5.0	ND
1,1,1-TRICHLOROETHANE	1.5	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.5	ND
1,2,3-TRICHLOROPROPANE	1.5	ND
1,3,5-TRIMETHYLBENZENE	1.5	ND
1,2,4-TRIMETHYLBENZENE	3.0	ND
TOLUENE	1.0	2.6
VINYL CHLORIDE	1.5	ND
XYLENES (TOTAL)	3.0	3.4
METHYL-T-BUTYLETHER	5.0	129

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113532
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-15-91

ORTEK
ENVIRONMENTAL LABORATORY
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MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-3S
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	150	2430
BROMOCHLOROMETHANE	100	ND
BROMODICHLOROMETHANE	100	ND
BROMOFORM	150	ND
BROMOBENZENE	200	ND
BROMOMETHANE	150	ND
n-BUTYLBENZENE	340	ND
tert-BUTYLBENZENE	150	ND
sec-BUTYLBENZENE	200	ND
CARBON TETRACHLORIDE	100	ND
CHLOROETHANE	150	ND
CHLOROMETHANE	200	ND
4-CHLOROTOLUENE	250	ND
2-CHLOROTOLUENE	100	ND
CHLOROBENZENE	100	ND
CHLOROFORM	100	ND
DIBROMOCHLOROMETHANE	100	ND
1,2-DIBROMO-3-CHLOROPROPANE	200	ND
1,2-DIBROMOETHANE	150	ND
DIBROMOMETHANE	200	ND
DICHLOROFIFLUOROMETHANE	150	ND
1,4-DICHLOROBENZENE	200	ND
1,2-DICHLOROBENZENE	200	ND
1,3-DICHLOROBENZENE	300	ND
1,3-DICHLOROPROPANE	100	ND
1,2-DICHLOROPROPANE	100	ND
2,2-DICHLOROPROPANE	150	ND
1,1-DICHLOROETHANE	150	ND
1,1-DICHLOROPROPENE	100	ND
1,2-DICHLOROETHANE	100	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	200	ND
cis-1,2-DICHLOROETHENE	550	ND
1,1-DICHLOROETHENE	200	ND
ETHYLBENZENE	150	164
HEXACHLOROBUTADIENE	500	ND
p-ISOPROPYLTOLUENE	150	ND
ISOPROPYLBENZENE	150	ND
METHYLENE CHLORIDE	300	ND
NAPHTHALENE	500	ND
n-PROPYLBENZENE	100	ND
STYRENE	150	ND
1,1,2,2-TETRACHLOROETHANE	200	ND
1,1,1,2-TETRACHLOROETHANE	100	ND
TETRACHLOROETHENE	100	ND
TRICHLOROFLUOROMETHANE	300	ND
1,2,3-TRICHLOROBENZENE	500	ND
1,2,4-TRICHLOROBENZENE	500	ND
1,1,1-TRICHLOROETHANE	150	ND
TRICHLOROETHENE	100	ND
1,1,2-TRICHLOROETHANE	150	ND
1,2,3-TRICHLOROPROPANE	150	ND
1,3,5-TRIMETHYLBENZENE	150	ND
1,2,4-TRIMETHYLBENZENE	300	ND
TOLUENE	100	378
VINYL CHLORIDE	150	ND
XYLENES (TOTAL)	300	ND
METHYL-T-BUTYLETHER	500	ND

ND = Not Detected
 * = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113534
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-15-91

ORTEK
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Wisconsin Certification No: 405099530

Sample ID: MW-3D
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	100	8600
BROMOCHLOROMETHANE	100	ND
BROMODICHLOROMETHANE	100	ND
BROMOFORM	100	ND
BROMOBENZENE	100	ND
BROMOMETHANE	100	ND
n-BUTYLBENZENE	100	340
tert-BUTYLBENZENE	100	ND
sec-BUTYLBENZENE	100	ND
CARBON TETRACHLORIDE	100	ND
CHLOROETHANE	100	ND
CHLOROMETHANE	100	ND
4-CHLOROTOLUENE	100	ND
2-CHLOROTOLUENE	100	ND
CHLOROBENZENE	100	ND
CHLOROFORM	100	ND
DIBROMOCHLOROMETHANE	100	ND
1,2-DIBROMO-3-CHLOROPROPANE	100	ND
1,2-DIBROMOETHANE (EDB)	100	ND
DIBROMOMETHANE	100	ND
DICHLORODIFLUOROMETHANE	100	ND
1,4-DICHLOROBENZENE	100	ND
1,2-DICHLOROBENZENE	100	ND
1,3-DICHLOROBENZENE	100	ND
1,3-DICHLOROPROPANE	100	ND
1,2-DICHLOROPROPANE	100	ND
2,2-DICHLOROPROPANE	100	ND
1,1-DICHLOROETHANE	100	ND
1,1-DICHLOROPROPENE	100	ND
1,2-DICHLOROETHANE	100	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	100	ND
cis-1,2-DICHLOROETHENE	100	ND
1,1-DICHLOROETHENE	100	ND
ETHYLBENZENE	100	760
HEXACHLOROBUTADIENE	100	ND
p-ISOPROPYLTOLUENE	100	ND
ISOPROPYLBENZENE	100	180
METHYLENE CHLORIDE	100	ND
NAPHTHALENE	100	480
n-PROPYLBENZENE	100	280
1,1,2,2-TETRACHLOROETHANE	100	ND
1,1,1,2-TETRACHLOROETHANE	100	ND
TETRACHLOROETHENE	100	ND
TRICHLOROFLUOROMETHANE	100	ND
1,2,3-TRICHLOROBENZENE	100	ND
1,2,4-TRICHLOROBENZENE	100	ND
1,1,1-TRICHLOROETHANE	100	ND
TRICHLOROETHENE	100	ND
1,1,2-TRICHLOROETHANE	100	ND
1,2,3-TRICHLOROPROPANE	100	ND
1,3,5-TRIMETHYLBENZENE	100	300
1,2,4-TRIMETHYLBENZENE	100	690
TOLUENE	100	220
VINYL CHLORIDE	100	ND
STYRENES + o-XYLENES	200	ND
m & p-XYLENES	200	1900
METHYL-T-BUTYLETHER	100	660

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113613
Date Analyzed: 07/31/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

NORTEK
ENVIRONMENTAL LABORATORY
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SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-4
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.0	ND
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.0	ND
BROMOBENZENE	1.0	ND
BROMOMETHANE	1.0	ND
n-BUTYLBENZENE	1.0	ND
tert-BUTYLBENZENE	1.0	ND
sec-BUTYLBENZENE	1.0	ND
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.0	ND
CHLOROMETHANE	1.0	ND
4-CHLOROTOLUENE	1.0	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	1.0	ND
1,2-DIBROMOETHANE (EDB)	1.0	ND
DIBROMOMETHANE	1.0	ND
DICHLORODIFLUOROMETHANE	1.0	ND
1,4-DICHLOROBENZENE	1.0	ND
1,2-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.0	ND
1,1-DICHLOROETHANE	1.0	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	1.0	ND
cis-1,2-DICHLOROETHENE	1.0	ND
1,1-DICHLOROETHENE	1.0	ND
ETHYLBENZENE	1.0	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	1.0	ND
ISOPROPYLBENZENE	1.0	ND
METHYLENE CHLORIDE	1.0	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	1.0	ND
1,1,2,2-TETRACHLOROETHANE	1.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	1.0	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	1.0	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.0	ND
1,2,3-TRICHLOROPROPANE	1.0	ND
1,3,5-TRIMETHYLBENZENE	1.0	ND
1,2,4-TRIMETHYLBENZENE	1.0	ND
TOLUENE	1.0	ND
VINYL CHLORIDE	1.0	ND
STYRENES + o-XYLENES	2.0	ND
m & p-XYLENES	2.0	ND
METHYL-T-BUTYLETHER	1.0	4.0

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113608
Date Analyzed: 07/31/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY
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CLIENT: DAMES & MOORE
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SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW5
Sample Desc: GROUNDWATER
Date Collected: 06/11/91
Date Received: 06/13/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	5.0	ND
BROMOCHLOROMETHANE	5.0	ND
BROMODICHLOROMETHANE	5.0	ND
BROMOFORM	5.0	ND
BROMOBENZENE	5.0	ND
BROMOMETHANE	5.0	ND
n-BUTYLBENZENE	5.0	ND
tert-BUTYLBENZENE	5.0	ND
sec-BUTYLBENZENE	5.0	ND
CARBON TETRACHLORIDE	5.0	ND
CHLOROETHANE	5.0	ND
CHLOROMETHANE	5.0	ND
4-CHLOROTOLUENE	5.0	ND
2-CHLOROTOLUENE	5.0	ND
CHLOROBENZENE	5.0	ND
CHLOROFORM	5.0	ND
DIBROMOCHLOROMETHANE	5.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	5.0	ND
1,2-DIBROMOETHANE (EDB)	5.0	ND
DIBROMOMETHANE	5.0	ND
DICHLORODIFLUOROMETHANE	5.0	ND
1,4-DICHLOROBENZENE	5.0	ND
1,2-DICHLOROBENZENE	5.0	ND
1,3-DICHLOROBENZENE	5.0	ND
1,3-DICHLOROPROPANE	5.0	ND
1,2-DICHLOROPROPANE	5.0	ND
2,2-DICHLOROPROPANE	5.0	ND
1,1-DICHLOROETHANE	5.0	ND
1,1-DICHLOROPROPENE	5.0	ND
1,2-DICHLOROETHANE	5.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	5.0	ND
cis-1,2-DICHLOROETHENE	5.0	ND
1,1-DICHLOROETHENE	5.0	ND
ETHYLBENZENE	5.0	ND
HEXACHLOROBUTADIENE	5.0	ND
p-ISOPROPYLTOLUENE	5.0	ND
ISOPROPYLBENZENE	5.0	ND
METHYLENE CHLORIDE	5.0	2.5 JB
NAPHTHALENE	5.0	ND
n-PROPYLBENZENE	5.0	ND
1,1,2,2-TETRACHLOROETHANE	5.0	ND
1,1,1,2-TETRACHLOROETHANE	5.0	ND
TETRACHLOROETHENE	5.0	ND
TRICHLOROFLUOROMETHANE	5.0	ND
1,2,3-TRICHLOROBENZENE	5.0	ND
1,2,4-TRICHLOROBENZENE	5.0	ND
1,1,1-TRICHLOROETHANE	5.0	ND
TRICHLOROETHANE	5.0	ND
1,1,2-TRICHLOROETHANE	5.0	ND
1,2,3-TRICHLOROPROPANE	5.0	ND
1,3,5-TRIMETHYLBENZENE	5.0	ND
1,2,4-TRIMETHYLBENZENE	5.0	ND
TOLUENE	5.0	ND
VINYL CHLORIDE	5.0	ND
STYRENES	5.0	ND
m & p-XYLENES	10.0	ND
o-XYLENES	5.0	ND
METHYL-T-BUTYL ETHER	5.0	ND

ND = Not Detected
J = Estimated Concentration
B = Detected in Method Blank

COMMENTS: Lab Sample ID: 9106140 - 113655
Date Analyzed: 06/17/91
Analyzed by EPA Method 8260.

Signed: [signature] Date: 8-6-91

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ENVIRONMENTAL LABORATORY
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SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-6
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	0.3	ND
BROMOCHLOROMETHANE	0.2	ND
BROMODICHLOROMETHANE	0.2	ND
BROMOFORM	0.3	ND
BROMOBENZENE	0.4	ND
BROMOMETHANE	0.3	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	0.3	ND
sec-BUTYLBENZENE	0.3	ND
CARBON TETRACHLORIDE	0.2	ND
CHLOROETHANE	0.3	ND
CHLOROMETHANE	0.4	ND
4-CHLOROTOLUENE	0.5	ND
2-CHLOROTOLUENE	0.2	ND
CHLOROBENZENE	0.2	ND
CHLOROFORM	0.2	ND
DIBROMOCHLOROMETHANE	0.2	ND
1,2-DIBROMO-3-CHLOROPROPANE	0.4	ND
1,2-DIBROMOETHANE	0.3	ND
DIBROMOMETHANE	0.4	ND
DICHLOROFIFLUOROMETHANE	0.3	ND
1,4-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,3-DICHLOROBENZENE	0.6	ND
1,3-DICHLOROPROPANE	0.2	ND
1,2-DICHLOROPROPANE	0.2	ND
2,2-DICHLOROPROPANE	0.3	ND
1,1-DICHLOROETHANE	0.3	ND
1,1-DICHLOROPROPENE	0.2	ND
1,2-DICHLOROETHANE	0.2	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	0.4	ND
cis-1,2-DICHLOROETHENE	1.1	ND
1,1-DICHLOROETHENE	0.4	ND
ETHYLBENZENE	0.3	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	0.3	ND
ISOPROPYLBENZENE	0.3	ND
METHYLENE CHLORIDE	0.6	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	0.2	ND
STYRENE	0.3	ND
1,1,2,2-TETRACHLOROETHANE	0.4	ND
1,1,1,2-TETRACHLOROETHANE	0.2	ND
TETRACHLOROETHENE	0.2	ND
TRICHLOROFLUOROMETHANE	0.6	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	0.3	ND
TRICHLOROETHENE	0.2	ND
1,1,2-TRICHLOROETHANE	0.3	ND
1,2,3-TRICHLOROPROPANE	0.3	ND
1,3,5-TRIMETHYLBENZENE	0.3	ND
1,2,4-TRIMETHYLBENZENE	0.6	ND
TOLUENE	0.2	ND
VINYL CHLORIDE	0.3	ND
XYLENES (TOTAL)	0.6	ND
METHYL-T-BUTYLETHER	1.0	ND

