EPA/ROD/R02-98/141
1998

EPA Superfund
Record of Decision:

CHEMSOL, INC.
EPA ID: NJD980528889
OU 01
PISCATAWAY, NJ
09/18/1998

EPA 541-R98-141

<IMG SRC 981410>

RECORD OF DECISION

Chemsol, Inc. Superfund Site

Piscataway, Middlesex County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
September 1998

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Chemsol, Inc. Superfund Site
Piscataway, Middlesex County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Environmental Protection Agency's selection of a second remedial action to address soil and groundwater contamination at the Chemsol Site (the "Site"), in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA) [42 U.S.C. º9601-9675], and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, as amended, 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for this second operable unit of the Site.

The New Jersey Department of Environmental Protection (NJDEP) has been consulted on the planned remedial action in accordance with CERCLA º121(f)[42 U.S.C. º9621(f)]. NJDEP is not in agreement with EPA's soil cleanup goals but does not object to the groundwater component of the remedy, (see Appendix IV. The information supporting this remedial action is contained in the Administrative Record for the Site, the index of which can be found in Appendix III to this document.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Chemsol Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy is the second of three operable units planned for the Chemsol Site. The major components of the selected remedy include:

Soil

! Excavation and off-site disposal of approximately 18,500 cubic yards of soil contaminated with polychlorinated biphenyls (PCBs) above 1 part per million (ppm) and lead above 400 ppm. The excavated areas will be backfilled with clean imported fill from an off-site location, covered with topsoil, then seeded with grass.

! Disposal of the excavated soils at an appropriate off-site disposal facility, depending on waste characteristics.

Groundwater

! Installation and pumping of approximately five additional extraction wells to contain contaminated groundwater on-site.

! Continued treatment of extracted groundwater through the existing groundwater treatment facility. The treated groundwater may continue to be released to the Middlesex County Utilities Authority (MCUA). If discharge to the MCUA becomes infeasible, treated groundwater will undergo additional on-site biological treatment, prior to being released on-site to Stream 1A.

! Performance of an additional groundwater investigation to determine the extent to which contaminated groundwater is leaving the property boundaries.

Surface Water and Sediments

! Monitoring of sediments and surface water to determine whether remediation of Lot 1B will result in lower PCB levels in the on-site streams, Stream 1A and 1B, over time.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy meets the requirements for remedial actions set forth in CERCLA °121 in that it: (1) is protective of human health and the environment; (2) complies with Federal and State requirements that are legally applicable or relevant and appropriate to the extent practicable given the unpredictable nature of groundwater hydrogeology in fractured bedrock; (3) is cost-effective; (4) utilizes alternative treatment (or resource recovery) technologies to the maximum extent practicable; and (5) satisfies the statutory preference for remedies that employ treatment to reduce the toxicity, mobility, or volume of the hazardous substances, pollutants or contaminants at the Site.

As part of this Record of Decision, EPA conducted a review of remedies selected at the Site consistent with CERCLA, Section 122(c), the National Contingency Plan, Section 300.430(f)(4)(ii) and OSWER Directives 9355.7-02 (1991), 2a(l994) and 3a (1995). EPA conducted a Type 1a review which is applicable to a site at which the remedial response is ongoing. I certify that the remedies selected for this Site remain protective of human health and the environment.

Because this remedy may result in hazardous substances remaining on the Site above health-based levels, a review will be conducted within five years after the initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Jeanne M. Fox
Regional Administrator

9/18/98
Date

RECORD OF DECISION

DECISION SUMMARY

Chemsol Site

Piscataway, Middlesex County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
September 1998

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SITE NAME, LOCATION AND DESCRIPTION

Site History

Chemsol, Inc. (Chemsol or Site) is located on a 40 acre tract of land at the end of Fleming Street, Piscataway, Middlesex County, New Jersey. The Site is comprised of two areas: in undeveloped parcel known as Lot 1A and a cleared area referred to as Lot 1B. Two small intermittent streams (Stream 1A and Stream 1B) and a small trench, known as the Northern Ditch, drain northward across the Site into a marshy wetland area located near the northeastern property boundary (see Figures 1 and 2).

Land use in the vicinity of the Site is a mixture of commercial, industrial, and residential uses. The Port Reading Railroad is directly south of the Site. Single family residences are located immediately to the west and northwest of the Site. An apartment complex with greater than 1,100 units is located to the north. Industrial and retail/wholesale businesses are located to the south and east of the Site.

Approximately 180 private wells at residential and commercial addresses were reported by the local health departments to be potentially active (i.e., not sealed) within a radius of two miles of the Site. Twenty-two of these wells are located at a distance less than 1/2 mile from the Site. The nearest public water supply well is over two miles away in the Spring Lake area of South Plainfield. No federally listed or proposed threatened or endangered species were found at the Site.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Chemsol operated as a solvent recovery and waste reprocessing facility in the 1950's through approximately 1964. Historically, the Site experienced numerous accidents, fires and explosions resulting from the storage, use or processing of flammable materials. In September 1958, a still exploded. In June 1964, a fire started when a 50-gallon drum of hexane exploded and in June 1962, a fire started when a pile of approximately 500,000 pounds of wax was ignited. In October 1964, a reaction between aluminum chloride and water generated hydrogen chloride gas resulting in the evacuation of the adjacent residential areas. Following this accident, Piscataway Township ordered the facility to cease operations. In 1978, the property was rezoned from industrial to residential. The Site is currently owned by Tang Realty Corporation. In September 1983, the Chemsol Site was formally placed on the National Priorities List (NPL) making it eligible for federal funds for investigation of the extent of contamination and for cleanup activities.

From 1983 to 1990, the New Jersey Department of Environmental Protection (NJDEP) directed Tang Realty, under various enforcement actions, to perform a series of Site investigations related to groundwater and soil contamination. Approximately 40 groundwater monitoring wells were installed on or in the vicinity of the Site by contractors for Tang Realty. Sampling results from these monitoring wells indicated that groundwater was contaminated with various volatile organic compounds (VOCs) including trichloroethylene, chloroform, chloroethane, toluene, carbon tetrachloride and methylene chloride. Furthermore, sampling and analyses of the soils (performed between 1980 and 1987) revealed the presence of polychlorinated biphenyls (PCBs) and other organic compounds.

In the summer of 1988, Tang Realty removed approximately 3,700 cubic yards of PCB-contaminated soils for off-site disposal. During the soils excavation, several thousand small (less than 1 gallon) containers of unknown substances were discovered. These unknown substances were stored in a trailer on-site. As a part of a U.S. Environmental Protection Agency (EPA) removal action undertaken in 1990 and 1991, these unknown substances were analyzed, grouped with other compatible Site wastes, and transported off-site. Approximately 10,000 pounds of crushed lab pack bottles, 13,500 pounds of hazardous waste solids, 615 gallons of hazardous waste liquids and 150 pounds of sulfur trioxide were disposed of off-site during the removal action. This removal action was completed in October 1991 by EPA.

In the fall of 1990, EPA and the NJDEP agreed that EPA should fund the remainder of the investigatory work. Subsequently, EPA initiated a Remedial Investigation and Feasibility Study (RI/FS) in order to assess the nature and extent of contamination at the Site and to evaluate remedial alternatives. EPA determined that the RI/FS would be performed in two phases. The first phase consisted of development of a Focused Feasibility Study (FFS) to evaluate the usefulness of an interim remedy to restrict off-site migration of contaminated groundwater. The second phase was to determine the nature and extent of contamination at the Site.

As part of the FFS, EPA sampled 22 on-site monitoring wells. The results of the FFS indicated that groundwater at the Site exists in a perched water zone (at depths of less than five feet), and also in the upper bedrock aquifer (to depths of at least 130 feet). Sampling results revealed that groundwater was highly contaminated with a wide variety of hazardous substances, including volatile organics, semi-volatile organics, as well as pesticides and inorganic compounds.

Based on the results of the FFS, EPA selected an interim remedy for the Chemsol Site in a Record of Decision (ROD) that was signed on September 20, 1991. The objective of this interim remedy was to restrict the migration of the contaminated groundwater until a more comprehensive Site-wide remedy could be selected and implemented. The interim remedy consisted of pumping groundwater from well C-1, a former monitoring well installed by Tang Realty's contractors found to be highly contaminated with VOCs. The pumped groundwater from C-1 would then be treated on-site through an air stripper, after which it would be filtered, followed by treatment by activated carbon and biological treatment. After treatment, the water was to be discharged to the on-site stream.

On March 9, 1992, EPA issued a Unilateral Administrative Order (UAO) to Tang Realty, Schering Corporation, Union Carbide Corporation and Morton International, Inc. (the Respondents) for performance of the interim remedy. Schering Corporation, Union Carbide Corporation and Morton International, Inc. were identified by EPA as potentially responsible for the contamination at the Site by having sent their waste to the Chemsol Site for reprocessing. Tang Realty was identified as the owner of the property.

In November 1993, the Respondents requested that the interim remedy be modified so that water from the treatment system could be discharged into the sewer system that leads to the Middlesex County Utilities Authority (MCUA), instead of into an on-site surface water body (Stream 1A), as specified in the ROD. As a result, in July 1994, EPA issued an Explanation of Significant Differences which modified the interim remedy to allow for discharge of treated groundwater to the sewer system. However, EPA also required that the Respondents design and build the biological portion of the treatment system so that, in the future, if the treated groundwater could not be sent to MCUA, the biological system could be brought quickly online to allow for direct discharge of treated groundwater to Stream 1A on-site.

Construction of the groundwater treatment plant was completed by the Respondents in June 1994 and the plant was brought into operation in September 1994. The well has been pumped at varying rates, averaging approximately 25 gallons per minute. The results of monthly monitoring indicate that the interim remedy has been effective in restricting the migration of highly contaminated groundwater from the Site. The second phase RI/FS for the Site was completed in June 1997.

Enforcement Activities

EPA initiated a Potentially Responsible Party (PRP) search by issuing Request for Information and Notice Letters in September 1990. Additional letters were issued in December 1991 and February 1992. Due to the need to restrict contaminated groundwater from migrating off the Site, an interim remedy was selected in a Record of Decision issued by EPA, on September 20, 1991. A UAO was issued to four companies to design and construct the interim remedy. During the course of the performance of this UAO, EPA was notified that a PRP group had been formed and was assisting the UAO Respondents in financing the interim remedy. The UAO, Respondents continue to operate the interim remedy, extraction and treatment system.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The second phase RI/FS report, the Proposed Plan and supporting documentation were made available to the public in the administrative record file at the Superfund Document Center in EPA Region II, 290 Broadway, New York, New York and the information repository at the Kennedy Library, 500 Hoes Lane, Piscataway New Jersey. The notice of availabilily for the above-referenced documents was published in the Home News and Tribune on August 11, 1997. The public comment period which related to these documents was held from August 11, 1997 to September 10, 1997 and later extended to October 10, 1997.

On August 27, 1997, EPA conducted a public meeting at the Piscataway Municipal Complex. The purpose of this meeting was to inform local officials and interested citizens about the Superfund process, to review planned remedial activities at the Site, to discuss the Proposed Plan and receive comments on the Proposed Plan, and to respond to questions from area residents and other interested parties. Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary (see Appendix V).

SCOPE AND ROLE OF THIS OPERABLE UNIT

This action is the second operable unit or phase taken to address the Site. The first operable unit consisted of an interim groundwater containment system which is currently operational at the Site. This action will address contaminated groundwater and soil within the Chemsol property boundaries. A third operable unit is planned to investigate the extent of groundwater contamination outside the property boundaries and to determine if any further groundwater remediation is necessary.

SUMMARY OF SITE CHARACTERISTICS

The second phase of the RI field work commenced in October 1992. The purpose of the RI was to accomplish the following: identify the nature and extent of contaminant source areas; define contamination of ground water, soils, surface water and sediment; characterize Site hydrogeology; and determine the risk to human health and the environment posed by the Site. The work was conducted by CDM Federal Programs Corporation under contract to EPA.

The results of the Rl can be summarized as follows.

Soil Investigation

A soil sampling program was designed based on historical Site usage, aerial photographs and the findings of previous investigations. Samples were taken using an extensive grid system. Group A samples were collected at 200 foot grid spacing in Lot 1B and 400 foot grid spacing in Lot 1A. These samples were analyzed for a full range of organic and inorganic contaminants. Group B samples were collected from Lot 1B at 100 foot grid spacing and field screened for PCBs. Group C samples were collected from biased sampling locations based on aerial photographs and previous investigations and on a 50 foot grid spacing around those Group B samples which showed PCBs in their field screening results. In addition, samples from Lot 1B were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP), a test which is used to determine whether a material is a hazardous waste, as defined by the Resource Conservation and Recovery Act (RCRA). Samples passing the TCLP test can be disposed at a facility which accepts non-hazardous waste, a so-called Subtitle D facility under RCRA. Subsurface soil samples were also taken from 102 locations across the Site.

The results of the RI show that the surface and subsurface soils in Lot 1A and Lot 1B contain various contaminants. The contaminants found were: VOCs, including carbon tetrachloride, trichloroethane, trichloroethene, tetrachloroethene, toluene, ethylbenzene, and xylenes; semi-volatile organic compounds (SVOCs), including polyaromatic hydrocarbons, phthalates, pesticides (such as aldrin, dieldrin, and DDE) and PCBs; and inorganics, including manganese and lead. The range of concentrations of certain contaminants detected in surface and subsurface soil is presented in Table 1. All the soil samples that were analyzed for TCLP, passed the TCLP test. Based on these data, EPA believes that all soils at the Site will pass the TCLP test.

Of the contaminants found, PCBs contributed the most to the risks at the Site (see the section entitled "Summary of Site Risk," below). The majority of PCB and lead contamination occurs in surface soils (0-2 feet depth), with the exception of one location where PCBs are found at a depth of 6 feet, near boring 76 (see Figure 3). The VOCs were found to be co-located with the PCBs and lead; therefore, any actions taken to address PCBs and lead would also address the VOCs.

Groundwater Investigation

As a part of the RI, additional groundwater monitoring wells were installed. Two rounds of groundwater sampling were performed during the RI. Samples were collected and analyzed from the 49 wells on the Site. EPA was initially unsuccessful in obtaining voluntary cooperation to install monitoring wells on properties adjacent to the Chemsol property. EPA continues to pursue this matter in order to facilitate further investigation of groundwater migration from the Site.

The geologic formation which underlies the Site is commonly referred to as the Brunswick formation and lies generally 3 to 14 feet below the ground surface. The Brunswick formation in general contains areas of red shale, gray shales and siltstones. A gray shale layer acts to preclude groundwater flow in some areas and separates the bedrock into an upper zone which is located above the gray shale, and a so-called "deep gray unit" bedrock zone. The Brunswick formation is overlain by a thin layer of overburden which consists of unconsolidated sand, silt, clay and cobble deposits and fill. This overburden was determined to be typically 3 to 6 feet thick at the Site.

Groundwater flow at the Site is complex. There is perched groundwater present in some areas of the overburden. However, the primary groundwater flow is through interconnected fractures in the bedrock. Due to the unpredictable nature and distribution of these fractures, the precise direction of flow and the rate of groundwater flow can be difficult to predict. In general, groundwater in the upper zone, above the gray shale, flows to the south. Below the gray shale, groundwater generally flows to the north. Near the southern boundary of the Site, groundwater is influenced by off-site commercial pumping activities to the south.

With regard to chemical contamination, the RI confirmed that well C-1 was by far the most contaminated of all on-site monitoring wells. The results also confirmed that VOCs are the primary contaminants in groundwater. The major VOC contaminants include benzene, carbon tetrachloride, chloroform, 1,2,-dichloroethane, 1,2-dichloroethene, tetrachloroethene, toluene and trichloroethene. The bedrock aquifer is contaminated far in excess of EPA's Safe Drinking Water Act maximum contaminant levels (MCLs) which are the federal regulatory standards for drinking water. The analytical results also indicate that MCLs for aluminum, iron and manganese have been exceded in many wells at the Site. Although many pesticides were detected in the groundwater, no MCLs were exceeded. In the second round of sampling, PCBs slightly in excess of MCLs were found in two wells, C-1 and TW-4 (see Table 2).

Groundwater contamination is present in the bedrock aquifer at both the northern and southern boundaries of the Site. Evaluation of the hydrogeological data indicates that contaminated groundwater continues to migrate off-site. However, due to the influences of groundwater pumping from off-site sources and the limited amount of off-site groundwater sampling data, there remains uncertainty as to the extent of this migration. Additional off-site sampling is required to further define the extent and source of off-site contamination.

In addition to sampling activities, EPA's consultant used mathematical modeling to help determine the optimum pumping plan which would best capture contaminated groundwater and minimize the amount of contaminated groundwater which leaves the Site. The modeling showed that, by pumping five additional wells, the contamination could be contained on-site except possibly for the deep bedrock groundwater in the northwest corner of the Site.

In addition, during the RI, EPA conducted an assessment to determine whether contamination previously detected in the Nova-Ukraine section of Piscataway was related to the Chemsol Site. The Nova-Ukraine is a housing development whose nearest part is located approximately 900 feet south-southeast of the Chemsol Site. Residential wells in this development had been sampled several times since 1980 by various government agencies and private consultants. Due to concentrations of VOCs in the wells, NJDEP delineated an Interim Groundwater Impact Area for a portion of the Nova-Ukraine area. This delineation made residents eligible for financial assistance to connect to a public water supply. All but four residences elected to be connected to a public water supply. Based on the results of the RI, EPA does not believe that the groundwater contamination of residential wells in the Nova-Ukraine area is related to the Chemsol Site.

Surface Water and Sediment Investigation

The ground elevation at the Site is generally lower than the adjacent area. Surface water runoff is towards the Site during rain events. There are several wetland areas, one drainage ditch, and two streams present at the Site. During sampling for the FFS in 1991, Stream 1A was sampled and determined to be free of contamination from the Site. During the RI, two rounds of sampling were conducted in Stream 1B. Twelve sampling locations were selected. At each location, one surface water sample and two sediment samples were collected.

Surface water sampling has indicated that the Chemsol Site is contributing low levels of contamination including VOCs, pesticides and organics to Stream 1B (Table 3). However, low levels of pesticides and inorganics also appear to be entering the Site from off-site sources. Levels of several contaminants exceeded State Water Quality Criteria. As noted in the previous section, the area surrounding the Site contains many industrial/commercial establishments. Sediment sampling conducted in conjunction with the surface water sampling indicates the presence of VOCs, SVOCs, pesticides, PCBs and metals (Table 4).

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future Site conditions. The baseline risk assessment estimates the human health and ecological risk which could result from the contamination at the Site if no remedial action were taken.

Human Health Risk Assessment

To perform a Human Health Risk Assessment, the reasonable maximum human exposure is evaluated. A four-step process is then utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: Hazard Identification-- identifies the chemicals of potential concern at the Site based on several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment– estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. Toxicity Assessment-- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization-- summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks.

The baseline risk assessment began with selecting chemicals of potential concern which would be representative of the contamination found in various media (surface soil, subsurface soil, surface water, sediment, and groundwater) at the Site (See Table 5 - Chemicals of Potential Concern). Due to the large number of chemicals detected at the Site, only those chemicals which were thought to pose the highest risk (based on factors such as frequency of detection and concentration detected) were retained as chemicals of potential concern. The chemicals of potential concern include: benzo(a)pyrene, pesticides, PCBs and inorganics in surface soil; 1,1,2,2-tetrachloroethane, pesticides, PCBs, and inorganics in subsurface soils; VOCs and SVOCs in surface water; and, polyaromatic hydrocarbons, PCBs, and inorganics in sediment. Several of the contaminants of concern listed above are known or suspected of causing cancer in animals and/or humans or of causing non-cancer health effects in the liver, kidney, respiratory tract, and the central nervous system.

In the exposure assessment, the potential exposure for human exposure to the chemicals of concerns, in terms of the type, magnitude, frequency, and duration of exposure, is estimated. The assessment is made for potentially exposed populations at or near the property considering both the current situation and potential future conditions. Please see Table 6 for a listing of potential exposure pathways.

An important factor which drives the risk assessment is the assumed future use of the Site. Based on discussions with the town and the fact that the Site is now zoned for residential, rather than industrial use, EPA assumed that the most probable future use of the Site would be for residential or recreational purposes. The Town expressed a preference for recreational use as the property is one of the last parcels of open land available in the Township. The current land uses at this Site have the potential to impact nearby residents (adults and children) and possible trespassers onto the Site. In the future, it is possible that potential human receptors would include residents (adults and children), Site workers (employees), and construction workers.

Pathways of exposure evaluated for the Site include: 1) sediment and soil ingestion; 2) dermal contact with soil and sediment; 3) ingestion of contaminated groundwater and surface water; 4) dermal contact with surface water; and, 5) inhalation of VOCs and particulates during showering. Because EPA assumed a future residential/recreational land use of the Site, the list of possible human receptors identified in the exposure assessment included trespassers, residents (adults and children), Site workers (employees), and construction workers. Exposure intakes (doses) were calculated for each receptor for all pathways considered.

Potential carcinogenic risks are evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (Sfs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals (See Table 7). Sfs, which are expressed in units of [mg/kg-day] [-1] are, multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper- bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects a conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely.

EPA's acceptable cancer risk range is 10^{-4} to 10^{-6} which can be interpreted to mean that an individual may have a 1 in 10,000 to 1 in 1,000,000 increased chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site. The State of New Jersey's acceptable risk standard is one in one million (10^{-6}).

EPA found that contaminants in the surface soil at the Site posed an unacceptable total cancer risk of 2.2×10^{-3} (i.e., 2.2 in a thousand) to potential future residents through ingestion and dermal contact. In addition, ingestion and inhalation (during showering) of contaminants in groundwater also posed unacceptable cancer risks (maximum of 2.4×10^{-2}) (i.e., 2.4 in a hundred) to potential future residents. For Site workers only the groundwater ingestion pathway was evaluated. The contaminants found in the groundwater posed unacceptable cancer risks of 5.4×10^{-3} (i.e., 5.4 in a thousand) to Site workers. Benzene, carbon tetrachloride, vinyl chloride, chloroform, 1,1-dichloroethene, trichloroethene, 1,2-dichloroethane, and PCBs are the predominant contributors to the estimated cancer risk in groundwater. The other receptors/exposure routes including ingestion or direct contact with subsurface soil, and dermal contact with surface water and sediment) have estimated cancer risk within or below EPA's acceptable risk range.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, (see Table 8) based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects (see Table 9). RfDs, which are expressed in units of milligrams per kilogram per day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared to the RfD to derive the hazard quotient for the contaminant in the particular medium (i.e., the hazard quotient equals the chronic daily intake divided by the RfD). The HI is obtained by adding the hazard quotients for all compounds within a particular medium that impact a particular receptor population. An HI greater than 1.0 indicates that the potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. With regard to non-cancer effects, based on the calculated HIs, EPA found that several potential exposure pathways could have unacceptable health effects including: ingestion of surface soil by children (HI=6.2) (see Table 8); ingestion of disturbed surface soil along the current effluent discharge line by children (HI=3.7); inhalation of particulates along the current effluent discharge line by children (HI=1.5); ingestion of contaminated groundwater by adults and children (HI=340 for adults and 800 for children); and, ingestion of contaminated groundwater by Site workers and construction workers (HI=120 for Site workers and 17 for construction workers). No noncancer effects were associated with subsurface soils, surface water and sediment.

In summary, the Human Health Risk Assessment concluded that exposure to surface soil and ground water, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health or welfare. In contrast, exposure to subsurface soils, sediments, and surface water was determined not to pose a significant threat to human health.

Ecological Risk Assessment

A qualitative and/or semi-quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals, constitutes an ecological risk assessment. A four-step process is utilized for assessing site-related ecological risks: Problem Formulation - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment - a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. Ecological Effects Assessment - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization - measurement or estimation of both current and future adverse effects.

The environmental evaluation focused on how the contaminants would affect the Site's natural resources. Natural resources include existing flora and fauna at the Site, surface water, wetlands and sensitive species or habitats. A wetlands delineation performed on-site determined that wetlands cover approximately 22 acres in Lot 1A and 3 acres in Lot 1B. Uplands in Lot 1A are wooded. No federally or State listed or proposed threatened or endangered flora or fauna are known to occur at or near the Site. However, white-tailed deer, woodchucks, rabbits, frogs, turtles and birds are known to inhabit the Site.

of exposures to ecological receptors considered for this ecological assessment include surface soil (generally collected from 0 to 2 feet below ground surface), surface sediment (generally collected from 0-6 inches), and surface water. Data from subsurface soils (soils under pavements or from depths greater than 2 feet) were not evaluated. These depths are greater than those considered likely for potential contact with burrowing animals or roots of vegetation. Subsurface sediments (sediments from depths greater than 6 inches) also were not evaluated since fish and micro invertebrates are not likely to be exposed to contaminants at greater depths. Similarly, groundwater data were riot used in this ecological assessment because it is unlikely that ecological receptors can contact contaminants associated with groundwater. Exposure may occur through: 1) ingestion of contaminated food items; 2) ingestion of contaminated surface water; 3) incidental ingestion of contaminated media (i.e., soil, sediment, or water ingested during grooming, eating, burrowing, etc.); 4) inhalation of contaminants; and, 5) adsorption upon contact with contaminated media.

Site surface soils were evaluated to assess terrestrial ecological risk from food chain transfer effects. Mathematical modeling was conducted to estimate exposure doses to representative mammalian and avian receptors (short-tailed shrew, American robin, and red-tailed hawk). A hazard quotient (HQ) approach was used to compare the calculated doses to reference toxicity values; a value exceeding unity (HQ > 1.0) indicates the potential for adverse ecological effects. The chemicals of concern selected for this evaluation included: toluene, carbon tetrachloride, 1,1,1-trichloroethene, chlorobenzene, xylenes, naphthalene, PCBs, pesticides, lead, and mercury.

Based on the terrestrial risk evaluation, the potential for adverse ecological effects exists for Lot 1A and Lot 1B. On Lot 1B, many of the contaminants greatly exceeded their respective reference toxicity values and require remediation. Lot 1B is also highly physically disturbed by development. On Lot 1A, the potential risk is from only a few contaminants that slightly exceed their respective reference toxicity values. Lot 1A exists in a relatively undisturbed state and is considered a locally valued habitat (i.e., predominantly forested wetland). Remedial action to address the potential risk assessed for Lot 1A would likely result in significant habitat disturbance or destruction. Therefore, it was determined that active remediation is not warranted in Lot 1A at this time to address terrestrial risk.

