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CHRYSLER CORPORATION

CONCEPTUAL REMEDIATION PLAN
CHRYSLER KENOSHA MAIN PLANT
NORTH AREA

(SITES MP-2, MP-3, AND MP-16)

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INTRODUCTION

Chrysler Corporation (Chrysler) has been engaged with a multi-phased site assessment and remedial activities at the Chrysler Kenosha Main Plant North Area since 1989. Because the characterization of subsurface conditions indicates that portions of the North Area exhibit impacted groundwater and soils, Chrysler intends to implement focused remedial activities at this location. Assisting Chrysler with the remedial activities shall be Triad Engineering Inc. (Triad) of Milwaukee, Wisconsin.

The goal of the site remediation at the Kenosha Main Plant North Area are to prevent the migration of impacted areas and to remove the source of impacts from the groundwater and soil. This goal can be met by capturing and treating groundwater and using the treated groundwater to stimulate natural bacterial degradation.

The conceptual remediation plan for the North Area presented herein addresses the following elements:

- Groundwater control and treatment
- Conceptual configuration
- Work plan
- Schedule

Included in this plan are figures showing the preliminary layout and typical recovery system construction.

GROUNDWATER CONTROL AND TREATMENT

Control

The migration of impacted groundwater can be controlled by the implementation of a planned collection system. The system design shall take into account the location of the impacted groundwater, the hydraulic conductivity of the soils, the regional groundwater flow, and site constraints including slabs, paving, buried utilities and subsurface foundation conditions. Based on these factors, a series of collection trenches and extraction sumps shall be installed to provide the required hydraulic control of the site. The collection system shall also be designed to minimize the withdrawal of clean water. Information provided in the Phase I, II, and III reports and subsequent progress reports of the monitoring program shall be used to locate and design the groundwater recovery system.

Computer modeling techniques shall be applied to verify that proper hydraulic control shall be achieved, and shall aid in optimally locating the trenches and extraction sumps and in sizing pumping/treatment systems. It appears that a trench design would be preferred due to the relatively low hydraulic conductivity of the soils. Extraction wells may be installed in subsequent phases for areas where trench construction would be impaired due to site constraints.

Treatment

The extracted groundwater shall need to be treated to a level suitable for sewer discharge and/or infiltration. Chrysler and their representatives shall work closely with the City of Kenosha and the Wisconsin DNR to establish the treatment and associated discharge criteria for treatment scenarios prior to the design of a treatment system. Treatment shall most likely consist of oil/water separation followed by treatment for removal of organic compounds with activated carbon or biological treatment. Because of winter conditions, infiltration may not be feasible during this period. As such, discharge shall be directed to the sanitary sewer in cold weather. Should this discharge to the sanitary sewer require treatment under winter or start-up conditions, preliminary treatment of groundwater consisting of filtration, and activated carbon shall be implemented. In warmer weather, biologically treated water shall be introduced to selected portions of the collection system via an infiltration gallery system to minimize discharge to the sanitary sewer system.

An aerobic biodegradation process to degrade the compounds of concern in the groundwater at the Chrysler Kenosha North Main Plant Area shall be evaluated for long-term treatment. The compounds of concern include organics which are amenable to aerobic biodegradation. This was determined by a previously completed bioremediation study (CleanTech, 1992). The microorganisms which shall be cultured to degrade the compounds of concern at the North Area shall be indigenous to the site. Indigenous bacteria are utilized since this allows for accelerated adaptation of the microorganisms to the altered environment. Samples of the groundwater which contain indigenous bacteria shall be taken to a laboratory and cultured. The bacteria shall be cultured in order to provide a suitable seed for the bioreactor system. The results from the bioremediation study which was previously completed shall be utilized to provide for proper growth amendments for the bacterial seed. The groundwater shall also be analyzed to determine pH, dissolved oxygen, ammonia, BOD, COD, phosphate and other essential characteristics of the groundwater. A process study shall be completed to determine the retention time requirements and other necessary system information.

Reactor design is a critical aspect to an effective remediation program. At this site, a multistage, fixed-film, upflow reactor is proposed. A fixed-film reactor allows for long cell retention times which subsequently reduce biomass. The process involves oxidation, synthesis, and endogenous respiration. During oxidation, bacteria secrete enzymes that act as catalysts to convert waste to a form that can be digested by bacteria. The process releases energy which the organisms capture along with the oxidized wastes to grow and reproduce in the synthesis process. As the food source is reduced, bacteria enter the endogenous respiration phase in which biomass is consumed. A fixed-film layer shall form on the plastic media in the reactor. Suspended bacterial growth shall also develop in the voids of the media. As air bubbles rise through the reactor, they are sheared in the plastic media. The process is continually monitored to maintain an optimal environment to accelerate bacterial growth.