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113535
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-15-91

ORTEK
ENVIRONMENTAL LABORATORY
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SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-7
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	0.3	4.6
BROMOCHLOROMETHANE	0.2	ND
BROMODICHLOROMETHANE	0.2	ND
BROMOFORM	0.3	ND
BROMOBENZENE	0.4	ND
BROMOMETHANE	0.3	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	0.3	ND
sec-BUTYLBENZENE	0.3	ND
CARBON TETRACHLORIDE	0.2	ND
CHLOROETHANE	0.3	ND
CHLOROMETHANE	0.4	ND
4-CHLOROTOLUENE	0.5	ND
2-CHLOROTOLUENE	0.2	ND
CHLOROBENZENE	0.2	ND
CHLOROFORM	0.2	ND
DIBROMOCHLOROMETHANE	0.2	ND
1,2-DIBROMO-3-CHLOROPROPANE	0.4	ND
1,2-DIBROMOETHANE	0.3	ND
DIBROMOMETHANE	0.4	ND
DICHLOROFIFLUOROMETHANE	0.3	ND
1,4-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,3-DICHLOROBENZENE	0.6	ND
1,3-DICHLOROPROPANE	0.2	ND
1,2-DICHLOROPROPANE	0.2	ND
2,2-DICHLOROPROPANE	0.3	ND
1,1-DICHLOROETHANE	0.3	ND
1,1-DICHLOROPROPENE	0.2	ND
1,2-DICHLOROETHANE	0.2	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	0.4	ND
cis-1,2-DICHLOROETHENE	1.1	ND
1,1-DICHLOROETHENE	0.4	ND
ETHYLBENZENE	0.3	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	0.3	ND
ISOPROPYLBENZENE	0.3	ND
METHYLENE CHLORIDE	0.6	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	0.2	ND
STYRENE	0.3	ND
1,1,2,2-TETRACHLOROETHANE	0.4	ND
1,1,1,2-TETRACHLOROETHANE	0.2	ND
TETRACHLOROETHENE	0.2	ND
TRICHLOROFLUOROMETHANE	0.6	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	0.3	ND
TRICHLOROETHENE	0.2	ND
1,1,2-TRICHLOROETHANE	0.3	ND
1,2,3-TRICHLOROPROPANE	0.3	ND
1,3,5-TRIMETHYLBENZENE	0.3	ND
1,2,4-TRIMETHYLBENZENE	0.6	ND
TOLUENE	0.2	ND
VINYL CHLORIDE	0.3	ND
XYLENES (TOTAL)	0.6	ND
METHYL-T-BUTYLETHER	1.0	4.8

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113536
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-15-91

ORTEK
VIRONMENTAL LABORATORY
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ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-8
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.0	1.4
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.0	ND
BROMOBENZENE	1.0	ND
BROMOMETHANE	1.0	ND
n-BUTYLBENZENE	1.0	1.9
tert-BUTYLBENZENE	1.0	1.4
sec-BUTYLBENZENE	1.0	1.8
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.0	ND
CHLOROMETHANE	1.0	ND
4-CHLOROTOLUENE	1.0	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	1.0	ND
1,2-DIBROMOETHANE (EDB)	1.0	ND
DIBROMOMETHANE	1.0	ND
DICHLORODIFLUOROMETHANE	1.0	ND
1,4-DICHLOROBENZENE	1.0	ND
1,2-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.0	ND
1,1-DICHLOROETHANE	1.0	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	1.0	ND
cis-1,2-DICHLOROETHENE	1.0	ND
1,1-DICHLOROETHENE	1.0	ND
ETHYLBENZENE	1.0	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	1.0	ND
ISOPROPYLBENZENE	1.0	1.7
METHYLENE CHLORIDE	1.0	ND
NAPHTHALENE	1.0	2.2
n-PROPYLBENZENE	1.0	1.2
1,1,2,2-TETRACHLOROETHANE	1.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	1.0	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	1.0	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.0	ND
1,2,3-TRICHLOROPROPANE	1.0	ND
1,3,5-TRIMETHYLBENZENE	1.0	ND
1,2,4-TRIMETHYLBENZENE	1.0	ND
TOLUENE	1.0	ND
VINYL CHLORIDE	1.0	ND
STYRENES + o-XYLENES	2.0	ND
m & p-XYLENES	2.0	ND
METHYL-T-BUTYLETHER	1.0	ND

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113609
Date Analyzed: 07/31/91 and 08/07/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY
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MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-9
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l	PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.0	ND	trans-1,2-DICHLOROETHENE	1.0	ND
BROMOCHLOROMETHANE	1.0	ND	cis-1,2-DICHLOROETHENE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND	1,1-DICHLOROETHENE	1.0	ND
BROMOFORM	1.0	ND	ETHYLBENZENE	1.0	ND
BROMOBENZENE	1.0	ND	HEXACHLOROBUTADIENE	1.0	ND
BROMOMETHANE	1.0	ND	p-ISOPROPYLTOLUENE	1.0	ND
n-BUTYLBENZENE	1.0	ND	ISOPROPYLBENZENE	1.0	ND
tert-BUTYLBENZENE	1.0	ND	METHYLENE CHLORIDE	1.0	ND
sec-BUTYLBENZENE	1.0	ND	NAPHTHALENE	1.0	ND
CARBON TETRACHLORIDE	1.0	ND	n-PROPYLBENZENE	1.0	ND
CHLOROETHANE	1.0	ND	1,1,2,2-TETRACHLOROETHANE	1.0	ND
CHLOROMETHANE	1.0	ND	1,1,1,2-TETRACHLOROETHANE	1.0	ND
4-CHLOROTOLUENE	1.0	ND	TETRACHLOROETHENE	1.0	ND
2-CHLOROTOLUENE	1.0	ND	TRICHLOROFLUOROMETHANE	1.0	ND
CHLOROBENZENE	1.0	ND	1,2,3-TRICHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND	1,2,4-TRICHLOROBENZENE	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND	1,1,1-TRICHLOROETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	1.0	ND	TRICHLOROETHENE	1.0	ND
1,2-DIBROMOETHANE (EDB)	1.0	ND	1,1,2-TRICHLOROETHANE	1.0	ND
DIBROMOMETHANE	1.0	ND	1,2,3-TRICHLOROPROPANE	1.0	ND
DICHLORODIFLUOROMETHANE	1.0	ND	1,3,5-TRIMETHYLBENZENE	1.0	ND
1,4-DICHLOROBENZENE	1.0	ND	1,2,4-TRIMETHYLBENZENE	1.0	ND
1,2-DICHLOROBENZENE	1.0	ND	TOLUENE	1.0	ND
1,3-DICHLOROBENZENE	1.0	ND	VINYL CHLORIDE	1.0	ND
1,3-DICHLOROPROPANE	1.0	ND	STYRENES + o-XYLENES	2.0	ND
1,2-DICHLOROPROPANE	1.0	ND	m & p-XYLENES	2.0	ND
2,2-DICHLOROPROPANE	1.0	ND	METHYL-T-BUTYLETHER	1.0	ND
1,1-DICHLOROETHANE	1.0	ND			
1,1-DICHLOROPROPENE	1.0	ND			
1,2-DICHLOROETHANE	1.0	ND			

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113611
Date Analyzed: 07/31/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY
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MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-10S
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.0	6.9
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.0	ND
BROMOBENZENE	1.0	ND
BROMOMETHANE	1.0	ND
n-BUTYLBENZENE	1.0	5.4
tert-BUTYLBENZENE	1.0	2.2
sec-BUTYLBENZENE	1.0	6.1
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.0	ND
CHLOROMETHANE	1.0	ND
4-CHLOROTOLUENE	1.0	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	1.0	ND
1,2-DIBROMOETHANE (EDB)	1.0	ND
DIBROMOMETHANE	1.0	ND
DICHLORODIFLUOROMETHANE	1.0	ND
1,4-DICHLOROBENZENE	1.0	ND
1,2-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.0	ND
1,1-DICHLOROETHANE	1.0	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	1.0	ND
cis-1,2-DICHLOROETHENE	1.0	ND
1,1-DICHLOROETHENE	1.0	ND
ETHYLBENZENE	1.0	2.1
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	1.0	2.5
ISOPROPYLBENZENE	1.0	12
METHYLENE CHLORIDE	1.0	ND
NAPHTHALENE	1.0	130
n-PROPYLBENZENE	1.0	29
1,1,2,2-TETRACHLOROETHANE	1.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	1.0	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	1.0	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.0	ND
1,2,3-TRICHLOROPROPANE	1.0	ND
1,3,5-TRIMETHYLBENZENE	1.0	1.6
1,2,4-TRIMETHYLBENZENE	1.0	2.9
TOLUENE	1.0	3.2
VINYL CHLORIDE	1.0	ND
STYRENES + o-XYLENES	2.0	ND
m & p-XYLENES	2.0	ND
METHYL-T-BUTYLETHER	1.0	4.5

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113610
Date Analyzed: 07/31/91 and 08/07/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY

2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: MW-10D
Sample Desc: GROUNDWATER
Date Collected: 06/07/91
Date Received: 06/12/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	1.0	ND
BROMOCHLOROMETHANE	1.0	ND
BROMODICHLOROMETHANE	1.0	ND
BROMOFORM	1.0	ND
BROMOBENZENE	1.0	ND
BROMOMETHANE	1.0	ND
n-BUTYLBENZENE	1.0	ND
tert-BUTYLBENZENE	1.0	ND
sec-BUTYLBENZENE	1.0	1.3
CARBON TETRACHLORIDE	1.0	ND
CHLOROETHANE	1.0	ND
CHLOROMETHANE	1.0	ND
4-CHLOROTOLUENE	1.0	ND
2-CHLOROTOLUENE	1.0	ND
CHLOROBENZENE	1.0	ND
CHLOROFORM	1.0	ND
DIBROMOCHLOROMETHANE	1.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	1.0	ND
1,2-DIBROMOETHANE (EDB)	1.0	ND
DIBROMOMETHANE	1.0	ND
DICHLORODIFLUOROMETHANE	1.0	ND
1,4-DICHLOROBENZENE	1.0	ND
1,2-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROBENZENE	1.0	ND
1,3-DICHLOROPROPANE	1.0	ND
1,2-DICHLOROPROPANE	1.0	ND
2,2-DICHLOROPROPANE	1.0	ND
1,1-DICHLOROETHANE	1.0	ND
1,1-DICHLOROPROPENE	1.0	ND
1,2-DICHLOROETHANE	1.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	1.0	ND
cis-1,2-DICHLOROETHENE	1.0	ND
1,1-DICHLOROETHENE	1.0	ND
ETHYLBENZENE	1.0	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	1.0	ND
ISOPROPYLBENZENE	1.0	ND
METHYLENE CHLORIDE	1.0	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	1.0	ND
1,1,2,2-TETRACHLOROETHANE	1.0	ND
1,1,1,2-TETRACHLOROETHANE	1.0	ND
TETRACHLOROETHENE	1.0	ND
TRICHLOROFLUOROMETHANE	1.0	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	1.0	ND
TRICHLOROETHENE	1.0	ND
1,1,2-TRICHLOROETHANE	1.0	ND
1,2,3-TRICHLOROPROPANE	1.0	ND
1,3,5-TRIMETHYLBENZENE	1.0	ND
1,2,4-TRIMETHYLBENZENE	1.0	ND
TOLUENE	1.0	ND
VINYL CHLORIDE	1.0	ND
STYRENES + o-XYLENES	2.0	ND
m & p-XYLENES	2.0	ND
METHYL-T-BUTYLETHER	1.0	4.2

ND = Not Detected

COMMENTS: Lab Sample ID: 9106124 - 113612
Date Analyzed: 07/31/91
Analyzed by EPA Method 8021.
Analyzed past hold time. Results must be considered minimum values.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: TRIP BLANK
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	0.3	ND
BROMOCHLOROMETHANE	0.2	ND
BROMODICHLOROMETHANE	0.2	ND
BROMOFORM	0.3	ND
BROMOBENZENE	0.4	ND
BROMOMETHANE	0.3	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	0.3	ND
sec-BUTYLBENZENE	0.3	ND
CARBON TETRACHLORIDE	0.2	ND
CHLOROETHANE	0.3	ND
CHLOROMETHANE	0.4	ND
4-CHLOROTOLUENE	0.5	ND
2-CHLOROTOLUENE	0.2	ND
CHLOROBENZENE	0.2	ND
CHLOROFORM	0.2	ND
DIBROMOCHLOROMETHANE	0.2	ND
1,2-DIBROMO-3-CHLOROPROPANE	0.4	ND
1,2-DIBROMOETHANE	0.3	ND
DIBROMOMETHANE	0.4	ND
DICHLOROFIFLUOROMETHANE	0.3	ND
1,4-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,3-DICHLOROBENZENE	0.6	ND
1,3-DICHLOROPROPANE	0.2	ND
1,2-DICHLOROPROPANE	0.2	ND
2,2-DICHLOROPROPANE	0.3	ND
1,1-DICHLOROETHANE	0.3	ND
1,1-DICHLOROPROPENE	0.2	ND
1,2-DICHLOROETHANE	0.2	ND
trans-1,2-DICHLOROETHENE	0.4	ND
cis-1,2-DICHLOROETHENE	1.1	ND
1,1-DICHLOROETHENE	0.4	ND
ETHYLBENZENE	0.3	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	0.3	ND
ISOPROPYLBENZENE	0.3	ND
METHYLENE CHLORIDE	0.6	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	0.2	ND
STYRENE	0.3	ND
1,1,2,2-TETRACHLOROETHANE	0.4	ND
1,1,1,2-TETRACHLOROETHANE	0.2	ND
TETRACHLOROETHENE	0.2	ND
TRICHLOROFLUOROMETHANE	0.6	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	0.3	ND
TRICHLOROETHENE	0.2	ND
1,1,2-TRICHLOROETHANE	0.3	ND
1,2,3-TRICHLOROPROPANE	0.3	ND
1,3,5-TRIMETHYLBENZENE	0.3	ND
1,2,4-TRIMETHYLBENZENE	0.6	ND
TOLUENE	0.2	ND
VINYL CHLORIDE	0.3	ND
XYLENES (TOTAL)	0.6	ND
METHYL-T-BUTYLETHER	1.0	ND

