STATEMENT OF BASIS

for

Occidental Chemical Corporation
Montague Township, Michigan
EPA I.D. No. MID 006 014 906

February 15, 2001

Statement of Basis for Occidental Chemical Corporation Located in Montague Township, Michigan

INTRODUCTION

This Statement of Basis (SB) explains the proposed remedy for contaminated groundwater, soil, and sediment at the Occidental Chemical Corporation (OCC) facility. In addition, the SB includes summaries of all corrective measure scenarios evaluated by OCC. The United States Environmental Protection Agency (U.S. EPA) will select a final remedy for the OCC facility only after the public comment period has ended and the information provided by the public has been reviewed and substantive comments considered.

This SB is being issued by U.S. EPA as part of its public participation responsibilities under the Resource Conservation and Recovery Act (RCRA). The document summarizes information that can be found in greater detail in the final RCRA Facility Investigation (RFI) and Corrective Measure Study (CMS) Reports and other pertinent documents contained in the Administrative Record. U.S. EPA encourages the public to review these documents in order to gain a more comprehensive understanding of the OCC facility and the RCRA activities that have been conducted.

U.S. EPA may modify the proposed remedy or select another remedy based on new information or public comments. Therefore, the public is encouraged to review and comment on all corrective measure scenarios. The public can be involved in the remedy selection process by reviewing the documents contained in the Administrative Record and attending the public meeting scheduled for March 1, 2001 at the Montague Township Hall.

PROPOSED REMEDY

The U.S. EPA is proposing the following remedy to address all contaminated media at and from the OCC facility:

- Continued collection of contaminated groundwater by the purge well system and treatment using carbon filtration before discharge to White Lake;

- Evaluation and implementation of feasible on-site collection/treatment options for contaminated groundwater and residual waste to expedite groundwater cleanup;

- Implementation of a groundwater monitoring program to ensure the long-term integrity of the remedy and protection of human health and the environment;

- *In situ* treatment of on-site contaminated surface soil, or in the alternative, excavation and off-site thermal treatment;

- *In situ* treatment and containment of contaminated sediment in White Lake combined with "hotspot" removal, or in the alternative, dredging and on-site treatment;

- Long-term maintenance of site access controls; and

- Implementation of institutional controls that restrict land and groundwater use.

A more detailed discussion of U.S. EPA's proposed remedy is provided in the following sections.

FACILITY BACKGROUND

The OCC facility is located in Montague Township, Muskegon County, Michigan, just west of the town of Montague, Michigan and just north of White Lake. Land use surrounding the OCC facility is residential to the east and south, industrial and woodlots to the west, and undeveloped woodlots to the north. Private wells are located to the south and east. Residences to the south were connected to the Montague public water supply in 1976.

The manufacturing portion of the OCC facility was operated from 1952 until 1983. OCC produced gaseous chlorine, sodium hydoxide, hydrogen gas, and fine chemical derivatives (hexachlorocyclopentadiene, muriatic acid, hydrochloric acid). Hexachlorocyclopentadiene is a raw material used in the production of other chemicals, including pesticides, flame retardants, resins, dyes, pharmaceuticals, and plastics. Various volatile organic compounds (chloroform, carbon tetrachloride, trichloroethylene, tetrachloroethylene), C-series compounds (hexachlorobutadiene, hexachlorocyclopentadiene, octachlorocyclopentene, hexachlorobenzene), and mirex were generated as hazardous wastes during the manufacturing operations.

On October 30, 1979, the Ingham County Michigan Circuit Court entered a Consent Judgement to address contamination at the OCC facility. In the following years, wastes and contaminated soil were excavated and placed in an on-site containment vault; a purge well system was installed to halt the movement of contaminated groundwater into White Lake; and a groundwater monitoring program was implemented to evaluate the effectiveness of the purge well system. The adequacy of the cleanup performed by OCC remained in dispute with the State of Michigan throughout the 1980's.

On March 24, 1993, U.S. EPA issued a RCRA Administrative Order that required OCC to conduct the necessary investigations to fully identify the nature and extent of contamination at the facility and to evaluate and implement the long-term corrective measures necessary to protect human health and the environment. From 1993 through 2000, OCC continued operation and maintenance of the purge well system and monitoring, conducted a water user survey, installed fencing to restrict site access, removed an uncontrolled asbestos waste pile, conducted field investigations (RFI), and evaluated corrective measure alternatives (CMS) to address contamination posing a risk to human health and the environment. The results of the interim measures, RFI, and CMS follow.

Interim Corrective Measures

° Over 2.5-billion gallons of contaminated groundwater has been collected by the purge well system and treated on-site to remove contaminants. This resulted in the removal of approximately 60,000-pounds of chlorinated organic hazardous wastes from the environment that potentially discharge to White Lake.

° Water users were identified in the vicinity of the groundwater contaminant plume. Groundwater being used by nearby residences was sampled in 1994. The survey confirmed that there was no exposure to contaminated groundwater at nearby residences.

° Approximately two miles of 8-foot high, 9-gauge wire fencing was installed in 1994 to restrict site access to 170 acres of the former manufacturing area where soil impacts were identified in the RFI.

° Four-hundred cubic yards of soil and asbestos-containing material were removed from a 4,800 square foot area in October 2000 near Dowie's Point and disposed off-site.

Investigation Results

° Contaminated groundwater in the sand underlying the OCC facility was encountered from 20 to 50 feet below the ground surface. The contaminant plume extends from the northern disposal areas to the purge well system located at White Lake (approximately 6500 feet long). The maximum width of the plume is approximately 2000 feet (see Figure 1). The plume is contained entirely on OCC property except for a small portion at the northern portion of Blueberry Ridge. Contaminants that exceed State of Michigan drinking water criteria along with their maximum detected concentrations are chlorides (12,100,100 parts per billion [ppb]), carbon tetrachloride (46,000 ppb), chloroform (520 ppb), tetrachloroethylene (73,000 ppb), trichloroethylene (2,300 ppb), hexachlorobutadiene (890 ppb), hexachlorocyclopentadiene (1,100 ppb), hexachloroethane (1,800 ppb), and octachlorocyclopentene (61 ppb).

° The source of groundwater contamination appears to be from activities associated with the northern disposal areas (residue, brine sludge), the central brine sludge disposal areas, the former fine chemicals production facility, and the former chlorine production plant. Residual contamination or a dense non-aqueous phase liquid (DNAPL) of C-series and volatile organic compounds appears to be present in groundwater at the northern residue disposal area and the former fine chemicals production facility. The DNAPL is a continuing source of groundwater contamination.