The assessment of aquatic risk evaluated the ecological significance of sediment contamination in Stream 1B and the associated ditch by comparing contaminant concentrations to ecologically-based screening values (D. Persaud, et al. August 1993. "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario." Ontario Ministry of Environment and Energy). Ecological risks in these sediments, while indicated, are considered minimal. Additionally, these areas may not represent actual sources of contamination, but may represent the presence of a migration pathway from the more heavily contaminated Lot 1B. Thus, while remediation of the Stream 1B and the ditch is not warranted at this time, they will be monitored to assess the affect of the remedial action in Lot 1B on contaminant levels.

The assessment of aquatic risk also evaluated the potential risk from surface water in Stream 1B. The potential risk is considered similar to the potential risk from sediment in that, while several contaminants exceed NJ State Surface Water Quality, the contaminants may be migrating from more heavily contaminated areas of the Site. Therefore, surface water is also included in the stream monitoring.

Uncertainties

The procedures and estimates used to assess risks, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure. Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the baseline risk assessment provides upper bound estimates of the risks to populations near the Site, and it is highly unlikely to underestimate those actual risks related to the Site.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the RI report.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the Risk Assessment.

The following objectives were established for the Chemsol Site:

(1) Restoring the soil at the Site to levels which would allow for residential/recreational use (without restrictions);

(2) augment the existing groundwater system to contain that portion of contaminated groundwater that is unlikely to be technically practicable to fully restore and restore the remaining affected groundwater to State and federal drinking water standards;

(3) remove and treat as much contamination as possible from the fractured bedrock;

(4) prevent human exposure to contaminated groundwater;

(5) prevent human exposure to surface soils contaminated with PCB concentrations above 1 part per million (ppm) and lead concentrations above 400 ppm; and

(6) eliminating, to the greatest extent practicable, continuing sources of contamination to the groundwater.

Soil cleanup levels for PCBs at the Site are based on the toxicity reassessment developed by EPA since the original 1990 EPA "Guidance on Remedial Actions for Superfund Sites with PCB Contamination". For residential land use, an action level of 1 ppm is specified for PCBs. The 400 ppm lead cleanup level is based on EPA's 1994 "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities." VOCs in soil were found to be co-located with the PCBs and lead; therefore EPA did not develop separate cleanup levels for VOCs in soil. EPA estimates that there are approximately 18,500 cubic yards of soil that contain PCBs at levels above 1 ppm and/or lead at levels above 400 ppm.

The State of New Jersey has developed State-wide soil cleanup criteria for several of the contaminants found at the Chemsol Site, including several VOCs, SVOCs, lead (400 ppm) and PCBs (0.49 ppm). Based on the data collected to date, in meeting EPA's cleanup levels for PCBs and lead cited previously, EPA believes the remedy will also achieve the State of New Jersey residential direct contact and impact to groundwater soil cleanup criteria. For instance, VOC and PCB, contamination is concentrated in the areas around borings 74 and 76 and extends as deep as 6 feet in these locations. As these locations are excavated to achieve the 1 ppm action level for PCBs, it appears based on current data, that NJDEP's cleanup criteria of 0.49 ppm for PCB and its VOCs criteria may be achieved through the use of NJDEPs compliance averaging procedure.

The ultimate goal of the Superfund Program approach to groundwater remediation as stated in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR part 300) is to return usable groundwater to their beneficial uses within a time frame that is reasonable. Therefore, for the Chemsol Site, the final groundwater remediation goals will be federal MCLs and State groundwater quality standards. Due to the complex geology and the possible presence of non-aqueous phase liquids at this Site, EPA believes that it may not be technically practicable to fully restore some portion of the contaminated on-site groundwater to federal and State standards. By law, any areas of contaminated groundwater which cannot be restored to meet federal and/or State groundwater standards require a waiver of such standards on the basis of technical impracticability. As will be discussed in subsequent sections, if after implementation of the remedy, it proves to be technically impracticable to meet groundwater quality standards, EPA will waive such standards for that portion of the plume that is found to be technically impracticable to remediate. Such a waiver would be documented in an Explanation of Significant Differences (ESD). A Classification Exception Area (CEA) would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may require a technical impracticability waiver.

DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

CERCLA º121(b)(1), [42 U.S.C. º9621(b)(1)] mandates that a remedial action must be protective of human health and the environment, cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment which permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA º121(d), [42 U.S.C. º9621(d)], further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA º121(d)(4),[42 U.S.C. º9621(d)(4)].

EPA's FS evaluated, in detail, four remedial alternatives for addressing soil contamination at the Site and three remedial alternatives for addressing groundwater contamination. Cost and construction time, among other criteria, were evaluated for each remedial alternative. The time to implement a remedial alternative reflects the estimated time required to construct the remedy. The estimates do not include the time to possibly negotiate with the potentially responsible parties, prepare design documents, or procure contracts.

The remedial alternatives are:

SOIL

Alternative S-1: No Further Action

Estimated Capital Costs:$388,660
Estimated Annual O&M Costs (30 years):$0
Estimated Total Present Worth Value:$388,660
Estimated Implementation Period:3-6 months

The Superfund process requires that the "no-action" alternative be considered as a baseline for comparison with other alternatives. Under Alternative S-1, EPA would take no action at the Site. However, the No-Action alternative includes, as with the other soil alternatives, a single sampling event for drummed waste and soil stockpiled at the Site, along with their transportation and off-site disposal. The drummed wastes were generated from the various investigations performed at the Site and the stockpiled soils were generated from construction activities performed at the Site. Since contaminants would remain on-site, institutional controls (e.g., a deed restriction) would be placed on property that would restrict future use of the Site. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Alternative S-2A: Capping with Soil

Estimated Capital Costs:$1,855,850
Estimated Annual O&M Costs (30 years):$2,000
Estimated Total Present Worth Value:$1,894,000
Estimated Implementation Period:3-6 months

Alternative S-2A includes the construction of a single layer (18 inches thick) soil cap covering 12 acres of the property which are contaminated above the soil cleanup levels. It would also require institutional controls to ensure that no intrusive activities would be performed on the capped area in the future since such activities would affect the cap's integrity. This alternative would allow for many recreational uses of the property, such as a park or playground, among others. A single sampling event of drummed waste and stockpiled soil along with their transportation and off-site disposal would be performed. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from the initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Alternative S-3: Excavation and Off-Site Disposal

Estimated Capital Costs:$5,573,001
Estimated Annual O&M Costs (30 years):$0
Estimated Total Present Worth Value:$5,573,000
Estimated Implementation Period:6-12 months

Alternative S-3 includes excavation and off-site disposal of all surface soils contaminated with PCBs and lead that are above EPA's cleanup levels. Approximately 18,500 cubic yards of soil with PCB levels greater than 1 part per million and lead levels greater than 400 parts per million will be trucked off-site and disposed of at a licensed and approved RCRA/TSCA (Toxic Substances Control Act) facility. The excavated areas would be backfilled with imported clean fill from an off-site location, and covered with topsoil and seeded with grass. The excavation and off-site disposal of the contaminated soils will allow for residential or recreational use of the Site in the future. As with Alternative S-1, this alternative includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site. Since this alternative would result in the removal of soils above EPA's cleanup levels no contaminants would remain in on-site soils above health-based levels and, therefore, five year reviews of the remedy would not be necessary.

Alternative S-4A: Excavation and On-Site Low Temperature Thermal Desorption of PCB-Contaminated Soil with Disposal of Lead Contaminated Soil.

Option-A [On-Site Solidification of Lead Contaminated Soil]
Estimated Capital Costs:$11,963,134
Estimated Annual O&M Costs (30 years):$0
Estimated Total Present Worth Value:$11,963,134
Estimated Implementation Period:3-6 months

For Option A, all surface soil contaminated with PCBs above 1 part per million (18,500 cubic yards) would be excavated. The excavated soil would be treated on-site by low temperature thermal desorption (LTTD) to remove PCBs and VOCs. The LTTD unit would be operated in compliance with the Clean Air Act (CAA), RCRA, and all applicable State regulations. The treated soil would then be backfilled to the excavated areas, topsoil would be placed on the treated soils and the area seeded. As with the other soil Alternatives, Alternative S-4A includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site.

The lead contaminated soils would be solidified/stabilized on-site by mixing with Portland cement. The area on-site where this contaminated soil is placed would be protected from future intrusions. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Option-B [Off-Site Disposal of Lead Contaminated Soil]
Estimated Capital Costs:$12,241,639
Estimated Annual O&M Costs(30 years):$O
Estimated Total Present Worth Value:$12,242,000
Estimated Implementation Period:6-9 months

As in Option A, all surface soil contaminated with PCBs above 1 part per million (18,500 cubic yards) would be excavated. The excavated soil would be treated on-site by low temperature thermal desorption (LTTD) to remove PCBs and VOCs. The LTTD unit would be operated in compliance with the CAA, RCRA, and all applicable State regulations. The treated soil would then be backfilled to the excavated areas, topsoil would be placed on the treated soils and seeded. As with the other soil Alternatives, Alternative S-4B includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site.

Under Option B, the lead-contaminated soil would be excavated and transported off-site for disposal at a licensed and approved RCRA disposal facility. The excavated areas would be backfilled with clean fill, and seeded. Since this alternative would result in the removal of soils above EPA's cleanup levels no contaminants would remain in on-site soils above health-based levels and, therefore, five year reviews of the remedy would not be necessary.

GROUNDWATER

Alternative GW-1: No Action with Monitoring

Estimated Capital Costs:$0
Estimated Annual O&M Costs(30 years):$59,336
Estimated Total Present Worth Value:$912,000
Estimated Implementation Period:0 months

The Superfund program requires that a "No-Action" alternative be considered as a baseline for comparison with other alternatives. Under this alternative, EPA would cease actions at the Site to treat the contaminated groundwater and to restrict the off-site migration of contaminated groundwater. However, the No-Action alternative does include long-term monitoring. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Alternative GW-2(A and B): Continue Existing Interim Action - Extract Groundwater from Well C-1

Option - A
Estimated Capital Costs:$45,097
Estimated Annual O&M Costs(30 years):$452,738
Estimated Total Present Worth Value:$7,000,300
Estimated Implementation Period:0 months

Under Option-A of this alternative, the current extraction of the groundwater from well C-1 would continue. The extracted groundwater first passes through an air stripper, after which it is filtered, followed by activated carbon adsorption. The treated water is then discharged to the Middlesex County Utilities Authority (MCUA) Publicly Owned Treatment Works (POTW). The treatment process generates a small quantity of non-bio-solids waste annually. The capital cost of $45,097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property. This pumping is expected to continue until MCLs and State groundwater quality standards are reached in the plume. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Also, a CEA would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded.

Option - B
Estimated Capital Costs:$45,097
Estimated Annual O&M Costs(30 years):$726,336
Estimated Total Present Worth Value:$11,209,000
Estimated Implementation Period:3 months

In addition to the treatment described in Option-A, a biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. This phase is a contingency in the event that in the future, treated groundwater cannot be sent to MCUA. The biological treatment will provide additional treatment so the groundwater will achieve federal and State surface water quality standards which would allow for discharge to Stream 1A. The capital cost of $45, 097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property. Because this altemative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Also, a CEA would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded.

GW-5(A and B): Extract Groundwater from Additional Wells - Use Existing Treatment Processes Air Stripping/Aerobic Mixed Growth Biotreatment/Filtration/Activated Carbon Adsorption

Option - A
Estimated Capital Costs:$390,189
Estimated Annual O&M Costs(30 years):$670,892
Estimated Total Present Worth Value: $10,699,000
Estimated Implementation Period:3 months

Option-A of this alternative is almost identical to Alternative GW-2A. They differ in that, in addition to well C-1, groundwater would be pumped from other on-site wells. EPA cost estimates are based on pumping five additional wells. However, the number of wells to be pumped will be determined during the remedial design. Pumping from these additional wells will allow for more effective on-site containment of the plume, and also allow for groundwater extraction from other contaminated areas on-site. As in Alternative GW-2A, the treated groundwater would be discharged to MCUA POTW. The capital cost of $390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs associated with installation of additional extracting wells. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Also, a CEA would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded.

Option - B
Estimated Capital Costs:$390,189
Estimated Annual O&M Costs(30 years):$766,336
Estimated Total Present Worth Value:$12,169,000
Estimated Implementation Period:3 months

A biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. Use of the biological treatment phase would allow for discharge to Stream 1A in compliance with federal and State standards. The capital cost of $390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs associated with installation of additional extraction wells. Because this alternative would result in contaminants remaining on-site above health based levels, a review would be conducted within five years from initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Also, a CEA would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA º121, 42 U.S.C. º9621, by conducting a detailed analysis of the viable remedial alternatives pursuant to the NCP, 40 CFR º300.430(e)(9) and OSWER Directive 9355.3-01. The detailed analysis consisted of an assessment of the individual alternatives against each of nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The following "threshold" criteria are the most important and must be satisfied by any alternative in order to be eligible for selection:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy would meet all of the applicable (legally enforceable), or relevant and appropriate (pertaining to situations sufficiently similar to those encountered at a Superfund site such that their use is well suited to the site) requirements of federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. Reduction of toxicity, mobility, or volume through treatment refers to a remedial technology's expected ability to reduce the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants at the site.

5. Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation

periods until cleanup goals are achieved.

6. Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. Cost includes estimated capital and operation and maintenance costs, and the present-worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. State acceptance indicates whether, based on its review of the RI/FS reports and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the selected alternative.

9. Community acceptance refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows:

Overall Protection of Human Health and the Environment

Soil

Alternative S-1, No Action, would not be protective of human health and the environment because the Site would remain in its current condition. The soils would continue to pose a threat to potential future residents, trespassers, potential ecological receptors and the environment. Therefore, Alternative S-1 has been eliminated from consideration and will not be discussed further.

Alternative S-2A relies on containment and institutional controls to provide protection over time. Deed restrictions would have to be enforced to ensure that the cap is not breached in the future in order for this alternative to be protective.

Upon completion of Alternative S-3 and Alternative S-4(A and B), the potential risks to human health and the environment from organic and inorganic contaminants would be minimized if not eliminated through off-site removal or treatment of contaminants in the surface soils to protective levels.

Groundwater

Alternative GW-1, No Adion, would not be protective of human health and the environment because the groundwater would continue to migrate off-site continuing to pose a potential threat to users. Therefore, Alternative GW-1 has been eliminated from consideration and will not be discussed further.

Alternatives GW-2 (A and B) and GW-5 (A and B) would be protective of human health by controlling the migration of contaminated groundwater through pumping and by removing contaminants through treatment of pumped groundwater. GW-5 (A and B) captures and removes more contamination than GW-2 (A and B).

Compliance with ARARs

Soil

There are no chemical specific ARARs for soil. However, the State has developed State-wide soil cleanup criteria that while not legally applicable, were considered by EPA in selecting cleanup levels for the Site. If implemented, Alternatives S-3 and S-4(A and B) would meet location-specific and action-specific Federal and State ARARs for the contamination in the soils. The major ARARs for Alternative S-3 are Federal and State Resource Conservation and Recovery Act (RCRA) requirements which control the transportation and disposal of hazardous waste. For example, the soil excavated under Alternative S-3 would be disposed at a facility which is licensed under RCRA to accept hazardous waste. Alternatives S-4(A and B) would involve the use of an on-site treatment technology which would be subject to RCRA treatment regulations and Clean Air Act requirements regarding emissions from the treatment system. Air emissions will require air permit equivalences from the State of New Jersey. In addition, because a portion of the Site is classified as wetlands, all alternatives (soil and/or groundwater) would need to comply with Section 404 of the Clean Water Act and federal Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. A wetland restoration and monitoring plan will be prepared as a part of the remedial design plan to address potential impact to the wetlands, such as groundwater drawdown.

Groundwater

Alternatives GW-2 (A and B) and GW-5(A and B) would meet the chemical-specific ARARs for the treated water before discharge. These include New Jersey Pollutant Discharge Elimination System requirements for discharges to surface water. In addition, air emissions from the treatment plant would need to comply with Federal and State emissions standards. Alternatives GW-2(A and B) and GW-5(A and B) produce a non-hazardous filter cake. Also, a CEA would be established for the Site until such time that it can be shown that State groundwater quality standards are not exceeded.

Alternative GW-5(A and B) is more likely to achieve State and federal water quality standards in the aquifers than is GW-2, because GW-5(A and B) would utilize several wells to extract contaminated groundwater from the aquifer whereas GW-2 would utilize only one extraction well. The additional extraction will provide greater capture of contaminants and therefore increase the likelihood of achieving State and federal water quality standards. It is possible that it will be technically impracticable to restore all portions of the aquifers to meet State and federal standards. Any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards require a waiver of such standards on the basis of technical impracticability. If after implementation of the remedy, it proves to be technically impracticable to meet water quality standards, EPA would waive such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may require a technical impracticability waiver.

Remedial activities for groundwater at the Site may disturb or impact wetlands. Impacts may include groundwater drawdown or alteration of the hydrologic characteristic of the area, as well as improvement or installation of wells. These potential impacts will be considered in the remedial design report.

Long-Term Effectiveness and Permanence

Soil

Alternatives S-4(A and B) provide the highest degree of long-term effectiveness and permanence since the waste would be treated to permanently remove organic contaminants. Alternative S-3 provides a high degree of long-term effectiveness by removing waste from the Site but does not provide a high degree of permanence since waste would not be destroyed but only contained off-site.

Under Alternative S-2A, contaminated soils would remain on-site and, therefore, this remedy would provide the least amount of long-term effectiveness and permanence. In addition, institutional controls would need to be employed and enforced in order to ensure effectiveness.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) provide varying amounts of containment of the contaminated groundwater. Additional off-site investigations to determine the extent of groundwater contamination are necessary to ensure that risks to neighboring communities are minimized. Alternatives GW-5 (A and B) provide a higher degree of long-term effectiveness than Alternatives GW-2 (A and B) by capturing a larger mass and volume of contaminants in the groundwater. The on-site treatment facility will therefore, treat a greater quantity of contaminated groundwater and remove a larger mass of contam)nants from the extracted groundwater. The additional extraction wells would also better contain the plume on-site.

Short-Term Effectiveness

Soil

Alternatives S-2A, S-3, and S-4(A and B) do involve construction activities that would pose a low level risk of exposure to soils by ingestion, direct contact and inhalation to Site workers; however this risk can be managed by appropriate health and safety measures. All of the alternatives can be implemented relatively quickly, in less than a year following completion of design.

Alternative S-3 involves a significant increase in dust, vapor, and noise generation during soil excavation. These would be minimized through the use of measures which would be undertaken to ensure that all activities are performed in such a way that vapors, dust, and other materials are not released to the surrounding community during excavation. In addition, Alternative S-3 includes off-site transportation of the excavated soils. This will increase truck traffic and noise in the community during the period when soil is being transported off-site. Transportation flow pattems will be designed to minimize traffic impacts on the community. This may entail constructing a road from the Site which will bypass residential areas.

Under Alternative S-4(A and B), a thermal desorber would be placed on-site, causing increases in noise and emissions from the unit. To minimize the risk from inhalation of vapors from the thermal desorber which is required, a secondary chamber would be utilized that would oxidize all organic compounds released from the LTTD process to carbon dioxide, water and hydrochloric acid.

Groundwater

All the groundwater alternatives provide short-term effectiveness in protecting the Site workers and neighboring communities from the risks due to ingestion and inhalation of VOCs. Alternatives GW-2(A and B) and GW-5(A and B) would pose a low level risk to Site workers during construction; however, this risk can be managed by the use of appropriate health and safety measures. Alternative GW-2 is a continuation of the existing system and is running now. Alternatives GW-5 (A and B) can be implemented very quickly (in approximately 3 months) since they are simply an addition to the current system.

Reduction of Toxicity, Mobility or Volume Through Treatment

Soil

Alternatives S-4(A and B) provide for physical removal of the contaminated material and the maximum reduction in toxicity and mobility through treatment. Alternative S-2A and Alternative S-3 do not include the use of treatment to reduce the toxicity, mobility or volume of contaminated soil. For Alternative S-2A, reduction in the mobility of the contamination would be achieved through the use of containment. For Alternative S-3, reduction in toxicity, mobility and volume would be achieved through excavation and off-site disposal rather than through treatment.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) reduce the toxicity and volume of contamination from the extracted groundwater. However, Alternative GW-5(A and B) would operate at approximately twice the pumping rate of Alternative GW-2(A and B). The mobility of the contaminants is completely controlled by the pump-and-treat alternatives to the extent that the groundwater is within the capture zone of the wells. Greater reduction of volume and toxicity of contaminated groundwater is achieved by GW-5 than GW-2. Alternative GW-5 also results in greater capture and containment of contaminated groundwater.

Implementability

Soil

All of the services and materials needed to implement the soil alternatives are readily available commercially. Each alternative utilizes standard technologies for excavation, capping and transportation of soils. However, due to the high demand for thermal desorption units, there may be a delay in implementing Alternative S-4 (A and B). All the alternatives are technically feasible but Alternatives S-4(A and B) require a treatability study to obtain design parameters for the full-scale system. Alternatives S-4(A and B) have complex administrative issues because of the quantity of equipment that needs to be set up at the Site and the need to provide substantive compliance with State air emissions permit requirements. Alternative S-3 is easily implementable using standard excavation technology. If possible, a temporary access road that would provide more direct access from the Site to nearby highways, would be built, in order to minimize the number of trucks traveling through the community. Engineering controls are readily implementable to minimize air borne dust and contaminants for all excavation activities. If necessary, a small pilot-scale study will be undertaken to help in estimating the ambient air impact for soil excavation at the Site.

Groundwater

All of the services and materials needed to implement the groundwater alternatives are readily available commercially. All the alternatives are technically feasible but Alternatives GW-2(A and B) and GW-5(A and B) require skilled operators to successfully implement the remedy. The alternatives are also feasible from an administrative standpoint. The required activities for the pump-and-treat would occur on Chemsol property. The treatment plant for the interim remedy has already been built and has been in operation for the last three years with discharge to the MCUA POTW. The effluent line for the discharge to Stream 1A has also been installed even though it is not currently being used.

All the services needed to implement the alternatives already exist. The pump-and-treat alternatives require the most services since they require operation of the treatment plant and disposal of filtered waste from the plant.

Costs

The capital, annual operation and maintenance, and present worth costs are presented in Tables 10 and 11, (Appendix II). Present worth costs for all the alternatives were calculated assuming a 5% interest rate and a 30-year operation and maintenance period.

Soil

Capital costs for Alternative S-1 are estimated to be $338,660 which includes costs for a single sampling event of drummed waste and stockpiled soils along with transporting and off-site disposal of the drummed waste and the stockpiled soil. There would be no operation and maintenance costs so that the total present worth is estimated to be $338,660.

Capital costs for Alternative S-2A are estimated to be $1,855,850. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of constructing and seeding the soil cap. Annual operation and maintenance costs are estimated to be $2,000. The total present worth is estimated to be $1,894,000.

Capital costs for Alternative S-3 are estimated to be $5,573,000. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and disposing of the contaminated soils off-site. There are no annual operation and maintenance costs so that the total present worth is estimated to be $5,573,000.

Capital costs for Alternative S-4A are estimated to be $11,963,134. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site. There are no annual operation and maintenance costs since the treatment would be accomplished in less than a year so that the total present worth is estimated to be $11,963,134.

Capital costs for Alternative S-4B are estimated to be $12,241,639. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site and disposing the lead-contaminated soils off-site. There are no annual operation and maintenance costs since the work would be accomplished in less than a year so that the total present worth is estimated to be $12,242,000.

Groundwater

In the case of all groundwater alternatives, the costs (Table 11, Appendix II) are in addition to those already incurred to install and operate the existing interim extraction and treatment system at the Site.

Alternative GW-1 does not have any capital cost. The annual operation and maintenance costs are estimated to be $59,336 and include costs for monitoring the groundwater. The total present worth cost is estimated to be $912,000.

Capital costs for Alternative GW-2A are estimated to be $45,097. These costs include costs associated with installation of underground piping from well C-1 to the treatment plant. The annual operation and maintenance costs are estimated to be $452,738. The total present worth is estimated to be $7,000,300.

Capital costs for Alternative GW-2B are estimated to be $45,097 and include costs associated with installation of underground piping from well C-1 to the treatment plant. Annual operation and maintenance costs are estimated to be $726,336. The total present worth is estimated to be $11,209,000.

Capital costs for Alternative GW-5A are estimated to be $390,189 and include costs associated with installation of underground piping from well C-1 to the treatment plant and costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be $670,892. The total present worth is estimated to be $10,699,000.

Capital costs for Alternative GW-5B are estimated to be $390,189 and include costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be $766,336. The total present worth is estimated to be $12,169,000.

State Acceptance

The NJDEP will not concur with this ROD. This stems from the fact that EPA's residential cleanup level for PCBs in soil is 1 ppm while NJDEP's residential cleanup criterion is 0.49 ppm. NJDEP cannot concur with the ROD unless it specifically requires institutional controls if the Site is not remediated to the NJDEPs 0.49 ppm residential use criterion for PCBs. However, NJDEP does not object to EPA's groundwater remedy.

Community Acceptance

EPA solicited input from the community on the remedial alternatives proposed for the Chemsol Site. While the community is supportive of EPA's preferred remedy, some citizens have indicated their preference for EPA to cleanup the soils at the Site to NJDEP cleanup criteria of 0.49 ppm for PCBs, instead of EPA's cleanup level of 1 ppm. The attached Responsiveness Summary addresses the comments received during the public comment period.

SELECTED REMEDY

Based upon consideration of the results of the RI/FS, the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative S-3 and Alternative GW-5 are the appropriate remedies for the Site, because they best satisfy the requirements of CERCLA º121 and the NCP's nine evaluation criteria for remedial alternatives, 40 CFR º300.430(e)(9). This remedy is comprised of the following components:

Soil

- Excavation and off-site disposal of approximately 18,500 cubic yards of contaminated soil with PCBs above 1 part per million (ppm) and lead above 400 ppm. The excavated areas will be backfilled with clean imported fill from an off-site location, covered with topsoil, then seeded with grass.