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113537
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-5-91

NORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: FIELD BLANK
Sample Desc: GROUNDWATER
Date Collected: 06/05/91
Date Received: 06/10/91
Job #: 20255-003

VOLATILE ORGANIC ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	0.3	ND
BROMOCHLOROMETHANE	0.2	ND
BROMODICHLOROMETHANE	0.2	ND
BROMOFORM	0.3	ND
BROMOBENZENE	0.4	ND
BROMOMETHANE	0.3	ND
n-BUTYLBENZENE	3.4	ND
tert-BUTYLBENZENE	0.3	ND
sec-BUTYLBENZENE	0.3	ND
CARBON TETRACHLORIDE	0.2	ND
CHLOROETHANE	0.3	ND
CHLOROMETHANE	0.4	ND
4-CHLOROTOLUENE	0.5	ND
2-CHLOROTOLUENE	0.2	ND
CHLOROBENZENE	0.2	ND
CHLOROFORM	0.2	0.4
DIBROMOCHLOROMETHANE	0.2	ND
1,2-DIBROMO-3-CHLOROPROPANE	0.4	ND
1,2-DIBROMOETHANE	0.3	ND
DIBROMOMETHANE	0.4	ND
DICHLORODIFLUOROMETHANE	0.3	ND
1,4-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,3-DICHLOROBENZENE	0.6	ND
1,3-DICHLOROPROPANE	0.2	ND
1,2-DICHLOROPROPANE	0.2	ND
2,2-DICHLOROPROPANE	0.3	ND
1,1-DICHLOROETHANE	0.3	ND
1,1-DICHLOROPROPENE	0.2	ND
1,2-DICHLOROETHANE	0.2	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	0.4	ND
cis-1,2-DICHLOROETHENE	1.1	ND
1,1-DICHLOROETHENE	0.4	ND
ETHYLBENZENE	0.3	ND
HEXACHLOROBUTADIENE	1.0	ND
p-ISOPROPYLTOLUENE	0.3	ND
ISOPROPYLBENZENE	0.3	ND
METHYLENE CHLORIDE	0.6	ND
NAPHTHALENE	1.0	ND
n-PROPYLBENZENE	0.2	ND
STYRENE	0.3	ND
1,1,2,2-TETRACHLOROETHANE	0.4	ND
1,1,1,2-TETRACHLOROETHANE	0.2	ND
TETRACHLOROETHENE	0.2	ND
TRICHLOROFLUOROMETHANE	0.6	ND
1,2,3-TRICHLOROBENZENE	1.0	ND
1,2,4-TRICHLOROBENZENE	1.0	ND
1,1,1-TRICHLOROETHANE	0.3	ND
TRICHLOROETHENE	0.2	ND
1,1,2-TRICHLOROETHANE	0.3	ND
1,2,3-TRICHLOROPROPANE	0.3	ND
1,3,5-TRIMETHYLBENZENE	0.3	ND
1,2,4-TRIMETHYLBENZENE	0.6	ND
TOLUENE	0.2	1.3
VINYL CHLORIDE	0.3	ND
XYLENES (TOTAL)	0.6	ND
METHYL-T-BUTYLETHER	1.0	ND

ND = Not Detected
* = Dry Weight Basis

COMMENTS: Lab Sample ID: 9106090 - 113538
Analyzed by EPA Method 8260

Signed: [signature] Date: 7-5-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: METHOD BLANK
Sample Desc:
Date Collected:
Date Received:
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	5.0	ND
BROMOCHLOROMETHANE	5.0	ND
BROMODICHLOROMETHANE	5.0	ND
BROMOFORM	5.0	ND
BROMOBENZENE	5.0	ND
BROMOMETHANE	5.0	ND
n-BUTYLBENZENE	5.0	ND
tert-BUTYLBENZENE	5.0	ND
sec-BUTYLBENZENE	5.0	ND
CARBON TETRACHLORIDE	5.0	ND
CHLOROETHANE	5.0	ND
CHLOROMETHANE	5.0	ND
4-CHLOROTOLUENE	5.0	ND
2-CHLOROTOLUENE	5.0	ND
CHLOROBENZENE	5.0	ND
CHLOROFORM	5.0	ND
DIBROMOCHLOROMETHANE	5.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	5.0	ND
1,2-DIBROMOETHANE (EDB)	5.0	ND
DIBROMOMETHANE	5.0	ND
DICHLORODIFLUOROMETHANE	5.0	ND
1,4-DICHLOROBENZENE	5.0	ND
1,2-DICHLOROBENZENE	5.0	ND
1,3-DICHLOROBENZENE	5.0	ND
1,3-DICHLOROPROPANE	5.0	ND
1,2-DICHLOROPROPANE	5.0	ND
2,2-DICHLOROPROPANE	5.0	ND
1,1-DICHLOROETHANE	5.0	ND
1,1-DICHLOROPROPENE	5.0	ND
1,2-DICHLOROETHANE	5.0	ND

PARAMETERS	DETECTION LIMITS	RESULTS ug/l
trans-1,2-DICHLOROETHENE	5.0	ND
cis-1,2-DICHLOROETHENE	5.0	ND
1,1-DICHLOROETHENE	5.0	ND
ETHYLBENZENE	5.0	ND
HEXACHLOROBUTADIENE	5.0	ND
p-ISOPROPYLTOLUENE	5.0	ND
ISOPROPYLBENZENE	5.0	ND
METHYLENE CHLORIDE	5.0	6.2
NAPHTHALENE	5.0	ND
n-PROPYLBENZENE	5.0	ND
1,1,2,2-TETRACHLOROETHANE	5.0	ND
1,1,1,2-TETRACHLOROETHANE	5.0	ND
TETRACHLOROETHENE	5.0	ND
TRICHLOROFLUOROMETHANE	5.0	ND
1,2,3-TRICHLOROBENZENE	5.0	ND
1,2,4-TRICHLOROBENZENE	5.0	ND
1,1,1-TRICHLOROETHANE	5.0	ND
TRICHLOROETHANE	5.0	ND
1,1,2-TRICHLOROETHANE	5.0	ND
1,2,3-TRICHLOROPROPANE	5.0	ND
1,3,5-TRIMETHYLBENZENE	5.0	ND
1,2,4-TRIMETHYLBENZENE	5.0	ND
TOLUENE	5.0	ND
VINYL CHLORIDE	5.0	ND
STYRENES	5.0	ND
m & p-XYLENES	10.0	ND
o-XYLENES	5.0	ND
METHYL-T-BUTYL ETHER	5.0	ND

ND = Not Detected
J = Estimated Concentration
B = Detected in Method Blank

COMMENTS: Lab Sample ID: 9106140 - METHOD BLANK
Date Analyzed: 06/17/91
Analyzed by EPA Method 8260.

Signed: [signature] Date: 8-1-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

ORTEK
Oneida Environmental Technology Center
2496 West Mason Street
P.O. Box 12435
Green Bay, WI 54307-2435
414/498-2222

GC/MS ORGANIC ANALYSIS SUMMARY

Client: Dames and Moore
Address: 250 E. Wisconsin Avenue
Milwaukee, WI 53202

Project Name:
SAS/Project Number: 20255-003
Batch Number: 9106124
Results Sheet #: 1167

Contact: K. Stehr

-CLIENT ID REPORTED ON FORMS AS EPA SAMPLE #
-VOLATILE ORGANIC ANALYSIS PERFORMED BY MODIFIED EPA METHOD 8240 ON A DB624 CAPILLARY COLUMN.

FORM INDEX:
Form 1A - Volatile Organics Data Sheet
(EPA Sample No.'s VBLK designate the method blank which was run with the samples)

"Q" COLUMN QUALIFIERS:
- U - Compound analyzed for but not detected
- D - Compound identified in the analysis at a secondary dilution
- B - Indicates the analyte is found in the associated method blank
- J - Estimated value, concentration of analyte below quantitation limit
- E - Compound exceeds calibration range; actual concentrations could be higher than reported

Comments:

First anlalysis within hold time but at 100 fold dilution. Second analysis exceeded hold but with no dilution. Reported values must be considered minimum concentrations.

Signed: [signature] Date: 7-29-91

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-10S

Lab Name: ORTEK Contract:

Lab Code: ORTEK Case No.: SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 113610

Sample wt/vol: 5 (g/mL) mL Lab File ID: 71703

Level: (low/med) Date Received: 06/12/91

% Moisture: not dec. Date Analyzed: 07/17/91

Column: (pack/cap) CAP Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/L (ug/L or ug/Kg)	Q
74-87-3	Chloromethane	5	U
74-83-9	Bromomethane	5	U
75-01-4	Vinyl Chloride	5	U
75-00-3	Chloroethane	5	U
75-09-2	Methylene Chloride	4	BJ
67-64-1	Acetone	5	U
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	6	
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	5	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	7	
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-pentanone	5	U
591-78-6	2-Hexanone	5	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	3	J
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-02-7	Xylene (total)	5	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLK

Lab Name: ORTEK **Contract:**

Lab Code: ORTEK **Case No.:** **SAS No.:** **SDG No.:**

Matrix: (soil/water) WATER **Lab Sample ID:** VBLK050

Sample wt/vol: 5 **(g/mL)** mL **Lab File ID:** 717B1

Level: (low/med) **Date Received:** 06/12/91

% Moisture: not dec. **Date Analyzed:** 07/17/91

Column: (pack/cap) CAP **Dilution Factor:** 1

CONCENTRATION UNITS: ug/L (ug/L or ug/Kg)

CAS NO.	COMPOUND	CONCENTRATION (ug/L)	Q
74-87-3	Chloromethane	5	U
74-83-9	Bromomethane	5	U
75-01-4	Vinyl Chloride	5	U
75-00-3	Chloroethane	5	U
75-09-2	Methylene Chloride	4	J
67-64-1	Acetone	16	
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	5	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	4	J
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-pentanone	5	U
591-78-6	2-Hexanone	5	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-02-7	Xylene (total)	5	U

ORTEK
ENVIRONMENTAL LABORATORY

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ORTEK
Oneida Environmental Technology Center
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P.O. Box 12435
Green Bay, WI 54307-2435
414/498-2222

GC/MS ORGANIC ANALYSIS SUMMARY

Client: Dames & Moore, Ltd.
Address: 250 East Wisconsin Ave,
Suite 1500
Milwaukee, WI 53202
(414) 347-0800
FAX: (414) 347-0288

Contact: K. Stehl

Project Name:
SAS/Project Number: 20255-003
Batch Number: 9109043
Results Sheet #: 459458

-CLIENT ID REPORTED ON FORMS AS EPA SAMPLE #
OLATILE ORGANIC ANALYSIS PERFORMED BY MODIFIED EPA METHOD 8240 ON A DB624
APILLARY COLUMN.