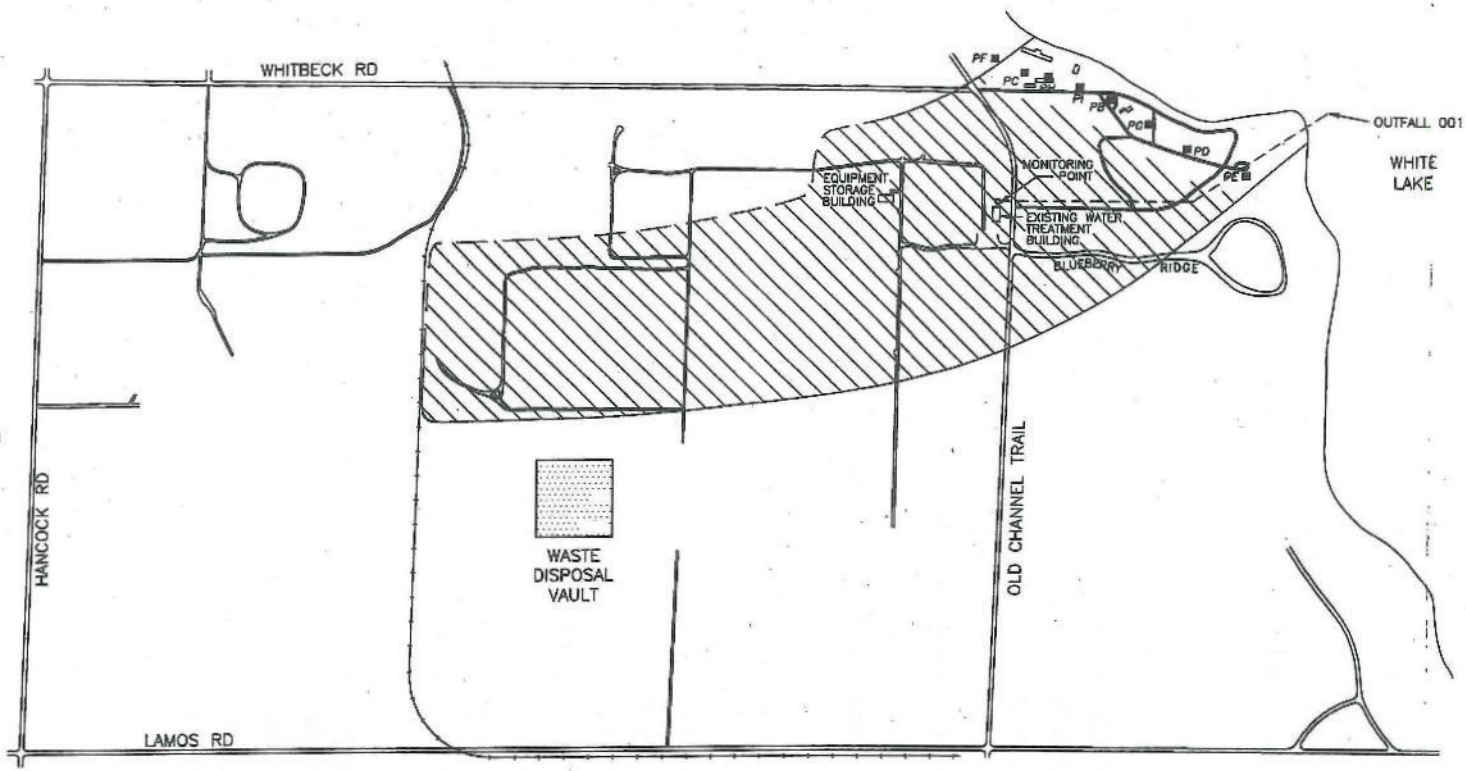


FIGURE 1

GROUNDWATER BASELINE LAYOUT & PLUME DEFINITION

GLEN SPRINGS HOLDINGS, INC.
MONTAGUE, MICHIGAN

AUGUST, 2000 24791.01

EARTH TECH

° Surface soil (upper 2 feet) in the northern, central, southern, former burn pit, and former small disposal pile exposure areas (see Figure 2) are locally contaminated with C-series compounds (hexachlorocyclopentadiene, octachlorocyclopentene, and hexachlorobenzene), mirex, and volatile organic compounds (carbon tetrachloride, methylene chloride, and tetrachloroethylene). Surface soil is locally contaminated with dioxin and furan compounds in the stack fall and former burn pit exposure areas.

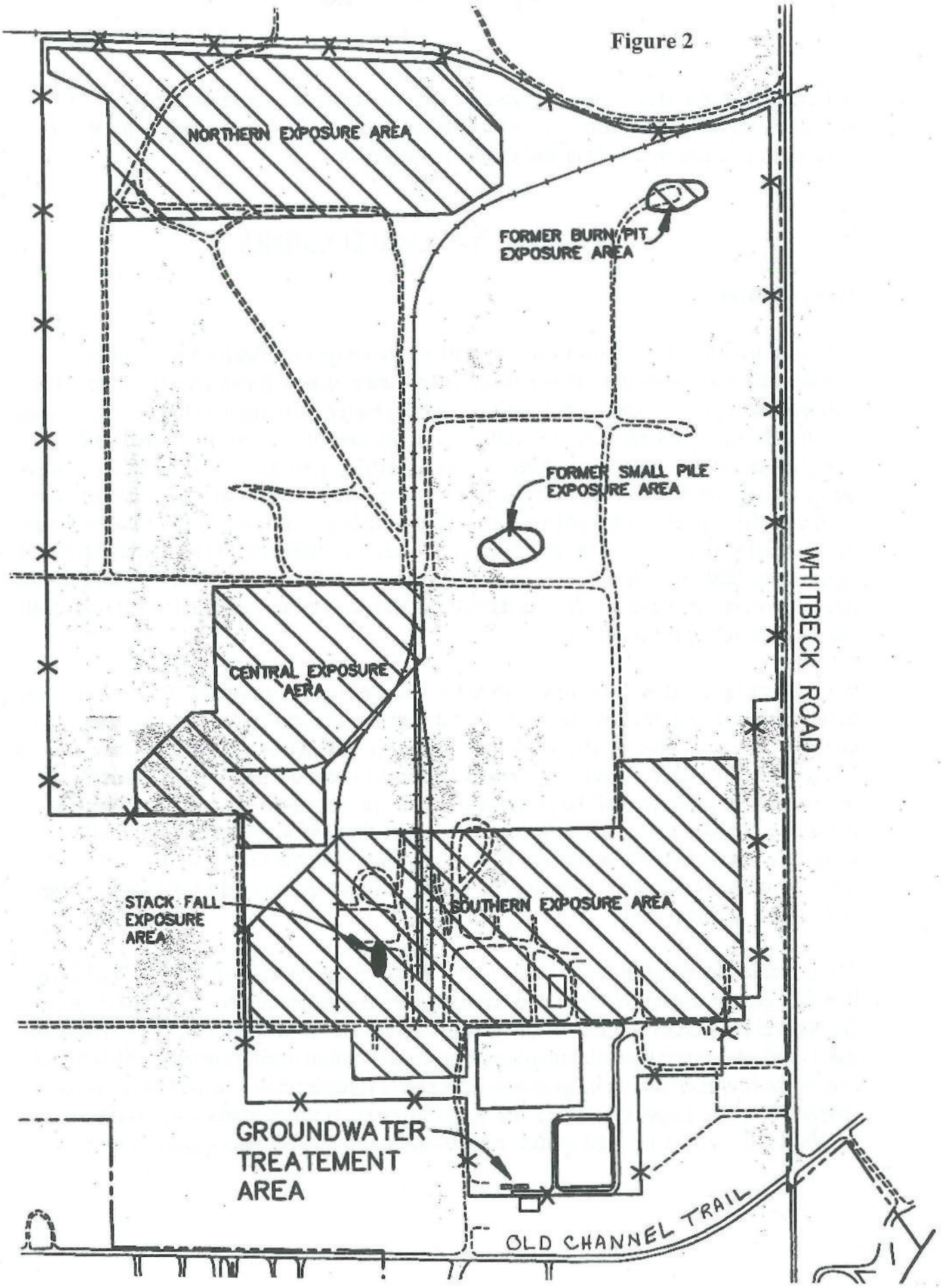
° OCC performed a treatability study to assess bioremediation of surface soil. The results of the study will be available in March 2001. Based on U.S. EPA research, proposed Daramend® bioremediation appears to be a viable technology for breaking down resistant C-series compounds present in surface soil at the OCC facility.