! Disposal of the excavated soils at an appropriate off-site disposal facility, depending on waste characteristics.

Groundwater

! Installation and pumping of additional extraction wells to contain contaminated groundwater on-site.

! Continued treatment of extracted groundwater through the existing groundwater treatment facility. The treated groundwater may continue to be released to the Middlesex County Utilities Authority (MCUA), if not, will undergo on-site biological treatment, prior to being released on-site, to Stream 1A.

! Perform an additional groundwater investigation to determine if contaminated groundwater is leaving the property boundaries.

Surface Water and Sediments

! Monitoring of sediments and surface water to determine if remediation of Lot 1B results in lower PCB levels in the on-site streams, Stream 1A and 1B over time.

The selection of this remedy is based on the comparative analysis of the alternatives discussed above and provides the best balance of tradeoffs with respect to the nine evaluation criteria.

STATUTORY DETERMINATIONS

As was previously noted, CERCLA º121 (b)(1), mandates that a remedial action must be protective of human health and the environment, cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121 (b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, or contaminants at a site. CERCLA º121(d), further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA º121 (d)(4).

For the reasons discussed below, EPA has determined that the selected remedy meets the requirements of CERCLA º121.

Protection of Human Health and the Environment

The selected soil remedy protects human health and the environment by removing contaminated surface soils (0-2 feet depth) for off-site disposal. In addition, borings 74 and 76 with PCB contamination down to 6 feet depth, will also be excavated. Such excavation may also enable the NJDEP soil cleanup criteria to be achieved through soil compliance averaging. All excavated soils will be disposed of off-site at an appropriate disposal facility, depending on the characteristics of the soils.

The selected groundwater remedy will be protective of human health and the environment by controlling the migration of contaminated groundwater through pumping and the removal of contaminants through treatment of the pumped groundwater. This action will contain the highly contaminated groundwater on-site as well as provide for removal of contaminants, through treatment.

Compliance with ARARs

As part of the selected remedy, contaminated soils will be excavated and disposed of off-site. There are no chemical specific ARARs for soil. However, EPA and the State have promulgated guidances that while not legally applicable, were considered by EPA in establishing cleanup levels for the Site. The selected soil remedy will meet location - specific, and action-specific federal and State ARARs. Chemical-specific ARARs include: the Clean Air Act of 1976 which governs emissions resulting from excavation and off-site disposal of soils and Section 112 of the Clean Air Act which defines National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (See Table 12).

Location-specific ARARs for the selected soil remedy include: Executive Order 11990 (Wetlands Protection); the Wetlands Construction and Management Procedures (40 CFR, Appendix A); Executive Order 11988 (Floodplain Management); and, the National Historic Preservation Act of 1966. Since a portion of the Site is classified as wetlands, the soil remedy needs to comply with Section 404 of the Clean Water Act and federal Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Any actions which disturb or impact wetlands would additionally require development of a wetland mitigation plan.

Action-specific ARARs for the soil remedy include: portions of the Resource Conservation and Recovery Act and its implementing regulations, specifically those portions dealing with the transportation, storage and disposal (including land disposal) of hazardous wastes and Department of Transportation requirements governing the off-site transport of hazardous materials.

As far as the selected groundwater remedy, the major chemical-specific ARARS are the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels(MCLs) and the New Jersey Groundwater Quality Standards. For a given contaminant, at the conclusion of the groundwater remedy, groundwater in the aquifer at the Site boundaries should meet either the MCL or the Groundwater Quality Standard, whichever is more stringent (see Table 2). However, it is possible that the selected groundwater remedy will not meet chemical-specific ARARS for the organic contaminants in all groundwater beneath the Site. The water quality in the fractured bedrock aquifer is not expected to be restored to below MCLs or background levels for at least several decades due to the potential presence of DNAPLs. Any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards (see Table 2) would require a waiver of such standards on the basis of technical impracticability. If after implementation of the remedy, it proves to be technically impracticable to meet the ARARS in Table 2, EPA would waive such standards. Performance data from the groundwater system would be used to determine the parameters and locations (both horizontally and vertically) which require such a technical impracticability waiver. Extracted groundwater would be treated to meet federal and State ARARS related to discharge of treated groundwater such as National Pollutant Discharge Elimination System (NPDES) and New Jersey Pollutant Discharge Elimination System (NJPDES) requirements.

Location-specific ARARS, include for the selected groundwater remedy include: Executive Order 11990 (Wetlands Protection); the Wetlands Construction and Management Procedures (40 CFR, Appendix A); Executive Order 11988 (Floodplain Management); and, the National Historic Preservation Act of 1966. Since a portion of the Site is classified as wetlands, the groundwater remedy would comply with Section 404 of the Clean Water Act and federal Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Any actions which disturb or impact wetlands would additionally require development of a wetland mitigation plan.

Action-specific ARARS for the groundwater remedy include: portions of the Resource Conservation and Recovery Act and its implementing regulations, specifically those portions dealing with the transportation, storage and disposal (including land disposal) of hazardous wastes.

Cost Effectiveness

The selected soil remedy is cost-effective as it has been determined to provide the greatest overall long-term and short-term effectiveness in proportion to its present worth cost, $5.6 million with no annual operation and maintenance. Alternative S-4(A and B) would provide an equivalent level of protection, but at almost twice the cost [$11.96 - $12.24] million. Alternative S-2A (Capping with Soil), is estimated to cost $1.9 million, which is less than the selected remedy, but since contamination would be left on Site, Alternative S-2A would not provide a high degree of long-term effectiveness.

The selected groundwater remedy is cost-effective as it has been determined to provide the greatest overall long-term and short-term effectiveness. Even though the selected remedy, GW-5, has a higher O&M cost than GW-1 and GW-2, the pumping of these additional groundwater extraction wells allows for more effective on-site containment of the plume and also allows for groundwater extraction from other contaminated areas on-site.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected soil and groundwater remedies represent the maximum extent to which permanent solutions, and alternative treatment technologies can be utilized in a cost-effective manner for the Chemsol Site. Furthermore, the selected remedies provide the best balance of tradeoffs with respect to the nine evaluation criteria.

Preference for Treatment as a Principal Element

The selected groundwater remedy satisfies the statutory preference for treatment as a principal element. The selected remedy utilizes treatment to reduce levels of contamination in groundwater to achieve ARARs, to the extent practicable. The activated carbon in the extracted groundwater are either destroyed by catalytic oxidation or are collected on liquid phase carbon which are later regenerated. Regeneration of the carbon converts the organic contaminants to carbon dioxide, water and hydrochloric acid, thereby eliminating the toxicity.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Site was released to the public in August 1997. This Plan identified Alternative S-3 as the preferred alternative to address the soil contamination and Alternative GW-5 as the preferred alternative to address the groundwater contamination at the Chemsol, Inc. Site. Upon review of all comments submitted, EPA determined that no significant changes to the selected remedy, as it was presented in the Proposed Plan, were necessary.

APPENDIX I

FIGURES

<IMG SRC 98141A1>
<IMG SRC 98141A2>
<IMG SRC 981241A3>

APPENDIX II

TABLES

TABLE - 1
CONTAMINANTS IN SURFACE AND SUBSURFACE SOILS

Contaminants	Concentrations Surface Soil (parts per billion)	Concentrations Subsurface Soil (parts per billion)
VOLATILE ORGANICS		
Carbon Tetrachloride	0 - 5,000	680 - 1700
Trichloroethene	3,500 - 32,000	3 - 18,000
Tetrachlorothene	0 - 7,000	2 - 12,000
1,1,2,2, - Tetrachlorethane	15 - 110	49,000
Chlorobenzene	0 - 3,300	4 - 8,300
Xylene (Total)	56,000 - 110,000	2 - 40,000
Toluene	2 - 380,000	10 - 27,000
Ethybenzene	2,900 - 15,000	8 - 8,800
SEMI-VOLATILES		
Bis(ethylhexyl)phthalate	0 - 63,000	66 - 17,000
Naphthalene	29 - 18,000	44 - 3,800
1,2,-Dichlorobenzene	200 - 1,600	34 - 10,000
PESTICIDES/PCB		
Aldrin	58 - 8,300	0.3 - 2,000
Dieldrin	43 - 13,000	1.1 - 130
4,4-DDE	0 - 4,600	0.13 - 120
Toxaphene	0 - 3,400	--
PCBs	540 - 310,000	21 - 2,600
INORGANICS		
Manganese	30.4 - 1,840 (parts per million)	282 - 2,300 (parts per million)
Lead	7 - 1,920 (parts per million)	2.4 - 914 (parts per million)

TABLE - 2
CONTAMINANTS IN GROUNDWATER

Contaminants	Concentrations (parts per billion)	Federal MCLs (parts per billion)	State of New Jersey Water Quality Standards (parts per billion)
VOLATILE ORGANICS			
Carbon Tetrachloride	2 - 35,000	5	2
Trichloroethene	0.9 - 180,000	5	1
Tetrachloroethene	1 - 5,700	5	1
Chlorobenzene	4 - 4,200	100	4
Xylene (Total)	1 - 5,700	10	44
Toluene	2 - 27,000	1,000	1,000
Ethylbenzene	11 - 1,600	700	700
Vinyl Chloride	3 - 3,310	2	2
Benzene	1 - 16,000	5	1
2-Butanone	270 - 21,000	NA	NA
Chloroform	1 - 55,000	80**	100*
1,2-Dichloroethene	0.5 - 39,000	70 - 100***	10
SEMI-VOLATILES			
1,2-Dichlorobenzene	2 - 3,300	600	600
PCBS	0 - 10	0.5	0.5
INORGANICS			
Manganese	6.1 - 19,100	50	50
Aluminum	63.9 - 61,000	50 - 200	50 - 200

NA - Not available for this constituent
* - MCL is for Trihalomethanes
** - Proposed
*** - [cis-70 ppb, trans-100ppb]

TABLE 3

SUMMARY OF CHEMICALS IN
SURFACE WATER

<IMG SRC 98141A4>
<IMG SRC 98141A5>
<IMG SRC 98141A6>

TABLE 4
SUMMARY OF CHEMICALS IN
SEDIMENT

<IMG SRC 98141A7>
<IMG SRC 98141A8>
<IMG SRC 98141A9>
<IMG SRC 98141B>
<IMG SRC 98141B1>

TABLE 5

CHEMICALS OF POTENTIAL CONCERN

<IMG SRC 98141B2>

TABLE 6

POTENTIAL EXPOSURE PATHWAYS

<IMG SRC 98141B3>
<IMG SRC 98141B4>
<IMG SRC 98141B5>
<IMG SRC 98141B6>
<IMG SRC 98141B7>
<IMG SRC 98141B8>

TABLE 7

CARCINOGENIC TOXICITY VALUES

<IMG SRC 98141B9>
<IMG SRC 98141C>
<IMG SRC 98141C1>
<IMG SRC 98141C2>

TABLE 8

HAZARD INDEX

TABLE 8

CHEMSOL, INC SITE
TOXICITY ENDPOINTS/TARGET ORGANS FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
QUANTITATIVELY EVALUATED IN THE RISK ASSESSMENT

CHEMICALS	TOXICITY ENDPOINT/TARGET ORGAN*
Acetaldehyde (TIC)	Respiratory Tract
Acetone	Liver, Kidney
Acrotein	Respiratory Tract
Carbon Tetrachloride	Liver
Chloroform	Liver
1,2-Dichlorethene (Total)	Liver
Trichloroethene	Liver, Kidney
Manganese	Central Nervous System

MATRIX	EXPOSURE ROUTE	RECEPTOR	HAZARD INDEX	HAZARD INDEX BY TOXICITY ENDPOINT/TARGET ORGAN
Surface Soil: (Lot 1A)		Residents:		
	Ingestion	Children	1.5	Manganese - 1.2
	Inhalation of Particulates	Children	0.6	Manganese - 0.6
(Lot 1B)		Residents:		
	Ingestion	Children	6.2	Manganese - 2.6
	Inhalation of Particulates	Children	0.9	Manganese - 0.91
Surface/Subsurface Soil: (Effluent Discharge Line)		Residents:		
	Ingestion	Children	3.7	Manganese - 3.1
	Inhalation of Particulates	Children	1.5	Manganese - 1.5

TABLE 8 (cont'd)

CHEMSOL, INC SITE
TOXICITY ENDPOINTS/TARGET ORGANS FOR NONCARCINOGENIC CHEMICALS OF POTENTIAL CONCERN
QUANTITATIVELY EVALUATED IN THE RISK ASSESSMENT

MATRIX	EXPOSURE ROUTE	RECEPTOR	HAZARD INDEX	HAZARD INDEX BY TOXICITY ENDPOINT/TARGET ORGAN
Ground Water: (Site-Wide)		Residents:		
	Ingestion	Adults	340	Acetone - 3.0 Carbon Tetrachloride - 130 Chloroform - 35 1,2 - Dichloroethene (Total) - 61 Trichloroethene - 70 Manganese - 40
	Ingestion	Children	800	Acetone - 6.9 Carbon Tetrachloride - 310 Chloroform - 82 1,2-Dichloroethene (Total) - 140 Trichloroethene - 160 Manganese - 94
	Ingestion	Site Workers/ Employees	120	Acetone - 1.1 Carbon Tetrachloride - 48 Chloroform - 13 1,2-Dichloroethene (Total) - 22 Trichloroethene - 25 Manganese - 14
	Ingestion	Construction Workers	17	Carbon Tetrachloride - 4.4 Chloroform - 3.3 1,2-Dichloroethene (Total) - 5.7 Manganese - 3.7

*Sources: Integrated Risk Information System (IRIS) on-line September and November 1994 and January 1995, HEAST FY 1994 - Annual.

TABLE 9

NONCARCINOGENIC TOXICITY VALUES

<IMG SRC 98141C3>
<IMG SRC 98141C4>
<IMG SRC 98141C5>
<IMG SRC 98141C6>
<IMG SRC 98141C7>
<IMG SRC 98141C8>

TABLE 10

SUMMARY OF COST ESTIMATES FOR SOIL ALTERNATIVES

ALTERNATIVE		TOTAL CAPITAL COST	ANNUAL O&M COST	TOTAL PRESENT WORTH
No Action				
	1	$388,660	$0	$388,660
Capping				
with soil	2A	$1,855,850	$2,000	$1,894,000
with asphalt	2B	$2,650,481	$175,000	$6,013,000
Off-Site Disposal				
	3	$5,573,001	$0	$5,573,000
On-site LTTD for PCBs				
on-site solidification for Lead	4A	$11,963,134	$0	$11,963,000
off-site disposal for Lead	4B	$12,241,639	$0	$12,242,000

TABLE 11

SUMMARY OF COSTS ESTIMATES FOR GROUNDWATER ALTERNATIVES

ALTERNATIVE	TOTAL CAPITAL COST	ANNUAL O&M COSTS	TOTAL PRESENT WORTH
No Action -1	$0	$59,336	$912,000
Continue, Existing Interim Action			
Extract from C-1.21gpm			
Discharge to POTW - 2A	$45,097	$452,738	$7,000,300
Discharge to Stream - 2B	$45,097	$726,336	$11,209,000
Extract from C-1, C-2, TW-4			
TW-5, TW-8, DMW-9, 55 gpm			
Discharge to POTW - 5A	$390,189	$670,892	$10,699,000
Discharge to Stream - 5B	$390,189	$766,336	$12,169,000

TABLE 12

POTENTIAL ARARs/TBCs

Table 12-1
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Statute, Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Soil:				
Toxic Substances Control Act.	15 USC 2605	Applicable to storage and disposal of PCB and pesticide contaminated material.	Applicable	Establishes requirements for soil containing > 50 ppm PCBs.
Toxic Substances Control Act	Requirements for PCB Spill Cleanup (40 CFR 761.125)	Establishes PCB cleanup levels for soils and solid surfaces.	Applicable	Applicable to spills of materials containing PCBs at concentrations of 50 ppm or greater than occurred after February 17, 1978. These requirements my be relevant and appropriate to the evaluation of PCB levels in site soils.
Toxic Substances Control Act	Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive 9355.4-01)	Provides guidance on identifying principal threat and low-threat areas of PCB contamination. At industrial sites, PCBs at concentrations of 500 ppm or greater generally pose a principal threat.	Applicable	Will be considered at Chemsol with respect to soil PCB contamination.
Toxic Substances Control Act	Revised interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (OSWER Directive 9355.4-12)	Recommends a screening level for lead of 400 ppm in soil for residential land use.	Applicable	Chemsol is expected to be developed for residential use. This will be considered to screen soil lead contamination levels.
Resource Conservation and Recovery and Recovery Act (RCRA)	Hazardous Waste Determination - Toxicity Characteristic (40 CFR 261.24)	Establishes maximum concentrations of contaminants for the toxicity characteristic using the test method described in 40 CFR 261 Appendix II.	Applicable	Applicable to the determination of whether soils, if excavated, require handling as a hazardous waste.

Table 12-1
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Statute, Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Air:				
Clean Air Act.	42 USC 7401 Section 112	Establishes limits on pollutant emmissions to atmosphere.	Applicable	Pollutants deemed hazardous or non-hazardous based on public health.
National Primary and Secondary Ambient Air Quality Standards (NAAQS).	40 CFR 50	Establishes primary and secondary NAAQS under Section 109 of the Clean Air Act.	Potentially Applicable	Primary NAAQS define levels of air quality necessary to protect public health. Secondary NAAQS define levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Applicable to remedial action alternative(s) that may emit pollutants to the atmosphere
National Emission Standards for Hazardous Air Pollutants (NESHAPS).	40 CFR 61	Establishes NESHAPs.	Potentially Applicable	Establishes NESHAPs for toxic emissions.
Ground Water:				
Safe Drinking Water Act (SDWA).	Pub. L. 95-523, as amended by Pub. L. 96502, 22 USC 300 et. seq.	Set limits to the maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs).	Applicable	The aquifer system has been designated as a drinking water aquifer by the EPA.
National Primary Drinking Water Standards.	40 CFR Part 141	Applicable to the use of public water systems; Establishes maximum contaminant levels, monitoring requirements and treatment techniques.	Applicable	Primary MCLs are legally enforceable.

Table 12-1
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Statute, Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
National Secondary Drinking Water Standards.	40 CFR Part 143	Applicable to the use of public water system; Controls contaminants in drinking water that primarily effect the aesthetic qualities relating to public acceptance of drinking water.	Applicable	Secondary MCLs pertain to aesthetic charateristics (taste, odor) and are not legally enforceable.
Surface Water:				
Clean Water Act (CWA).	33 USC 1251 et.seq.	Applicable for alternatives involving treatment with point-source discharges to surface water.	Potentially Applicable	Criteria available for water and fish ingestion, and fish consumption for human health. State criteria are also available.
Clean Water Act (CWA).	Ambient Water Quality Criteria (AWQC) (40 CFR 131.36(b)(1))	Non-enforceable guidelines established for the protection of human health and/or aquatic organisms.		AWQC will be applicable to remedial alternatives which involve discharges to surface water.
Clean Water Act (CWA).	Effluent Discharge Limitations (40 CFR 401.15)	Regulates the discharge of contaminants from an industrial point source.		Regulations will be applicable to remedial alternatives which involve discharges to surface water.
RCRA: Resource Conservation and Recovery Act (RCRA) - Identification and Listing of Hazardous Waste.	40 CFR Part 264.1	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR parts 262-265 and Parts 124, 270, 271.	Potentially Applicable	May be considered an ARAR for solids produced during groundwater treatment.
Resource Conservation and Recovery Act Maximum Concentration Limits.	40 CFR Part 264	Groundwater protection standards for toxic metals and pesticides.	Potentially Applicable	These provisions are applicable to RCRA regulated units that are subject to permitting.

Table 12-1
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Statute, Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Land Disposal Restrictions	40 CFR 268	Established maximum concentrations of contaminants on the basis of which hazardous wastes are restricted from land disposal.	Potentially Applicable	This regulation will be applicable to remedial alternatives which utilize land disposal of soils determined to be a hazardous waste.
Pretreatment Standards.	40 CFR 403	Establishes pretreatment standards to control pollutants that pass through or interfere with POTW treatment processes or may contaminate sewage sludge.	Potentially Applicable	Applicable to remedial action alternative that includes discharge to POTW or to a sewer system that is connected to a POTW.
State				
Soil				
	NJ Soil Cleanup Criteria	Non-promulgated soil criteria developed based on protection of human health or ground water quality used for developing site-specific cleanup levels.	TBC Applicable	TBCs for the evaluation of soil quality.
Groundwater and Surface Water: NJ Water Pollution Control Act	NJ Surface Water Quality Standards (NJAC 7:9B-1.14(c))	Established water quality standards for various surface water classes.	Applicable	Potential ARARs due to classification of Stream 1A near site as FW2-NT. Will affect alternatives which include discharges to the Stream 1A.
NJ Groundwater Quality Standards	NJAC 7:9-Subchapter 6	Establishes constituent standards for groundwater pollutants. It defines numerical criteria for limits on discharges to groundwater and standards for cleanups.	Applicable	Potential ARARs for groundwater alternatives.
Hazardous Waste Criteria, Identification and Listing	NJAC 7:26-Subchapter 8	Defines those solid wastes that are subject to regulation as hazardous waste	Applicable	Applies to offsite disposal of material, TCLP limits are applicable.

Table 12-2
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Ground Water and Surface Water:				
Clean Air Act.	Section 404	Prohibits discharge of dredged or fill material into wetlands without a permit. Preserves and enhances wetlands.	Applicable	Requires a permit for any remedial activity that proposes to discharge dredged or fill material into wetlands.
Regulations of Activities Affecting Water of the U.S.	33 CFR 320-329	Corps of Engineers, Department of the Army regulations are codified in Title 33 (Navigation and Navigable Waters) of the Code of Federal Regulations (33 CFR Parts 200-399).	Applicable	Applicable to remedial activities that affect U.S. waters subject to Army Corps of Engineers regulations.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.	40 CFR, Part 264.18	Part 264.18 establishes location standards including seismic considerations and flood plain requirements.	Potentially Applicable	May be applicable to remedial activities affected by seismic considerations or remedial activities conducted in flood plain areas.
Fish And Wildfife: Fish And Wildlife Coordination Act.	16 USC 661	Provides procedures for consultation between regulatory agencies to consider wildlife conservation during water resource-related projects.	Potentially Applicable	May be applicable to remedial activities that may affect fish and wildlife resources.
Endangered Species Act.	16 USC 1531	Requires Federal agencies to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of endangered/threatened species or adversely modify or destroy the critical habitats of such species.	Potentially Applicable	Applicable to remedial activities that may affect endangered or threatened species that may exist in areas affected by the remedial activity.

Table 12-2
Potential Chemical Specific ARARs/TBCs
Feasibility Study For the Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Fish And Wildlife Coordination Act.	Protection of Wildlife Habitats 16 USC 661	Prevents the modification of a stream or a river that affects fish or wildlife.	Potentially Applicable	Potential ARAR if remedial activities result in modifications to the Stream 1A which affect fish or wildlife.
Floodplain, Wetland, Coastal Zone: Executive Order On Floodplain Management.	Executive Order No 11988 40 CFRs 6.302(b) and Appendix A	Requires Federal agencies to evaluate the potential effects of actions that may take place in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain.	Potentially Applicable	Applicable to remedial actions that affect wetland areas.
Wetland Executive Order.	Executive Order No. 11990 Protection of Wetlands	Regulates activities conducted in a wetland area to minimize the destruction, loss or degradation of the wetlands	Potentially Applicable	Potential ARARs if a remedial action is proposed within a wetland area.
Wetland Executive Order.	Wetlands Construction and Management Procedures (40 CFR 6, Appendix Z)	Sets forth EPA policy for carrying out the provisions of Executive Order 11900. Regulates activities conducted in a wetland area to minimize the destruction, loss or degradation of the wetlands	Potentially Applicable	Potential ARARs if a remedial action is proposed within a wetland area.
Other: National Historic Preservation Act (NHPA).	7 CFR 650	Establishes regulations for determining a site's eligibility for listing in the National Registery of Historic Places.	Applicable	Requires consideration of remedial activity impact upon any property included in or eligible for inclusion in The National Registry of Historic Places.