FORM INDEX:
Form 1A - Volatile Organics Data Sheet
(EPA Sample No.'s VBLK## designate the method blank which was run with the samples)

"Q" COLUMN QUALIFIERS:
- U - Compound analyzed for but not detected
- D - Compound identified in the analysis at a secondary dilution
- B - Indicates the analyte is found in the associated method blank
- J - Estimated value, concentration of analyte below quantitation limit
- E - Compound exceeds calibration range; actual concentrations could be higher than reported

---

Comments: The sample was initial run on 09/11/91 at a dilution due to anticipated high levels. Due to over-dilution, the sample was reanalyzed with only the subsequent results reported.

gned: [signature] Date: 9-26-91

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-10S

Lab Name: ORTEK Contract: 459458

Lab Code: ORTEK Case No.: 116772 SAS No.: 20255-0 SDG No.: MW-10S

Matrix: (soil/water) WATER Lab Sample ID: 116772

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 109CV192

Level: (low/med) LOW Date Received: 09/06/91

% Moisture: not dec. ____ Date Analyzed: 09/25/91

Column: (pack/cap) ______ Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	2	BJ
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	8	
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	3	J
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLK10

Name: ORTEK Contract: 459458

Lab Code: ORTEK Case No.: 116772 SAS No.: ______ SDG No.: MW-10S

Matrix: (soil/water) WATER Lab Sample ID: WBLK092591

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 109CV185

Level: (low/med) LOW Date Received: ______

% Moisture: not dec. ____ Date Analyzed: 09/25/91

Column: (pack/cap) ______ Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	2	J
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No.
405099530

Sample ID: MW-1 DL
Sample Desc: WATER
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	100	ND
Bromomethane	100	ND
Vinyl Chloride	100	ND
Chloroethane	100	ND
Methylene Chloride	50	27 BJ
Acetone	100	ND
Carbon Disulfide	50	150
1,1-Dichloroethene	50	ND
1,1-Dichloroethane	50	ND
1,2-Dichloroethene (total)	50	ND
Chloroform	50	ND
1,2-Dichloroethane	50	ND
2-Butanone	100	ND
1,1,1-Trichloroethane	50	ND
Carbon Tetrachloride	50	ND
Vinyl Acetate	100	ND
Bromodichloromethane	50	ND
1,2-Dichloropropane	50	ND
cis-1,3-Dichloropropene	50	ND
Trichloroethene	50	ND
Dibromochloromethane	50	ND
1,1,2-Trichloroethane	50	ND
Benzene	50	1200
Trans-1,3-Dichloropropene	50	ND
Bromoform	50	ND
4-Methyl-2-pentanone	100	ND
2-Hexanone	100	ND
Tetrachloroethene	50	ND
1,1,2,2-Tetrachloroethane	50	ND
Toluene	50	ND
Chlorobenzene	50	ND
Ethylbenzene	50	36 J
Styrene	50	ND
Xylenes (total)	50	27 J

ND = Not Detected

Comments: Lab Sample ID: 9110044 - 117867 DL
Date Analyzed: 10/10/91
Analyzed by GC/MS Method 8240.

Signed: [signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
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CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530

Sample ID: MW-5
Sample Desc: WATER
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	10.0	ND
Bromomethane	10.0	ND
Vinyl Chloride	10.0	ND
Chloroethane	10.0	ND
Methylene Chloride	5.0	3.8 BJ
Acetone	10.0	ND
Carbon Disulfide	5.0	ND
1,1-Dichloroethene	5.0	ND
1,1-Dichloroethane	5.0	ND
1,2-Dichloroethene (total)	5.0	ND
Chloroform	5.0	ND
1,2-Dichloroethane	5.0	ND
2-Butanone	10.0	ND
1,1,1-Trichloroethane	5.0	1.9 J
Carbon Tetrachloride	5.0	ND
Vinyl Acetate	10.0	ND
Bromodichloromethane	5.0	ND
1,2-Dichloropropane	5.0	ND
cis-1,3-Dichloropropene	5.0	ND
Trichloroethene	5.0	ND
Dibromochloromethane	5.0	ND
1,1,2-Trichloroethane	5.0	ND
Benzene	5.0	ND
Trans-1,3-Dichloropropene	5.0	ND
Bromoform	5.0	ND
4-Methyl-2-pentanone	10.0	ND
2-Hexanone	10.0	ND
Tetrachloroethene	5.0	ND
1,1,2,2-Tetrachloroethane	5.0	ND
Toluene	5.0	ND
Chlorobenzene	5.0	ND
Ethylbenzene	5.0	ND
Styrene	5.0	ND
Xylenes (total)	5.0	ND

ND = Not Detected

Comments: Lab Sample ID: 9110044 - 117868
Date Analyzed: 10/07/91
Analyzed by GC/MS Method 8240.

Signed: D-[signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530

Sample ID: MW-9
Sample Desc: WATER
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	10.0	ND
Bromomethane	10.0	ND
Vinyl Chloride	10.0	ND
Chloroethane	10.0	ND
Methylene Chloride	5.0	3.1 BJ
Acetone	10.0	ND
Carbon Disulfide	5.0	ND
1,1-Dichloroethene	5.0	ND
1,1-Dichloroethane	5.0	ND
1,2-Dichloroethene (total)	5.0	ND
Chloroform	5.0	ND
1,2-Dichloroethane	5.0	ND
2-Butanone	10.0	ND
1,1,1-Trichloroethane	5.0	ND
Carbon Tetrachloride	5.0	ND
Vinyl Acetate	10.0	ND
Bromodichloromethane	5.0	ND
1,2-Dichloropropane	5.0	ND
cis-1,3-Dichloropropene	5.0	ND
Trichloroethene	5.0	ND
Dibromochloromethane	5.0	ND
1,1,2-Trichloroethane	5.0	ND
Benzene	5.0	ND
Trans-1,3-Dichloropropene	5.0	ND
Bromoform	5.0	ND
4-Methyl-2-pentanone	10.0	ND
2-Hexanone	10.0	ND
Tetrachloroethene	5.0	ND
1,1,2,2-Tetrachloroethane	5.0	ND
Toluene	5.0	ND
Chlorobenzene	5.0	ND
Ethylbenzene	5.0	ND
Styrene	5.0	ND
Xylenes (total)	5.0	ND

ND = Not Detected

Comments: Lab Sample ID: 9110044 - 117869
Date Analyzed: 10/07/91
Analyzed by GC/MS Method 8240.

Signed: [signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530

Sample ID: MW-10 D
Sample Desc: WATER
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	10.0	ND
Bromomethane	10.0	ND
Vinyl Chloride	10.0	ND
Chloroethane	10.0	ND
Methylene Chloride	5.0	ND
Acetone	10.0	ND
Carbon Disulfide	5.0	ND
1,1-Dichloroethene	5.0	ND
1,1-Dichloroethane	5.0	ND
1,2-Dichloroethene (total)	5.0	ND
Chloroform	5.0	ND
1,2-Dichloroethane	5.0	ND
2-Butanone	10.0	ND
1,1,1-Trichloroethane	5.0	ND
Carbon Tetrachloride	5.0	ND
Vinyl Acetate	10.0	ND
Bromodichloromethane	5.0	ND
1,2-Dichloropropane	5.0	ND
cis-1,3-Dichloropropene	5.0	ND
Trichloroethene	5.0	ND
Dibromochloromethane	5.0	ND
1,1,2-Trichloroethane	5.0	ND
Benzene	5.0	ND
Trans-1,3-Dichloropropene	5.0	ND
Bromoform	5.0	ND
4-Methyl-2-pentanone	10.0	ND
2-Hexanone	10.0	ND
Tetrachloroethene	5.0	ND
1,1,2,2-Tetrachloroethane	5.0	ND
Toluene	5.0	6.7
Chlorobenzene	5.0	ND
Ethylbenzene	5.0	16
Styrene	5.0	ND
Xylenes (total)	5.0	13

ND = Not Detected

Comments: Lab Sample ID: 9110044 - 117870
Date Analyzed: 10/07/91
Analyzed by GC/MS Method 8240.

Signed: D. [signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No.
405099530

Sample ID: VBLKA10
Sample Desc: METHOD BLANK
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	10.0	ND
Bromomethane	10.0	ND
Vinyl Chloride	10.0	ND
Chloroethane	10.0	ND
Methylene Chloride	5.0	0.6 J
Acetone	10.0	33
Carbon Disulfide	5.0	ND
1,1-Dichloroethene	5.0	ND
1,1-Dichloroethane	5.0	ND
1,2-Dichloroethene (total)	5.0	ND
Chloroform	5.0	ND
1,2-Dichloroethane	5.0	ND
2-Butanone	10.0	ND
1,1,1-Trichloroethane	5.0	ND
Carbon Tetrachloride	5.0	ND
Vinyl Acetate	10.0	ND
Bromodichloromethane	5.0	ND
1,2-Dichloropropane	5.0	ND
cis-1,3-Dichloropropene	5.0	ND
Trichloroethene	5.0	ND
Dibromochloromethane	5.0	ND
1,1,2-Trichloroethane	5.0	ND
Benzene	5.0	ND
Trans-1,3-Dichloropropene	5.0	ND
Bromoform	5.0	ND
4-Methyl-2-pentanone	10.0	ND
2-Hexanone	10.0	ND
Tetrachloroethene	5.0	ND
1,1,2,2-Tetrachloroethane	5.0	ND
Toluene	5.0	ND
Chlorobenzene	5.0	ND
Ethylbenzene	5.0	ND
Styrene	5.0	ND
Xylenes (total)	5.0	ND

ND = Not Detected

Comments: Lab Sample ID: 9110044 - METHOD BLANK
Date Analyzed: 10/10/91
Analyzed by GC/MS Method 8240.

Signed: [signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
414-498-2222
FAX: 414-498-4067
2496 West Mason Street P.O. Box 12435 Green Bay, WI

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530

Sample ID: VBLKA07
Sample Desc: METHOD BLANK
Date Collected: 10/02/91
Date Received: 10/04/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Chloromethane	10.0	ND
Bromomethane	10.0	ND
Vinyl Chloride	10.0	ND
Chloroethane	10.0	ND
Methylene Chloride	5.0	5.8
Acetone	10.0	ND
Carbon Disulfide	5.0	ND
1,1-Dichloroethene	5.0	ND
1,1-Dichloroethane	5.0	ND
1,2-Dichloroethene (total)	5.0	ND
Chloroform	5.0	ND
1,2-Dichloroethane	5.0	ND
2-Butanone	10.0	ND
1,1,1-Trichloroethane	5.0	ND
Carbon Tetrachloride	5.0	ND
Vinyl Acetate	10.0	ND
Bromodichloromethane	5.0	ND
1,2-Dichloropropane	5.0	ND
cis-1,3-Dichloropropene	5.0	ND
Trichloroethene	5.0	ND
Dibromochloromethane	5.0	ND
1,1,2-Trichloroethane	5.0	ND
Benzene	5.0	ND
Trans-1,3-Dichloropropene	5.0	ND
Bromoform	5.0	ND
4-Methyl-2-pentanone	10.0	ND
2-Hexanone	10.0	ND
Tetrachloroethene	5.0	ND
1,1,2,2-Tetrachloroethane	5.0	ND
Toluene	5.0	ND
Chlorobenzene	5.0	ND
Ethylbenzene	5.0	ND
Styrene	5.0	ND
Xylenes (total)	5.0	ND

ND = Not Detected

Comments: Lab Sample ID: 9110044 - METHOD BLANK
Date Analyzed: 10/07/91
Analyzed by GC/MS Method 8240.

Signed: [signature] Date: 11-5-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

ORTEK
Oneida Environmental Technology Center
2496 West Mason Street
P.O. Box 12435
Green Bay, WI 54307-2435
414/498-2222

GC/MS ORGANIC ANALYSIS SUMMARY

Client: Dames and Moore
Address: 250 East Wisconsin Ave
Milwaukee, WI 53202

Contact: Kristine Stehr

Project Name: 20255-003
SAS/Project Number:
Batch Number: 9106090

-CLIENT ID REPORTED ON FORMS AS EPA SAMPLE #
-SEMIVOLATILE ORGANIC ANALYSIS PERFORMED BY EPA METHOD 8270 ON A DB5 CAPILLARY COLUMN.

FORM INDEX:
Form 1B - Semivolatile Organics Data Sheet, page 1
Form 1C - Semivolatile Organics Data Sheet, page 2

"Q" COLUMN QUALIFIERS:
U - Compound analyzed for but not detected
D - Compound identified in the analysis at a secondary dilution
B - Indicates the analyte is found in the associated method blank
J - Estimated value, concentration of analyte below quantitation limit
E - Compound exceeds calibration range

Comments:

Signed: [signature] Date: 7-6-91

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-2S

Lab Name: ORTEK Contract: 1895

Lab Code: ORTEK Case No.: 113531 SAS No.: 20255-0 SDG No.: MW-1

Matrix: (soil/water) WATER Lab Sample ID: 113531

Sample wt/vol: 995 (g/mL) ML Lab File ID: 106BB065

Level: (low/med) LOW Date Received: 06/11/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 06/11/91

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 06/18/91

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	CONCENTRATION (UG/L)	Q
91-20-3	Naphthalene	14	
208-96-8	Acenaphthylene	10	U
83-32-9	Acenaphthene	0.3	J
86-73-7	Fluorene	0.5	J
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
56-55-3	Benzo(a)Anthracene	10	U
218-01-9	Chrysene	10	U
205-99-2	Benzo(b)Fluoranthene	10	U
207-08-9	Benzo(k)Fluoranthene	10	U
50-32-8	Benzo(a)Pyrene	10	U
193-39-5	Indeno(1,2,3-cd)Pyrene	10	U
53-70-3	Dibenz(a,h)Anthracene	10	U
191-24-2	Benzo(g,h,i)Perylene	10	U

1B

EPA SAMPLE NO.