The major design elements of the in-situ biostimulation treatment system are:

1. Trench systems downgradient of the source area to intercept the impacted groundwater. The pumping rate shall be determined by the portion of the plume which requires treatment. As previously discussed, this rate shall in turn be modeled using a digital computer to determine proper control of the groundwater.

2. Treatment of the pumpage, as previously described, reducing the contaminants to a level suitable for infiltration.

3. Inoculation of the treated effluent with nutrients and oxygen for infiltration via infiltration galleries (perforated pipe installed in shallow trenches).

The infiltration in the source area is managed so that biological degradation are optimized. Again, site constraints related to paving and subsurface debris shall be considered in the final location of the infiltration galleries.

By stimulating the indigenous bacteria, biodegradable organics, which include most of the petroleum components, are removed at a rate limited primarily to the transport of oxygen and nutrients through the ground. The remediation period for in-situ biotreatment is often one-half or less that of a typical pump-and-treat system. During the course of treatment, monitoring of the groundwater and soil shall be implemented to document the removal of the contaminants and to show proper control of groundwater movement.

CONCEPTUAL CONFIGURATION

A cursory examination of the groundwater monitoring data with respect to impacted areas within the site indicates groundwater control and treatment is recommended to the west, and north of the former tank farm (Site MP-2) and the eastern and southern portions of Site MP-16. The collection configuration shall be a series of trenches which augment the existing collection system which was installed during UST removal activities in the former tank farm area. Figure 1 shows the proposed siting of the trenches, collection sumps, treatment system and the infiltration area. Trench design would be similar to Sump 1 and 2 applications in place at the Kenosha Main Plant South Area; 10-20 feet depth, bottom drain tile, pea gravel fill and clay cap. Specific trench locations would be selected to avoid major subsurface obstacles. Figure 2 illustrates a typical recovery system construction.

Should treatment be required, the existing winterized pump stations and oil/water separator facility associated with the former tank farm (Sump 4) would be expanded to include a simple insulated metal building, slab-on-grade construction, to house treatment. Additionally, recovery sumps (Sump 5 and Sump 6) shall be added to the new sections of trench to enhance groundwater control and depression.

The overall treatment scheme shall consist of an oil/groundwater system in the recovery sumps. Two separate pumps shall be installed in each sump; one for recovery of possible free product and the other shall serve as a drawdown pump which shall provide a cone of influence to maintain control over the area of treatment. The drawdown pump installed in the recovery sump shall also be used to pump the groundwater to the treatment system.

For the long-term biological treatment system, extracted groundwater shall be pumped to an equalization tank. In the equalization tank, the water shall be stabilized and neutralized. A pH probe shall be integrated with a neutralization system to monitor the pH of the groundwater. The system shall operate between a pH of 6.0 to 7.5. The pH system shall consist of an automated system of acid/caustic feeds. In addition, a separate feed system shall be used to supply the required nutrients to the system. The water is then pumped into the bioreactor at the base through a distribution system. The groundwater, air, and acclimated bacteria are thoroughly mixed in the reactor. A fixed-film, plastic media system, as described previously, shall be used. The treated groundwater shall then flow by gravity from the top of the reactor into a holding tank. From the holding tank, the groundwater shall then be distributed by a piping network discharged into a series of infiltration galleries. Additionally, some treated water may be discharged to the sanitary sewer. The use of existing on-site wells to assist the bioventing shall also be evaluated.

The prudent approach shall be to initially implement groundwater control via the collection systems and preliminary treatment (if required). Such an approach would not only provide more immediate and enhanced control of groundwater, but would also result in actual operating data for implementing additional steps such as biological treatment and infiltration. Additionally, the winter season could inhibit full implementation and operation; therefore, applying groundwater control strategies as an initial step is most beneficial.

WORK PLAN

To accomplish the remediation plan discussed, a work plan consisting of three tasks has been defined:

1. Process Design
2. Construction Documents
3. Execution

These tasks are further developed as follows:

Task 1 - Process Design

This task defines process requirements and establishes a groundwater control and treatment system scheme:

- Model extraction/infiltration system for finalizing trench configurations
- Perform groundwater and soil sampling and treatability tests
- Evaluate extraction and reinfiltration by field pumping and permeability testing.
- Establish groundwater recovery and treatment process scheme

For the process design for the groundwater treatment system, the essential parameters such as the system's detention time, process hydraulics, and supplemental feed requirements shall be developed. A series of groundwater samples shall be cultured in the laboratory to provide additional information on bacterial growth requirements. Information on the groundwater shall also be obtained at this time. This information shall include the following parameters:

- Oil & Grease
- Biological Oxygen Demand
- Chemical Oxygen Demand
- Total Suspended Solids
- Nitrate and Nitrite
- Phosphorus
- pH and Dissolved Oxygen
- Heavy Metals and Volatile Organics
- Flow Characteristics

Information on the soil shall also be evaluated. In addition to the information obtained from the biotreatability study, samples shall be taken from selected pit excavations to determine organic carbon content and the percentage of fine grained material. This information shall assist in determining if contamination degradation shall be an oxygen transport limited or a diffusion limited process. Several in-place permeabilities shall be measured and reported in cm/sec.

The design of the system shall be facilitated with hydraulic modeling which shall evaluate the infiltration rate necessary to raise the piezometric surface above the contaminant zone. It shall also evaluate the withdrawal rates necessary to create a contaminant capture zone to control the contaminant plume. In addition to modeling, sustained pump tests shall be completed to determine the transmissivity of the soils in the treatment zone. The pump shall provide sufficient information to size the hydraulic capacity of the biotreatment system.

Task 2 - Construction Documents

This task consists of preparing documents suitable to instruct trade contractors as to proper installation for such elements as site work, trenches, extraction systems, treatment system, infiltration galleries and utility tie-in. Activities for construction shall also be scheduled.

Task 3 - Execution

The execution of the remediation plan shall consist of the following:

- Recovery system/preliminary treatment installation and start-up
- Biological treatment/infiltration system installation and start-up
- Biological remediation system performance monitoring
- Continued quarterly groundwater monitoring

<u>Recovery System/Preliminary Treatment Installation and Start-up</u>

The installation of trenches, pumping systems and any required preliminary treatment shall be coordinated. Field inspection of construction activities shall be provided.

<u>Biological Treatment/Infiltration System Installation and Start-up</u>

The bioreactor system shall be installed at the site and initially monitored to determine the operating characteristics of the system. The system shall be evaluated by monitoring such parameters as BOD, pH, BTEX, and VOAs, and viable bacterial counts. The dissolved oxygen concentrations shall be measured not only in the bioreactor, but also in each of the monitoring wells. Various pre-remediation conditions shall be analyzed at system start-up. These include: contaminant concentrations, viable cell counts, pH, nutrient levels, dissolved oxygen concentrations, etc. System optimization shall include establishing the predominant cultures, evaluating detention periods, monitoring dissolved oxygen concentrations, etc.

Biological Remediation System Performance Monitoring

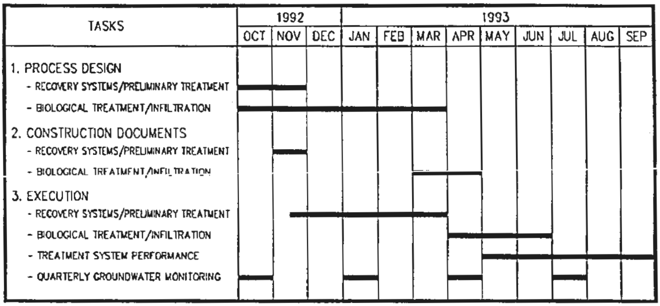
System operation shall consist of monitoring the system's performance. This shall include samples and analyzing for the contaminants of concern and operating parameters. Sampling shall be conducted on a periodic basis until the system has been satisfactorily operational.

Continued Quarterly Groundwater Monitoring

The ongoing groundwater monitoring program will continue on a quarterly basis to characterize groundwater flow, control, pollutant concentration and other subsurface conditions. The findings shall be documented in a progress report for submittal to the Wisconsin DNR.

SCHEDULE

The schedule for the first 12 months of the remediation plan is as shown:



As discussed, the initial activities shall focus on groundwater control for the area. The scheduling of the recovery system execution is such that installation should take place prior to the more difficult winter construction season. During this same period, process evaluation necessary for biological treatment shall progress to a point where spring construction is anticipated. Following the installation and operationally testing of the biological treatment system, periodic performance testing as well as quarterly sampling to monitoring subsurface conditions shall continue for the duration of remedial activities.