Table 12-2
Potential Location Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
National Historic Preservation Act of 1966 (16 USC 470,et seq.)	16 USC 470,et seq. Protection of Historic Places	Requires actions to take into account effects on properties included in or eligible for the National Register of Historic Places and minimizes harm to National Historic Landmarks.	Potentially Applicable	Potential ARAR if activities impact areas identified as having the potential for cultural resources.
State				
Wetlands: NJ Freshwater Wetlands Protection Act	NJSA 13:9B Regulation of Activities In and Around Wetlands	Provides for classification of freshwater wetlands and establishes permit requirements for activities which impact freshwater wetlands.	Potentially Applicable	Potential ARAR if a remedial action is proposed within a wetland area.
NJ Freshwater Wetlands Regulations	NJAC 7:7	Regulates alteration or disturbance in and around freshwater wetland areas.	Potentially Applicable	Potential ARAR if a remedial action is proposed within a wetland area.
Historic Areas: NJ Conservation Restriction and Historic Preservation Restriction Act	NJSA 13:8B-1 Protection of Historic Places	Allows for the acquisition and enforcement of conservation restrictions and historic preservation restrictions by the NJDEP at historic sites.	Potentially Applicable	Potential ARAR if activities impact areas identified as having the potential for cultural resources.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Hazardous and Solid Waste Amendments of 1984 (HSWA)	Land Disposal Restrictions	Prohibits placement of hazardous wastes in locations of vulnerable hydrogeology and lists certain wastes, which will be evaluated for prohibition by EPA under RCRA.	Potentially Applicable	Potential ARARS which may limit the use of land disposal in remediating certain hazardous wastes.
Clean Air Act	National Ambient Air Quality Standards (NAAQS)-Particulates (40 CFR 50)	Establishes maximum concentrations for particulates and fugitive dust emissions.	Potentially Applicable	ARARs for alternatives involving treatment methods which result in discharges to ambient air.
Clean Air Act	Emissions Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR 61)	Establishes emissions limitations for hazardous air pollutants.	Potentially Applicable	ARARs for alternatives involving treatment methods which result in discharges to ambient air.
Hazardous Materials Transportation Act	Rules for Transportation of Hazardous Materials (49 CFR 170, 171)	Procedures for packaging, labeling, manifesting, and off-site transport of hazardous materials.	Potentially Applicable	ARARs for alternatives, involving the off-site shipment of hazardous materials or waste.
Occupational Safety and Health Act	Recordkeeping, Reporting and Related Regulations (29 CFR 1904)	Outlines recordkeeping and reporting requirements.	Potentially Applicable	ARARs for all contractors/subcontractors involved in Hazardous activities.
Occupational Safety and Health Act	General Industry Standards (29 CFR 1910)	Establishes requirement for 40-hour training and medical surveillance of hazardous waste workers	Potentially Applicable	ARARs for workers and the workplace throughout the implementation of hazardous activities.
Occupational Safety and Health Act	Safety and Health Standards (29 CFR 1926)	Regulations specify the type of safety equipment and procedures for site remediation/excavation.	Potentially Applicable	ARARs for workers and the workplace throughout the implementation of hazardous activities.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Threshold Limit Values, American Conference of Governmental Industrial Hygienists.	ACGIH ISBN: 0-936712-92-9	Threshold Limit Value (TLVs) and Biological Exposure Indices (BEIs) are listed as guidelines to assist in the control of health hazards.	TDC	TLVs and BEIs were not developed for use as legal standards but may be used as a basis for a health and safety program during site remedial activities.
Groundwater and Surface Water: Clean Water Act.	33 USC 1251 et.seq.	Restoration and maintenance of chemical, physical and biological integrity of the nation's water.	Applicable	Sets standards to restore and maintain the integrity of the nation's water.
Effluent Limitations.	Section 301	Technology-based discharge limitations for point sources of conventional, nonconventional, and toxic pollutants.	Applicable	Applicable for treatment options requiring discharge either to surface water bodies or to POTWs.
Water Quality Standards And Effluent Limitations.	Section 302	Protection of intended uses of receiving waters (e.g., Public water supply, recreational uses).	Applicable	Applicable for treatment options requiring discharge either to surface water bodies or to POTWs.
Water Quality Standards And Implementation Plans.	Section 303	Requires State to develop water quality criteria.	Applicable	Applicable for treatment options requiring discharge either to surface water bodies or to POTWs.
Toxic And Pretreatment Effluent Standard.	Section 307	Establish list of toxic pollutants and promulgate pretreatment standards for POTWs discharge.	Applicable	Applicable for treatment options requiring discharge either to surface water bodies or to POTWs.
National Pollutant Discharge Elimination System (NPDES) Permit Regulations.	40 CFR 122	Establishes permitting requirements for effluent discharge.	Potentially Applicable	Applicable for treatment options requiring discharge either to surface water bodies or to POTWs.
NPDES Regulations,	40 CFR 125	Establishes criteria and standards for technology-based treatment requirements under the Clean Water Act.	Potentially Applicable	May be applicable for treatment alternatives including discharge to surface water or POTW.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Regulations on Test Procedures for the Analysis of Pollutants.	40 CFR 136	Establishes test procedures for pollutant analysis in water.	Potentially Applicable	Applicable for alternatives including discharge to surface water or POTW.
Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, USEPA Office of Emergency and Remedial Response.	EPA/540/G-88/003 OSWER Directive. 9283.1-2	Provides guidance for developing, evaluating, and selecting groundwater remedial action at Superfund sites.	TBC	Guidance for selecting remedial alternative. Includes action related considerations, such as overall protection of human health and the environment, and implementability.
RCRA:				
Resource Conservation And Recovery Act (RCRA) Subtitle C - Hazardous Waste.	40 CFR Part 264 RCRA	Applicable to the treatment, storage, transportation and disposal of hazardous waste and wastes listed under 40 CFR Part 261.	Potentially Applicable	May be required for waste/soil disposal of treatment options.
RCRA Subtitle D - Solid Waste.	40 CFR Part 264 RCRA Subtitle D	Applicable to the management and disposal of non-hazardous wastes.	Potentially Applicable	Specifies minimum technical standards for solid waste disposal facilities.
RCRA - Part 264 Standards for Owners and Operators.	40 CFR Part 264	Standards for owners and operators of hazardous waste facilities.	Potentially Applicable	Includes design requirements for capping, treatment, and post closure care.
RCRA - Part 262 Standards for generators Part 263 Standards for transporters.	40 CFR Parts 262 and 263	Applicable to generators and transporters of hazardous waste.	Potentially Applicable	Applicable to off-site disposal or treatment of hazardous material.
RCRA - Land disposal restrictions.	40 CFR Part 268	Applicable to alternatives involving land disposal of hazardous wastes, and requires treatment to diminish a waste's toxicity and /or minimize contaminant migration.	Potentially Applicable	May be required for waste/soil disposal or treatment options.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
Federal				
Transportation of Hazardous Wastes.	49 CFR 170-189	Federal Highway Administration, Department of Transportation, and National Highway Traffic Safety Administration regulations are codified in Title 23 (Highways) of the Code of Federal Regulations (23 CFR Parts 1-1399) Additional Transportation regulations are codified in Title 49 (Transportation) of the Code of Federal Regulations (49 CFR Parts 1-1399)	Potentially Applicable	Applicable to remediation alternatives that involve the off-site transportation of hazardous waste.
RCRA - Part 270 Hazardous Waste Permit Program.	40 CFR 270	EPA administered hazardous waste permit program.	Applicable	Covers the basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.
Wetlands:				
Wetland Permits.	Section 404	Applicable to remedial actions in and around wetlands.	Potentially Applicable	Applicable to treatment options involving excavation or dredging in and around wetlands if discharge to Stream 1A is chosen.
Other:				
National Historic Preservation Act (NHPA).	7 CFR 650	Regulations for determining a site's eligibility for listing in the National Register of Historic Places	Applicable	A federal agency must take into account the effect of a project on any property included in or eligible for inclusion in the National Register of Historic Places.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
State				
NJ Hazardous Waste Regulations	Labeling, Records and Requirements (NJAC 7:26-7)	Requirements for hazardous waste generators.	Potentially Applicable	Potential ARARs for alternatives which involve the generation of a hazardous waste.
NJ Industrial Site Recovery Act	Hazardous Discharge Site Remediation Regulations (NJAC 58:10B-12 and 13)	Requires the documentation and maintenance of engineering or institutional controls when such are used in lieu of remediating a site; also establishes a one in one million additional cancer risk as a basis for residential and non-residential soil remediation standards.	Potentially Applicable	Potential ARARs for active remediation alternatives and for alternatives which involve the use of institutional or engineering controls in lieu of permanent remediation.
NJ Industrial Site Recovery Act	Technical Requirements for Site Remediation (NJAC 7:26E)	Establishes remedial action requirements, including workplan and reporting requirements.	Potentially Applicable	Potential ARARs for active remediation alternatives.
NJ Water Pollution Control Act	Pollutant Discharge Elimination System Permit/Discharge Requirements (NJAC 7:14A-2.1)	Requires any discharger to land or water to obtain a permit pursuant to NJSA (58:10A-1)	Potentially Applicable	ARARs for alternatives involving treatments which discharge effluents to surface or groundwater.
NJ Water Pollution Control Act	Discharge to Groundwater Requirements (NJAC 7:14A-6)	Requires any discharger to ground water to obtain a permit.	Potentially Applicable	ARARs for alternatives involving discharges to ground water.
NJ Water Pollution Control	Effluent Standards/Treatment requirements (NJAC 7.9B-1.6)	Establishes effluent standards and treatment requirements for discharge of toxic effluent.	Potentially Applicable	ARARs for alternatives involving treatments which discharge toxic pollutants to area water bodies.

Table 12-3
Potential Action Specific ARARs/TBCs
Feasibility Study For Chemsol Inc. Site

Standard, Requirement, Criteria Or Limitation	Citation Or Reference	Description	Status	Comments
State				
NJ Air Pollution Control Act	Permits and Emissions Limitations for VOCS (NJAC 7:27-16)	Requires sources which emit VOCs be registered and permitted with the NJDEP and meet design specifications.	Potentially Applicable	ARARs for alternatives involving treatments which impact ambient air (e.g., air stripping).
NJ Air Pollution Control Act	Toxic Substance Emissions (NJAC 7:27-17)	Requirements for emissions control apparatus for sources of toxic emissions.	Potentially Applicable	ARARs for alternatives involving treatments which impact ambient air (e.g., air stripping).
NJ Air Pollution Control Act	Emergency Situations (NJAC 7:27-12)	Requirements for standby plans to reduce emissions of air contaminants during an air pollution emergency.	Potentially Applicable	ARARs for alternatives involving treatments which impact ambient air.
NJ Water Quality Planning Act (NJSA 58:4A-14)	Well Drilling Permits and Well Certification Forms	Requires NJDEP approval for drilling and construction of new wells.	Potentially Applicable	ARARs for alternatives involving installation of monitoring wells.

APPENDIX III

ADMINISTRATIVE RECORD INDEX

Document Number: CHM-001-0001 To 0147 Date: 10/02/92

Title: (Letter forwarding the enclosed Project Operations Plan for Remedial Investigation/Feasibility Study activities at the Chemsol, Inc. site)

Type: CORRESPONDENCE
Category: 3.1.0.0.0 Sampling and Analysis Plan (SAP)
Author: Goltz, Robert D.: CDM Federal Programs Corporation
Recipient: Haklar, James: US EPA
Kollar, Keith: US EPA

Document Number: CHM-001-0148 To 0471 Date: 10/02/92

Title: Project Operations Plan for Remedial Investigation/Feasibility Study, Chemsot Inc. Site, Piscataway, New Jersey, Appendices

Type: PLAN
Category: 3.1.0.0.0 Sampling and Analysis Plan (SAP)
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-001-0472 To 0594 Date: 10/14/92

Title: Chemsol, Inc., Revised Health and Safety Plan, October 1992, Contractor QA/QC Sign Off

Type: PLAN
Category: 3.1.0.0.0 Sampling and Analysis Plan (SAP)
Author: Bilimoria, Maheyar: CDM Federal Programs Corporation
Goltz, Robert D.: CDM federal Program Corporation
Recipient: none: US EPA

Document Number: CHM-001-0595 To 0897 Date: 10/02/92

Title: (Letter forwarding the enclosed Volume 1 of the Final Remedial Investigation/Fessibitfty Study Work Plan for the Chemsol, Inc., site)

Type: CORRESPONDENCE
Category: 3.3.0.0.0 Work Plan
Author: Goltz, Robert D.: CDM Federal Program Corporation
Recipient: Maklar, James: US EPA
Kollar, Keith: US EPA

Document Number: CHM-001-0898 To 0903 Date: 08/12/92
Confidential

Title: (Letter announcing a September 2, 1992, public meeting for the Chemsol, Inc., site, with attached List of addressees)

Type: CORRESPONDENCE
Category: 10.3.0.0.0 Public Notice(s)

Author: Katz, Steven: US EPA
Recipient: various: resident
Attached: CHM-001-0918

--Doc
ument Number: CHM-001-0904 To 0907 Date: 09/02/92

Title: Public Meeting, Chemsol Superfund Site, September 2, 1992, Sign-in Sheet

Type: OTHER
Category: 10.5.0.0.0 Documentation of Other Public Meetings
Author: various: various
Recipient: none: none
Attached: CHM-001-0908

Document Number: CHM-001-0908 To 0911 Parent: CHM-001-0904 Date: 08/02/92
Confidential

Title: Public Meeting, Chemsol, Superfund Site, September 2, 1992, Sign-in Sheet

Type: OTHER
Category: 10.5.0.0.0 Documentation of Other Public Meetings
Author: various: various
Recipient: none: none

Document Number: CHM-001-0912 To 0912 Date: 08/19/92

Title: (Newspaper article entitled:) EPA to present plan for contamination cleanup at Chemsol

Type: CORRESPONDENCE
Category: 10.6.0.0.0 Fact Sheets and Press Releases
Author: Glick, Andrea: Home News
Recipient: none: none

Document Number: CHM-001-0913 To 0914 Date: 08/30/92

Title: (Newspaper article entitled:) EPA targets tainted superfund site in Piscataway for extensive study

Type: CORRESPONDENCE
Category: 10.6.0.0.0 Fact Sheets and Press Release
Author: Melisurgo, Lenny: The Star Ledger
Recipient: none: none

Document Number: CHM-001-0915 To 0917 Date: 10/01/92

Title: Chemsol Inc., New Jersey, EPA Region 2, Congressional Dist. 12 Middlesex County, Piscataway

Type: OTHER
Category: 10.6.0.0.0 Fact Sheets and Press Releases
Author: none: none
Recipient: none: none

Document Number: CHM-001-0918 To 0923 Parent: CHM-001-0898 Date: 08/12/92

Title: (Letter announcing a September 2, 1992, public meeting for the Chemsol, Inc., site, with attached list of addresses)

Type: CORRESPONDENCE
Category: 10.3.0.0.0 Public Notice(s)
Author: Katz, Steven: US EPA
Recipient: various: resident

Document Number: CHM-001-0924 To 1471 Date: 10/01/96

Title: Remedial investigation Report, Chemsol Inc. Superfund Site, Volume 1

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-001-1472 To 1531 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume 1A

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-001-1532 To 2023 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume II

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-001-2024 To 2348 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume III

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-001-2349 To 0399 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume IV

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CHM Federal Program Corporation
Recipient: none: US EPA

Document Number: CHM-002-0400 To 0947 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume V

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-002-0948 To 1373 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume VI

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-002-1374 To 1709 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume VII

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-002-1710 To 2084 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume VIII

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-002-2085 To 2484 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfumd Site, Volume IX

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-002-2485 To 0581 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume X

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-003-0582 To 0740 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume XI

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-003-0741 To 1439 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume XII

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-003-1440 To 1977 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume XIII

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-003-1978 To 2435 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume XIV

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

Document Number: CHM-003-2436 To 0174 Date: 10/01/96

Title: Remedial Investigation Report, Chemsol Inc. Superfund Site, Volume XV

Type: REPORT
Category: 3.4.0.0.0 RI Reports
Author: none: CDM Federal Programs Corporation
Recipient: none: US EPA

CHEMSOL, INC. SUPERFUND SITE
OPERABLE UNIT ONE
ADMINISTRATIVE RECORD UPDATE
INDEX OF DOCUMENTS

3.0 REMEDIAL INVESTIGATION

3.3 Work Plans

P. 300001- 300386 Plan: Remedial Investigation and Feasibility Study Work Plan, Chemsol, Inc. Superfund Site, Piscataway, Middlesex County, New Jersev, Volume 1 of 2, prepared by U.S. EPA, Region II, June 1992.

Plan: Project Operations Plan for Remedial Investigation/Feasibility Study, Chemsol, Inc. Site, Piscatawav, New Jersey, Appendices, prepared by CDM Federal Programs Corporation, prepared for U.S. EPA, Region II, October 2, 1992. (This document can be found in the Chemsol, Inc. Superfund Site, Operable Unit One, Administrative Record File, pages CHM-001-0148 to CHM-001-0471.)

Plan: Chemsol, Inc., Revised Health and Safety Plan, October 1992, Contractor OA/OC Sign Off, prepared by CDM Federal Programs Corporation, prepared for U.S. EPA, Region II, October 14, 1992. (This document can be found in the Chemsol, Inc. Superfund Site, Operable Unit One, Administrative Record File, pages CHM-001-0472 to CHM-001-0594.)

3.4 Remedial Investigation Reports

Report: Remedial Investigation Report, Chemsol, Inc. Superfund Site, Volumes 1 - 15, prepared by CDM Federal Programs Corporation, prepared for U.S. EPA, Region II, October 1, 1996. (This document can be found in the Chemsol, Inc. Superfund Site, Operable Unit One, Administrative Record File, pages CHM-001-0924 to CHM-004-0174.)

3.5 Correspondence

Letter to Mr. James Haklar and Mr. Keith Kollar, U.S. EPA, Region II, from Mr. Robert D. Goltz, CDM Federal Programs Corporation, re: Letter forwarding the enclosed Project Operations Plan for Remedial Investigation/Feasibility Study activities at the Chemsol, Inc. site, October 2, 1992. (This document can be found in the Chemsol, Inc. CHM-001-0147.)

4.0 FEASIBILITY STUDY

4.3 Feasibility Study Reports

P. 400001- 400442 Report: Feasibility Study Report, Chemsol, Inc, Superfund Site, Township of Piscataway, Middlesex County, New Jersey, prepared by CDM Federal Programs Corporation, prepared for U.S. EPA, Region II, June 24, 1997.

P. 400443- 400465 Affidavit (w/attachments) of Mr. Willard F Potter, Senior Project Director, de maximis, inc., Facility Coordinator, Chemsol, Inc. Superfund Site, prepared for U.S. EPA, Region II, October 10, 1997.

4.4 Proposed Plans (SOP, FOP)

P. 400466- 400486 Plan: Superfund Proposed Plan, Chemsol, Inc. Superfund Site, Piscataway, Middlesex County, New Jersey, prepared by U.S. EPA Region II, August 1997.

4.6 Correspondence

P. 400487- 400487 Fax transmittal, to Mr. Nigel Robinson, U.S. EPA, Region II, from Mr. Gil Horwitz, BSM, NJDEP, re: Geologist's comments to follow and if comments not accepted, explain why or call to discuss with Dave Barskey, December 3, 1996.

P. 400488- 400489 Letter to Mr. James Haklar, Project Manager, New Jersey Superfund Branch, U.S. EPA, Region II, from Mr. Paul Harvey, Case Manager, Bureau of Federal Case Management, NJDEP, re: Draft Feasibility Study Report, Dated October 1996, Chemsol Superfund Site, Piscataway Township, December 18, 1996.

5.0 RECORD OF DECISION

5.4 Correspondence

P. 500001- 500002 Letter to Ms. Carole Petersen, Chief, New Jersey Remediation Branch, U.S. EPA, Region II, from Mr. Bruce Venner, Chief, Bureau of Federal Case Management, NJDEP, re: Draft Record of Decision, Chemsol Superfund Site, Piscataway Township, March 25, 1998.

P. 500003- 500003 Letter to Ms. Jeanne M. Fox, Regional Administrator, U.S. EPA, Region II, from Mr. Richard J. Gimello, Assistant Commissioner, NJDEP, re: Record of Decision, Non-Concurrence, Chemsol Site, Piscataway Township, August 27, 1998.

8.0 HEALTH ASSESSMENTS

8.1 ATSDR Health Assessments

P. 800001- 800041 Report: Site Review And Undate, Chemsol, Incorporated, Piscataway, Middlesex County, New Jersey, Cerclis No. NJD980528889, prepared by U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, (ATSDR), July 20, 1995, revised December 5, 1995.

10.0 PUBLIC PARTICIPATION

10.3 Public Notices

P. 10.0001- 10.0001 Notice: "The United States Environmental Protection Agency Announces An Extension Of The Public Comment Period For The Chemsol, Inc.

Superfund Site", prepared by U.S. EPA, Region II, undated.

P. 10.0002- 10.0002 Letter to Interested Citizen, from Ms. Pat Seppi, Community Involvement Coordinator, U.S. EPA, Region II, re: Announcement of a 30-day public comment period beginning August 11, 1997, until September 10, 1997 and public meeting to be held Wednesday, August 27, 1997, for the Chemsol, Inc. Superfund Site, Piscataway, New Jersey, August 11, 1997.

10.4 Public Meeting Transcripts

P. 10.0003- 10-0539 Chemsol, Inc. Superfund Site (1) Appendix - A, Public Meeting Transcript for The Proposed Plan For Final Cleanup at the Chemsol, Inc. Superfund Site in Piscataway, New Jersey, prepared by Fink & Carney, Computerized Reporting Services, Certified Stenotype Reporters, prepared for U.S. EPA, Region II, August 27, 1997; (2) Appendix - B, Responsiveness Summary - Written comments received by EPA during the public comment period, Volume 1 of 2, October 10, 1997; (3) Appendix - B, Responsiveness Summary - Written comments received by EPA during the public comment period, Volume 2 of 2, October 10, 1997; (4) Appendix - C, Proposed Plan, August 1997; (5) Appendix - D, Responsiveness Summary - Public Notice Printed in The Home News and Tribune on August 11, 1997.)

10.6 Fact Sheets and Press Releases

P. 10.0540- 10.0542 Fact Sheet: Chemsol, Inc. Superfund Site, Piscataway, New Jersey, U.S. EPA, Region II, August 1997.

P. 10.0543- 10.0544 Press Release: EPA proposes cleanup plan for contaminated soil and groundwater at Chemsol Federal Superfund Site in Piscataway, New Jersey, prepared by U.S. EPA, Region II, Thursday, August 21, 1997.

APPENDIX IV

STATE LETTER

<IMG SRC 98141C9>
<IMG SRC 98141D>

State of New Jersey
Christine Todd Whitman — Department of Environmental Protection — Robert C. Shunn, Jr.
Governor — Commissioner

MAR 25 1998

Carole Petersen, Chief
USEPA - Region II
New Jersey Remediation Branch
290 Broadway
New York, N.Y. 10007-1866

Dear Ms. Petersen:

Re: Draft Record of Decision, Chemsol Superfund Site, Piscataway Township

The Department of Environmental Protection has reviewed the draft ROD for the Chemsol site. As discussed between Pam Lange and Lisa Jackson in a recent conference call, the Department does not anticipate concurring with this ROD due to the issues outlined below.

1. The main issue is quite similar to the Renora Superfund site. The different PCB cleanup criteria of the two agencies is the most significant problem. The Department cannot concur with the ROD unless it specificially states that if the site is not remediated to the State's 0.49 ppm residential use criterium, then a Declaration of Environmental Restriction (DER) must be established for the site.

2. Declaration for the Record of Decision. Statement of Basis - This section should state that the ROD is for on-site ground water and that the off-site ground water is not fully delineated.

3. Declaration for the Record of Decision, Description of Selected Remedy, Ground Water, third bullet - This statement is contradicted at Page 6, Paragraph 3 where it states that ground water is migrating off-site. This third bullet should be modified to state that the extent of off-site contamination needs to be determined.

4. Page 9, Paragraph 2 - The ROD should address whether the calculated risk meets the New Jersey standard of one in a million.

5. Page 12, Remedial Action objectives, #2. - This statement is very confusing as written. Split into two sentences and delete the "technical practicable" issue.

6. Page 13, last paragraph - This section should include the requirement that a Classification Exception Area (CEA) must be established for the Chemsol site and the full extent of ground water contamination.

7. Page 16, Option A - The ROD should state that a DER would be necessary for this scenario.

8. Page 17, Groundwater Alternatives Section A general statement should be included at the beginning of this section which states that a CEA must be established for all of the ground water alternatives.

9. Page 22, First Paragraph under "Groundwater", Last sentence - A CEA would have to be established for the on-site contamination concurrent with the remedy. An off-site CEA would be established once the extent of

contamination is determined.

10. Page 28, Third Bullet under "Groundwater" - Same as number 3 above.

11. Page 30, Paragraph 2 - The last three sentences contain typos and incorrect structure.

12. Figure 1 - Does not include the town and county, address, scale, etc.

13. Responsiveness Summary - The Department has not received this document and therefore cannot provide comments at this time.

As stated above, the Department does not anticipate concurring with the ROD unless all of our comments are addressed. Should you wish to further discuss these issues, please contact me at (609) 633-1455.

<IMG SRC 98141D1>

c:
Paul Harvey, BFCM
John Prendergast, BEERA
Joe Marchesani, BGWPA

APPENDIX V

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
CHEMSOL, INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

As part of its public participation responsibilities, the U.S. Environmental Protection Agency (EPA) held a public comment period from August 11 through October 10, 1997, for interested parties to comment on EPA's Proposed Plan for the Chemsol Inc. Site ("the Site") in Piscataway, New Jersey. The Proposed Plan described the alternatives that EPA considered for remediating contaminated soil and groundwater at the Site.

EPA held a public meeting at the Piscataway Municipal Complex on August 27, 1997. During the public meeting, representatives from EPA discussed the preferred remedy, answered questions, and received oral and written comments on the alternative recommended in the Proposed Plan and other remedial alternatives under consideration.

In addition to comments received during the public meeting, EPA received written comments throughout the public comment period. EPA's responses to significant comments, both oral and written, received during the public meeting and public comment period, are summarized in this Responsiveness Summary. All comments summarized in this document were factored into EPA's final determination of a remedy for cleaning up the Site. EPA's selected remedy for the Site is described in the Decision Summary of the Record of Decision.

This Responsiveness Summary is divided into the following sections:

I. Overview: This section discusses EPA's preferred alternative for remedial action.

II. Background: This section briefly describes community relations activities for the Chemsol, Inc. Site.

III. Response to Written Comments from Potentially Responsible Parties: This section provides responses to comments received from the Chemsol Site Potentially Responsible Parties (PRP) Group during the public comment period. No other written comments were received.

IV. Public Meeting Comments and EPA's Responses: This section provides a summary of commenters' major issues and concerns, and expressly acknowledges and responds to all significant comments raised at the August 27, 1997 public meeting.

V. Response to Written Comments: This section provides a summary of, and responses to, comments received in writing during the public comment period.

Appendix A: Transcript of the August 27, 1997 public meeting.
Appendix B: Written comments received by EPA during the public comment period.
Appendix C: Proposed Plan
Appendix D: Public Notice printed in the August 11, 1997 Home News and Tribune

I. OVERVIEW

At the initiation of the public comment period on August 11, 1997, EPA presented its preferred alternatives for the Chemsol, Inc. Site located in Piscataway, New Jersey. The preferred remedy for the contaminated soils included the excavation and off-site disposal of approximately 18,500 cubic yards of contaminated soil, and backfilling of the excavated areas with clean imported fill from an off-site location, followed by grass seeding. The preferred remedy also included the installation, and pumping of additional extraction wells with discharge to the existing treatment plant and an additional groundwater investigation to determine if contaminated groundwater leaves the site, after implementation of the remedy. The preferred remedy is identical to the remedy selected by EPA for this Site.