MW-3S

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

Lab Name: ORTEK Contract: 1895

Lab Code: ORTEK Case No.: 113531 SAS No.: 20255-0 SDG No.: MW-1

Matrix: (soil/water) WATER Lab Sample ID: 113534

Sample wt/vol: 995 (g/mL) ML Lab File ID: 106BB066

Level: (low/med) LOW Date Received: 06/11/91

Moisture: not dec. ____ dec. ____ Date Extracted: 06/11/91

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 06/18/91

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	CONCENTRATION	Q
91-20-3	Naphthalene	120	
208-96-8	Acenaphthylene	10	U
83-32-9	Acenaphthene	37	
86-73-7	Fluorene	24	
85-01-8	Phenanthrene	42	
120-12-7	Anthracene	5	J
206-44-0	Fluoranthene	28	
129-00-0	Pyrene	20	
56-55-3	Benzo(a)Anthracene	12	
218-01-9	Chrysene	14	
205-99-2	Benzo(b)Fluoranthene	25	
207-08-9	Benzo(k)Fluoranthene	10	U
50-32-8	Benzo(a)Pyrene	11	
193-39-5	Indeno(1,2,3-cd)Pyrene	7	J
53-70-3	Dibenz(a,h)Anthracene	2	J
191-24-2	Benzo(g,h,i)Perylene	6	J

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-7

Lab Name: ORTEK Contract: 1895

[redacted] Code: ORTEK Case No.: 113531 SAS No.: 20255-0 SDG No.: MW-1

Matrix: (soil/water) WATER Lab Sample ID: 113536

Sample wt/vol: 1000 (g/mL) ML Lab File ID: 106BB064

Level: (low/med) LOW Date Received: 06/11/91

% Moisture: not dec. ____ dec. ____ Date Extracted: 06/11/91

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 06/18/91

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
91-20-3	Naphthalene	0.7	J
208-96-8	Acenaphthylene	10	U
83-32-9	Acenaphthene	0.9	J
86-73-7	Fluorene	2	J
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
56-55-3	Benzo(a)Anthracene	10	U
218-01-9	Chrysene	10	U
205-99-2	Benzo(b)Fluoranthene	10	U
207-08-9	Benzo(k)Fluoranthene	10	U
50-32-8	Benzo(a)Pyrene	10	U
193-39-5	Indeno(1,2,3-cd)Pyrene	10	U
53-70-3	Dibenz(a,h)Anthracene	10	U
191-24-2	Benzo(g,h,i)Perylene	10	U

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 EAST WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No.
405099530

Sample ID: MW-6
Sample Desc: GROUNDWATER
Date Collected: 09/24/91
Date Received: 09/06/91
Job #: 20255-003

SEMIVOLATILE ORGANIC ANALYSIS

PARAMETER	DETECTION LIMITS	CONCENTRATION ug/l
Naphthalene	0.1	2.03
Acenaphthylene	0.4	ND
Acenaphthene	0.02	ND
Fluorene	0.02	ND
Phenanthrene	0.02	ND
Anthracene	0.02	ND
Fluoranthene	0.02	ND
Pyrene	0.1	ND
Benzo(a)Anthracene	0.02	ND
Chrysene	0.02	ND
Benzo(b)Fluoranthene	0.02	ND
Benzo(k)Fluoranthene	0.02	ND
Benzo(a)Pyrene	0.02	ND
Indeno(1,2,3-cd)Pyrene	0.1	ND
Dibenz(a,h)Anthracene	0.1	ND
Benzo(g,h,i)Perylene	0.1	ND
Dibenzofuran	0.1	ND

ND = Not Detected

Comments: Lab Sample ID: 9109043 - 116773
Analyzed by GC/MS EPA Method 8270.

Signed: D. [signature]   Date: 10-10-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106090
Our lab # : 113531
Your sample ID: MW-2S
Sample Matrix : WATER

Report Date: 07/16/91

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test		Result	Units
113531	Silver	<	0.4	UG/L
	Arsenic		3.9	UG/L
	Barium		180	UG/L
	Cadmium		0.3	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed *Nick Milberg* Date *7-16-91*

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106090
Our lab # : 113533
Your sample ID: MW-2S/DUP
Sample Matrix : WATER

Report Date: 07/16/91

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test		Result	Units
113533	Silver	<	0.4	UG/L
	Arsenic		5.7	UG/L
	Barium		170	UG/L
	Cadmium	<	0.5	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed *Nikki Milberg* Date 7-16-91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI [illegible]
414-498-2222
FAX: 414-498-[illegible]

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106090
Our lab # : 113534
Your sample ID: MW-3S
Sample Matrix : WATER

Report Date: 07/16/91

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test		Result	Units
113534	Silver	<	0.4	UG/L
	Arsenic		3.8	UG/L
	Barium		240	UG/L
	Cadmium	<	0.5	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead		6.4	UG/L
	Selenium	<	3.0	UG/L

Signed *Nikki Melberg* Date 7-16-91

Signed ______________________ Date ______________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 13435 Green Bay, WI 54307-3435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our lab # : 113613
Your sample ID: MW-3D
Sample Matrix : WATER

Report Date: 07/17/91

COLLECTION INFORMATION

Date/Time/By: 06/07/91 K S
Location :

Lab#	Test		Result	Units
113613	Silver	<	0.4	UG/L
	Arsenic		5.8	UG/L
	Barium		99	UG/L
	Cadmium		0.7	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed Nick Melberg Date 7-25-91

Signed ______________ Date ______________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106090
Our lab # : 113536 Report Date: 07/16/91
Your sample ID: MW-7
Sample Matrix : WATER

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test		Result	Units
113536	Silver	<	0.4	UG/L
	Arsenic		3.4	UG/L
	Barium		260	UG/L
	Cadmium	<	0.5	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed ________________ Date 7-16-91

Signed ________________ Date ________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our lab # : 113610 Report Date: 07/17/91
Your sample ID: MW-10S
Sample Matrix : WATER

COLLECTION INFORMATION

Date/Time/By: 06/07/91 K S
Location :

Lab#	Test		Result	Units
113610	Silver	<	0.4	UG/L
	Arsenic		9.2	UG/L
	Barium		180	UG/L
	Cadmium		0.4	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead		51	UG/L
	Selenium	<	3.0	UG/L

Signed *Neil K Melby* Date *7-25-91*

Signed ______________________ Date __________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our lab # : 113612
Your sample ID: MW-10D
Sample Matrix : WATER

Report Date: 07/17/91

COLLECTION INFORMATION

Date/Time/By: 06/07/91 K S
Location :

Lab#	Test		Result	Units
113612	Silver	<	0.4	UG/L
	Arsenic	<	3.0	UG/L
	Barium		120	UG/L
	Cadmium		0.3	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed *Nick Melby* Date 7-25-91

Signed ______ Date ______

ORTEK
VIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12433 Green Bay, WI 54307-2433
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106090
Our lab # : 113538 Report Date: 07/16/91
Your sample ID: FIELD BLANK
Sample Matrix : WATER

COLLECTION INFORMATION

Date/Time/By: 06/05/91 K S
Location :

Lab#	Test		Result	Units
113538	Silver	<	0.4	UG/L
	Arsenic	<	3.0	UG/L
	Barium	<	10	UG/L
	Cadmium	<	0.5	UG/L
	Chromium	<	2	UG/L
	Mercury	<	0.2	UG/L
	Lead	<	2.0	UG/L
	Selenium	<	3.0	UG/L

Signed *Mark Mellery* Date *7-16-91*

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI [illegible]
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our Lab # : 113615 Report Date: 07/08/91
Your Sample ID: MW-10D/PAINT
Sample Matrix : WASTE

COLLECTION INFORMATION

Date/Time/By: 06/06/91 K S
Location :

Lab#	test		Result	Units
113615	Silver	<	1.1	MG/KG
	Arsenic		0.5	MG/KG
	Barium		64	MG/KG
	Cadmium		2.1	MG/KG
	Chromium		180	MG/KG
	Mercury		180	MG/KG
	Lead		2100	MG/KG
	Selenium	<	0.3	MG/KG

Signed *[signature]* Date 7-25-91

Signed ______________________ Date __________

ORTEK
ENVIRONMENTAL LABORATORY

414-498-2222
FAX: 414-498-4067

CLIENT: DAMES AND MOORE
ADDRESS: 250 E. WISCONSIN AVE.
SUITE 1500
MILWAUKEE,WI. 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No.
405099530

Sample ID: PRODUCT/MW-3S
Sample Desc: PRODUCT
Date Collected: 06/07/91
Date Received: 06/13/91
Job #: 20255-003

TPH SURVEY

Heated Headspace Gas Chromatographic Method
(A California Method for Gasoline)

PARAMETER	DETECTION LIMIT	CONCENTRATION mg/kg*
Gasoline	5.0	828,000
Diesel Fuels	5.0	306,000

ND = Not Detected
* = Dry Weight Basis

Comments: Lab Sample ID:9106140 - 113657
Date Analyzed:06/24/91
Sample appears to be a mixture of degraded gasoline and diesel/fuel oil.
Analyzed by GC/FID.

Signed: marcia a. kuehl Date: 3/12/92

ORTEK
ENVIRONMENTAL LABORATORY
1496 West Mason Street P.O. Box 13435 Green Bay, WI 54307-3435
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVE
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530

Sample ID: PRODUCT/MW-3S
Sample Desc: GW
Date Collected: 06/07/91
Date Received: 06/13/91
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION ug/l
Benzene	1.0	ND
Bromoform	1.0	ND
Bromomethane	1.0	ND
Carbon Tetrachloride	1.0	ND
Chlorobenzene	1.0	ND
Chloroethane	1.0	ND
2-Chloroethylvinylether	2.0	ND
Chloroform	1.0	ND
Chloromethane	1.0	ND
Dibromochloromethane	1.0	ND
1,2-Dichlorobenzene	1.0	ND
1,3-Dichlorobenzene	1.0	ND
1,4-Dichlorobenzene	1.0	ND
Dichlorobromomethane	1.0	ND
1,1-Dichloroethane	1.0	ND
1,2-Dichloroethane	1.0	ND
1,1-Dichloroethene	1.0	ND
cis-1,2-Dichloroethene	1.0	ND
trans-1,2-Dichlorethene	1.0	ND
1,2-Dichloropropane	1.0	ND
cis-1,3-Dichloropropene	1.0	ND
trans-1,3-Dichloropropene	1.0	ND
Ethylbenzene	1.0	10
Methylene Chloride	1.0	ND
1,1,2,2-Tetrachloroethane	1.0	ND
Tetrachloroethane	1.0	ND
Toluene	1.0	5.1
1,1,1-Trichloroethane	1.0	ND
1,1,2-Trichloroethane	1.0	ND
Trichloroethene	1.0	ND
Vinyl Chloride	1.0	ND
Total Xylenes	3.0	54

ND = Not Detected

Comments: Lab Sample ID: 9106140 - 113657
Date Analyzed: 06/21/91 - 07/23/91
Analyzed by GC/MS Method 8240.

Signed: [signature] Date: 8-13-91

ORTEK
ENVIRONMENTAL LABORATORY
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No: 405099530

Sample ID: METHOD BLANK
Sample Desc:
Date Collected:
Date Received:
Job #: 20255-003

VOLATILE ORGANIC WATER ANALYSIS

PARAMETERS	DETECTION LIMITS	RESULTS ug/l	PARAMETERS	DETECTION LIMITS	RESULTS ug/l
BENZENE	5.0	ND	trans-1,2-DICHLOROETHENE	5.0	ND
BROMOCHLOROMETHANE	5.0	ND	cis-1,2-DICHLOROETHENE	5.0	ND
BROMODICHLOROMETHANE	5.0	ND	1,1-DICHLOROETHENE	5.0	ND
BROMOFORM	5.0	ND	ETHYLBENZENE	5.0	ND
BROMOBENZENE	5.0	ND	HEXACHLOROBUTADIENE	5.0	ND
BROMOMETHANE	5.0	ND	p-ISOPROPYLTOLUENE	5.0	ND
n-BUTYLBENZENE	5.0	ND	ISOPROPYLBENZENE	5.0	ND
tert-BUTYLBENZENE	5.0	ND	METHYLENE CHLORIDE	5.0	6.2
sec-BUTYLBENZENE	5.0	ND	NAPHTHALENE	5.0	ND
CARBON TETRACHLORIDE	5.0	ND	n-PROPYLBENZENE	5.0	ND
CHLOROETHANE	5.0	ND	1,1,2,2-TETRACHLOROETHANE	5.0	ND
CHLOROMETHANE	5.0	ND	1,1,1,2-TETRACHLOROETHANE	5.0	ND
4-CHLOROTOLUENE	5.0	ND	TETRACHLOROETHENE	5.0	ND
2-CHLOROTOLUENE	5.0	ND	TRICHLOROFLUOROMETHANE	5.0	ND
CHLOROBENZENE	5.0	ND	1,2,3-TRICHLOROBENZENE	5.0	ND
CHLOROFORM	5.0	ND	1,2,4-TRICHLOROBENZENE	5.0	ND
DIBROMOCHLOROMETHANE	5.0	ND	1,1,1-TRICHLOROETHANE	5.0	ND
1,2-DIBROMO-3-CHLOROPROPANE	5.0	ND	TRICHLOROETHANE	5.0	ND
1,2-DIBROMOETHANE (EDB)	5.0	ND	1,1,2-TRICHLOROETHANE	5.0	ND
DIBROMOMETHANE	5.0	ND	1,2,3-TRICHLOROPROPANE	5.0	ND
DICHLORODIFLUOROMETHANE	5.0	ND	1,3,5-TRIMETHYLBENZENE	5.0	ND
1,4-DICHLOROBENZENE	5.0	ND	1,2,4-TRIMETHYLBENZENE	5.0	ND
1,2-DICHLOROBENZENE	5.0	ND	TOLUENE	5.0	ND
1,3-DICHLOROBENZENE	5.0	ND	VINYL CHLORIDE	5.0	ND
1,3-DICHLOROPROPANE	5.0	ND	STYRENES	5.0	ND
1,2-DICHLOROPROPANE	5.0	ND	m & p-XYLENES	10.0	ND
2,2-DICHLOROPROPANE	5.0	ND	o-XYLENES	5.0	ND
1,1-DICHLOROETHANE	5.0	ND	METHYL-T-BUTYL ETHER	5.0	ND
1,1-DICHLOROPROPENE	5.0	ND			
1,2-DICHLOROETHANE	5.0	ND			

ND = Not Detected
J = Estimated Concentration
B = Detected in Method Blank

COMMENTS: Lab Sample ID: 9106140 - METHOD BLANK
Date Analyzed: 06/17/91
Analyzed by EPA Method 8260.