° The nature and extent of subsurface contamination (below 2 feet) was not extensively investigated within the designated exposure areas. Subsurface soil sampling was focused at the perimeter of each exposure area to confirm the areal limit of potential subsurface contamination. There were no significant detections of volatile organic or C-series compounds in the perimeter soil borings. Soil borings within two exposure areas (northern and central) detected significant concentrations of tetrachloroethylene, C-series compounds (hexachlorobutadiene, hexachlorocyclopentadiene, octachlorocyclopentene, and hexachlorobenzene), and mirex in subsurface soil. These locations were used for residue disposal and fine chemical production.

° At least 3,000 cubic yards of sediment at the OCC outfall to White Lake is contaminated with PCBs, C-series compounds (hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, and octachlorocyclopentene), and asbestos. There is an approximate 1,250 square foot "hotspot" area just beneath the outfall where significant concentrations of PCBs (>100 ppm) occur. PCBs and C-series compounds were not found in surface water but significant concentrations were found in zebra mussels inhabiting the highly contaminated sediment area. The source of contamination appears to be historical discharges from the OCC outfall. Current outfall monitoring shows no ongoing releases of C-series compounds to White Lake.

° OCC performed a treatability study to assess the bioremediation of White Lake sediment using BioGeoCheMix™ but U.S. EPA concluded the data to be invalid because the methodology produced highly variable results. The ability to break down PCBs and C-series compounds in White Lake sediment is unknown and significant testing is required before approval.

Figure 2


NORTHERN EXPOSURE AREA
FORMER BURN PIT EXPOSURE AREA
FORMER SMALL PILE EXPOSURE AREA
WHITBECK ROAD
CENTRAL EXPOSURE AERA
STACK FALL EXPOSURE AREA
SOUTHERN EXPOSURE AREA
GROUNDWATER TREATEMENT AREA
OLD CHANNEL TRAIL

° Contaminated soil is a source of volatile organics emitted to ambient air at the OCC facility. Tetrachloroethylene was most frequently detected in air samples, with lesser detections of trichloroethylene and carbon tetrachloride.

SUMMARY OF FACILITY RISKS

Groundwater

A human health risk assessment was performed to address residential exposure to contaminated groundwater. This potential exposure pathway is incomplete because the contaminated groundwater is not used as drinking water. The risk calculated for exposure to groundwater is not expected to occur. The estimated cancer risk associated with potential groundwater exposure from residential drinking water is 3.4×10^{-1}. This risk is equivalent to three additional persons in ten contracting cancer from a lifetime exposure to these contaminants. This potential risk substantially exceeds U.S. EPA's upper range of potential risk of 1 in 10,000 and warrants a corrective measure to protect human health in the event that groundwater is consumed. The non-cancer health effects associated with hexachlorocyclopentadiene, such as damage to human organs, were also found to exceed the acceptable hazard standard.

The goal of the proposed corrective measure is to cleanup groundwater and mitigate risks to human health and the environment. Groundwater cleanup objectives include three components: groundwater cleanup levels, point of compliance, and remediation time frames. Groundwater cleanup levels represent specific concentrations of chemicals designed to be protective of the groundwater use and other possible routes of exposure. Point of compliance represents the locations where the media cleanup levels should be achieved. Remediation time frames typically include both the time it would take to implement the remedy and the estimated time to achieve the groundwater cleanup levels at the point of compliance.

The groundwater cleanup levels at the OCC facility are derived from State of Michigan Part 201 generic cleanup criteria and screening levels developed under the authority of the Natural Resources and Environmental Protection Act (Michigan Part 201). These are risk-based goals such that attaining the given concentration during cleanup will not result in adverse health effects or in an excess cancer rate (greater than 1 in 100,000). Since groundwater discharges to White Lake, more stringent groundwater/surface water interface criteria may be used as the groundwater cleanup level where applicable.

The point of compliance for groundwater represents where groundwater cleanup levels should be achieved within a contaminated aquifer. The groundwater point of compliance for RCRA Corrective Action should be throughout the area where groundwater is contaminated above the cleanup levels, or, when waste is left in place, at and beyond the boundary of the waste management area encompassing the original sources of groundwater contamination. U.S. EPA typically refers to this point of compliance as the "throughout-the-plume/unit boundary" point of compliance.

The groundwater cleanup levels below are typically exceeded throughout-the-plume as evident in groundwater sampled at the Northern Exposure Area, Central Exposure Area, Old Channel Trail, Blueberry Ridge, and purge well system at White Lake. In the vicinity of the former fine chemicals production facility (Central Exposure Area), groundwater cleanup levels are exceeded in the deeper portion of the sand aquifer for chlorides, trichloroethylene, and tetrachloroethylene.

GROUNDWATER CONTAMINANT	GROUNDWATER CLEANUP LEVEL (ppb)
Carbon tetrachloride	5.0
Chloride	125,000*
Chloroform	100
cis-1,2-dichloroethylene	70
trans-1,2-dichloroethylene	100
Hexachlorobutadiene	0.053*
Hexachlorobenzene	1.0
Hexachlorocyclopentadiene	50
Hexachloroethane	6.7*
Mirex	0.02
Octachlorocyclopentene	50
Tetrachloroethylene	5.0
Trichloroethylene	5.0

* Groundwater/Surface Water Interface Criteria

Surface Soil

Human health and ecological risk assessments were performed at six exposure areas: 1) Northern; 2) Central; 3) Southern; 4) Stack Fall; 5) Former Burn Pit; and 6) Former Small Disposal Pile. The exposure areas are shown in Figure 2.

Northern Exposure Area - This area was used for disposal of wastes from brine operations and fine chemical production. Soil from the Northern Exposure Area was excavated and placed in the on-site landfill over 15 years ago. Clean soil from the construction of the on-site landfill was used to grade the area.