II. BACKGROUND

The Remedial Investigation and Feasibility Study(RI/FS) and Proposed Plan for the Site were made available at the information repositories for the Site: EPA Superfund Document Center at EPA's Region II office in New York City, and at the Kennedy Library in Piscataway, New Jersey. The notice of availability for these documents was published in the Home News and Tribune on August 11, 1997. The public was given the opportunity to comment on the preferred alternative during the public comment period which began on August 11, 1997 and concluded on October 10, 1997. In addition, a public meeting was held on August 27, 1997 at the Piscataway Municipal Complex. At this meeting, representatives from EPA answered questions concerning the Site and the remedial alternatives under consideration. It should be noted that the public comment period originally was to have ended on September 10, 1997. However, in response to a request made from the responsible parties, the comment period was extended to October 10, 1997.

III. RESPONSES TO WRITTEN COMMENTS FROM THE RESPONSIBLE PARTIES

Please note that the comments provided by the Chemsol Site PRP Group include a brief summary comment followed by a narrative which may extend to several pages. Only the summary comment has been provided below. For the full comment, see Appendix B.

Note: For ease of reference, the comments are numbered to match those in the Chemsol Site PRP Group comments. Section 1 of these comments consisted of an introduction which summarized the more detailed comments in Sections 2 and 3.

COMMENTS REGARDING PROPOSED SOIL REMEDY

PRP Comment 2.1

The remedial action objective to allow for future site use without restrictions cannot be achieved by the selected remedy.

PRP Comment 2.1.1

Because the proposed remedy would not achieve the state soil cleanup criteria, it cannot satisfy the remedial action objective to allow for future site use without restrictions.

EPA's Response 2.1/2.1.1

EPA has examined the selected soil excavation contours in light of its cleanup levels and has determined that the remedial action objectives can be met by the selected remedy. As stated in Section 2.4.2 on Page 2-9 of the FS Report, by excavating all surface soils contaminated with PCB concentrations > 1 ppm and lead concentrations > 400 ppm and isolated localized subsurface soils,contaminated with PCB concentrations > 1 ppm and lead concentrations > 400) ppm. EPA believes that the selected remedy (Alternative S-3) may also comply with the State of New Jersey's PCB soil cleanup criterion of 0.49 ppm through its soil compliance averaging methodology .

There are no chemical specific ARARs for soil. However, the NJDEP has developed, but not promulgated State-wide soil cleanup criteria. EPA does not consider these levels to be ARARs. EPA's cleanup criterion for PCB contaminated soils is 1 ppm and the NJDEP's soil cleanup criterion is 0.49 ppm.

After this excavated soil is replaced with imported clean soil, according to EPA's risk assessment and PCB guidance, there will be no unacceptable risks to human health through direct contact and therefore no use restrictions will be required by EPA. As shown on revised Figure 2-2 of the FS Report, the subsurface soils represented by soil borings SB-74 and SB-76 will also be excavated because they are contaminated with VOCs and may serve as a continuing source of groundwater contamination. At soil boring SB-76, the VOC contaminated subsurface soil also contains the highest concentration of PCBs (5.8 ppm) in the site subsurface soil. Hence, removing these isolated localized "hot spots" may result in the State of New Jersey's PCB soil cleanup criterion of 0.49 ppm to be met. If it is later determined the New Jersey 0.49 ppm criteria is not met, additional excavation can be performed by the PRPs or the State can pay for the added cost of excavation if the remedy is funded under Superfund. If additional excavation is not performed, New Jersey will require that some restriction be put on the property. The nature of the restriction will depend on the nature of the PCB contamination above 0.49 ppm.

PRP Comment 2.1.2

If the remedial action objectives are revised to consider the State soil cleanup criterion, a new remedial alternative analysis must be performed to comply with the NCP, as a remedial alternative which complies with the State's soil cleanup criterion was not previously evaluated and is expected to result in significantly greater costs and increased risk to human health and the environment. (The comment goes on to make several assertions regarding the soil excavation volumes and costs associated with the State soil cleanup criterion of 0.49 ppm for PCBs).

EPA's Response 2.1.2

As stated in the response to comment 2.1 and 2.1.1 above, there is no reason to revise the remedial action objectives. The selected remedy (Alternative S-3)will comply with EPA's cleanup criterion of 1 ppm and based on available data, may also meet the State of New Jersey's PCB soil cleanup criterion of 0.49 ppm. The costs for Alternative S-3 which are shown on Table 4-6 in the FS Report include both scope and bid contingencies and so there will be no significant greater costs. Table 5-2 of the FS report provides the sensitivity of the cost estimates due to change in estimated volumes of contaminated soil. There will also be no need to conduct a new remedial alternative analysis, because the one performed in the FS report is in full compliance with the NCP.

Note that Superfund requires compliance with applicable or relevant and appropriate requirements (ARARs). EPA does not agree that the NJDEP PCB cleanup criterion is an ARAR. EPA considered this a "to-be-considered" requirement [(40 CFR 300.5) (SARA 122d(2c)] since it is not a promulgated standard. EPA has chosen to adopt its own PCB cleanup level of 1 ppm, rather than the State's non-promulgated criterion.

PRP Comment 2.1.3

The selected soil remedy cannot satisfy the remedial action objective to allow for future site use without restrictions based on the significant present and anticipated future environmental and physical development constraints located on the site.

EPA's Response 2.1.3

As stated in the response to comment 2.1.1, Section 2.4.2 on page 2-9 of the FS Report clearly recognizes that certain portions of the property are being used and will be used in the future for groundwater extraction, treatment, and discharge. The FS report also recognizes that groundwater in the fractured bedrock aquifer underneath the Chemsol site is contaminated and is likely to remain contaminated for a long period of time. In the context of the Superfund program, land use restrictions on a property are solely based on the level of contamination above a specific contaminant concentration (the soil cleanup criteria or action levels for PCBs and lead). The ability to develop or not develop a property based on considerations of total available acreage or the presence or absence of wetlands is not applicable. Such "use restrictions" would be present even if the property being considered for development were totally free of any chemical contamination.

PRP Comment 2.2

The selection of the remedy is not supported by the administrative record.

PRP Comment 2.2.1

By requiring the soil be disposed as a hazardous waste, the Proposed Plan proposes a remedy not evaluated by the FS, contrary to the requirements of the NCP.

EPA's Response 2.2/2.2.1

The PRP Group may have misinterpreted the Proposed Plan. The Proposed Plan does not anticipate any soil to be disposed of as hazardous waste. It merely states that disposal would take place at a licensed and approved disposal facility. EPA believes that it is highly probable that most of the PCB contaminated soil could be taken to a licensed Subtitle D facility for disposal. It is possible that isolated very small portions of the PCB contaminated soil may have to be taken to a licensed Subtitle C or TSCA regulated facility for disposal if the concentration is 50 ppm or greater.

Please note that samples collected for TCLP analysis during the RI were collected along a systematic grid across the entire Lot 1B of the site property and are as such considered to be representative samples for the area to be excavated. It is therefore incorrect to state that the selected remedy (Alternative S-3) is not supported by the administrative record or that it is contrary to the requirements of the NCP. All samples taken and analyzed for TCLP, passed the TCLP test.

PRP Comment 2.2.2
Should soil sampling during remedial design reveal a larger volume of soil requiring excavation, the remedy must be re-evaluated as selection would not be based on all relevant facts, information, and alternatives.

EPA's Response 2.2.2

Costs estimates in the Record of Decision are generally +50% - 30%. The specifics of the remedy (i.e., actual amount of soil and area of excavation) are determined during the remedial design stage. If, during the remedial design of the remedy, a larger volume of soil is required for excavation and differs significantly from the remedy selected in the Record of Decision with respect to scope, performance, or costs, EPA may require a re-evaluation of the remedial alternatives. This re-evaluation can be performed through an Explanation of Significant Differences (ESD). ESDs are utilized to describe modifications to the remedy chosen in the ROD due to site-specific conditions that may be discovered during remedial design. Based on the Administrative Record, EPA believes that the remedy currently selected in this Record of Decision most appropriately complies with the NCP criteria.

PRP Comment 2.2.3

Stockpiled soils meeting the criteria for backfill should not be required to be disposed of, but should be permitted to be used as backfill.

EPA's Response 2.2.3

It is EPA's understanding that soils presently stockpiled behind the groundwater treatment plant were put there under protective cover, because they are either hazardous, contaminated, or do not meet the New Jersey soil cleanup criteria. If additional future sampling performed during remedial design indicates that some portions of these soils are not contaminated or hazardous and meet all of the New Jersey soil cleanup criteria then they can be used as backfill.

PRP Comment 2.3

A selection of soil capping as the remedial alternative is supported by the administrative record.

EPA's Response 2.3

In selecting the preferred alternative, EPA evaluated all of the alternatives based on the nine criteria. Especially important in the case of the capping alternative is the criterion regarding long-term effectiveness and permanence. EPA did not select capping as the preferred remedy because soil contamination above the soil cleanup criteria would be left in place indefinitely requiring long term monitoring. In addition, the capping alternative, does not meet the remedial objective for unrestricted use. The selected soil remedy is cost-effective as it has been determined to provide greatest overall long-term and short-term effectiveness in proportion to its present worth cost, $5.6 million with no annual operation and maintenance.

Alternative S-4(A and B) would provide an equivalent level of protection, but at almost twice the cost [$11.96 - $12.24] million. Alternative S-2A (Capping with Soil), is estimated to cost $1.9 million, which is less than the selected remedy, but since contamination would be left on site, Alternative S-2A would not provide a high degree of long-term effectiveness and would be more permanent.

PRP Comment 2.3.1

The Proposed Plan is not consistent with the EPA guidance on which soil cleanup levels were based; consequently, the remedy selection should be reconsidered as these guidance documents recommend capping for sites with contaminant concentrations at the levels present at the Chemsol site.

EPA's Response 2.3.1

EPA disagrees with this comment. EPA notes that its PCB guidance (Solid Waste and Emergency response, Directive 9355.4-01 FS, August 1990) is currently being revised to reflect changes in how risks associated with PCBs are calculated by EPA as well as recent changes in PCB regulations. EPA's Proposed Plan is consistent with the goals and expectation for Superfund cleanups as outlined in the National Contingency Plan, 40 CFR Part 300 (the "NCP"). Although the PCB guidance is being re-evaluated, EPA notes that its selected remedy is entirely consistent with the guidance as currently written. EPA notes that, for a future residential area, its PCB guidance recommends either on-site or off-site containment of soil with PCB concentrations below 100 ppm. The comment seems to misinterpret the PCB guidance as saying that containment should occur on-site. This is an incorrect interpretation of the guidance. EPA's PCB guidance does not dictate on-site or off-site containment of PCB-contaminated waste. The decision-making process to determine whether on-site or off-site containment is appropriate is part of the detailed analysis of alternatives as outlined in the NCP. EPA's PCB guidance merely discusses some of the unique factors associated with response actions at PCB-contaminated sites that might be considered under the detailed analysis of alternatives. Therefore, EPA's selected remedy, excavation and off-site containment of PCB contaminated soils is entirely consistent with the current PCB guidance and the NCP.

Cleanup standards are primarily selected based on site specific human health and ecological risk assessment. The risk assessment showed that soils contaminated with PCBs greater than 1 ppm and lead greater than 400 ppm posed unacceptable risks. Removing these PCBs and lead contaminated soils would also remove co-mingled VOCs, thereby speeding up the groundwater cleanup. In addition, VOC contaminated soils would also be excavated from deeper soils in selected areas such as in the areas around borings 74 and 76. While Guidances may be helpful in making determinations as to the appropriate cleanup standards, they do not constitute rule making by the Agency and the Agency may take action at variance with the guidance based on the facts and information for a particular Superfund site. EPA believes that the soil clean up levels chosen are consistent with EPA's guidance documents and EPA site specific risk assessment.

PRP Comment 2.3.2

The FS and Proposed Plan overestimate the costs of capping, resulting in an invalid cost comparison.

EPA's Response 2.3.2

EPA does not agree that it has overestimated the costs of capping resulting in an invalid costs comparison. The physical properties of a soil required for the purposes of constructing an engineered cap are necessarily different from those required for merely backfilling an excavation. Also, please note that the acreage of the cap and the acreage of the area requiring excavation are different by design. The excavation contours have an irregular shape and they have been designed to remove the bare minimum of soil that is contaminated above the cleanup criteria defined for lead and PCBs in the FS and the Proposed Plan. The cap will be constructed using a regular shaped area that completely covers the irregular shaped contaminated soil area and allows for proper surface water infiltration and drainage. That is why the area to be capped is necessarily larger than the area to be excavated.

Further, stockpiled soils have been dealt with in the FS and the Proposed Plan in the same consistent manner in both the capping alternative (S-2A) and the preferred alternative (S-3), so that a proper unbiased comparison can be made between the various alternatives. EPA's cost comparison is fully valid and completely consistent with relevant EPA guidance on costing of alternatives for a RI/FS and the NCP.

COMMENTS REGARDING PROPOSED GROUNDWATER REMEDY

PRP Comment 3.1

Geologic and contaminant-related factors dictate that a Technical Impracticability ARAR waiver should be granted and the remedial action objective be revised accordingly to seek containment of the contaminated groundwater.

EPA's Response 3.1

Please note that the remedial action objective in the Proposed Plan and FS Report clearly states that the goal of the selected remedial action is to contain the contaminated groundwater (that which is above Federal and State MCLs) from all depth zones and, as an element of this containment, reduce the mass of contaminants to the maximum extent possible. The remedial action objective further states that another goal of the selected remedial action is to augment the existing interim remedy as necessary, in order to achieve these goals. The FS report also states that aquifer restoration is highly unlikely in this fractured bedrock, precisely because it recognizes the potential existence of DNAPLs. The Proposed Plan also states that, if after implementation of the remedy, it proves to be technically impracticable to meet groundwater quality standards, EPA would seek waivers for such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both horizontally and vertically) which may require a technical impracticability waiver. The goals of containing the most contaminated water to prevent offsite migration and reducing the contaminant mass to the maximum extent possible are not necessarily mutually exclusive. The interim remedy groundwater treatment plant is currently performing very similar reduction in contaminamt mass as is envisioned for the selected remedy. The current interim remedy groundwater extraction system, however, does not contain all of the contaminated groundwater across the site from all depth zones and this has been clearly demonstrated by measurements made over the past several years of operation. The decision to waive ARARs can only be made after a sufficient amount of performance data from the selected groundwater extraction and treatment system becomes available. EPA does not believe that sufficient data exist to support a technical impracticability ARAR waiver at this time.

PRP Cornment 3.2

The remedial action objectives in the Proposed Plan must conform to those in the FS because the remedy selection is based on the screening and evaluation of alternatives presented in the FS.

EPA's Response 3.2

The remedial action objectives stated in the FS Report and in the Proposed Plan are not different but rather complementary. The purpose of the Proposed Plan is to supplement the RI/FS, briefly describe the remedial alternatives analyzed by the agency, propose a preferred remedial action alternative, and summarize the information relied upon to select the preferred alternative. The Proposed Plan gives notice to the public and an opportunity for them to comment on the selected remedy.

With respect to the Chemsol Site, the Proposed Plan merely seeks to recognize that over time, there may some portions of the aquifer that are unlikely to be technically practicable to restore. The Proposed Plan also states that there may be other portions of the same fractured bedrock aquifer where the groundwater quality does improve with time due to operation of the selected groundwater remedy, and therefore, such portions of the aquifer could be restored to Federal and State drinking water standards. The determination of the horizontal and vertical extent of the above referenced portions of the aquifer that can and cannot be remediated is not possible based on all of the information gathered at present and will require further offsite investigations.

PRP Comment 3.3

The EPA uses a "preliminary" groundwater model in its remedy selection, resulting in misinterpretation of key model parameters and, consequently, a remedy selection process based on incomplete and, at times, inaccurate information.

EPA's Response 3.3

The following responses are to the main points raised in this section. The discussion of conceptual and numerical models in the RI and the FS reports clearly recognized the limitations of the models and the existence of data gaps in the vast body of information gathered during the RI/FS. EPA has reviewed the groundwater model submitted by Eckenfelder, Inc., the Chemsol Site PRP Group technical consultants. EPA believes that this model is not necessarily any better and has many technical limitations and unresolved problems of its own. In particular, the Chemsol PRP Site Group criticized the EPA's conceptual model as mapping groundwater elevations based on depth below ground surface without regard to hydrostratigraphic zones. Yet, the Eckenfelder numerical model uses horizontal layers that do not necessarily account for the dipping stratigraphic layers. (For a more complete discussion, see the separate technical review comments prepared for EPA by CDM Federal Programs Corporation in Section 4 of this Responsiveness Summary.)

The FS model (CDM's DYNFLOW model which is a true 3-dimensional model that directly accounts for the dipping stratigraphic layers) incorporated the major known features of the local groundwater system, both on site and off site. It was reasonably well calibrated to two comprehensive water level data sets: one without recovery pumping and one with recovery pumping at the site. By using these two comprehensive water level data sets, EPA believes that the model results are reliable. It is appropriate, however, that a more refined model may be developed prior to final design. The conceptual model incorporated into the FS numerical model is very similar to the conceptual model presented by Eckenfelder Inc. The FS model explicitly represents a system of dipping stratigraphic aquifer units as described by Eckenfelder, including a sequence of relatively conductive layers separated by relatively low permeability layers (e.g. the gray shale marker beds) which provide some hydraulic confinement to the aquifer units. One difference between the conceptual models is that the FS model explicitly includes a "deep conductive zone" identified for a portion of the interval between the gray shale marker units, while the Eckenfelder conceptual model represents the interval between the gray shale marker layers as a single "Principal Aquifer" layer.

The PRP Group also objected to EPA's inclusion of the car wash well in its groundwater model. EPA decided to include the car wash well after observing its operations during groundwater sampling at off-site locations.

The interval between the gray shale units ("Principal Aquifer") was represented in the FS model by a lower conductivity "Red Shale" property set above and below a "Deep Conductive" layer of limited thickness. The composite hydraulic conductivity for the interval is actually somewhat less than that assigned to the "Principal Aquifer" by Eckenfelder. The "Regional Shale" aquifer property set, which has a horizontal hydraulic conductivity of 25 feet/day in the strike direction, was not used for the interval between the gray shale units in the FS model. The FS model was reasonably well calibrated to site conditions both with and without recovery pumping in long term operation. A comprehensive set of site water level data was available and used for comparison with model simulated results for each case.

It was, indeed, incorrect to state in the FS Report that DYNFLOW is "certified" by the International Ground Water Modeling Center (IGWMC). However, the DYNFLOW and DYNTRACK codes have been reviewed and tested by the IGWMC at the request of USEPA. Subsequent to this review the codes were adopted for use on a particular site by USEPA. Since that time, DYNFLOW and DYNTRACK have been used on a number of USEPA Superfund sites. EPA's consultant would be willing to make DYNFLOW and DYNTRACK available free of charge to the Chemsol Site PRP Group for use on this study. Similar arrangements have been made in the past. Generally, the codes are available for sale to consulting organizations and others; a number of consulting companies have purchased DYNFLOW and DYNTRACK in the past few years.

PRP Comment 3.4

The capture zones should be defined by a refined, calibrated groundwater model.

EPA's Response 3.4

The competing effects of the "car wash well" and Site groundwater extraction wells clearly have a significant influence on the capture zones. The FS model allowed for offsite pumping from the "car wash well." EPA agrees that the FS model should be further refined and calibrated during remedial design. However, the current Eckenfelder model is not the refined and calibrated model that both EPA and the PRP Group are seeking. The Eckenfelder model has significant problems with the way boundary conditions have been defined and the recharge rates used in the model are much lower than other studies from the same area of New Jersey. No quantitative justification was provided for those lower recharge rates.

PRP Comment 3.5

Off-site delineation sampling should be limited o the area down gradient of the Site, as defined by the refined groundwater model.

EPA's Response 3.5

Please note that the observed gradients in various stratigraphic zones at the Chemsol site are relatively flat and they can be strongly influenced by offsite pumping. Hence, defining the area "down gradient" of the site is difficult and can vary with time. Definition of such "down gradient" areas is better performed through actual offsite investigation measurements than by relying on a groundwater model alone. Naturally defined "down gradient" areas can only be determined in an idealized imaginary situation where there are no external pumping sources that alter and sometimes reverse gradients.

PRP Comment 3.6

The final remedy must consider the significant constraints on the groundwater treatment plant discharge.

EPA's Response 3.6

The total flow rates defined in the existing interim remedy permit for discharge to the MCUA sewer system and the NJDEP surface water discharge permit equivalent are based on the March 1994 Final Remedial Design Report. These total flow rates are not absolute numbers that can be considered to be valid constraints. The designed capacity of the existing groundwater treatment plant is 50 gpm. EPA required the construction of both discharge pipelines (to the MCUA and to Stream 1A) in 1994, because EPA always anticipated that MCUA could decide in future to stop accepting discharges of partially treated groundwater from Superfund sites. Stream 1A clearly has more than sufficient flow capacity to accept rates defined in the selected remedy. The extraction system has to be designed to achieve capture of all of the contaminated groundwater from all depth zones and to achieve the remedial action objectives. The selected remedial extraction system for Alternative GW-5 in the FS Report was designed to capture groundwater from the most contaminated wells based on two rounds of sampling conducted during the RI.

PRP Comment 3.7

The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis.

EPA's Response 3.7

It is incorrect to state that the options in the selected groundwater remedy have no technical basis. The construction of the biological treatment plant was based on the March 1994 Final Remedial Design Report. This design was recommended to EPA by the Chemsol Site PRP Group based on the findings of the treatability studies performed in 1992 by consultants chosen by the PRP Group's Design Engineer. The selected remedy is based on the existing treatment system which in turn is based on the above referenced design. It is also irrelevant to state that a supplemental food source would have to be added to establish adequate biofilm growth. EPA's quarterly and semi-annual inspections of the existing treatment plant have observed that biofouling of the air stripper packing material occurs regularly and that frequent backwashing of the pressure filtration media is required due to accumulation of biosolids in the filter cake. In fact regular preventive in measures are implemented by Bigler Associates (current plant operator) to destroy this biofilm that is very persistent. Biofilm growth in the existing treatment system as operating currently is well documented in the Chemsol Site PRP Group's reports to EPA. If the treatment plant can achieve surface water discharge standards defined by NJDEP, without operating the biological treatment system, then such data should be provided to EPA for evaluation. A limited amount of data has been presented to show that the effluent may be able meet toxicity requirements of the surface water discharge permit. However, no data has been provided to explain how other permit parameters such as phosphorus and total dissolved solids would be satisfied.

PRP Comment 3.8

A refined, calibrated groundwater model should be used to develop any long-term monitoring program.

EPA's Response 3.8

As stated in the response to previous comments, EPA expects that the FS groundwater model will be further refined and calibrated with more investigative data collected during remedial design. The sampling requirements stated in the Proposed Plan are completely consistent, relevant, and necessary to evaluate and monitor performance of the selected remedy. They can not be eliminated.

EPA'S RESPONSE TO POTENTIALLY RESPONSIBLE PARTIES' COMMENTS REGARDING THE RI REPORT

EPA examined Eckenfelder's Technical Review of the Chemsol Site Remedial Investigation (RI) Report.

Eckenfelder has presented a revised conceptual hydrogeologic model of the Chemsol Site, based on their review of the RI Report and additional review of previous data. They clearly state in Section 1 of the Monitoring Report 1 that because of the complexity of the site, additional revision may be required as additional data are obtained. This is an entirely reasonable stipulation. Furthermore, in Section 1 of the Technical Review they state that the document is "..intended to facilitate a technical dialog between the USEPA and the Chemsol Site PRP Group (Group) regarding the issues related to site remediation." This is another commendable and entirely reasonable idea.

The EPA and Eckenfelder conceptual hydrogeologic models of the Site are not identical, but they share a number of common ideas. Just as Eckenfelder has observed that additional revision of the model may be appropriate, there are some aspects of the EPA model that might be reconsidered.

Eckenfelder's primary criticism of the RI Report relates to the grouping of monitoring wells. In Section 2.1 of the Technical Review, Eckenfelder concurs with several conclusions EPA made regarding behavior of the aquifer based on observations from the packer testing program, but then states that EPA ignored their own observations and grouped monitoring wells strictly on the basis of elevation. It is true that elevation was considered as an important aspect of the well grouping, but it was not the only one. Stratigraphic relationships and hydraulic connections were considered as well by EPA.

It is possible that Eckenfelder's criticism is based at least in part on a misinterpretation of the RI Report. On page 2-2 of the Technical Review, they cite RI Figure 3-23 as an example of EPA grouping wells in separate hydrostratigraphic units. It is true that water elevations observed in wells above and below the gray shale are plotted on a single map. However, it is clearly shown on the figure and explicitly stated in the text of the report that the water levels were not contoured together, and were not to be considered representative of a single hydraulic zone.

What is not apparent is the rationale for Eckenfelder's statement that the zone represented by the TW-series wells above the gray shale is an aquitard, and therefore not appropriate for mapping of horizontal hydraulic gradients. There is no doubt that this zone has lower hydraulic conductivity than the highly fractured zone immediately above the gray shale and some relatively highly fractured zones observed in the zone between the upper and lower gray shales. It does not necessarily follow, however, that the zone deserves classification as an aquitard. EPA is not aware of any evidence that the conductivity of this zone is significantly lower than what might be called "average" Brunswick Shale. Furthermore, the zone certainly has a horizontal component of flow. If Eckenfelder believes that the magnitude of that component is small enough to be ignored, they should support that position with data.

Eckenfelder points out in Section 3 of the Technical Review that vertical head losses indicate that there are zones of moderate to low vertical conductivity. There is a reasonable vertical head loss between some of the TW-series wells and the C-series wells immediately above the shallow gray shale. Specifically, significant vertical head differences (several feet) are observed at the TW10/C-7 and TW-11/C-6 clusters. However, the vertical head differences at the TW-3/C-8, TW4/C-10 and TW-2/C-9 clusters are on the order of only a few tenths of a foot. Classification of the zone as an aquitard on the basis of vertical head loss, therefore, does not seem justified.

The argument that the TW-series wells above the gray shale should not be considered as part of the aquifer because they are within the upper, presumably weathered rock zone could also be applied to the TW-series wells below the gray shale, which Eckenfelder has grouped in the primary aquifer. As noted above, some of the TW-series have heads several feet higher than wells completed at the same location but in deeper intervals. The August 29, 1994 pre-pumping water elevations in wells TW-7, TW-14 and TW-15 are in the same range (about 62 feet above sea level), but there are no deeper wells similar to the C-series for evaluation of vertical head loss.