Signed: ______ Date: 8-6-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street · P.O. Box 12435 · Green Bay, WI
414-498-2222
FAX: 414-498-4067

GC/MS ORGANIC ANALYSIS SUMMARY

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVENUE
SUITE 1500
MILWAUKEE WI 53202

CONTACT: KRISTINE STEHR

PROJECT NAME:
SAS/PROJECT NUMBER: 202SS-003
BATCH NUMBER: 9201130

-CLIENT ID REPORTED ON FORMS AS EPA SAMPLE #
-SEMIVOLATILE ORGANIC ANALYSIS PERFORMED BY EPA METHOD 8270 ON A DB5 CAPILLARY COLUMN.

FORM INDEX:
- Form 1B - Semivolatile Organics Data Sheet, page 1
- Form 1C - Semivolatile Organics Data Sheet, page 2

"Q" COLUMN QUALIFIERS:
- U - Compound analyzed for but not detected
- D - Compound identified in the analysis at a secondary dilution
- B - Indicates the analyte is found in the associated method blank
- J - Estimated value, concentration of analyte below quantitation limit
- E - Compound exceeds calibration range

COMMENTS: High level PAH's detected.

Signed: [signature] Date: 1/24/92

1A

ACID FRACTION SEMIVOLATILE ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-3S

Lab Name: ORTEK Contract: 20255-003

Lab Code: ORTEK Case No: DM001 SAS No.: SDG No.: 122098

Matrix: (soil/water) WATER Lab Sample ID: 122098

Sample wt/vol: 995 (g/mL) ML Lab File ID: 201BB092

Level: (low/med) LOW Date Received: 01/21/92

% Moisture: not dec. dec. Date Extracted: 01/21/92

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 01/22/92

GPC Cleanup: (Y/N) N pH: Dilution Factor: 25

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	250	U
95-57-8	2-Chlorophenol	250	U
95-48-7	2-Methylphenol	250	U
106-44-5	4-Methylphenol	250	U
88-75-5	2-Nitrophenol	250	U
105-67-9	2,4-Dimethylphenol	250	U
65-85-0	Benzoic Acid	1300	U
120-83-2	2,4-Dichlorophenol	250	U
59-50-7	4-Chloro-3-methylphenol	250	U
88-06-2	2,4,6-Trichlorophenol	250	U
95-95-4	2,4,5-Trichlorophenol	1300	U
51-28-5	2,4-Dinitrophenol	1300	U
100-02-7	4-Nitrophenol	1300	U
534-52-1	4,6-Dinitro-2-Methylphenol	1300	U
87-86-5	Pentachlorophenol	1300	U

JAN 28 '92 09:55AM ORTEK

ACID FRACTION 1B / SEMIVOLATILE

~~SEMIVOLATILE ORGANICS~~ ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-3∅ S

Lab Name: ORTEK Contract: 20255-003

Lab Code: ORTEK Case No.: DM001 SAS No.: ________ SDG No.: 122098

Matrix: (soil/water) WATER Lab Sample ID: 122098

Sample wt/vol: 995 (g/mL) ML Lab File ID: 201BB092

Level: (low/med) LOW Date Received: 01/21/92

% Moisture: not dec. ____ dec. ____ Date Extracted: 01/21/92

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 01/22/92

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 25

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	250	U
111-44-4	bis(2-Chloroethyl)Ether	250	U
95-57-8	2-Chlorophenol	250	U
541-73-1	1,3-Dichlorobenzene	250	U
106-46-7	1,4-Dichlorobenzene	250	U
100-51-6	Benzyl Alcohol	250	U
95-50-1	1,2-Dichlorobenzene	250	U
95-48-7	2-Methylphenol	250	U
39638-32-9	bis(2-Chloroisopropyl)Ether	250	U
106-44-5	4-Methylphenol	250	U
621-64-7	N-Nitroso-Di-n-Propylamine	250	U
67-72-1	Hexachloroethane	250	U
98-95-3	Nitrobenzene	250	U
78-59-1	Isophorone	250	U
88-75-5	2-Nitrophenol	250	U
105-67-9	2,4-Dimethylphenol	250	U
65-85-0	Benzoic Acid	1300	U
111-91-1	bis(2-Chloroethoxy)Methane	250	U
120-83-2	2,4-Dichlorophenol	250	U
120-82-1	1,2,4-Trichlorobenzene	250	U
91-20-3	Naphthalene	20000	E
106-47-8	4-Chloroaniline	250	U
87-68-3	Hexachlorobutadiene	250	U
59-50-7	4-Chloro-3-Methylphenol	250	U
91-57-6	2-Methylnaphthalene	250	U
77-47-4	Hexachlorocyclopentadiene	250	U
88-06-2	2,4,6-Trichlorophenol	250	U
95-95-4	2,4,5-Trichlorophenol	1300	U
91-58-7	2-Chloronaphthalene	250	U
88-74-4	2-Nitroaniline	1300	U
131-11-3	Dimethyl Phthalate	250	U
208-96-8	Acenaphthylene	250	U
606-20-2	2,6-Dinitrotoluene	250	U

ACID FRACTION 1C SEMIVOLATILE

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW-3S

Lab Name: ORTEK Contract: 20255-003

Lab Code: ORTEK Case No.: DM001 SAS No.: ______ SDG No.: 122098

Matrix: (soil/water) WATER Lab Sample ID: 122098

Sample wt/vol: 995 (g/mL) ML Lab File ID: 201BB092

Level: (low/med) LOW Date Received: 01/21/92

% Moisture: not dec. ____ dec. ____ Date Extracted: 01/21/92

Extraction: (SepF/Cont/Sonc) SEPF Date Analyzed: 01/22/92

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 25

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	CONCENTRATION	Q
99-09-2	3-Nitroaniline	1300	U
83-32-9	Acenaphthene	1800	
51-28-5	2,4-Dinitrophenol	1300	U
100-02-7	4-Nitrophenol	1300	U
132-64-9	Dibenzofuran	1300	
121-14-2	2,4-Dinitrotoluene	250	U
84-66-2	Diethylphthalate	250	U
7005-72-3	4-Chlorophenyl-phenylether	250	U
86-73-7	Fluorene	2400	
100-10-6	4-Nitroaniline	1300	U
534-52-1	4,6-Dinitro-2-Methylphenol	1300	U
86-30-6	N-Nitrosodiphenylamine (1)	250	U
101-55-3	4-Bromophenyl-phenylether	250	U
118-74-1	Hexachlorobenzene	250	U
87-86-5	Pentachlorophenol	1300	U
85-01-8	Phenanthrene	6400	E
120-12-7	Anthracene	850	
84-74-2	Di-n-Butylphthalate	250	U
206-44-0	Fluoranthene	2800	
129-00-0	Pyrene	2600	
85-68-7	Butylbenzylphthalate	250	U
91-94-1	3,3'-Dichlorobenzidine	500	U
56-55-3	Benzo(a)Anthracene	2100	
218-01-9	Chrysene	1600	
117-81-7	bis(2-Ethylhexyl)Phthalate	250	U
117-84-0	Di-n-Octyl Phthalate	250	U
205-99-2	Benzo(b)Fluoranthene	3500	
207-08-9	Benzo(k)Fluoranthene	250	U
50-32-8	Benzo(a)Pyrene	1700	
193-39-5	Indeno(1,2,3-cd)Pyrene	660	
53-70-3	Dibenz(a,h)Anthracene	220	J
191-24-2	Benzo(g,h,i)Perylene	530	

(1) - Cannot be separated from Diphenylamine

ORTEK
ENVIRONMENTAL LABORATORY
414-498-2222
FAX: 414-498-4067
West Mason Street · P.O. Box [illegible] · Green Bay, WI [illegible]

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106140
Our lab # : 113657 Report Date: 07/16/91
Your sample ID: PRODUCT/MW-3S
Sample Matrix : WASTE

COLLECTION INFORMATION

Date/Time/By: 06/07/91 K S
Location :

Lab#	Test		Result	Units
113657	Silver	<	1.0	MG/KG
	Arsenic		0.7	UG/L
	Barium	<	1	MG/KG
	Cadmium	<	0.6	MG/KG
	Chromium	<	2	MG/KG
	Mercury	<	0.1	UG/L
	Lead		110	MG/KG
	Selenium	<	0.3	UG/L

Signed *Nikki Molberg* Date 7-16-91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
414-498-2222
FAX: 414-498-4067

CLIENT: DAMES & MOORE
ADDRESS: 250 E WISCONSIN AVE #1500
MILWAUKEE WI 53202

ATTENTION: KRISTINE STEHR
TELEPHONE: (414) 347-0800

Wisconsin Certification No. 405099530
Sample ID: PRODUCT/MW-3S
Sample Desc: OIL
Date Collected: 6-7-91
Date Received: 6-13-91
Results Sheet #: 1161
Batch No.: 9106140

PCB OIL ANALYSIS

PARAMETER	DETECTION LIMIT	CONCENTRATION	UNITS
Aroclor 1016	1.0	ND	mg/kg
Aroclor 1221	1.0	ND	mg/kg
Aroclor 1232	1.0	ND	mg/kg
Aroclor 1242	1.0	ND	mg/kg
Aroclor 1248	1.0	ND	mg/kg
Aroclor 1254	1.0	ND	mg/kg
Aroclor 1260	1.0	ND	mg/kg

ND = Not Detected

Comments: Lab Sample ID: 113657
Extraction Date: 6-14-91
Date Analyzed: 6-17-91
Analyzed by GC Method 8080 on a PTE-5 capillary column and confirmed on a SPB-608 capillary column. Extraction cleanup required.

Signed: [signature] Date: 6-19-91

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our Lab # : 113617 Report Date: 07/09/91
Your Sample ID: TOC/3-5
Sample Matrix : SOIL

COLLECTION INFORMATION

Date/Time/By: 06/06/91 K S
Location :

Lab#	test	Result	Units
113617	TOC	11700	mg/kg

Signed D. J. DeCarlo Date 7/25/91

Signed ____________________ Date ________

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our Lab # : 113618 Report Date: 07/09/91
Your Sample ID: TOC/7-9
Sample Matrix : SOIL

COLLECTION INFORMATION
Date/Time/By: 06/06/91 K S
Location :

Lab#	test	Result	Units
113618	TOC	29800	mg/kg

Signed D. J. DeCarlo Date 7/25/91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106124
Our Lab # : 113619 Report Date: 07/09/91
Your Sample ID: TOC/14-16
Sample Matrix : SOIL

COLLECTION INFORMATION

Date/Time/By: 06/06/91 K S
Location :

Lab#	test	Result	Units
113619	TOC	10500	mg/kg

Signed D. J. DeCarlo Date 7/25/91

Signed ______ Date ______

ORTEK
ENVIRONMENTAL LABORATORY
2496 West Mason Street P.O. Box 12435 Green Bay, WI 54307-2435
414-498-2222
FAX: 414-498-4067

- SAMPLE ANALYSIS REPORT -

To: DAMES & MOORE
250 E WISCONSIN AVE
SUITE 1500
MILWAUKEE WI 53202

Attn: KRISTINE STEHR

Batch ID : 9106140
Our Lab # : 113656 Report Date: 07/09/91
Your Sample ID: TOC/20-25
Sample Matrix : SOIL

COLLECTION INFORMATION
Date/Time/By: 06/11/91 J T
Location :

Lab#	test	Result	Units
113656	TOC	33300	mg/kg

Signed ________ Date 7-16-91

Signed ________ Date ________

ORTEK

Client: DAMES & MOORE Scope I.D.: 9102
Project: 9106124 Page: 1
Prepared by: Kristen Funk Date: 6/14/91
Checked by: Perry O. Kyle Date: 7/17/91

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor: Report Number: 7

Test Performed In General Accordance Of: ASTM: C136 and C117

General Data:

Sample Location:
Sample Number: 113620 GS 1-3
Depth of Sample: 1.0'-3.0'
Sampled by:
Sample Designated For: Classification

Date Sampled: 6/6/91
Dated Received: 6/13/91
Source of Sample:
Munsell Color Code: 2.5 YR. 2.5/0

Laboratory Data:

Date Tested: June 14-17, 1991
Test Performed by: KAF

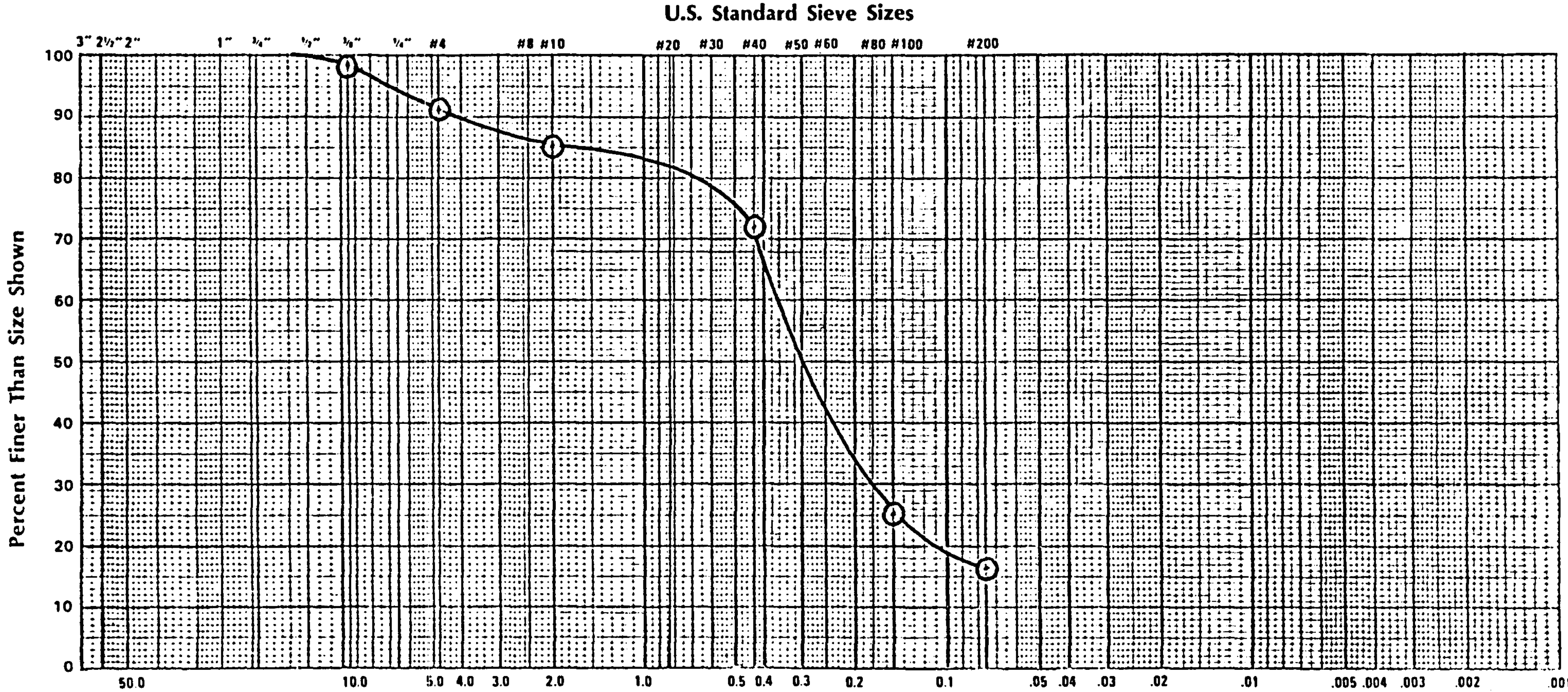
24 Hrs. Turn Around ____ Yes X No
Washed Gradation X Yes ____ No

Weight of Test Sample 460.8 Grams

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					
1½					
1					
3/4					
1/2	0	0	100		
3/8	6.7	1.5	98.5		
#4	34.3	7.4	91.1		
10	27.4	5.9	85.2		
40	60.6	13.2	72.0		
100	216.2	46.9	25.1		
200	40.2	8.7	16.4		
Pan	75.3	16.3			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 8.9	% = 5.9	% = 13.2	% = 55.7	% =	% =

Location Sampled: Subgrade Sample: Sample No. 113620 Elev. or Depth: 1.0'-3.0' Date Sampled: 6/6/91

Sample Source: Contaminated Soil - GS 1-3 Sampled Moisture Content (%): 8.0 Report No.: 7

Soil Classification (ASTM: D2487): SILTY SAND, fine to medium grained, black (SM)

Atterberg Limits: LL____ PL____ PI____

Munsell Color Code: 2.5 YR. 2.5/0

Date Received: 6/13/91

Coefficients: Cc = ____ Cu= ____

ORTEK

Client: DAMES & MOORE Scope I.D.: 9102

Project: 9106124 Page: 2

Prepared by: Robert Rouse Date: 7/5/91

Checked by: Perry O. [signature] Date: 7/17/91

FORM CE5019 (1/91)

ORTEK

Client: DAMES & MOORE Scope I.D.: 9102

Project: 9106124 Page: 1

Prepared by: Kristen Funk Date: 6/13/91

Checked by: Perry O. Kaplan Date: 7/17/91

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

Contractor: Report Number: 8

Test Performed In General Accordance Of: ASTM: C136 and C117

General Data:

Sample Location:

Sample Number: 113621 GS 5-7

Depth of Sample: 5.0'-7.0'

Sampled by:

Sample Designated For: Classification

Date Sampled: 6/6/91

Dated Received: 6/13/91

Source of Sample:

Munsell Color Code: 2.5 Y. 2/0

Laboratory Data:

Date Tested: June 13-17, 1991

Test Performed by: KAF

24 Hrs. Turn Around ___ Yes X No

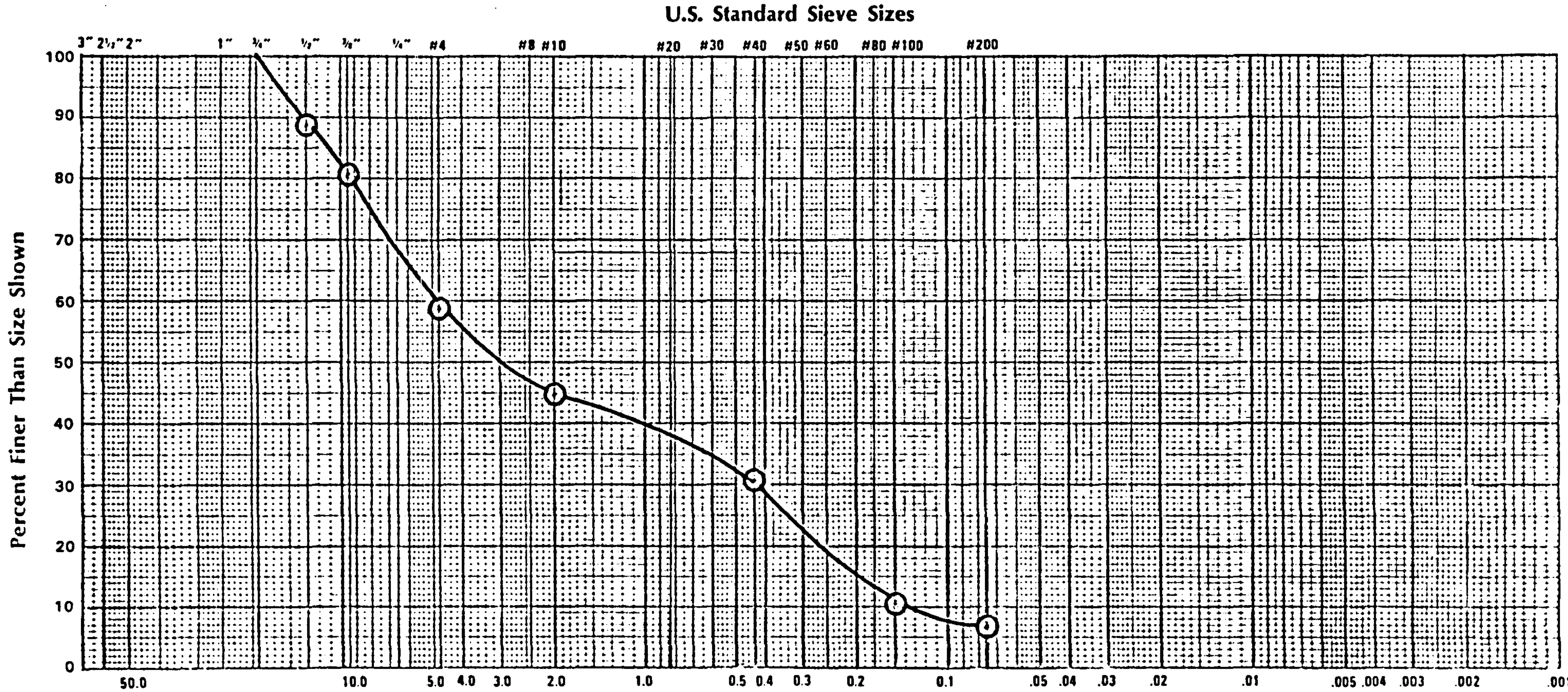
Washed Gradation X Yes ___ No

Weight of Test Sample 210.1 Grams

Sieve Size	Weight Retained (gms)	% Retained	% Passing	Project Specification % Passing By Weight	Source of Specification
3"					
1½					
1					
3/4	0	0	100		
1/2	23.4	11.1	88.9		
3/8	17.6	8.4	80.5		
#4	45.9	21.8	58.7		
10	29.2	13.9	44.8		
40	30.1	14.3	30.5		
100	41.7	19.8	10.7		
200	8.6	4.1	6.6		
Pan	14.1	6.7			

Remarks:

GRAIN SIZE DISTRIBUTION CURVE



Particle Size in Millimeters

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		
% =	% = 41.3	% = 13.9	% = 14.3	% = 23.8	% = 6.7	% =

Location Sampled: Subgrade Sample: Sample No. 113621 Elev. or Depth: 5'-7' Date Sampled: 6/6/91

Sample Source: Contaminated Soil - GS 5-7 Sampled Moisture Content (%): 20.7 Report No.: 8

Soil Classification (ASTM: D2487): SAND W/SILT and GRAVEL, fine to medium to coarse grained, black (SP-SM)

Atterberg Limits: LL____ PL____ PI ____

Munsell Color Code: 2.5 Y. 2/0

Date Received: 6/13/91

Coefficients: Cc = ____ Cu= ____

ORTEK

Client: DAMES & MOORE Scope I.D.: 9102

Project: 9106124 Page: 2

Prepared by: Robert Rouse Date: 7/5/91

Checked by: Jerry O. Kyl[illegible] Date: 7/17/91

FORM CES019 (1/91)

SOLUBILIZATION PROPERTIES OF ASPHALTENES

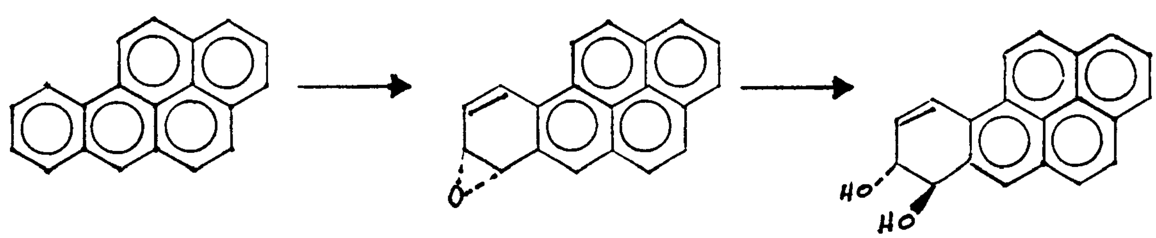
Ursula Borgerding Estate
March, 1992

1.0 PHYSICAL PROPERTIES AND REACTIONS OF PAHs

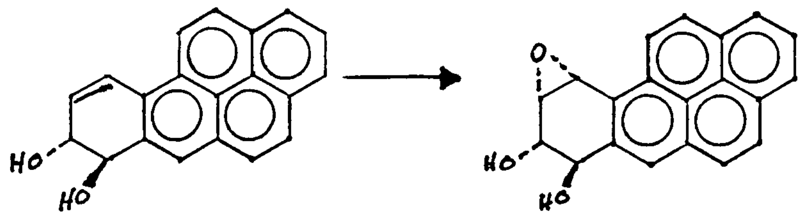
PAHs are crystalline solids having high melting and boiling points and low vapor pressures and water solubilities. PAHs are characterized by formula weights greater than 166 and contain least three fused rings. Less than three rings causes aromatic systems to be less volatile and more soluble (not withstanding other elements on the ring) (National Research Council of Canada, 1983). Lastly, PAHs have a strong affinity for particulate matter and will preferentially sorb to the particulates, thus creating a physical route of transportation through the atmosphere and aquatic environment. This same characteristic limits the migration of PAHs in the subsurface, as the compounds will preferentially sorb to the particulates in the aquifer materials.

1.1 Metabolic Reactions

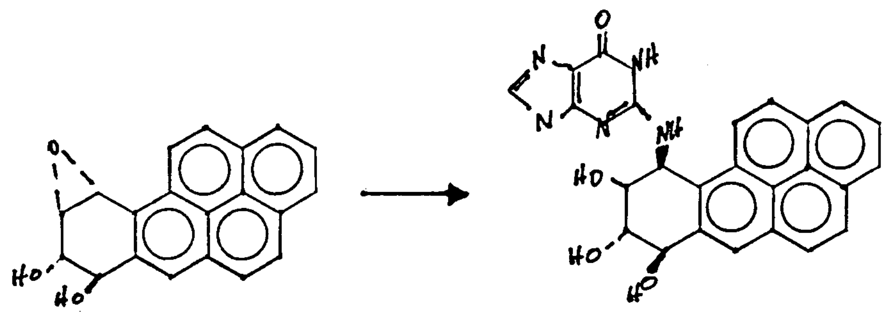
When a PAH enters a living organism, the organism will try to convert the PAH into a more water soluble compound which can be more readily excreted. It is the metabolic path of PAH conversion that produces the actual cancer-causing compounds. Taking benzo[a]pyrene as an example, observation shows that PAHs are generally converted first into an arene oxide (an epoxide in which the aromaticity of one ring has been destroyed). The next reaction is a nucleophilic substitution, where the solvent (water) contributes an hydroxide nucleophile to the epoxide. This reaction opens the epoxide ring to give a product containing two functional groups:



In some organisms, the products of this reaction undergo further reaction with hydroxide ions (hydrolysis) and are excreted without causing cancer. However, according to Morrison and Boyd (1987), these products sometimes undergo further epoxidation to yield dihydroxy epoxides. Again taking benzo[a]pyrene as an example, further epoxidation yields the diol epoxide:



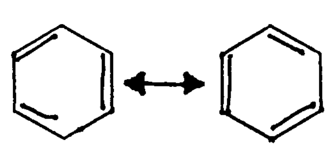
It is believed that these products are the actual carcinogens. The next question to consider is how these compounds cause cancer. The answer lies in a straightforward nucleophilic attack on the DNA of a cell. In this case, the $-NH_2$ of the nucleoside base in DNA guanine attacks the number ten carbon atom of the epoxide:



The observable damage is evident; the product is too large to fit into the DNA double helical structure and hydrogen can no longer bond to the other nucleoside base on the other strand, so mutant DNA results from this process (Morrison and Boyd, 1987).