The presence of tetrachloroethylene, hexachlorobenzene, octachlorocyclopentene, and/or mirex was found at 32 of the 62 surface soil sample locations at respective maximum concentrations of 0.26 parts per million (ppm), 17 ppm, 5.3 ppm, and 20 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Northern Exposure Area is 2.3×10^{-7}. This is equivalent to two additional persons in ten-million contracting cancer from exposure to these contaminants in an industrial setting. This potential risk does not exceed U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000 nor do any of the maximum concentrations exceed Michigan Part 201 soil cleanup goals for industrial/commercial II property. The non-cancer health effects associated with octachlorocyclopentene, such as damage to human organs, were also found not to exceed the acceptable hazard standard.

In a residential setting, the risk to human health posed by surface soil contamination in the Northern Exposure Area is 1.2×10^{-6}, which slightly exceeds U.S. EPA's acceptable lower range of potential risk. The maximum concentrations of hexachlorobenzene and mirex also exceed Michigan Part 201 soil cleanup goals for residential/commercial I property. The proposed corrective measure to address this risk is an institutional control that restricts residential development.

Hazards to ecological receptors such as the deer mouse, bob-white, white-tailed deer, and red-tailed hawk from contaminated surface soil do not exceed the acceptable hazard standard.

Central Exposure Area - This area was the location of the Fine Chemicals Production Facility. It includes contaminated soil associated with fine chemical production (e.g., "No Mans Land") and a brine sludge disposal area. Soil excavated from the area was placed in the on-site landfill over 15 years ago and a large depression remains from the excavation.

The presence of tetrachloroethylene, carbon tetrachloride, hexachlorobenzene, hexachlorocyclopentadiene, octachlorocyclopentene, hexachlorobutadiene, and/or mirex was found at 26 of the 60 surface soil sample locations at respective maximum concentrations of 1.0 ppm, 0.054 ppm, 1.3 ppm, 81 ppm, 25 ppm, 17 ppm, and 0.083 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Central Exposure Area is 2.2×10^{-7}. This is equivalent to two additional persons in ten-million contracting cancer from an exposure to these contaminants in an industrial setting. This potential risk does not exceed U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000 nor do any of the maximum concentrations exceed Michigan Part 201 soil cleanup goals for industrial/commercial II property. The non-cancer health effects associated with hexachlorocyclopentadiene and octachlorocyclopentene, such as damage to human organs, were also found not to exceed acceptable hazard standards.

In a residential setting, the risk to human health posed by surface soil contamination in the Central Exposure Area is 9.4×10^{-7}, which is slightly below U.S. EPA's acceptable lower range of potential risk. None of the maximum concentrations exceed Michigan Part 201 soil cleanup goals for residential/commercial I property. Any potential risk will be addressed by an institutional control that restricts residential development.

Hazards to ecological receptors such as the deer mouse, bob-white, white-tailed deer, and red-tailed hawk from contaminated surface soil do not exceed the acceptable hazard standard.

Southern Exposure Area - This area was the location of various piles, impoundments, tank farms, ground stains, and storage areas. Production of hydrogen gas, chlorine gas, and caustic from brine occurred in this area. All production facilities were demolished in 1995 and 1996, foundations excavated to two-feet below grade, and the area graded and seeded.

The presence of tetrachloroethylene, carbon tetrachloride, chloroform, trichloroethylene, hexachlorobenzene, octachlorocyclopentene, hexachloroethane, and/or mirex was found at 37 of the 56 surface soil sample locations at respective maximum concentrations of 0.43 ppm, 0.12 ppm, 0.4 ppm, 0.11 ppm, 3.5 ppm, 1.5 ppm, 0.11 ppm, and 0.81 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Southern Exposure Area is 2.7×10^{-7}. This is equivalent to two or three additional persons in ten-million contracting cancer from an exposure to these contaminants in an industrial setting. This potential risk does not exceed U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000 nor do any of the maximum concentrations exceed

Michigan Part 201 soil cleanup goals for industrial/commercial II property. The non-cancer health effects associated with octachlorocyclopentene, such as damage to human organs, were also found not to exceed the acceptable hazard standard.

In a residential setting, the risk to human health posed by surface soil contamination in the Southern Exposure Area is 9.8×10^{-7}, which is slightly below U.S. EPA's acceptable lower range of potential risk. None of the maximum concentrations exceed Michigan Part 201 soil cleanup goals for residential/commercial I property. Any potential risk will be addressed by an institutional control that restricts residential development.

Hazards to ecological receptors such as the deer mouse, bob-white, white-tailed deer, and red-tailed hawk from contaminated surface soil do not exceed the acceptable hazard standard.

Stack Fall Exposure Area - This area is where the stack from the former power plant fell during demolition. Three soil samples were collected after the rubble was cleared and analyzed for dioxins and furans.

Dioxins and furans were found in all three surface soil samples at a maximum concentration (total toxicity equivalents) of 0.00071 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Stack Fall Exposure Area (approximately 0.1 acres) is 2.6×10^{-5}. This is equivalent to two or three additional persons in one-hundred thousand contracting cancer from an exposure to these contaminants in an industrial setting. This potential risk does not exceed U.S. EPA's acceptable upper range of potential risk of 1 in 10,000 nor does the maximum concentration exceed U.S. EPA's dioxin/furan cleanup level of 0.005 ppm for commercial/industrial soil or Michigan Part 201 cleanup criteria of 0.00099 ppm for industrial/commercial II property.

In a residential setting, the risk to human health posed by dioxin and furan surface soil contamination in the Stack Fall Exposure Area is 1.8×10^{-4}, which slightly exceeds U.S. EPA's acceptable upper range of potential risk of 1 in 10,000. The maximum concentration also exceeds the Michigan Part 201 soil cleanup goal of 0.00009 ppm for residential/commercial I property. This unacceptable risk will be addressed by an institutional control that restricts residential development.

Hazards to the deer mouse from dioxin/furan contaminated surface soil exceed the acceptable hazard standard but are not exceeded for the bob-white, white-tailed deer, and red-tailed hawk. Because of the small exposure area (0.1 acres) and the lack of an

unacceptable hazard to species higher in the food chain, a corrective measure to protect the deer mouse is not warranted.

Former Burn Pit Exposure Area - This area was used to burn trash from 1952 through 1978. All debris in the area and the top three-inches of underlying soil was excavated and placed in the on-site landfill over 15 years ago.