No wells open to zones monitored by the TW-series wells above the gray shale were pumped during the EPA packer testing program, or during any of the previous groundwater investigations. Therefore, the hydraulic properties of this zone can only be estimated. Eckenfelder used the Neuman-Witherspoon method to estimate vertical hydraulic conductivity for both the unit they call the principal aquifer (between the upper and lower gray shales) and the upper bedrock (the zone monitored by the TW-series wells above the upper gray shale, identified as an aquitard). The K_v of the principal aquifer calculated was 3.5×10^{-4} cm/sec. Two values were calculated for the upper bedrock zone. At the C-8/TW-3 cluster, the K_v was 1.1×10^{-4} cm/sec, and at the C10/TW-4 cluster, K_v was 6.5×10^{-5} cm/sec. It is noted that these values are lower than the one estimate for the principal aquifer, but not much lower.

Eckenfelder has defined the thickness of the upper permeable aquifer (the zone monitored by the C-series wells above the upper gray shale) as 40 feet. They do not provide any rationale for selecting this thickness. Based on EPA observations, a thickness of 15 to perhaps 20 feet for this zone is more realistic. Using EPA's observed thickness of the highly permeable zone, the thickness of the upper bedrock in the vicinity of the C-8/TW-3 and C10/TW-4 clusters is 100 feet and 90 feet, respectively.

It is reasonable to assume that horizontal hydraulic conductivity (K) is at least 10 times K_v. In their previous submissions, Eckenfelder estimated that K was as much as 33 times K_v,. If a 10-fold difference is assumed, and units are converted from cm/sec to gpd/ft^2, the estimated values of K at the clusters discussed above are 23 gpd/ft^2 and 14 gpd ft^2, respectively. Multiplying these values for K by the respective thicknesses, transmissivity (T) values at the cluster locations of 2,300 gpd/ft and 1,260 gpd/ft, can be estimated. Compared with estimates of T for other zones presented in Table 3-1 of the Technical Review (>5,000 gpd/ft to 29,000 gpd/ft), it is obvious that these values are lower. However, they are within a range that is generally observed in moderately productive aquifers.

Based on the above discussion, the Chemsol PRP group must make the following modifications in classifying the hydrostratigraphic units at the Chemsol Site;

- Overburden Zone (OZ) - This unit is the shallowest water-bearing unit at the site. It is composed of the thin unconsolidated soils and the weathered bedrock. It is monitored by all the OW-series wells (and perhaps the shallow PZ-series piezometers). The zone has been defined in this manner in both the RI and the Eckenfelder Technical Review. Groundwater flow is generally north to northeasterly, and the zone likely interacts with shallow surface water.

- Upper Bedrock Zone (UBA) - The UBA stratigraphically overlies the upper gray shale. At the site, the UBA thickens down dip (to the northwest) from a feather edge to nearly 200 feet. The shallowest part of the UBA may have some weathered, low permeability areas, and is likely influenced by local surface features. A highly fractured sub-unit (UBFZ) exists within the UBZ, immediately above the shallow gray shale. The UBFZ contains some of the most productive zones observed during the packer testing program.

Wells monitoring the shallow part of the UBA include TW-1, TW-2, TW-3, TW-4, TW-5, TW-5A, TW-10, TW-11 and TW-12. Wells monitoring the UBFZ include C-6, C-7, C-8, C-9 and C-10. It should be noted that TW-11 and TW-12 are included in the UBA on the basis of stratigraphic position only.

Pre-pumping hydraulic gradients in the UBA suggested generally southerly flow from the northern site boundary to the vicinity of well TW-4, where discharge to the UBFZ may be occurring. The pre-pumping hydraulic gradient in the UHPZ is not well defined. It was generally northerly on the August 29, 1994 measurement, but, as shown in the RI report, significant fluctuations were observed in the C-series wells, which were considered likely indications of external pumping influences.

! Shallow Gray Shale Aquitard (SGSA) - This approximately 15-foot zone apparently acts primarily as an aquitard. The packer testing program did note some hydraulic communication across the shallow gray shale, but in most cases the communication could be correlated with open bore holes across the shale unit. Three of the TW-series wells (TW-6, TW-8 and TW-14) completely or partially straddle the shallow gray shale within the general area in which the unit subcrops. It is likely that the topographic position (i.e. shallowest water zone at their location) is more important than stratigraphic position of these wells. However, as discussed below, these wells will be grouped with the underlying zone.

! Upper Principal Aquifer (UPA) - This zone includes the upper 100 feet of shale stratigraphically below the SGSA. The 100-foot limit is essentially an arbitrary boundary applied for mapping purposes.

Wells included in the UPA are: TW-6, TW-7, TW-8, TW-9, TW-13, TW-14, TW-15, C-3, C-4, C-5, DMW-9 and DMW-10. As noted above, three of the TW-series wells completed within the SGSA Well TW-6 showed far greater hydraulic response during packer tests pumping from below the SGSA than above. Therefore, it is grouped with the UPA wells. Wells TW-14 and TW-15 are included primarily on the basis of stratigraphic position. The extent of hydraulic connection between these wells and the main part of the Site is not known. It should be noted that since they are shallow wells, are completed in potentially weathered rock, are located some distance from the Site, are separated from the Site by a railroad right-of-way with associated drainage ditches and other structures, there is a distinct possibility that heads measured in the wells are not directly related to heads measured in other wells in the group. Figure 4-4 of Eckenfelder's Technical Review of the RI report shows the August 29, 1994 water elevations in the UPA. If wells TW-14 and TW-15 were not included on the map, the overall magnitude of the northerly gradient would drop from about 0.003 to less than 0.001. Eckenfelder's conclusion that pre-pumping flow was northerly must be used with caution. It was apparently northerly on August 29, 1994, but it would not have required much off-site influence to significantly change the direction of the hydraulic gradient.

! Intermediate Principal Aquifer (IPA) - This zone is similar to Eckenfelder's proposed Lower Principal Aquifer. Eckenfelder proposed a well grouping for mapping purposes to include the portion of the principal aquifer below approximately a 100-foot stratigraphic thickness, but above the lower gray shale). The packer testing program did not show any significant hydraulic barrier at the lower gray shale, with the possible exception of the off-site influences noted at wells DMW-1 and DMW-2. Because of the lack of evidence for a significant barrier, grouping based on position relative to the shale seems unnecessarily arbitrary. By using the shale, Eckenfelder has placed both wells at the DMW-5 /DMW-6 cluster above the shale and both wells at the DMW-3/DMW-4 cluster below it. It seems more appropriate to recognize depth, and separate wells in cluster locations.

The IPA includes wells DMW-1, DMW-3, DMW-5, DMW-7, DMW-11, C-2 and MW-104. The August 29, 1994 gradient in this set of wells was northerly, at low magnitude.

! Deep Principal Aquifer(DPA) - This is the bedrock zone primarily below the lower gray shale. As discussed above, it seems more appropriate to move MW-104 and DMW-3 to the Intermediate group, based on the lack of an identifiable hydraulic barrier and grouping wells of approximate equal elevation. For the same reasons, MW-103 and DMW-6 are included in the DPA. The DPA includes, therefore, wells MW-103, DMW-6, DMW-8, MW-101, DMW-2, MW-102 and DMW-4.

Eckenfelder did not plot a contour map for the deep group. The August 29, 1994 data plotted for the DPA wells show a very flat gradient, generally to the southeast.

There is one additional unexplained item in the effectiveness Monitoring Report. Eckenfelder did not use the elevation for well C-4 on the contour maps of the UPA for January 2 and February 6, 1997. A note on the maps states that the elevations were anomalous compared with the historic data. The "anomalous" values were 56.65 and 58.01 feet, respectively. Considering that recorded elevations for well C-4 vary, Eckenfelder plotted and used the 60.16 feet elevation measured on March 12, 1997. Considering that the August 29, 1994 elevation for well C-4 was 58.2 feet, and the previously reported values vary from less than 53 to greater than 60 feet, the classification of the January and February 1997 values as anomalous must be explained.

EPA'S RESPONSE TO TECHNICAL COMMENTS ON POTENTIALLY RESPONSIBLE PARTIES' EVALUATION OF GROUNDWATER EXTRACTION ALTERNATIVES

KEY ISSUES

Model Boundary Conditions

The description of model boundary conditions provided in Appendix A does not present a clear and consistent relationship between the model boundary conditions and field conditions.

It is difficult to understand how a river boundary condition was appropriately applied to all of the model layers at the northwestern boundary which corresponds (in plan) with Bound Brook. At Bound Brook, the stratigraphic units represented in the model would have dipped hundreds of feet below the river. River boundary parameters were not provided in the Appendix.

The General Head boundary condition parameter values applied at the northeast and southwest model boundaries were not documented. An explanation of how these values were derived is also needed.

Insufficient justification was provided for applying a uniform rate of inflow at the upper model boundary. Downdip, there might be flow out of the stratigraphic unit represented by the top model layer to the overlying shale. If the top model layer was intended to represent the overlying shale to the northwest as well as the "Upper Aquitard" unit described at the Site, then the increase in thickness of this layer to the northwest (downdip) must be accounted for.

No justification was provided for specifying a no-flow boundary condition at the bottom of the model. Near the subcrop to the southeast, there may be leakage into or out of the aquifer unit represented by the bottom model layer.

Recharge

Previous model studies in the area have used recharge rates of 8.2 inches/year (Brown, 1994) and 6 inches/year (CDM, 1996). The model being reviewed uses a much lower recharge rate of 2 inches/year at subcrop areas. It is assumed that most of the surface recharge is diverted by the overburden, which is not included in the model, before reaching the shale. More detailed, quantitative justification for the greatly reduced recharge rate must be provided. This is important because the simulated capture zone achieved for a given rate of pumping will be very sensitive to the recharge rate applied.

Calibration

Appendix A did not present detailed calibration of the model to conditions with long term continuous site pumping. Since the model is being used to predict the effects of such pumping, a detailed calibration should be presented for conditions both with and without recovery pumping operational.

SPECIFIC COMMENTS

Page   Comment

A2-I The "Deep Conductive Zone" identified by CDM is not explicitly included in the conceptual stratigraphy or the model. Some model detail is lost by lumping this unit within a more general "Principal Aquifer".

Table A2-I Well DMW-3 is listed for both the lower Principal Aquifer and Deep Bedrock.

A2-2 The "Upper Bedrock Aquitard" may not merit the "aquitard" designation. The vertical hydraulic conductivity of 0.2 to 0.3 feet/day ascribed to this unit is not so different from that ascribed to the "Principal Aquifer" of 1 foot/day. Similarly, the model horizontal hydraulic conductivities are not so different, 2.5 versus 9.4 feet/day.

A2-4 There appear to be as many data points for the Deep Bedrock as for other stratigraphic units. Is the reason that no flow direction was determined that no consistent gradient is indicated by the data?

A3-2 Representing dipping hydrostratigraphic beds as horizontal grid layers can lead to complications for establishing boundary conditions as described previously.

Fig. A3-2 No scale is provided. It would be helpful to know the width of the subcrops.

A3-3 The statement "Although layer thickness is not centered into the model directly, transmissivity was used to represent the pinching out of Layer 1 on site." needs clarification. Based on Table A3-2, it appears that a constant hydraulic conductivity (not transmissivity) was specified for this layer.

A3-3 What is the basis for assigning "river" boundary conditions at Bound Brook? The model layers dip well below the stream.

A3-3 The General Head boundary condition parameters should be documented, with more explanation of how they were derived.

A3-4 CDM concluded from the base flow analysis that the most reasonable range of recharge was from 6 to 7.5 inches/year, not 4 to 7.5 inches/year.

A3-4 More justification and quantification is needed to support the statement that "The effective recharge to the bedrock units will be considerably less than the estimated 4 to 7.5 inches per year."

A3-4 If the "car wash" well is operating, or might be operating in the future, this may have a significant effect on the capture zone of site recovery wells. It would be helpful if evidence that it is not operating be provided in more detail.

A3-5 A MODFLOW type 3 aquifer is confined/unconfined, not confined as indicated for layer 1. Which representation was used?

A3-5 For layer 2, it should probably state that a transmissivity (not hydraulic conductivity) of 1,690 square feet per day was used for the initial run. Elsewhere on pages A3-S and A3-6, the units of transmissivity should be expressed as square feet per day. Based on Table A3-2, layer 2 was probably represented as a type 0 (confined) aquifer, not type 3.

A3-5 For layers 3, 4 and 5, MODFLOW aquifer type 0 is a confined aquifer, not type 3.

A3-6 The initial leakance value of 0.0001/day selected for the Gray Shale units seems very low. Since these units are 10 to 20 feet thick, this leakance corresponds to a vertical hydraulic conductivity of 0.001 to 0.002 feet/day. For comparison, it was previously stated that the Upper Aquitard vertical conductivity was estimated from pumping test data to be 0.2 to 0.3 feet/day, or 2 orders of magnitude higher.

A3-7 References to April 29, 1994 should be changed to August 29, 1994.

A3-7 As discussed above, a more detailed model calibration to conditions with recovery pumping operating should be documented. Comparison of simulated and measured response at a comprehensive set of site monitoring wells should be provided. Comparing model results to target head contours developed from a few data points is not sufficient. In particular, the drawdown cone indicated by the target head contours shown in Figure A3-6 appears to be defined entirely by an estimated head at the pumping well, C-1.

Table A3-1 Water level measurements for a number of the wells shown in Table A2-2 are not included in

Table A3-1. No explanation is provided.

Table A3-2 The leakance value of 0.001/day shown for the Upper Aquitard seems low. For a thickness of 20 to 40 feet, this corresponds to a vertical hydraulic conductivity of 0.02 to 0.04 feet/day, compared with a previous estimate based on pumping test data of 0.2 to 0.3 feet/day. This should be explained.

Table A3-2 The leakance values shown for the Upper and Lower Gray Shale units, 0.000014/day and 0.00065/day, are also very low. Selection of these values should be explained.

Table A3-2 As discussed previously, the basis for selecting a recharge rate of 2 inches/year for subcrop areas needs to be quantified. Similarly, the use of a constant inflow rate to the top layer of the model needs to be explained.

Fig. A3-8 Simulated response in the Upper Aquitard and Upper Permeable units are indicated in the legend, but are not graphed.

A3-8 It should be stated how the pumping flux for well C-1 is distributed among model layers.

A3-9 Although recharge is shown to be a sensitive model parameter, for many models, it is possible to maintain a satisfactory calibration when adjustments are made to recharge together with adjustments to boundary conditions and/or hydraulic properties.

A4-2 It should be indicated to which model layers fluxes are assigned to represent pumping from well C-1. It is implied that it pumps from the Principal Aquifer only. In fact, well C-1 probably pumps from the Upper Permeable Aquifer also.

A4-3 The model's ability to represent long-term pumping from well C-1 was not thoroughly demonstrated in the model documentation.

A4-3 It is not clear how the model uncertainty of plus or minus 30 percent was arrived at.

IV. PUBLIC MEETING COMMENTS AND EPA'S RESPONSES

Questions or comments are summarized in bold, followed by EPA's response.

1. Several members of the audience expressed their preference for the State of New Jersey cleanup guideline of 0.49 ppm instead of EPA's level of 1 ppm for PCBs in soil.

EPA's Response: There are no chemical-specific ARARs for soil. However, the State has developed State-wide soil cleanup criteria that while not promulgated, were considered by EPA in developing cleanup levels for the Site. Based on EPA's guidance, EPA has selected a PCB cleanup level of 1 ppm for soils at the Chemsol Site. The NJDEP's cleanup criterion for PCB contaminated soil in residential areas is 0.49 ppm; it is not legally applicable and EPA believes that a PCB cleanup level of 1 ppm is protective of human health and the environment.

With the implementation of Alternative S-3, the levels of PCBs remaining in the soil after excavation will not exceed 1 ppm. However, EPA intends on excavating additional soils from three hot spots; these excavations may go as deep as six feet, down to bedrock. With the excavation of these hot spots and by using NJDEPs soil compliance averaging methodology, EPA believes it will achieve the State of New Jersey cleanup guideline of

0.49 ppm.

2. State Assemblyman Smith asked if the responsible parties have stepped up to the plate, and if so, have they been acting in accord with the Superfund Law.

EPA's Response: The responsible parties had spent approximately $10 million on the current interim remedy to date. They have designed, constructed and are currently operating and maintaining the on-site treatment system. At the meeting, EPA also indicated that the responsible parties are complying with the Superfund Law.

3. Assemblyman Smith asked if there is any reason to believe that the responsible parties would not implement EPA's recommended alternatives, estimated at $18 million.

EPA's Response: EPA indicated that the responsible parties have indicated that they are willing to negotiate with EPA the implementation of the Record of Decision.

4. Assemblyman Smith and Mike Beson, representing Congressman Pallone, asked if the 22 potentially active groundwater wells within a half mile radius of the site were tested for contamination. They also asked EPA to re-sample the wells.

EPA's Response: Approximately 5 years ago, EPA offered to sample residential wells. Some of the residents agreed, and EPA sampled their wells. Others did not want their wells to be sampled. EPA is willing to sample all wells within the half mile radius of the Site. EPA will coordinate this effort with the Piscataway Health Department.

5. Assemblyman Smith followed up by making reference to Page 19 of the Proposed Plan, "The State of New Jersey cannot concur on the preferred remedy unless its site direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria." He wanted to know the status of the State of New Jersey's response to EPA's cleanup.

Response: Mr. Paul Harvey from the State of New Jersey indicated that they have commented on the Proposed Plan, and the State prefers its 0.49 ppm cleanup criterion for PCBs in unrestricted use areas.

6. The question was asked, if it was a part of EPA's plan to activate the biological treatment plant and discharge the treated water directly to Stream 1A.

EPA's Response: It may eventually happen. Currently, EPA prefers Option A, which calls for discharge of treated groundwater to the Middlesex County Utilities Authority (MCUA). However, the responsible parties are not sure how much longer they will be allowed to discharge the treated groundwater to MCUA. In the event that MCUA stops accepting discharge from the treatment plan, the biological process would be activated. The treated groundwater from the treatment plant would undergo additional treatment (biological treatment) that would enable direct discharge to Stream 1A.

7. Members of the audience indicated that EPA and the responsible parties should do everything in their power to make sure that MCUA continues to accept the treated groundwater so there would be no discharge to the stream.

EPA's Response: No response necessary.

8. The question was asked about the logistics of trucking 18,000 cubic yards of soil and the risk of contaminated soil becoming airborne or spilling onto the street.

EPA's Response: Soil excavation is a relatively standard procedure in the construction industry and that there are standard practices that address the issues such as possible airborne dust and spillage. Health and safety issues would be addressed in the remedial design report. When the treatment plant was being built, monitoring was done to determine the level of dust in the air, especially when trucks travel back and forth on Fleming Street. If the dust levels were too high, work would cease or some form of standard dust suppression measures would be implemented.

9.   A member of the audience indicated that the magnitude of soil to be excavated will be higher than during the construction of the treatment plant and was concerned especially with the close proximity of apartment buildings adjacent to the site.

EPA's Response: EPA has been involved in several site constructions, especially in the summer when the weather is dry. EPA has done monitoring at these sites and has been successful in implementing dust suppression measures, and can implement the same measures at this site.

10.   Will incineration of the contaminated soil at the Site cause any air pollution problem?

EPA's Response: EPA did not choose that alternative. At the meeting, EPA indicated that the alternative was not incineration but low temperature thermal desorption and that such a system would be equipped with the necessary devices to eliminate or minimize the release of dust and other pollution to the air.

11.   A home owner asked what can parents expect of children, now adults who twenty years ago played on mounds of dirt and materials at the site, and rode their bicycles freely throughout the site. What is the potential of them coming down with cancer, and what kind of cancer?

EPA's Response: This question came up at a past public meeting. At that time, EPA indicated that, it was impossible to quantify the risk for exposures so long ago. Based on its studies, EPA can say what the current and future risks are for people going on-site (including children) and if the site is not remediated a year, two years or three years from now. Unfortunately, EPA cannot say what the risks were back in the 1960's and 1970's.

12.   EPA was asked to translate the unacceptable total risk of 2.2 X 10 -3.

EPA's Response: This means that there would be an additional two people in a thousand who can be expected, if they were exposed to the site on a regular basis over a 70 year period, to come down with cancer based on the current exposure at the site.

13.   Has the EPA ever considered conducting a door to door survey to find out how many people in the neighborhood have died of cancer?

EPA's Response: EPA does not do that type of work. Congress in the last Superfund Law authorized an agency that is part of the Centers for Disease Control, the Agency for Toxic Substances and Disease Registry (ATSDR), to perform such a health evaluation. EPA indicated that it would be wi1ling to put the resident in touch with one of the biological scientists from the ATSDR. EPA held a conference call on September 26, 1997 with ATSDR to hear the citizen's concerns. During the conference call, the Superfund and health assessment processes were explained to the citizen in detail. A copy of the health assessment that was prepared by ATSDR was forwarded to the concerned citizen.

14.   A resident indicated that from what she has seen at the site, only the plant seems to fenced in.

EPA's Response: This is not true. Areas other than the plant are fenced. Lot 1B, the area where industrial activities occurred, has been fenced for at least five years.

15.   The individual followed up the question, asking if that's where most of the contaminants were found.

EPA's Response: The majority of the contamination was found in Lot 1B.

16. A resident made reference to the statement on page 17 of the Proposed Plan regarding EPA bypassing the residential areas (Fleming Street) when trucking out the excavated soil and asked where EPA would locate such a road.

EPA's Response: EPA indicated the proposed road location on a map to the audience. The proposed road will be located in the southeast portion of the site, next to the Port Reading Railroad Line. EPA was then urged to work with the Mayor's Office in ironing out details if such a temporaiy road had to be built. EPA indicated that it would cooperate with the local authorities to ensure that the community is impacted as little as possible during construction activities.

17. The statement was made by the Councilman that the responsible parties should absorb the cost for sampling the local residential wells and for hooking up such residents to the city water system as necessary.

EPA's Response: EPA will perform additional sampling of local residential wells to see what impact the Site has had since EPA's last sampling activities. EPA will ask the Potentially Responsible Parties (PRPs) to either perform the sampling activities, or to pay the cost if EPA performs them.

18. A member of the audience asked to be provided with a list of the Safe Drinking Water Act MCLs for the contaminants listed on page 6 and 7 that were found in surface and subsurface soils and groundwater.

EPA's Response: This information is available in Table 1-12 of the feasibility study report which is available in the repository, located at the Kennedy, Library, 500 Hoes Lane, Piscataway, NJ.

19. With the high level of removal of organic contaminants, as indicated in the data, is there a reason why the sewer authority would not let you continue to pump basically potable water to the sewer.

EPA's Response: The Middlesex County Utilities Authority (MCUA) is authorized to make the determination as to what material it will accept. At times, there are concerns on the part of the sewer authority on how much capacity they have to handle Superfund waste. EPA cannot comment on the sewer authority's decision making process in this matter.

20. EPA was asked if the 50 gallons per minute of groundwater that the treatment plant would be handling was excessive and if it was a case of the sewer authority not being able to handle it.

EPA's Response: EPA has no reason to believe that the sewer authority cannot handle the increased flow from the selected remedy.

21. Are soils contaminated with PCBs at the same location (hot spots) with other contamination?

EPA's Response: Yes, they are co-located.

22. If the soils were to be excavated, is there a possibility that volatiles may enter the air while the soil is being placed in the truck?

EPA's Response: Such a possibility does exist. However, EPA will take all precautions to ensure that the public is not exposed to any hazardous materials during construction.

23. Will trucks transporting the excavated soils be completely sealed to eliminate VOCs emission from the soil or will only a tarp be placed over the trucks?

EPA's Response: No decision has yet been made, but as the excavation proceeds, there will be procedures to monitor dust and organic emissions and contingencies to address any such elevated levels. The main suppression methods used in the past have been water and/or use of a tarp to cover the vehicle.

24. In trucking the material off-site, will EPA just be disposing of the material or will it be treated?

EPA's Response: EPA does not expect that treatment will be necessary prior to off-site disposal. PCBs are present at the Site in concentrations as high as 310 parts per million. Under the Toxic Substances Control Act (TSCA) law, soil contaminated with these levels can be disposed of at landfills without any treatment. For other contaminants found in the soil, all contaminants; are at levels that would not require any treatment pursuant to Resource Conservation and Recovery Act (RCRA) requirements. EPA also performed Toxicity Characteristic Leaching Procedure (TCLP) tests to determine if the contaminated soils could be disposed at a RCRA landfill. The samples tested passed the TCLP tests which indicates that the Site soils can be disposed at a RCRA landfill without prior treatment.

25. An individual concerned with sedimentary toxicity, asked if an ecological risk assessment was performed.

EPA's Response: An ecological risk assessment was performed. It involved a qualitative and/or semi-quantitative appraisal of the actual or potential effect of a hazardous waste site on plants and animals. A four-step process is utilized for assessing site-related ecological risks: Problem Formulation - a qualitative evaluation of contaminants release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment - a quantitative evaluation of contaminant release, migration and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. Ecological Effect Assessment - literature reviews, field studies, and toxicity tests, linking contaminant concentration to effects on ecological receptors. Risk Characterization - measurement or estimation of both current and future adverse effects.

26. As a follow-up, the individual asked if there are heavy metals in the sediment and if so, would a release of 50 gallons per minute of treated groundwater to the streams increase the toxicity of the stream by stirring up the contaminants in the sediments.

EPA's Response: The contamination is primarily in Stream 1B which is an intermittent ditch and does not have flow at certain times of the year. The treated groundwater would be released to Stream 1A, not to Stream 1B, and therefore would not be stirring up contaminated sediments.

27. A individual asked if EPA would be excavating Lot 1B, or both Lot 1B and 1A.

EPA's Response: It was indicated that most of the soil to be excavated will come from Lot 1B, but that some soils from Lot 1A will also be excavated.

28. The question was followed up as to at what depth would excavation take place.

EPA's Response: The depth of excavation varies from area based on testing performed in the remedial investigation. For some areas, EPA will excavate to two feet, others, four feet and six feet.

29. The question was asked if six feet was the deepest depth EPA was planning to excavate.

EPA Response: That is correct based on data available at this time.