1.2 Environmental Reactions

PAHs undergo reactions typical of aromatic organic molecules. Like benzene, PAH reactions are enhanced by the extensive electron delocalization in the ring system. For example, there are theoretically two different forms of benzene:



However, only one form of benzene has ever been isolated. It is postulated that the actual structure of benzene is a combination of these two forms, whereby the electrons are said to be "delocalized" and therefore shared among the carbon atoms. A common depiction of this structure shows the electrons on both sides of the benzene ring in a cloud-like formation. Due to the extensive ring systems of PAHs, this effect is even greater. Enhanced reactivity results from this electronic configuration.

Electron donating substituents on the PAH ring system, such as chlorine, substantially enhances reactivity. Another feature of the electronic configuration is that PAHs readily undergo photolysis because the electrons are more susceptible to excitation by solar energy. Other typical PAH reactions include electrophilic substitutions, 1,2– and 1,4– additions and addition/eliminations (Morrison and Boyd, 1987).

2.0 FORMATION IN THE ENVIRONMENT

PAHs are formed in the environment under conditions of extreme heat (> 2,000°C), producing PAHs with little to no alkylation (additional groups to the ring system). At medium temperatures (400-800°C), alkylated PAHs are formed. Temperatures such as these are typically produced by combustion.

There is also speculation that PAHs are produced by the transformation of biogenic material in sediments; however, this has not been adequately investigated. Diagenic processes, the physical and chemical changes occurring in sediments between the times of deposition and solidification, may also produce PAHs (National Research Council of Canada, 1983).

3.0 SOURCES OF POLYAROMATIC HYDROCARBONS

Sources of PAHs include transportation related emissions and industrial effluents. Once emitted to the atmosphere, the PAHs are dispersed and deposited, usually upon particulate matter. Because PAHs have a high affinity for particle surfaces, it is considered that many PAHs are associated with suspended particulate matter in both the atmospheric and aquatic environments (National Research Council of Canada, 1983). In addition, PAHs are also present in fossil fuels and heavy petroleum products, and during spills can be released directly to soil and surface water. Asphalts also contain high concentrations of PAHs, which, may be released to the environment by dissolution.

3.1 Fuel Consumption

The burning of wood and fossil fuels produces large quantities of atmospheric PAHs. Modern modes of transportation have caused vast amounts of PAH emissions with the invention of the internal combustion engine and industrial production of tires. In addition, coke production, aluminum production and charcoal manufacturing processes are all significant industrial producers of PAHs. Inefficient solid waste incineration also produces PAHs (incomplete combustion). Other environmental sources of PAHs include forest fires; both the high temperatures and the organic matter required for PAH production are present during forest fires (National Research Council of Canada, 1983).

3.2 Waterborne Sources

Waterborne sources of PAHs originate in municipal effluents, waste water from sanitary sewers, and storm drainage systems (National Research Council of Canada, 1983). These sources are typically products of operations involving the combustion of fossil fuels, where both non-contact and contact cooling water exposed to fossil fuel combustion products is discharged.

3.3 Industrial Effluents

Industrial effluents are the largest source of PAHs in the aquatic environment, and are created during the inefficient combustion and pyrolysis of organic materials. Significant levels of PAHs can occur in these effluents due to the industrial use of coal and coal products (National Research Council of Canada, 1983).

4.0 ENTRY

The majority of PAHs released to the atmosphere from combustion and pyrolytic sources are associated with airborne particles. PAHs preferentially sorb onto particulate matter through hydrogen-bonding processes. In these cases, the hydrogen bonds on the PAH molecule electrostatically orient the molecule to the oxygen functional groups on the particle surface and form a weak bond. These particle sizes are generally less than 2 μm.

Chemical decomposition occurs due to photolytic processes, producing free radicals which may react with other coexisting gaseous pollutants. Disregarding potential chemical decomposition, PAHs associated with fine particles may have residence times up to forty days in the atmosphere may be transported over long distances. However, atmospheric depositive processes are not well understood at this time (National Research Council of Canada, 1983).

5.0 ENVIRONMENTAL FATE

Solubility and sorption processes for PAHs are related; a concentration dependent equilibrium exchange exists between sorbed and soluble states, with the sorbed phase favored and a tiny fraction of PAHs in solution. In the laboratory, solubility is also influenced by compounds that incorporate PAHs into dissolved or collodial micelles. However, a certain micellar concentration several times greater than that found in the environment must be reached before this occurs (Morrison and Boyd, 1987).

Sorption studies reveal Van der Waals forces in action (dipole-dipole interactions between molecules that create a small electrostatic attraction). As these are weak forces, biological activity and dissolution could release the PAHs and thus make the PAHs more available for uptake by organisms or subject to sorption to particulate matter. Disruption of sediment layers can accelerate this process (Morrison and Boyd, 1987).

Sorption to suspended organic matter is more significant as the amount of total organic carbon increases, and is only slightly dependent upon the ionic strength of the solution. With marine sediments, these facts become more significant. In general, low molecular weight PAHs (such as naphthalene, phenanthrene, and anthracene) show no correlation with suspended particles but are subject to volatilization. Higher molecular weight PAHs (such as fluoranthrene, pyrene, and benzo[a]pyrene) do display correlations to suspended matter and have a maximum concentration at maximum turbidity (National Research Council of Canada, 1983).

Most photolytic studies and chemical oxidations have been conducted in non-aqueous environments. However, it is believed that photo-oxidation reactions of PAHs in aquatic systems produces quinones, which are considered hazardous (National Research Council of Canada, 1983).

Bacterial genera that degrade PAHs include Pseudomonas, Acinetobacter, Flavobacterium, Brevibacterium, Corynebacterium, Arthobacter, and Mycobacterium. Fungal genera include Cladosporium, Candida, Rhodotorula, Trichosporium, Torulopsis. Co-metabolic phenomena have also been observed. However, degradation rates depend upon the oxidation and reduction state, temperature, nutrient content, sediment structure, and bioavailability, all of which cannot be adequately duplicated nor predicted. It is known that lower weight PAHs degrade more rapidly than the higher weight PAHs, with the most complex PAHs being degraded the slowest. Large five ring PAHs (i.e. benzo[a]pyrene) are not observably degraded; it may be that these molecules are so strongly sorbed to particulate matter that these PAHs are simply unavailable (National Research Council of Canada, 1983).

6.0 ASPHALTENES

Asphaltenes are high-molecular weight compounds found in asphalt that can be broken down to form PAHs. The major constituent groups of asphalt are "asphaltenes, resins, and oils made up of saturated and unsaturated hydrocarbons" (Sittig, 1985). Asphaltenes have the highest molecular weights of these three, ranging from 1,000 to 2,600. Resins fall in the range of 370-500, and oils in the range of 290-630. Asphalts and tars have often been confused because the two are similar in appearance and are sometimes interchangeably used in the construction business. However, the differences are significant. Asphalt is a residue from fractional distillation of crude oil, whereas tars are produced by destructive distillation of coal, oil or wood (Sittig, 1985).

Asphalt consists mainly of the following compounds:

- saturated compounds (naphthenic or cycloparaffinic);

- aromatic compounds, containing single rings structures with long side chains and other condensed ring systems averaging 3 rings with shorter side chains and dimers of these molecules connected by saturated rings or chains; and

- small amounts of sulfur, nitrogen, and oxygen heteroatoms.

Generally, asphalt has been used to pave areas, from streets and highways to parking lots and driveways. The words "mineral pitch" and "bitumen" are used interchangeably with asphalt (Gosselin, 1984).

Petroleum asphaltenes are best described by the molecular types described above than by specific formulae. The proportion of asphaltenes in petroleum is dependent upon a number of factors, including source, depth of burial, specific gravity, and sulfur content of the crude oil (Speight and Moschopedis, 1979).

A number of researchers have attempted to classify the unique qualities of the asphaltic components. As early as 1908, Richardson defined the naphtha-soluble fractions as "petrolenes" and the insoluble fractions "asphaltenes." These terms were deliberately used in the plural to imply a solubility class as opposed to specific compounds. In 1916, J. Marcusson attempted to improve this scheme by introducing another term, whereby he divided asphalt into three components: neutral petroleum resins, asphaltenes, and asphaltous acids and their anhydrides. Strieter (1941) substituted pentane for naphtha in the precipitation of asphaltenes, thus altering the solubility definition for the asphaltenes class. Havens *et al.* (1956) further confirmed the existence of three discrete solubility fractions in asphalts (Havens, 1956). In 1957, Helm *et al.* attempted to evaluate the precipitation characteristics of asphaltenes with hydrocarbon solvents.

Mitchell and Speight (1972) dissolved Athabasca bitumen in an equal volume of benzene and subsequent dilution of the solution with 40 volumes of the specified solvent or solvent blend, and the yields were measured. A variety of hydrocarbon solvents were used. Earlier research (referenced in this paper) has shown that two types of asphaltenes exist in the Athabasca bitumen; one type lower in molecular weight and having few aromatic rings per unit (ie. six rings) and the other type having higher molecular weights and significantly more aromatic rings per unit (ie. thirty rings). Mitchell and Speight's research suggests that there is an apparent dissolution trend, whereby solvents such as *n*-alkanes, 2-methyl hydrocarbons, *n*-alkenes, and blends of benzene and *n*-pentane will dissolve only the lower molecular weight members of the asphaltene fraction while the more complex members remain insoluble.

The question remaining is why does this phenomenon occur? McKay et al. (1978) discusses why this precipitation transpires. Petroleum is a delicately balanced system of compounds that are dependent upon each other for solubility. This balance can be changed by adding large amounts of *n*-pentane, resulting in precipitation of some compounds. McKay suggests that two factors are responsible for maintaining the solubility of the compounds in complex mixtures (such as petroleum):

- the ratio of polar to non-polar molecules (in this discussion, polar compounds are those that are capable of hydrogen bonding with other polar molecules, such as carboxylic acids, phenolic groups, amides, etc.); and

- the ratio of high molecular weight to low molecular weight molecules.

In simple mixtures, polar and non-polar compounds are not miscible (are not mutually soluble). In more complex mixtures, such as petroleum, the polar and non-polar compounds are miscible as long as a certain ratio of these compounds is maintained. When this ratio is altered, such as by a large addition of a non-polar solvent such as *n*-pentane, polar molecules are less soluble. These less soluble polar molecules form hydrogen-bonded aggregates of nonuniform size and precipitate as asphaltenes. McKay also suggests that the occurrence of non-polar compound types such as aromatic hydrocarbons with the polar components of the asphaltenes may result from occlusion of non-polar molecules with aggregates of polar molecules.

When the ratio of high molecular weight to low molecular weight molecules is upset, large molecules precipitate. In principal, the solubility of molecules in a mixture is an additive phenomenon. Therefore, in a complex system such as asphalt, the ratio of low, medium, and high molecular weight compounds is a delicate balance and addition of small molecules such as *n*-pentane will destroy the balance and cause precipitation of asphaltenes, leaving PAH compounds in solution. McKay states that a solution having a small average molecular weight cannot dissolve the largest molecules in petroleum, and so these molecules precipitate as asphaltenes.

James Speight and Speros Moschopedis in 1979 continued with McKay's work and suggested that it is the carbon to hydrogen ratio that controls this precipitation. These researchers found that with *n*-pentane as the precipitating medium, the amounts of carbon and hydrogen in the precipitate vary over a surprisingly narrow range: 83 ± 3% C: 8.1 ± 0.7% H. It is this constancy that has led to the suggestion that asphaltenes have a definite composition. Because of this composition, asphaltenes are precipitated by hydrocarbon solvents, not only because of solubility properties.

The 1,000 gallon diesel spill at the Ursula Borgerding site resulted in a large influx of smaller alkane compounds and BTEX (benzene, toluene, ethyl-benzene, and xylene) compounds to the asphalt surface. The free product found on the ground water on the site, which consisted primarily of gasoline and diesel fuel, contained polyaromatic hydrocarbons, which contain at least three aromatic rings. This situation correlates with Mitchell and Speight's findings, that *n*-alkanes will dissolve the lower molecular weight fractions of bitumen. It is conceivable that the large addition of diesel fuel altered both the ratio of polar to non-polar molecules and the ratio of high to low molecular weight molecules in the asphalt, and this alteration may have resulted in the precipitation of the asphaltenes and the solubilization of smaller molecular weight components, such as the PAHs discovered at the site.

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