The presence of tetrachloroethylene, carbon tetrachloride, chloroform, hexachlorobenzene, hexachlorocyclopentadiene, octachlorocyclopentene, hexachlorobutadiene, mirex and/or dioxins/furans was found at 7 of the 25 surface soil sample locations at respective maximum concentrations of 7.5 ppm, 0.29 ppm, 0.18 ppm, 18 ppm, 12 ppm, 17 ppm, 4.4 ppm, 0.067 ppm, and 0.000022 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Former Burn Pit Exposure Area is 2.4×10^{-6}. This is equivalent to two or three additional persons in one-million contracting cancer from an exposure to these contaminants in an industrial setting. This potential risk slightly exceeds U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000 but none of the maximum concentrations of soil contaminants exceed Michigan Part 201 soil cleanup goals for industrial/commercial II property. The non-cancer health effects associated with hexachlorocyclopentadiene and octachlorocyclopentene, such as damage to human organs, were found not to exceed the acceptable hazard standard. The proposed corrective measure to address the potential risk associated with industrial exposure is placement of clean fill and topsoil, and grading and seeding of the excavated area to prevent direct contact with contaminants in the soil. Groundwater monitoring will be performed in four monitoring wells located along Whitbeck Road to ensure that groundwater cleanup levels are not exceeded due to migration of soil contaminants in the former burn pit to groundwater.

In a residential setting, the risk to human health posed by surface soil contamination in the Former Burn Pit Exposure Area is 1.38×10^{-5}, which exceeds U.S. EPA's acceptable lower range of potential risk. The maximum concentrations of carbon tetrachloride and hexachlorobenzene also exceed Michigan Part 201 soil cleanup goals for residential/commercial I property. The proposed corrective measure to address this risk is an institutional control that restricts residential development.

Hazards to the deer mouse from contaminated surface soil slightly exceed the acceptable hazard standard but are not exceeded for the bob-white, white-tailed deer, and red-tailed hawk. The placement of clean fill and topsoil, and grading and seeding of the excavated area will prevent direct contact with contaminants in the soil, improve the habitat, and protect the environment.

Former Small Disposal Pile Exposure Area - This area was used in the 1950's and 1960's to dispose of brine sludge from the chlor-alkali production area. All debris in the area and the top three-inches of underlying soil was excavated and placed in the on-site landfill over 15 years ago.

The presence of tetrachloroethylene, carbon tetrachloride, chloroform, hexachlorocyclopentadiene, octachlorocyclopentene, and/or mirex was found at 8 of the 21 surface soil sample locations at respective maximum concentrations of 0.064 ppm, 0.062 ppm, 0.12 ppm, 3,300 ppm, 750 ppm and 0.11 ppm. The estimated cancer risk associated with industrial exposure to surface soil in the Former Small Disposal Pile Exposure Area is 4.3×10^{-7}. This is equivalent to four additional persons in ten-million contracting cancer from an exposure to these contaminants in an industrial setting. This potential risk does not exceed U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000. The non-cancer health effects associated with hexachlorocyclopentadiene and octachlorocyclopentene, such as damage to human organs, approaches the acceptable hazard standard and the maximum concentrations of hexachlorocyclopentadiene and octachlorocyclopentadiene exceed the Michigan Part 201 soil cleanup goal of 720 ppm for both industrial/commercial II and residential/commercial I property. The proposed corrective measure to address this potential health hazard is a combination of *in situ* bioremediation using Daramend® technology in the southwest and northeast portions of the Former Small Disposal Pile Exposure Area and an institutional control that restricts the area from residential development. A successful demonstration of Daramend® technology to remediate contaminated soil in the former small disposal pile exposure area could allow for additional remediation of on-site contaminated soil currently being addressed through institutional controls.

Hazards to the deer mouse from contaminated surface soil significantly exceed the acceptable hazard standard but are not exceeded for the bob-white, white-tailed deer, and red-tailed hawk. The proposed corrective measure will temporarily disrupt the habitat but result in reduced hazards to the deer mouse when the soil cleanup goals are attained and the habitat is restored.

Subsurface Soil

Subsurface soil was not extensively investigated in the exposure areas. At the western edge of the Northern Exposure Area, subsurface soil sampled in two borings (greater than 10-feet deep) was found to be contaminated with C-series compounds, especially at the water table. At the location of the former fine chemicals production facility in the Central

Exposure Area (including "No Mans Land"), subsurface soil sampled in two borings (greater than 6-feet deep) was found to be contaminated with volatile organic and C-series compounds. In the Southern Exposure Area, none of the samples from four borings (greater than 4-feet deep) showed any contamination.

There is currently no risk from exposure because subsurface contaminants are found at a substantial depth below surface. However, contaminants in subsurface soil are a continuing source of groundwater contamination and could be encountered during future development of the OCC property. The corrective measures proposed to address subsurface contamination are supplemental on-site collection/treatment of contaminated groundwater and residual waste, and institutional controls that restrict subsurface excavations and residential development.

Ambient Air

Air sampling was conducted in the large Northern, Central, and Southern Exposure Areas. The potential cancer risks associated with exposure to ambient air and indoor air were all below U.S. EPA's acceptable lower range of potential risk of 1 in 1,000,000. In addition, none of the maximum concentrations detected in each area exceeded the Michigan Part 201 indoor air and ambient air cleanup goals for both industrial/commercial II and residential/commercial I property.