30. The same individual asked how soon after excavation could houses be built, or would one have to wait 30 years for the groundwater remedy to be completed.

EPA's Response: One would not have to wait 30 years for the groundwater to be cleaned up before houses could be built at the Site. Upon excavation of the contaminated soils followed by backfilling with clean fill, houses could be built. However, the NJDEP may require some deed restrictions on the Site if its PCB cleanup criterion of 0.49 ppm is not achieved.

31. Follow-up question. With the allotted time being 30 years, would it take that time to be deleted from the NPL or could it be deleted before 30 years.

EPA's Response: The 30 year timeframe mentioned in the Proposed Plan for groundwater pump and treat may not be an accurate estimate of how long it will take to clean up the site. The 30 year timeframe is used for costing purposes only. It is very difficult, if not impossible, to predict exactly how long it will take to clean-up the groundwater at the site. The Site cannot be deleted from the National Priorities List (NPL) until no further groundwater response is appropriate. Due to the complex nature of the fractured bedrock found at the Site, contaminants get trapped in spaces and are very difficult to remove. EPA intends to pump as much water, very aggressively into the treatment plant to remove the contaminants, and to minimize the potential for the contaminants from leaving the facility boundaries.

32. The same individual was interested in knowing if after performing the five year review and the groundwater has been cleaned up, would the site be ready for houses?

EPA's Response: The Site could be used for building houses before the groundwater is cleaned up, providing it does not interfere with the remediation and no potable wells are installed or utilized. However, as mentioned earlier, EPA's cleanup criteria for soils contaminated with PCBs is 1 ppm and the NJDEP's cleanup criteria is 0.49 ppm. So even though the soils will achieve EPA's cleanup criteria, the State of New Jersey may restrict some uses of the Site if its cleanup criteria are not achieved.

33. The same individual asked how deep is the groundwater and soil contamination.

EPA's Response: Based on current data, the groundwater contamination goes down several hundred feet and the soil contamination goes as deep as 6 feet.

34. The questioner was interested in determining the risk if houses were built at the site since excavation would only go as deep as six feet and in certain area the soil contamination is as deep as ten feet, possibly leaving some contaminated soils on-site.

EPA's Response: Based on EPA's risk assessment, soils below two feet at the Site do not pose any cancer or non-cancer threats associated with residential use. However, there is a small pocket of soil around borings 74 and 76 with levels of VOCs that are higher than the remaining subsurface soils. This area, if not removed, will continue to be a source for future groundwater contamination. Based on EPA's proposed remedy, this area of contamination would be excavated down to six feet, where the contamination exists, then disposed of off-site. Therefore, the subsurface soils would not pose any risk to future development of houses at the Site.

35. An individual was interested in knowing where Streams 1A and 1B go after leaving the site.

EPA's Response: EPA indicated that both streams flow to New Market Pond, which ultimately flows into the Bound Brook. The Bound Brook eventually flows into Raritan River.

36. The individual followed up her question asking if EPA intends to do off-site testing of the streams to be sure that contamination has not left the site.

EPA's Response: Elevated levels of PCBs were detected in portions of the streams. It is not clear if the PCB concentration in the stream sediments represent actual source areas of contamination or indicate the presence of a migration pathway for contaminants from the more heavily contaminated Lot 1B. In addition, ecological risks associated with PCBs are minimal. Therefore, remediation of the streams is not warranted at this time. Rather, monitoring is required to determine whether remediation of Lot 1B results in a lowering of PCB levels in the streams in Lot 1A.

37. The question was asked, since a railroad track exists next to the track, EPA should consider disposing of the excavated soils by rail.

EPA's Response: EPA evaluated this option, and though 18,000 cubic yards of soil seems like a large volume of soil, it is often quicker and more economical to transport the soil by truck than by rail.

UNITED STATES ENVIORNMENTAL PROTECTION AGENCY

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PUBLIC MEETING
FOR THE PROPOSED PLAN FOR FINAL CLEANUP
AT THE CHEMSOL, INC. SUPERFUND SITE IN :
PISCATAWAY, NEW JERSEY
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Municipal Building
455 Hoes Lane
Piscataway, New Jersey

August 27, 1997
7:15: o'clock p.m.

B e f o r e:

PAT SEPPI,
Community Relations Coordinator

NIGEL ROBINSON
Project Manager

LISA JACKSON,
Chief of Central New Jersey Superfund Section.

JIM HACKLER,
Previous Project Manager

P R 0 C E E D I N G S

MS. SEPPI: I would like to thank everybody for coming out tonight to this public meeting for the Proposed Plan for Final Cleanup at the Chemsol Superfund Site in Piscataway, New Jersey.

I am Pat Seppi, Community Relations Coordinator with the EPA, Region 2, in New York City. I would like to introduce the people that will be giving short presentations tonight.

Nigel Robinson is EPA Project Manager for the Chemsol site.

Jim Hackler is the old project manager for the Chemsol site and we have asked him to come tonight and Lisa Jackson is the Chief of the Central New Jersey Superfund Section.

Also Paul Harvey from the NJ Department of Environmental Protection is here and also Meyhear Billimoria is here and if anybody has questions for them they will be happy to answer them, I am sure.

If you did not already, please sign in. That is the way we make sure you are on our mailing list for updates or documents that we may want to send out to you. The reason we are here is to present EPA"s proposed plan. We have done a lot of studies, a lot of investigations and this is our plan that addresses the best way we found to clean up the contaminated soil and water.

Nigel will go into more detail about the other alternatives we have looked at during the presentation. It is important to us that the public is well aware and understand what it is we are trying to do. That is why we have the public meeting and 30-day public comment period.

Most of you probably received a copy of the proposed plan in the mail. If you did not there are copies in the back and copies of the fact sheet that went out with the proposed plan. The public comment period started August 11th and extends until September 10th. That is our typical 30-day public comment period. If you have any written comments after you leave here tonight or know anybody who has a comment please have them send it to Nigel so that it is in the proposed plan.

You will notice we have a court stenographer. The transcript from this meeting along with any other comments we receive in the mail will be part of the permanent record and will be addressed in what is called a responsiveness summary, which is attached to our final decision document, which is called the Record of Decision.

Lisa will explain a little bit more about that when she talks about the Superfund proposals. One of the other thing I wanted to mention was we have received from the public a request to extend the comment period an extra 30 days and we have granted that request.

Instead of the comment period being over on September 10th it will be over at the close of business on October 11th.

We usually do that if someone requests an extension. We try to accommodate them as much as possible. As I mentioned before there are a lot of documents that relate to Chemsol. You will find the documents in the repository that is right down the street in the library. You are certainly welcome to go look at those at any time.

We have tried to leave the bulk of the time for you for your questions and answers. As soon as we are finished we will open the floor for questions and answers. The Mayor of Piscataway is here. Camille Fernicola is here; Assemblyman Bob Smith, who has been very interested in this site and what is going on; two gentlemen Jim Stewart from Ward 4 and Brian Wahler from Ward 2.

I would like to turn this over to Lisa.

MS. JACKSON: I will keep this very brief because I assume most of you are somewhat familiar with what the Superfund process is about and I apologize, I think I have the longest overhead and this is the shortest screen I have ever seen.

The Superfund is the Federal government program for cleaning up abandoned hazardous waste sites throughout the county and it is a multi-step process. It kind of evolved when the Superfund came to be. The first step in the process is usually what we call site discovery. Someone, some entity phones into EPA a complaint about a site, which usually starts a whole gamut of investigatory activities to determine what the status of the site is.

As you might guess, most sites are found to be no problem or someone is addressing them or the contamination is not severe enough to warrant Federal

Government attention. There are those sites that are just the opposite. They do require attention and those eventually are ranked numerically and based on the number they are assigned the numbers above 28.5 they are put on the National Priorities List.

I am going to go through a few of the words that you will hear about night. Once a site is listed on that list it becomes available for long term response, sometimes by the Federal Government sometimes by the State of New Jersey. Chemsol was put on the Superfund list in 1983.

The first thing that usually happens even before it goes on the list, but I was not quite sure where to put this on the slide, someone comes up and starts to look at the site to determine whether or not there is something that should be done quickly to try to mitigate any immediate threat, to stop the contamination from getting worse while we do what has become a pretty long term investigation to look for contamination, the remedial investigations and feasibility studies and at this site we actually did something kind of inventive when Jim was project manager.

He did a focused feasibility study to accelerate the response, to make sure we address the problem as quickly as possible.

The other thing that goes on during all these processes is what I loosely term enforcement activities. The way the law is written as to how Federal money can be spent to clean up a site, to investigate a site but there is a strong preference and legally we are required to try to get those parties who placed the contamination, who owned the property that is contaminated to do the cleanup.

We spend quite a bit of effort and an awful lot of time trying to negotiate with what we what call responsible parties, instead of spending tax dollars to do it. At the culmination of all the study phases we issue what is called a Record of Decision. That is actually part of why we are here tonight.

The government is legally obligated to take comments on all decisions that it makes for cleanup of a site, other than those emergency type activities, and what we usually try to do is take comment or get public input if it is not a screaming emergency.

Part of our process is to put forth to you in the proposed plan our proposal of how we think we should be addressing this next phase of work. The comments can be given tonight orally because they are recorded by the stenographer, or you can write and send them to Nigel at the EPA. Either way they will become part of the official record.

If you think of something after you leave here tonight you still have plenty of time to get it on the record. The EPA will take those comments and at the end of that issue a legal document called a Record of Decision which outlines our final decision for that cleanup.

Once that document is issued we go and do more negotiating with the responsible parties to try to get them to implement the work with their money. If not we spend Federal money to implement it. Like Chemsol we also spend quite a bit of time in operating and maintenance. We are pumping water and continually pumping in order to monitor to see if we are seeing decreasing levels of contamination.

After this is all completed there is the deletion of a site from the NPL. Way back when it went on the NPL. Depending on the nature of the contamination it can be decades or many,

many years before it is finally deleted.

I am now going to turn it over to Nigel, who is going to describe the process for the Chemsol site.

MR. ROBINSON: Can everybody hear me?

Well, as Lisa and Pat said we are here to bring forth our proposed plan for the Chemsol Superfund Site here in Piscataway, New Jersey. Here we have put down two bullets as the purpose of the proposed plan and it is basically to identify EPA's preferred remedial alternative and rationale for its preference.

Basically we want to tell you what we have chosen and the reason why we chose it and to encourage the public to review and comment on the alternatives that are presented here in the proposed plan.

Before I move along I just want to show everybody here, I think you are probably all aware where the site is, but this is the location of the site right at the end of Flemming Street and right across from Stelton Road.

This is just a more detailed view of the site and right along here, this is basically the site along here and here right along the railroad. It is divided into two lots. It is approximately 40 acres. The larger lot, Lot 1-A is about 27 acres. Lot 1-B is about 13 acres.

The treatment plant, which I will talk a little bit more about as we go along is located right here. Just to give a brief background on the site, the site was previously a solvent recovery and waste reprocessing facility. They basically accepted waste from different generators and different companies and tried to reprocess it and sell it.

They operated from the 1950's through 1964. During their period of operation they had a whole series of accidents, explosions and fires. The plant was closed down or ceased operation back in 1964. The property was eventually rezoned for residential use in 1978.

The current owner of the site is Tang Realty, and as Lisa mentioned earlier the site was placed on the National Priorities List in 1983 and the EPA and the New Jersey DEP has been involved ever since.

From 1983 through 1990 the current owner, Tang Realty, under the direction of the New Jersey Department of Environmental Protection undertook groundwater investigation and in 1988 and 1990 removal actions were performed at the site and basically what happened was that we had hazardous waste in drums, in lap packs, bottles at the site, so we went there and we undertook a removal action.

Okay, after the removal action was completed we initiated what we call remedial investigation and feasibility study. That was done in 1990. We decided that we would use a two phase approach and we basically broke it up into Phase 1 and Phase 2, and primarily based on the result we realized that the groundwater was severely contaminated with various substances dumped to a depth of about 130 feet.

We wanted to move quickly so we could evaluate the options for containment of the contaminated groundwater and soil and prevent it from traveling off site.

In the second phase we decided that we would undertake it, so we could determine the nature and extent of the contamination at the site. The remedial investigation was completed last year and these are basically the findings for Phase 2.

What we found was that the soil and groundwater is contaminated with volatile organics, semi-volatile organics, pesticides, PCB's and metals.

Sediment samples also indicates the presence of volatile organic, semi-volatile organics, pesticides and metals and the surface water indicates low levels of pesticides and organics which appear to be entering from off site.

I did not prepare a table here to show the different contaminates that we found, but it is presented in the proposed plan so anybody that is interested can see all the contaminants we found there.

We also prepared what we call a risk assessment and the risk assessment is to evaluate the risk posed by whatever contamination we find at the site and so we looked at contamination that was found in the soil, the groundwater, the surface water, the sediment and the air and performed the risk assessment.

EPA acceptable cancer risk range is 10 to the minus 4 to 10 to the minus

6. What that means is there is a one in 10,000 to one in one million increased chance of developing cancer over a 70 year lifetime from exposure at the site. Based on our risk assessment we found unacceptable risk at the site and basically exposure to surface soil was 2.2 times 10 to the minus three and exposure to groundwater and that is 2.4 times 10 to the minus two.

In addition to a cancer risk we also found non-cancer risk and here we have non-cancer effects are assessed using a hazard index, HI. A hazardous index greater than one indicates a potential for non-cancer health risk. Acceptable non-cancer health effects associated are ingestion of surface soil and groundwater by children, adults, site employees and workers.

No risk or non-cancer effects associated with subsurface soil, sediment or surface water was found so basically most of the non-cancer risks were associated with soil on the surface, zero to two feet down and they are associated with children and adults and employees or workers at the site.

We also did an ecological risk assessment and what that entails is an appraisal of the actual or potential effect of a hazardous waste site on plants and animals. What we found from the ecological risk assessment is that there is a potential risk from surface soil to small mammals and birds.

We found a minimal potential risk from sediments but it was not sufficient to warrant disturbance or remediation of the stream bed. What we are saying is the risk was so small there was nothing to warrant digging up the stream and replace it. We found no significant potential for risk from surface water to water column receptors.

Here the topic is remedial action objectives. When we are working through the process of deciding what alternatives we will choose we have to have objectives and these are the objectives that we set about achieving.

Restoring the soil at the site to levels which would allow for residential, recreational use without restrictions so we want to clean up the site with as little restrictions as possible, so it can be used for residential recreational use such as parks, playgrounds, et cetera.

The other objective we had was to augment the existing groundwater system to contain that portion of contaminated groundwater that is unlikely to be technically practical to fully restore. Restore remaining groundwater to State and Federal drinking water standards and whatever contaminated groundwater that is there we want to be able to clean it up so we can restore it to whatever the State drinking water standard is or whatever the Federal government drinking water standard is.

We want to remove and treat as much contamination as possible from the fractured bedrock. I didn't touch on much of it, but one of the problems with this site is that after about six feet down you encounter bedrock and it is fractured. There are a lot of cracks in it, so a lot of contamination has seeped through these cracks.

So even though we are currently pumping and we are getting contamination out, a lot of it is still locked up in there and it is difficult to get out, so this was one of other objectives that we had. Remove and treat as much contamination as possible from the fractured rocks. The next one was to prevent human exposure to contaminated groundwater.

We want to minimize the exposure to whatever degree we can to humans. We want to prevent exposure to surface soil containing PCB's, one part per million and lead at 400 parts per million. PCB's at one part per million is the Federal cleanup standard for PCB's in residential areas and the lead standard is 400 parts per million.

So we want to clean up the site to meet these criterias. We want to eliminate the source of contamination to the groundwater. So if there is any organics, any chemical in the soil currently we want to be able to remove that soil so it will not continue to leach into the groundwater.

So basically we had to come up with remedial alternatives. Since we have two media that we have to contend with that are contaminated at the site, we have soil contamination and we have groundwater contamination our aim is to develop different alternatives so we can address the soil contamination and also address the groundwater contamination.

This is a short list of some of the alternatives that we looked at that will address the soil contamination. Some of them were eliminated for several different reasons, but this is the final list that we use for our evaluation and for the first alternative, S-1, that is no further action. Under the Superfund law we have to look at no further action, which is basically what would happen if we did nothing at the site and we use that as a bench mark to compare it with the other alternatives that we will choose or look at.

The second one was capping the area with soil. Basically that is moving soil in, placing it over the entire site or the areas that are contaminated. Seeding it with grass and by doing that that would eliminate the exposure of contaminants in the surface soil to adults, kids, workers or employees at the site.

The third alternative was excavation an off-site disposal. Under that alternative we basically would excavate the contaminated soil and just truck it off to some off-site disposal facility and that would pretty much take care of whatever source of contamination we have in the soil.

There is another alternative, S-4A. We would excavate and perform on-site low temperature thermal desorption of PCB contaminated soil. Basically what that is, it is not an incinerator but it is something close and we would excavate the soil, put it in this machinery and provide it with heat.

It would remove the PCB's and other organics, some of the other organics from the soil. It would be free of PCB's and organics and the portion of soil that contains lead, what we would do, since we cannot destroy lead we would just have to solidify it and leave it on site, so basically in solidifying it we would end up mixing it with cement and placing it in a certain area on site and once you do that then that minimizes the risk and contact of lead contaminated soil to children, adults, workers and just the environment in general.

The other one is basically the same process as the one before it, but instead of solidifying the lead contaminated soil on site we would truck it off to disposal facilities off-site.

The groundwater alternatives. As most people here know the groundwater treatment facility has been in operation since, I think, 1994 at the site, and basically what it does is we have a treatment plant and we pump from one well, now I think it is about 25 gallons per minute, and we pass it through a whole host of treatment processes that will remove organics and/or contaminants from the groundwater.

We looked at different groundwater alternatives that we could use to augment the current treatment facility there, and as I mentioned earlier we always have to look at the no action alternative. Basically what would happen if we did nothing and just walked away from the site.

The next one would be continue existing interim action, extract groundwater from Well C-1 and pass it through these different treatment processes. Under that one we have two options. We looked at two options. Currently we are using Option A, where the treated groundwater is released to the Middlesex County Utilities Authority and also Option B where the treated water is released to Stream 1A.

The third alternative for groundwater is basically just an addition to Alternative 2. We currently pump from just one well. What we would do in this alternative is to pump from additional wells, and we are looking at about five additional wells so we would pump here and just pump it right to the current treatment faci1ity and whatever is going on now would continue to go on. Currently we are pumping about 25 gallons per minute. Under this alternative it would go up to about 50, 55 gallons per minute.

We previously looked at soil alternatives and now we have to look at the cost. The cost is always an issue. Whether it is viable or not, too cheap, too expensive and we have different factors that we look at. We look at the capital cost. How much capital would it cost to implement it.

We have all of the different alternatives under the soil that I previously mentioned, the no action, capping the soil, excavation, thermal desorption treatment on site. When looking at the costs we have to look at operation and maintenance costs.

What that is, currently the facility there that is in operation incurs operation and maintenance costs because the groundwater has to be pumped and it has to be treated. You have to pay for electricity. You have to pay for treatment. You have to pay for maintenance, et cetera.

That is also another factor that we have to look at. Here we look at what we call the net present worth. That is how much money would we need to put up front so that over the next 30 years we could not meet the projected cost expenses. All of these costs here are based on a 30 year schedule. How much money would we need to put up front now so I could pay for the costs and pay for the operational costs over the next 30 years.

Then this column, this would be the implementation time. How long would it take to implement the remedy. In this case this is basically once you get the go ahead how long would it take physically on site to do whatever you need to do to the soil and whatever you need to do to the groundwater to get the whole thing running, and so from here we can see this is more in terms of cost. The net present worth is really the column that we need to focus on and we see for the no action it would cost us $338,000 that being the lowest and the most expensive one would cost us $12 million.

We had to do the same cost analysis for the groundwater alternative that we looked at and here we have a capital costs, annual cost, annual operation and maintenance cost and you can see here that it gets pretty high. Under the existing operation that we have at the plant you are looking at almost a half a million dollars a year to operate the plant.

Under another option, GW-5 it is close to three-quarters of a million dollars to operate it on an annual basis so this is the important column in that present net present worth, and we see what the costs are and for the no further action that is the cheapest one and it is over $900,000 and under GW-5, Option B, which would be releasing it to the stream it is a little over $12 million.

After we have come up with our list of alternatives, the soil alternatives and the groundwater alternatives we have to go through what we call an evaluation criteria. Basically we have a list of nine criteria that we have to evaluate, and the first one on the list of alternatives that we decide on we have to look at overall protection of human health and environment and determine if this alternative provides us with enough protection for human health in the environment.

We also have to look at compliance with ARAR's among other relevant and appropriate requirements.

To put it in a nutshell, we have to see if the alternatives comply with other environmental laws. We have to look at the long-term effectiveness of the alternatives.

We have to look at whether it reduces the toxicity or mobility or volume of the treatment whether they are in the soil or groundwater. We look at the short-term effectiveness, implementability. How easy is it to implement it. We look at cost and we look at whether the State will accept the alternatives that we choose and whether the community will accept the alternatives we chose.

That is one of reasons we are here today, to show you the alternatives that we prefer and see if you are accepting of it and what comments you have on it. So after going through all of that we did an analysis of what we thought was best based on all of those nine criterias that we just went through.

The EPA's preferred alternative for the soil portion of the contamination, we preferred the excavation and off-site disposal of the contaminated soils that are currently there at the site and for the groundwater portion, we prefer to extract and treat the groundwater with additional wells using existing treatment technology. So basically the treatment plant is there in operation. What we prefer to do is just to add additional wells, pump from them and pass that water through the treatment facility.

The next step in the process, and as Lisa mentioned earlier and briefly described is a Record of Decision and after going through this entire process we have to come up with a Record of Decision. That is what is our decision, what alternatives have we chosen and put it in a document, which is a legal document which is to be implemented at site.

So after the proposed plan, after we get the comments from the public we will prepare a Record of Decision and whatever decisions we make will be implemented, and in addition to that Lisa also mentioned that we will do additional groundwater investigation to determine if the contaminated groundwater is leaving the property boundaries.

Right now Well C-1 is capturing most of the groundwater at the site, but we still feel that some groundwater could be leaving the site and based on the alternative that we have chosen in adding additional wells, pumping wells at the site we think we will be capturing most of the groundwater at the site and basically capturing everything at the site, but we feel we still need to do additional investigation just to be sure that none is leaving the site or if any, minimal.

With that comes the end of my presentation and I will turn you over to Pat Seppi who will act as moderator in taking questions and answers.

MS. SEPPI: I know it seems we have thrown you a lot of information, but we have tried to keep it short because found in the past these long full blown explanations sometimes it is better to just let you ask questions and since we do have a court stenographer this is part of the record. We would ask you to come up to the mike to ask your question and state your name first so we will have it for the record, and if you could spell it also.

ASSEMBLYMAN SMITH: Actually let me thank the U.S. EPA for a very informative presentation and also for the work you have done so far to clean up the site. Your presentation did generate some questions.

No. 1, just prior to the

presentation we had a chance to talk informally and I believe Mr. Hacklar indicated that so far on the site approximately $10 million has been spent associated with the current clean up.

MR. HACKLAR: Roughly.

MR. SMITH: You mentioned to me the responsible party has stepped up to the plate and has been acting responsibly.

MR. HACKLAR: Tang Realty is one of a group of responsible parties. What has happened is that Tang Reality is one of a group of responsible parties that designed and constructed and is operating and maintaining the treatment system on the site, and that group is really the group that has spent the majority of the money so far.

ASSEMBLYMAN SMITH: But they are acting in accord with the Superfund Law. The responsible party is taking responsibility.

MR. HACKLAR: That is correct.

ASSEMBLYMAN SMITH: It appears that the alternatives recommended by the EPA for both groundwater and soil are on the order of $18 million dollars for that clean up that is currently being recommended; is that true.

MR. HACKLAR: Is that is correct.

ASSEMBLYMAN SMITH: Is there any reason to believe that the responsible parties will not be responsible with regard to that $18 million.

MR. ROBINSON: At this point there is no reason to believe they will not pay. As a matter of fact they are willing and looking forward to negotiating with us for implementing the Record of Decision.

ASSEMBLYMAN SMITH: That is certainly also good news. In the background information there is the statement, I believe on Page 2 that there are approximately 180 private wells at residential and commercial addresses that are potentially active, that means not sealed within a radius ot two miles of the site and 22 of these wells are located at a distance less than a half a mile from the site.

I guess the obvious question, at least with regard to the 22 wells that are at within a half a mile from the site is, have they been tested for contamination?

MR. HACKLAR: Previously, several years ago we did have a sampling event of residential wells in the area. That was probably five years ago. People that wanted their wells sampled approached us and we went out and sampled those wells.

While there are wells there sealed there are probably still wells in the area that may in fact not be sealed. It is my understanding that there is municipal water available to people if they want it in the area.

ASSEMBLYMAN SMITH: I believe

that is true. We are pretty much a fully -- our infrastructure is pretty much in place in Piscataway. That being said the recommendation to you from me is with respect to those 22 homes or those 22 wells which maybe active that whether the property owner has requested testing or not, I think the testing should be done.

We have now had several years elapse. You have been pumping water out of that site for three years. Groundwater is moving and I think with regards to those 22 wells it would provide some piece of mind to the community to know that the contamination is not migrating or the groundwater is not moving off-site and I know of you have your consultant here and hydrogeologists have looked at this thing and the technical people, that being said it would be nice to know with regard to those 22 wells that we know for a fact by means of current testing that the contamination has not moved and there is no potential threat to those people.

With regard to those 22 wells, if there are residential wells that are still active I believe Tang Realty should be responsible for the cost to connect them to the city water. The reason is the owner, if there is a home owner with an active well they would have to connect to city water. I would like to throw that on the table.

The question with regard to clean up standards are they the result of the risk assessment standards EPA put on the screen or are they dictated by the zoning on the site, would there be a different clean up if this was zoned industrial versus residential?

MR. HACKLAR: Basically it is a combination of both. The risk assessment showed us that there was a threat from the soil and that PCB's were a major factor. EPA does have a cleanup

level for lead and because we saw that
they were exceeding that level we felt
it would be appropriate to remediate for
lead.