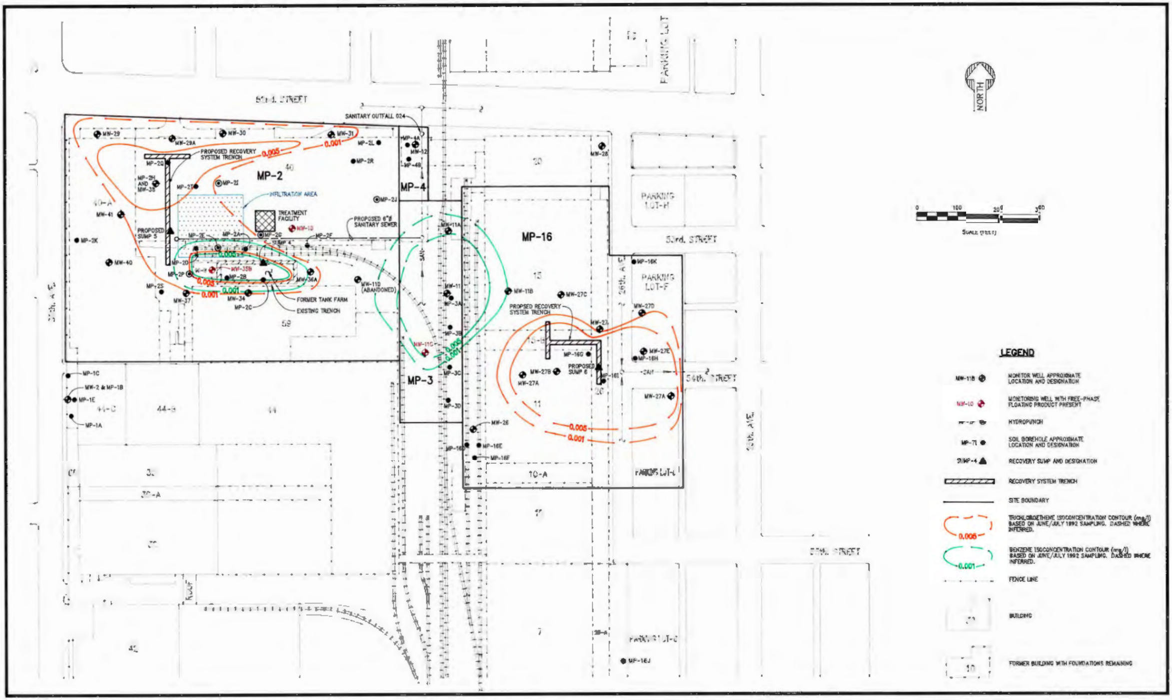


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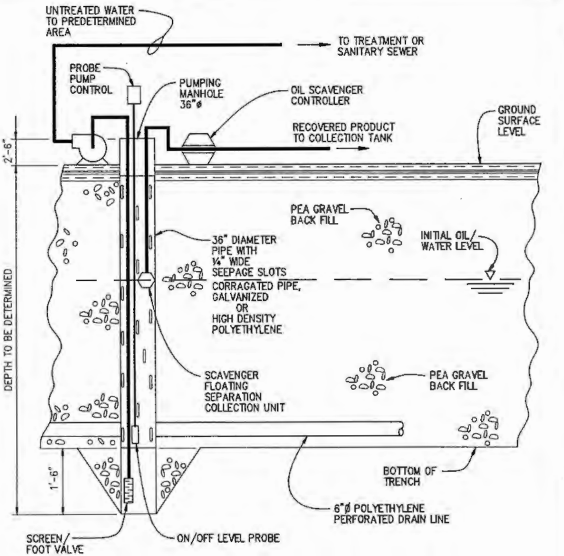
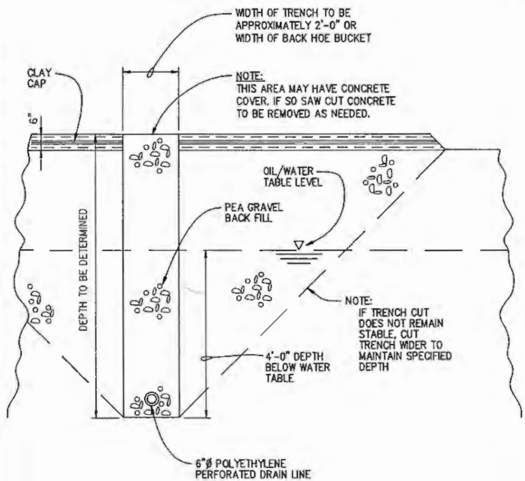
FIGURE 1
CONCEPTUAL REMEDIATION PLAN LAYOUT
CHRYSLER KENOSHA MAIN NORTH AREA



RECOVERY SYSTEM TRENCH & SUMP DETAIL

NOT TO SCALE



RECOVERY SYSTEM TRENCH CROSS SECTION DETAIL

NOT TO SCALE

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FIGURE 2
TYPICAL RECOVERY SYSTEM CONSTRUCTION
CHRYSLER KENOSHA MAIN NORTH AREA