White Lake Sediment

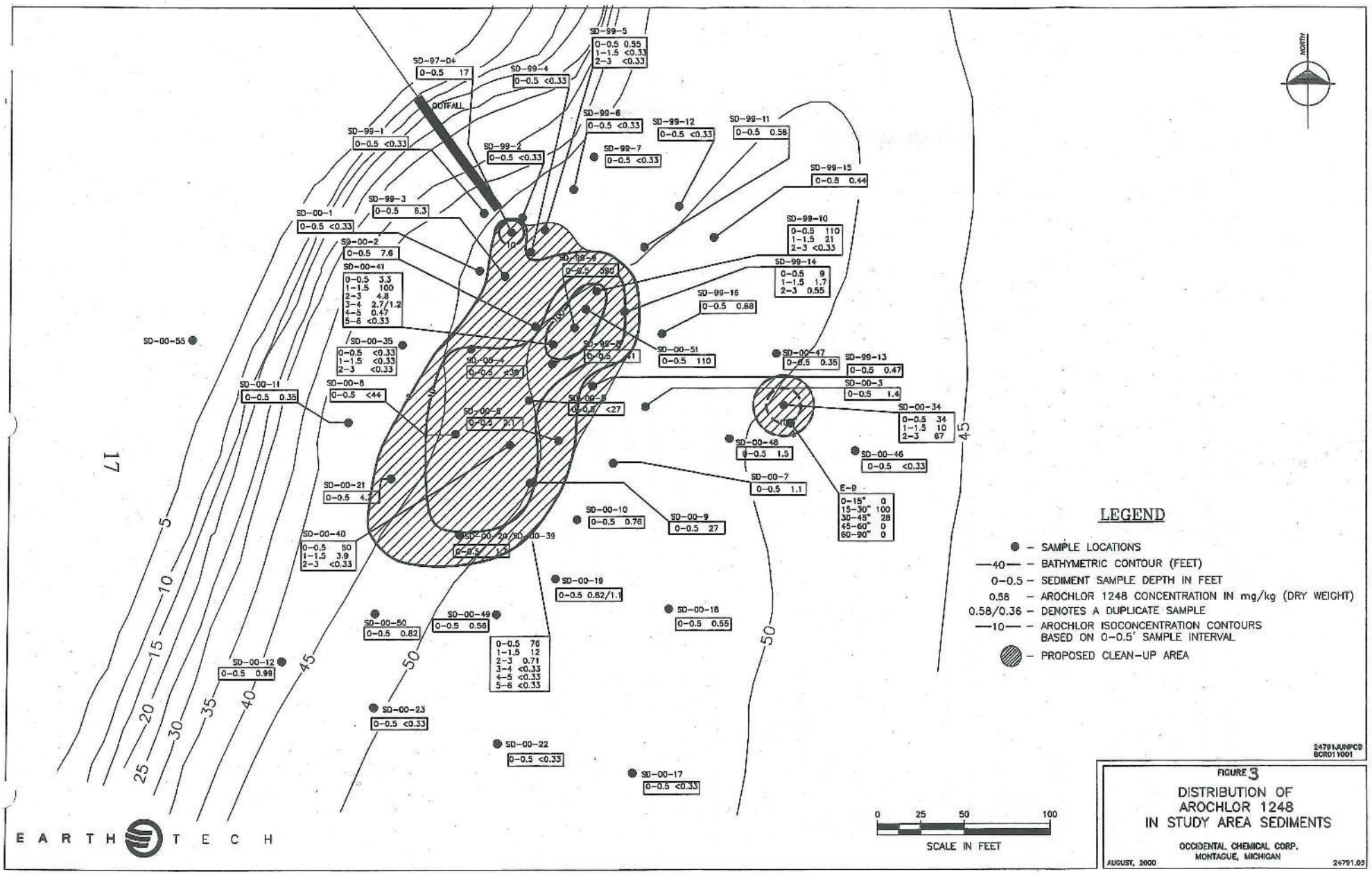
A human health and ecological risk assessment was performed to address exposure to contaminated sediment in the vicinity of the OCC outfall (White Lake Study Area). The outfall currently discharges treated groundwater from the OCC facility at a depth of 34-feet below the lake surface. A trough up to 65-feet deep is in the vicinity of the outfall. In the past, the outfall discharged process wastewater from organic and inorganic chemical manufacturing, and cooling water from a power plant.

The presence of PCBs (Aroclor 1248), hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloroethane, and octachlorocyclopentene were found in 54 of 75 sediment sample locations within the White Lake Study Area (23 acres) at respective maximum concentrations of 390 ppm, 110 ppm, 130 ppm, 330 ppm, 0.15 ppm, and 530 ppm. The estimated cancer risk associated with the consumption of fish within the White Lake Study Area by adults is 1.4×10^{-3}. This estimate uses conservative assumptions, including 15 grams of fish are eaten per day for 30 years, half of the fish eaten are caught from the White Lake Study Area which represents only 1% of White

Lake, and that fish spend half their time and obtain half their food from the White Lake Study Area. This potential risk exceeds U.S. EPA's acceptable upper range of potential risk of 1 in 10,000. Most of the cancer risk is associated with PCB (Aroclor 1248) accumulation in fish. The non-cancer health effects associated with the uptake of C-series compounds in fish and their ingestion by humans was also found to slightly exceed the acceptable hazard standard for children. Most of the health effects are associated with hexachlorobenzene and octachlorocyclopentene.

The proposed corrective measure to address this potential risk and health hazard is *in situ* bioremediation and capping provided these measures can be demonstrated to be effective in reducing toxicity and minimizing releases to the environment. Since bioremediation and capping may take up to three years to complete, U.S. EPA proposes "hotspot"removal of the most contaminated sediment (>100 ppm of PCB) during the first year to immediately reduce the toxicity of the sediment and the volume of contamination while bioremediation is investigated (see Figure 3). An alternative corrective measure would be to dredge and treat all of the contaminated sediment if bioremediation is not proven to be effective in reducing toxicity prior to capping.

Hazards to ecological receptors such as benthic organisms that live in the sediment (e.g., zebra mussels, scuds, snails), fish (large-mouth bass and common carp), mammals (river otter), and birds (herring gull and bald eagle) were evaluated. The acceptable hazard standard was exceeded for receptors living within the aquatic environment, including benthic organisms, large-mouth bass, and common carp, along with the herring gull which consumes these species. Almost all of the hazard to ecological receptors is associated with PCBs (Aroclor 1248). The proposed corrective measure will temporarily disrupt the White Lake habitat but minimize hazards to the environment when the sediment cleanup goals are attained and the habitat restored.



24791JUNPCB
BCR011001

FIGURE 3

DISTRIBUTION OF
AROCHLOR 1248
IN STUDY AREA SEDIMENTS

OCCIDENTAL CHEMICAL CORP.
MONTAGUE, MICHIGAN

AUGUST, 2000 24791.03

SCOPE OF CORRECTIVE ACTION

Many of the environmental problems at the OCC facility have been addressed through the Michigan Consent Judgement and implementation of interim corrective measures under the Order. These actions have helped stabilize the release of site contaminants to air, soil, and water. Final corrective measures are still necessary to fully address the remaining contaminants in the groundwater, soil, and sediment.

Contaminated groundwater is a principal threat at this facility because of the long-term potential for direct ingestion through drinking water wells and discharge to surface water. The short-term cleanup objective is to contain the migration of contaminated groundwater and the long-term objective is to reduce the contaminant concentrations throughout the plume below Michigan Part 201 cleanup goals in a reasonable time.

Localized areas of contaminated soil are a risk due to the long-term potential for direct human contact and migration of contaminants to groundwater. The cleanup objectives are to reduce the contaminant concentrations below Michigan Part 201 cleanup goals, reduce contributions to groundwater in a timely manner, and isolate contaminated soil from direct contact.

Contaminated sediment in White Lake is a threat to the aquatic environment and people consuming fish from the lake. The cleanup objectives are to minimize exposure to contaminated sediment by eliminating the exposure pathway. Calculations show that the elimination of concentrations of PCBs and hexachlorobenzene at levels above 2 ppm and 0.45 ppm respectively, in the White Lake Study Area sediment would remove significant ecological risks and reduce cancer risk and health hazards to an acceptable level for adults and children.

SUMMARY OF CORRECTIVE MEASURE SCENARIOS

The corrective measure scenarios analyzed to cleanup groundwater, soil, and sediment contamination at and from the OCC facility are presented below. These scenarios generally correspond with those outlined in the Final CMS Reports (Revision 1, 12/21/00 and 1/25/01).

° **Baseline Controls:** Institutional controls to restrict the entire former industrial area to non-residential use only; institutional controls to restrict water rights in the industrial area and in the area of the groundwater contaminant plume; and maintenance of fencing along the property line to restrict site access to the former industrial portion of the facility.

° **Groundwater Scenario 1:** Baseline Controls and Existing Pump and Treat (Purge Well) System.

° **Groundwater Scenario 2:** Baseline Controls, Existing Pump and Treat (Purge Well) System, and Two Additional Pump and Treat Systems.

° **Groundwater Scenario 3:** Baseline Controls, Existing Pump and Treat (Purge Well) System, and Two Dual-Phase Vapor Extraction Systems.

° **Site Scenario 1:** Capping of Surface Soil in Former Small Disposal Pile Exposure Area.

° **Site Scenario 2:** *In situ* Daramend® Bioremediation of Surface Soil in Former Small Disposal Pile Exposure Area.

° **Site Scenario 3:** *Ex situ* Daramend® Bioremediation of Surface Soil in Former Small Disposal Pile Exposure Area.

° **Site Scenario 4:** On-site Thermal Treatment of Surface Soil in Former Small Disposal Pile Exposure Area.

° **Site Scenario 5:** Off-site Thermal Treatment of Surface Soil in Former Small Disposal Pile Exposure Area.

° **Site Scenario 6:** On-site Disposal of Surface Soil in Former Small Disposal Pile Exposure Area.

° **White Lake Study Area Scenario 1:** *In situ* Bioremediation of White Lake Sediment Using BioGeoChe Mix™.

° **White Lake Study Area Scenario 2:** *In situ* Capping of White Lake Sediment.

° **White Lake Study Area Scenario 3:** *In situ* Bioremediation and Capping of White Lake Sediment Using BioGeoChe Mix™ (Scenarios 1 and 2).

° **White Lake Study Area Scenario 4:** Contained Aquatic Disposal of Dredged White Lake Sediment.

° **White Lake Study Area Scenario 5:** On-site Disposal of Dredged White Lake Sediment.

° **White Lake Study Area Scenario 6A:** On-site Thermochemical Treatment of Dredged White Lake Sediment.

° **White Lake Study Area Scenario 6B:** On-site Vitrification Treatment of Dredged White Lake Sediment.

OCC has estimated the capital cost, annual operation and maintenance (O&M) cost, and net present value associated with each corrective measure scenario.

Corrective Measure Scenario	Estimated Capital Cost	Annual O&M Cost	Net Present Value*
Baseline Controls	$ 35,000	$ 0	$ 35,000
Groundwater 1	$ 20,000	$ 850,000	$ 12,200,000
Groundwater 2	$ 1,633,000	$ 1,639,000	$ 37,324,000
Groundwater 3	$ 4,542,000	$ 2,447,000	$ 51,810,000
Surface Soil Site 1	$ 76,000	$ 31,000	$ 524,000
Surface Soil Site 2	$ 147,000	$ 0	$ 147,000
Surface Soil Site 3	$ 268,000	$ 0	$ 268,000
Surface Soil Site 4	$ 3,765,000	$ 0	$ 3,765,000
Surface Soil Site 5	$ 372,000	$ 0	$ 372,000
Surface Soil Site 6	$ 327,000	$ 120,000	$ 2,050,000
White Lake Study Area 1	$ 1,088,000	$ 90,000	$ 2,292,000
White Lake Study Area 2	$ 584,000	$ 67,000	$ 1,475,000
White Lake Study Area 3	$ 1,237,000	$ 67,000	$ 2,128,000
White Lake Study Area 4	$ 847,000	$ 134,000	$ 2,223,000
White Lake Study Area 5	$ 1,545,000	$ 148,000	$ 3,022,000
White Lake Study Area 6A	$ 3,299,000	$ 67,000	$ 3,784,000
White Lake Study Area 6B	$ 3,817,000	$ 67,000	$ 4,302,000

* O&M costs included in net present value are for a 30 year period. The actual remediation period may be longer for groundwater scenarios.

EVALUATION OF PROPOSED REMEDY

The proposed remedy to cleanup contaminated groundwater, soil, and sediment at and from the OCC facility is:

- Groundwater Scenario 1 (pump and treat), including baseline controls, plus supplemental collection and treatment measures to expedite cleanup (e.g., *in situ* oxidation, dual-phase extraction system, sparge-assisted soil vapor extraction).

- Surface Soil Site Scenario 2 (bioremediation), with contingent Surface Soil Site Scenario 5 (thermal treatment), and modified Surface Soil Site Scenario 1 (soil cover); and

- White Lake Study Area Scenario 3 (bioremediation and capping) and "hotspot" removal of small area containing the most contaminated sediment, with contingent White Lake Study Area Scenario 6A (dredging and thermochemical treatment).

The estimated net present value of the proposed remedy ranges from $14,586,000 to $16,467,000. The upper range of the estimate includes contingent excavation and treatment of contaminated soil, and dredging and treatment of contaminated sediment. The estimate does not include costs associated with supplemental measures to expedite groundwater cleanup and remove small area of contaminated sediment to reduce toxicity.

The following discussion profiles the performance of the proposed remedy against technical, environmental, human health, and institutional criteria.

1. **Technical.** Performance of the proposed remedy is evaluated through effectiveness and useful life. Institutional controls to restrict land and groundwater use, and fencing to restrict site access are expected to be effective when combined with the proposed engineered controls. The U.S. EPA will ensure OCC's responsibility for institutional controls and will coordinate the controls with state and local government. The groundwater remedy (purge well system) will continue to perform its intended function of containing, collecting, and treating contaminated groundwater to eliminate releases to White Lake. The effectiveness of technologies to treat residual wastes contributing to groundwater contamination has been demonstrated at other facilities but additional study to identify the specific areas of residual waste and further characterize the site geology are necessary before proceeding. Monitoring wells installed within the groundwater contaminant plume will demonstrate cleanup and monitoring wells installed at the

perimeter of the groundwater contaminant plume will ensure that groundwater cleanup levels are being met and that the plume is not expanding.

A study of the effectiveness of bioremediating surficial soil should be available in March. If proven to be effective, it may have application at other areas of the OCC facility. In the alternative, excavation and disposal are effective measures for eliminating the risk posed by contaminated soil. Topsoil application effectively isolates minimally contaminated soil from human contact and mammals.

The effectiveness of the chosen technology to bioremediate White Lake sediment requires additional study of at least one year. In addition, characterization of natural forces influencing the contaminated sediment area is needed to ensure that capping will effectively isolate the contaminated sediment from the White Lake environment as long as necessary. In the alternative, dredging is a proven technology for remediating contaminated sediment. Thermochemical treatment of PCBs and asbestos-containing material is an effective technology for destroying the contaminants contained in sediment.

Reliability of the proposed remedy is evaluated through operation and maintenance (O&M) requirements and demonstrated reliability. An O&M Manual would prescribe maintenance requirements for the fence to restrict access. The groundwater remedy has a proven record of having minimal risk of failure and has established O&M procedures. The bioremediation of contaminated soil and sediment needs further demonstration of reliability before it can be implemented, but in the alternative, thermochemical treatment has proven reliability. Capping sediment is a reliable technology, provided applicable EPA guidance is followed to demonstrate the appropriateness of capping sediment in White Lake. Proper cap construction that addresses the site-specific conditions must be fully identified to minimize long-term O&M requirements.

Implementability of the proposed remedy is evaluated through its constructability and the time required for implementation and improvements. Institutional controls will be implemented in accordance with the U.S. EPA-approved CMI Work Plan. The groundwater remedy has already been partially installed and continues to provide beneficial results. Supplemental remediation of groundwater contamination sources requires additional time (at least one year) but technologies are available to implement source cleanup (e.g., *in situ* oxidation, dual-phase extraction system, sparge-assisted soil vapor extraction) which would improve groundwater conditions in a more timely manner. If bioremediation can be

demonstrated for contaminated soil and sediment, improvements could be seen within two years. More immediate improvements are proposed by early "hotspot" removal of a small area of sediment that contains a significant volume of the contamination. In the alternative, thermochemical treatment could be implemented within a similar time frame if bioremediation does not prove feasible.

Safety of the proposed remedy is evaluated for workers, nearby communities and the local environment. The chances for fire, explosion and exposure to hazardous constituents are considered. The purge well system has a proven safety record. An O&M manual would be developed to further ensure safety through proper maintenance. Technologies applicable to the treatment of contaminant sources would be screened to ensure the safety of workers, nearby residences, and the environment. Any corrective measure activities associated with contaminated soil and sediment require the development of a health and safety plan. Potential impacts on the White Lake environment from bioremediation/capping or dredging/thermochemical treatment need to identified and minimized during implementation.

2. **Environmental.** The selected remedy should provide the greatest improvement to the environment over the shortest period of time. Adverse effects from the implementation of the remedy should be minimized.

Maintaining the current purge well system as the sole technology to address groundwater contamination protects White Lake but is not feasible to cleanup groundwater since it would take hundreds of years to improve the groundwater conditions. Expedited cleanup of the groundwater will be achieved by investigating and implementing alternative methods for removing the residual wastes contributing to ongoing groundwater contamination. For on-site treatment, discharge of treated groundwater must meet State of Michigan standards. The bioremediation of soil may take months longer than excavation and disposal but has the potential to reduce the toxicity of contaminated soil rather than moving it to another location for long-term maintenance. If effective, it also may have application to improve other areas of the OCC facility that would benefit the environment. Bioremediation and capping of contaminated sediment will prevent releases and adverse effects on the White Lake environment provided that additional study can demonstrate the technology to be effective. Early "hotspot" removal will substantially improve the White lake environment in a short period of time. In the alternative, dredging of contaminated sediment would immediately

improve the White Lake environment and thermochemical treatment would eliminate the contaminants contributing to sediment toxicity.

3. **Human Health.** The selected remedy should mitigate the short-term and long-term potential for exposure to contaminants and protect human health during and after its implementation. Compliance with existing State of Michigan and U.S. EPA criteria, standards or guidelines is essential.

   The overall protection of human health is addressed effectively for groundwater by institutional controls and the purge well system. The purge well system restricts the migration of contaminants into White Lake and the institutional controls restrict groundwater usage within the contaminant plume. However, future protection may be diminished because of the extremely long time frames (hundreds of years) that these corrective measures would have to be in place. Supplemental measures to address residual waste and groundwater contaminants at the source areas would expedite cleanup and address these long-term concerns. Compliance with groundwater cleanup levels would be addressed by a groundwater monitoring program.

   Bioremediation of contaminated soil to Michigan Part 201 cleanup goals will mitigate industrial exposure to contaminants at the Former Small Disposal Pile Exposure Area. In the alternative, soil excavation and off-site thermal treatment will also mitigate exposure. A soil cover at the Former Burn Pit Exposure Area will mitigate industrial and environmental exposure.

   Bioremediation and capping of contaminated sediment will eliminate the pathway into the White Lake environment that increases the human cancer risk associated with fish consumption. Effective and reliable bioremediation and capping are essential to prevent the long-term migration of contaminants into the White Lake environment. Long-term potential risk due to failure of the cap is minimized by a reduction in the toxicity of sediment from "hotspot" removal and biodegradation of resistant compounds. In the alternative, dredging and thermochemical treatment of contaminated sediment will also eliminate this pathway. Appropriate measures will be employed during dredging to prevent the dispersal of contaminants into the White Lake environment.

4. **Institutional.** The selected remedy should address applicable Federal, State and local standards, regulations and ordinances for the design, operation and timing of each corrective measure scenario.

On-site treatment of contaminated groundwater has addressed applicable regulations over its history. Michigan Part 201 cleanup goals have been designated for groundwater and soil. Applicable permits for construction and operation of additional on-site treatment units and discharges will be assessed and may increase the time necessary for implementation of the corrective measure scenarios. Design documents for components that require State or Federal permits will be submitted early on during the corrective measures implementation process and performed concurrently, where possible, to reduce the time necessary for implementation.

Based on information currently available, the proposed remedy provides the best balance of corrective measure scenarios with respect to the evaluation criteria. U.S. EPA believes that the proposed remedy is protective of human health and the environment and will effectively control the exposure to contaminants in groundwater, soil, and sediment. In the alternative, contingent remedies are in place if bioremediation does not meet the required performance standards. All applicable standards regarding groundwater protection and on-site/off-site waste management would be addressed and complied with during the corrective measures implementation process.

PUBLIC PARTICIPATION

U.S. EPA solicits input from the community on the corrective measures proposed for cleanup of contaminated groundwater, soil, and sediment. The public is also invited to provide comment on corrective measure scenarios not addressed in this Statement of Basis. U.S. EPA has set a public comment period from March 1, 2001 through April 15, 2001, to encourage public participation in the selection process. The comment period will begin with a public meeting where U.S. EPA will present the investigations results and the proposed remedy, answer pertinent questions, and accept oral comments.

The public meeting is scheduled for Thursday, 7:00 p.m., March 1, 2001, at the Montague Township Hall located at 8915 Whitbeck Road, Montague, Michigan, telephone number (231) 894-4414.

The Administrative Record for the OCC Facility is available at the following locations:

Montague Branch Muskegon County Library
8778 Ferry Street
Montague, Michigan 49437
(231) 893-2675

White Lake Community Library
3900 White Lake Drive
Whitehall, Michigan 49461
(231) 894-9531

U.S. EPA, Region 5
Waste, Pesticides and Toxics Division Records Center
77 West Jackson Boulevard, 7th Floor
Chicago, Illinois 60604-3590
(312) 886-0902
Hours: Mon-Fri, 8:00 a.m. - 4:00 p.m.

After consideration of the comments received, U.S. EPA will select the remedy and document the selection in the Final Decision and Response to Comments. In addition, public comments will be summarized and responses provided. The Final Decision and Response to Comments will be drafted at the conclusion of the public comment period and incorporated into the Administrative Record.

To send written comments or request technical information on the OCC facility, please contact:

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To request information on the public comment period process, please contact:

Ms. Terri Rancher
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