In looking at the areas to clean
up and not to clean up we did apply the
EPA cleanup criteria as a guide, so it
really is a combination of both.

MS. JACKSON: The even more
direct answer to the question, PCB's are
a good example. If we believe the site
is going to be used for residential, the
cleanup number for residential is 10
parts per million. We are not proposing
to go to 10. We are proposing to go to
one. We want to allow the site to be
used for residential, recreational.

ASSEMBLYMAN SMITH: If the
proposed use was industrial what would
be the number?

MS. JACKSON: The PCB's cleanup
number is 10. If we thought we were
going to have an industrial property
actually the guideline is 10 to 25. it

could be as high as 25.

ASSEMBLYMAN SMITH: Would it be fair to conclude to that the most conservative approach is to keep the residential zoning in place because that requires the greatest degree of cleanup?

MS. JACKSON: As far as our using residential it is almost a more stringent cleanup number.

ASSEMBLYMAN SMITH: That was the whole point of question. I did not phrase it articulately. I know that is information counsel needs to know and that is very helpful. There is a statement in here on Page 19, "The State of New Jersey cannot concur on the preferred remedy unless its soil direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria."

What is the status of the State of New Jersey's response to your proposed cleanup or has there not been a response received?

MR. HARVEY: We have commented on this proposed plan. The only potential problem is the State's criteria, it is not a standard, not a law, for PCB's is .49 parts per million. EPA criteria that they use is one part per million, so there is a slight different criteria. That is really the main potential problem.

ASSEMBLYMAN SMITH: It is not a happy thought, but I thought the legislature passed a statute earlier this session that indicated the State's standard could not be more stringent than Federal.

MR. HARVEY: That is true, but there is not a law.

ASSEMBLYMAN SMITH: Keep up your criteria. Fight hard for it. From an environmental point we want to see the site as clean as possible so please continue to push for the . 49.

What happens if you do not come

to agreement. What happens if the State does not agree with the preferred alternative because their cleanup criteria is more stringent than yours?

MS. JACKSON: There are a couple of ways we can go. We would like to approach the responsible parties in negotiations and ask them to use the State number because the State will insist if we do not use their number and do not meet it we leave restrictions on the property, which we do not want to do.

Our first hope is we will be able to work it out to use the state number, even though it is not law, but we intend and we have been cooperating all along and hope that will happen. If that does not happen there are alternatives. We can ask the State to help us fund whatever additional cleanup in order to meet their number.

Usually we can work it out in negotiations. It is one of those regulatory points that we are familiar with. It has happened at a couple of other sites. We usually try to work it out.

ASSEMBLYMAN SMITH: Does the public and Mayor and council as these negotiations proceed between the responsible parties and the State, is the local government informed of the status of those negotiations? Does the public ever know the status of those negotiations?

MS. JACKSON: Not usually. The legal document that would specify the cleanup level would be the Record of Decision. The public's opportunity to weigh in, is now.

If there is a strong feeling on the part of elected officials or the public at large this would be the time to make that clear.

ASSEMBLYMAN SMITH: I am very happy that you made that point because certainly everyone in the audience has to take that under advisement.

For myself I would endorse the State standard, the .49. Can you elaborate why the State picked .49?

MR. HARVEY: It is based on our own risk assessment work and that is done by our state scientists. That is all I really know. I do not know any details.

ASSEMBLYMAN SMITH: I would assume since it is a lower number it would result in lower risk numbers than on the overhead projector.

MS. JACKSON: it is not going to result in a huge difference. It is a lower number, a lower risk.

ASSEMBLYMAN SMITH: Has EPA quantified the cost?

MS. JACKSON: That is the interesting point. Right now there is no reason to believe it will cost any more. We are very hopeful. If you go to one you can go to .49. There are legal reasons but we believe we are

talking about a difference of a couple
of shovel fulls.

ASSEMBLYMAN SMITH: For the
record, I am for the .49. As I read
this it appears you are talking about a
30 year timeframe for the cleanup
approximately plus or minus.

MR. ROBINSON: Yes, basically
for all groundwater treatment we use a
30 year as a standard for costing and
for evaluation, so what we do is we pump
and every five years we look at the data
that we have collected, reevaluate it
and make a decision whether we continue
pumping the way we have been pumping or
whether changes need to be made or
whether we shut down the facility
because we are within the cleanup
criteria.

ASSEMBLYMAN SMITH: My last
comment is congratulations for working
hard on this site, bringing it to where
it is. I know the people in Piscataway
appreciate the fact the Superfund

cleanup is going forward. We know this is an enormous expense. The technical expertise is also enormous and we appreciate the full force of the State and Federal government to see that the cleanup occurs.

That being said, I would also endorse your proposals in terms of cleanup. It sounds to me removal from the site, while it is less expensive than the cleanup at the site and the groundwater alternative appears to be a reasonable alternative as well.

The two things that are a little unsatisfactory, I would like to press a little harder on is the fact there needs to be a way for the public and local officials to know what the final status of the negotiations are before its is signed on the dotted line. I think people want to know what is going to be agreed to, what is about to be agreed to before it is a done deal.

If there is some way to do that

I would urge they consider doing that on the site because it is of such an important interest to the community.

The second comment I want to make is to urge that those 22 wells that maybe active need sampling and in the event there is contamination the responsible party be held responsible.

MS. JACKSON: You do not have to speak now but if there is anyone in this situation and you are interested in having your well tested please come up after the meeting. We would love to hear from you. It is not a problem to do the test. I think that is a good suggestion.

MR. BESON: I am Mike Beson, B-e-s-o-n. I work for Congressman Palone. I am here representing him tonight.

I wanted to thank the EPA for coming out. Clearly Assemblyman Smith is correct in saying this is a very good plan in the terms of the way you are getting rid of the soil and groundwater. I think it is tremendous. Unfortunately it had to take this long. I know we have worked all in concert in trying to make this happen. I just wanted to say that we have to make sure that we test as many off-site wells as we possibly can. That is very important because we have a responsible party and because of off-site the groundwater contamination we have to make sure we get to as many off-site places as we can.

I encourage the people if you have those wells please come up. I an also agree with Assemblyman Smith about the PCB's standard, please use the State standard. The lower the standard the better. Certainly if it is not costing any more money it is probably the smarter thing to do.

Alternative Groundwater 5, Option B, that part of Option B it says: "Starting up existing biological treatment plan." Use of biological

treatment plan will allow for discharge
into Stream 1A. Is that part of your
plan?

MR. ROBINSON: It may eventually
become a part of the plan. Currently we
prefer Option A and the plan that is in
operation now uses Option A but there is
also a possibility and PRP and they have
indicated that to us that in the future
they are not sure how much longer they
can continue releasing the treated
groundwater to the Middlesex County
Utilities Authority and in the event
that the Authority will not accept the
water any more we have to resort to
Option B.

What option B is is an
additional piece of equipment that goes
through an additional chemical process
and in this case it is a biological
process that will do an additional
treatment and will enable the water to
be released to the stream.

MR. BESON: I would encourage

you to use the State standard. It is very nice if things can be cleaned up to a particular standard. In one case you contradict yourself. You say on Page 16, "It is possible that it will be technically impracticable to restore all portions of the aquifers to meet State and Federal standards."

I do not know if that has implications to this.

MR. ROBINSON: No.

MR. BESON: Option B, releasing it to the stream would be a last ditch scenario. We have Assemblyman Smith and Freeholder Brady. I know they would work with our Utilities Authority to make sure they would continue to accept it.

The responsibility party should do everything in its power to make sure it does not have to be released. I understand it would be within State and Federal standards. If there is no reason to do it you must pressure them and make sure it does not happen.

That was all I had to say. Assemblyman Smith, on the final negotiations I would be happy to keep in touch with you to let you know where we are. If you could filter information about where we are I would be happy to get it down to the local and state level.

MR. HACKLAR: On the pumping availability, the, status of the negotiations. One of the avenues that the EPA could proceed down with the responsible parties would be to enter into a consent order or administrative order on consent.

If that were the case it would go through a public notice period and the public would be able to comment on that.

MR. BESON: Okay. Thank you very much for coming tonight.

MS. SEPPI: Thank you, Mike. Councilman Stewart.

COUNCILMAN STEWART: I am Jim Stewart. I am the Councilman for Ward 4 in Piscataway. On behalf of the people of Ward 4 I would like to agree with previous speakers and Assemblyman Smith. We should ask for the .49 parts per million, especially in light of fact it is really not much more involved and not much more cost, some sort of bureaucratic thing that has to be worked out.

If that is the case I urge you to please try to work it out for the benefit of the people and I know Councilman Wahler before I came up here asked me to state he also feels the same way. He represents the people in Ward 2 in Piscataway. I see our Freeholder, Camille Fernicola from Piscataway is here too and she will have some comments later on, her thoughts about this.

Also, I agree very much with the comments about paying for the testing of the wells in the neighborhood. I remember back when this become an issue and the people were just finding out they had contamination in their wells, part of the problem in the testing involved was it was somewhat expensive for the average homeowner to foot the bill on a regular basis and I think to go back down say to them you should pay for testing the wells.

Even though it is a Superfund Site out there I think it is sort of unfair. If it could be worked out where your agency could pay for the testing of the wells I think it would be appropriate. I think it would be a fair thing to do. I also had some questions I would like to ask, one having to do with the actual logistics of trucking away, I think you are talking about 18,000 cubic yards of soil. What is the possibility for airborne dust and contamination or rain water washing some of the stuff down the streets and so forth and so on.

MR. ROBINSON: There is always that possibility, but a lot of these issues, health and safety issues they will be addressed and the remedial design and soil excavation is relatively standard procedure in the construction industry and they have measures that addresses all of these things. We will be going through that in the remedial design.

MR. HACKLAR: Just to give you a little bit about the historical information, when we were building the treatment plant out at the site monitoring was done to determine the level of dust in the air and especially if trucks were going back and forth on Flemming Street and if the dust was too high the work would cease or there would be some sort of dust suppression measures.

There are very standard measures. They are easily implementable.

COUNCILMAN STEWART: I think compared to the soil excavation so far this would be on the magnitude bigger. There might have been a little dust here and there on what you have done so far, but it sounds like there is a potential for contamination airborne into the nearby residences.

We do have high density apartment building in that area. There are a lot of people living in that small area. It worries me. I would like to get some more information exactly what those suppression techniques are. I do not claim to be an expert but I have seen trucks hauling away dirt. You can see it blowing in the street. Not that we have potholes in Piscataway but if it hits a bump, you know, what I am saying.

I would like to get some more detail.

MS. SEPPI: That is very common. We have a lot of sites in construction in New Jersey, especially with the summer we have had, it has been dry. We can get you that information. Dust suppression the perimeter air monitoring, it is a problem that we have at all sites. I think we have some pretty good ways of handling it.

As we did with the treatment facility we spend a lot of time with people in the town engineering the traffic. Everything will be worked out.

COUNCILMAN STEWART: Will we be able to get more specifics on the technology you will be using?

MS. SEPPI: Yes.

COUNCILMAN STEWART: I am glad to see we are going to truck the soil away and not leave it in place. I like the option of pumping out the water by putting more wells in.

One question I have, just before the meeting we were talking informally and I mentioned oil well drilling. Sometimes they use very aggressive methods for extracting the last bit of oil out. During the presentation you were talking about having something like three-quarters of a million dollars in operating expenses for a number of years.

I was wondering if more aggressive techniques you would not have to spend that much money. Is it technically feasible in this type of situation.

MR. ROBINSON: It is hard to say whether it is technically feasible now. I have spoken with representatives of PRP and they have indicated to me that is one of the options that they have looked at or are looking at and so once we sit down and start talking that will be something to bring up.

COUNCILMAN STEWART: It might actually be part of the final process.

MR. ROBINSON: Well, chances are it would not be written into the Record of Decision, but if we look at it and it is feasible it might be a case where it can be amended and can be implemented.

COUNCILMAN STEWART: I would rather see it over with quicker, sooner than later.

MR. ROBINSON: If you look at operating costs at three-quarters of a million dollars a year if we can get it done sooner it only makes financial sense.

COUNCILMAN STEWART: Thank you, very much.

MS. SEPPI: Yes, sir.

MR. PROSUK: My name is Richard Prosuk. I live about two and a half blocks away from your site. I have four or five questions that these distinguished gentleman asked already so I only have one left now anyway.

You mentioned before about incineration. With the type of dirt and soil would that create any kind of smog or any kind of outlet into the atmosphere during the incineration process.

MR. ROBINSON: Luckily we do not have to worry about that because we have not chosen that alternative. It is not really incineration. It is very low thermal desorption. It is like a big cylinder turning around and once you put this soil in there it has dust collectors so it is more or less a closed system and very little dust is released to the air.

MR. PROSUK: Nothing escapes to the atmosphere basically?

MR. ROBINSON: I would not say nothing does not escape, but we have safety measures there to try to collect everything.

MR. PROSUK: It would be monitored also; is that correct?

MS. SEPPI: That is not the option we chose.

MR. PROSUK: I just picked up that point when I was reading through this.

MS. WOLFSKEHL: My name is

Eileen Wolfskehl. I live at 1115 Kerwin Street. I am a home owner. My concern is -- well, you mentioned on Page 9 that you have a concern about the risks, the total cancer risk to potential future residents at the site. Well, my concern is the risks to the people who were children 20 years ago and played at the site.

What can we as parents expect of our now adult children. There are a lot of carcinogens on the site. Children went there freely with there bicycles. They played on a mound of what was supposed to be inert materials.

They slid down these mounds. They touched the dirt. I would like to know, you know, what is the potential risk of them coming down with cancer and what kinds of cancer. I think that the residents who have had their children play on the site, we should be aware so we know what too look out for.

MR. HACKLAR: This question has

come up at past public meeting. The community has been concerned about its children 20, 30 years ago playing on the site. Unfortunately, it is extremely difficult, if not impossible, for us to quantify a risk or even tell you what types of risks from things that happened so long ago.

We can tell you and we have told you tonight and in our studies what the current risk is if people, if children go on the site today or if the site is not remediated and children go on the site a year or two or three from now, but we are really not able to tell you what the risk was in the 1970's or the late 1960's from going on the site.

MS. WOLFSKEHL: Could you translate that on Page 9, the unacceptable total cancer risk 2.2 times 10 to the third, what does that mean?

MS. JACKSON: There would be an additional two people out of a thousand who can be expected, if they played and were exposed to the site on a regular basis over a 70 year period to come down with cancer because of their exposure at the site as it is today.

Of course we have no samples from the 1970's so we do not know what the conditions were then. I am not a physician, but I am an engineer and I can put you in contact with someone to talk about the risk. Fortunately one of the things I can say is all of our exposure assumptions are very conservative and usually based on long time period of exposure.

Usually with a child you are talking about a child under age 15 from say age 12 to 15 they did have a period of exposure, one of questions is how regularly they were over there and even so that would be a seven to eight year horizon as opposed to a 70 year horizon.

It is based on someone being in and around that contamination every day, it would assume, for instance if someone

came and built a house on that site and
gardened every day. With children one
thing is they eat dirt, they make mud
pies.

MS. WOLFSKEHL: Or they do not
wash their hands before lunch.

MS. JACKSON: We do that too.
They sometimes run a higher risk. I
understand your concerns. If you want
to come up, we can put you in touch with
someone but a lot of questions you are
asking we just do not have the data to
answer because we do not have samples
from that time period.

MS. WOLFSKEHL: With the
particular type of carcinogens that are
there could you pin it down to the types
of cancers. Let's say children did play
there almost on a regular basis from the
time they were allowed to ride there
bicycles at the age of eight to, I do
not know, 12, 15 what kinds of cancers
would there be.

MS. JACKSON: I think we are

talking about kidney. There was liver in there. There were tumors that could affect the nervous system. There could be brain tumors. I do not feel qualified to talk about that type of tumors.

Those would be the systems that would be effected. There are non-cancer effects to the same kind of systems, liver as part of the hepatic system and your kidneys that do not end in cancer but could still make you ill.

A lot of solvents affects the systems of the body, especially if they are eaten. I can't be more specific. We are not qualified to answer that.

MS. WOLFSKEHL: Has the EPA ever considered conducting a door to door survey to find out how many people in the neighborhood have died of cancer?

MS. JACKSON: We do not do that type of work because we do not have physicians in the agency. Congress in the last law authorized an agency that is part of the Center for Disease Control, the Agency for Toxic Substances and Disease Registry. A lot of questions you are asking it would be really good if I put you one of our biological scientists and they can do a lot of those assessments.

MS. WOLFSKEHL: I am a measly taxpayer that has no influence whereas you are an agency that could say here is a site, these people have been living near the site raising children for over 20 years. You know, it is logical to me that you would be the agency to influence another agency to look into this on our behalf.

MS. JACKSON: I will be happy to request it tomorrow. If you want to come up and leave your names I do not have to wait for the transcript. I will have him contact you to start that process rolling.

I do not know whether it will result in a full blown assessment or door to door survey because I do not know how they do their medical evaluations, but it does not require that you petition and it is not going to be they say no. They will come out and talk to you and talk about your concerns.

MS. SEPPI: They will be able to tell you what they are able to do and not able to do. All you have to do is request it. It does not have to come from another agency.

MS. WOLFSKEHL: I may be wrong but from what I have seen of the site only the plant is fenced in; is that true?

MR. HACKLAR: No, the lot that is identified as Lot 1B, which was historically the area where the industrial activities occurred that is fenced in and that has been fenced in for at least the last five years or so.

MS. WOLFSKEHL: Is that where most of the contaminants were found also?

MR. HACKLAR: The majority of contamination is in Lot 1-B.

MS. WOLFSKEHL: All right.

MS. SEPPI: Councilman Wahler.

COUNCILMAN WAHLER: Councilman Brian Wahler, Ward 2. It was brought to my attention by one of my constituents sitting behind me on Page 17 with the Alternative S-3 you talk about the EPA will also bypass the residential areas. Right now you are using Flemming Street for that. Do you have anywhere that road might possibly go? I have the map where the site is. I think that is on Page 3.

MS. SEPPI: Do you want the map up?

COUNCILMAN WAHLER: Let our planning division know. Maybe we can work with you on that, where it would the least impact the residents.

MR. BILLIMORIA: This is Lot 1-A and on the other side of this stream,

this property there is a narrow strip
which is also owned by Tang Reality and
it fronts onto, I guess this is New
Brunswick Avenue.

COUNCILMAN WAHLER: Yes, that
would be New Brunswick Avenue.

MR. BILLIMORIA: It is a little
bit north of cardboard factory. It used
to be a drum operation. It is at the
corner of the railroad and south
Brunswick Avenue. Just north of that
there is a little access road that is
owned by Tang Realty and that could be
used that way, you bypass the apartments
or the residences on the other side.

COUNCILMAN WAHLER: Maybe could
you possibly contact the Mayor's office
so we can work with if you do go with
that. That might be an acceptable
route. I do know the county is going
into reconstruct Stelton Road. I am
sure you are not talking about starting
moving the earth any time soon.

MS. SEPPI: We will cooperate

with everyone.

COUNCILMAN WAHLER: I agree with all at statements that Assemblyman Smith and some of my colleagues. If the residents want to test their wells I do believe that maybe the responsible party should be picking up the cost of hooking up to the water system.

On average if you have someone come anywhere from a thousand to 1,500 depending upon the distance and most people do not have a thousand or 1,500 to hook up immediately, so please keep that in mind when you do negotiate a settlement.

MR. MAGLIETTE: Ralph Magliette, Chairman of Environmental Commission and I have a couple of technical questions to ask.

On Page 6 and 7 we have Contaminants in Surface and Subsurface Soils, a list of contaminants and on Page 7 Contaminants in Groundwater. Can you provide the list what the MCL would

be for each of the contaminants you have
listed. Could I get that data because I
couldn't look up all the compounds and
find them.

MR. HACKLAR: We can get that to
you. Just for the public's information
that would be in EPA's remedial
investigation report, if you have to
time to look through it, but we can gets
you a copy of the MCL.

MR. MAGLIETTE: This table is
great but what level do we have to get
down to. You never say we need to get
down to one part per million or one part
per billion. We know what the actual
extent of the removal has to be, okay.

The other question I have is I
am going back to this treatment site you
have, going to Page 14. I was under the
impression that the pumping and
treatment facility as it is now has both
an air stripper followed by activated
carbon absorption. That being the case
why would the Sewage Authority not want

the treated groundwater, if you removed greater than 99 percent of all the organic contaminants, you gave the data, you had a high removal, is there a reason why you think they would not let you pump basically almost portable water in the sewer?

MR. HACKLAR: There are several possible reasons. Just being the appearance of Superfund water going through a public collection system, through a treatment plant. Another reason being that it is taking up space in a collection and treatment system and I do know, it is not necessarily with MCUA but other sewage authorities space can be at a premium.

MR. MAGLIETTE: Do you feel that 50 gallons per minute is an excessive flow rate, that they could not take that.

MR. HACKLAR: I do not know what capacity MCUA has. If they are under any restrictions due to any requirement

by the Clean Water Act. I could not
comment on that.
MS. WOLFSKEHL: The soils that
are contaminated with PCB's, are those
also the same hot spots where the
organic contamination is?
MR. HACKLAR: They are
co-located.
MS. WOLFSKEHL: If we were to
excavate the soil that has both there is
a possibility we might have volatile in
the air when you put it into the air and
put it on the truck.
MR. HACKLAR: That is a
possibility.
MR. MAGLIETTE: I am not
familiar with all of the new methods of
disposal. Are you going to have
completely sealed trucks so you do not
have VOC emissions come off the soil
when it is trucked away or are you going
to put a tarp over it?
MR. HACKLAR: At this point we
have not made a decision on that. As

the excavation is proceeding there will be procedures to monitor dust and also organic emissions so if we do see a problem we will correct it.

MR. MAGLIETTE: If you look at the list of the soils and look at the organics we have carbon tetrachloride which has a very high vapor measurement. If you excavate it and striped all the VOC down it is in the air in an area that is highly densely populated.

I understand it is a small amount per say, but my question is are you going to build in additional safeguards to protect the residents, what do they normally do?

MS. JACKSON: The main suppression method is water or the use of some type of cover, not a fully enclosed vehicle but a tarp.

With the low levels we see at the site, I think the risk assessment did not show a risk of inhalation of volatiles at that site so the levels are not high enough to show a risk. We would be careful, but we would not spend money just to be spending it.

MR. MAGLIETTE: When you say you are going to truck the material off-site, are you going to dispose of it and treat it?

MR. ROBINSON: We are disposing it.

MR. MAGLIETTE: You are taking the contaminated soil from Piscataway and putting it in somebody else's backyard and burying it? You are not detoxifying the soil?

MR. HACKLAR: Before any of the soil is disposed of it will be tested to determine if it is in fact a hazardous waste as defined by the Resource Recovery Act.

Depending on what the waste is, whether it is classified as hazardous waste or non-hazardous waste that will determine where the material will go. If it is determined to be hazardous waste and meets the criteria and we have EPA special tests for that then it would go to a facility that is operating in accordance with RCRA.

MR. MAGLIETTE: Let us say PCB's which is exquisitely toxic and find some supplier or some waste generator or shipper who is going to take this waste and just bury it somewhere else, are you going to blend it to reduce the concentration of PCB'S?

MR. HACKLAR: It would be placed in a commercial RCRA disposal facility.

MR. MAGLIETTE: Not that I would want to have the waste treated on site, but is it not better to detoxify the soil? It is almost like you are saying dilution is the solution.

We have soil that has x PCB concentration. We are going to mix it in non PCP soil. If we are below the EPA number then it is safe. I would not agree it is better to do it for this site.

MS. JACKSON: We have to look at cost when we look at cleanup alternatives. There is a couple of ways that allows you to get rid of five hundred parts per million. We would be required to incinerate it. We are not talking about levels above that.

MR. MAGLIETTE: If you look at Page 6 you have levels of 21 to 2,600 and 540 to 310,000 parts per billion so that would be 310 parts per million.

MS. JACKSON: That is the highest level in soil. We are not required by law to do the incineration. Land disposal in a commercial facility regulated by the Federal and State government is acceptable. In this case isn't it better the EPA is saying no, we prefer the land disposal. We have to look at cost at this and all the other sites.

MR. MAGLIETTE: You have done the ecological risk assessment. I was concerned if sedimentary toxicity testing had been done.

MR. HACKLAR: It was not performed. It was a qualitative and quantitative assessment similar to what we performed for the human health risk assessment, where we looked at reasonable maximum exposures but it was felt at this stage the actual laboratory tests were not warranted.

MR. MAGLIETTE: Would you not postulate that there would be at the very least heavy metals in the sediment of runoff after all these years?

My question is twofold. I am not trying to bait you on it. Is the fact we may in some future date not be allowed to discharge to the sewer utility, we are going to be pumping 50 gallons per minute into the stream. At that flow rate you may have start sediment toxicity testing, which was not done previously, because you might be enhancing the toxicity as it goes through the channel because it is a very shallow

MR. HACKLAR: The streams on site, when we talk about streams they are really in essence just intermittent ditches. At certain times of the year they do not have any flow.

While there were contaminants detected in the sediment we are addressing the soil and as we go through we do believe that we will be removing the contamination that would be causing any of the problems.

You are only talking about sediment here. In essence you are talking about soil just because the streams are in the ditches.

MR. MAGLIETTE: Right, but we have no data to base it on. That is all supposition.

MR. HACKLAR: The sediment values, the results are compared to toxicity values in the ecological assessment which is really our first step. We would not initially jump to the laboratory tests at this point.

MR. MAGLIETTE: You have reference data that you have made that calculation?

MR. HACKLAR: Yes, that is available in the remedial investigation.

MS. PICCIUTO: Hi, my name is Rosemary Picciuto. I also am a local residence of Piscataway for 32 years. I live on Charter Street. My children also played to that mound of dirt and I am worried, they are now of child bearing age. we have to worry about the future generation.

Also, did you know in 1966 there was a town picnic at this site also to celebrate the 300th anniversary of this township. We had a big picnic. I think we all should have been notified before that this was contaminated and it was a risk to all of us.

When I bought my house in 1965 I was not notified. If I want to sell my house today I have to notify the people

I am in a Superfund Site and that decreases the value of my home. I do not think it is fair for you taking so long. I have been living with this for 32 years. I will be dead and buried by then.

MS. SEPPI: I think someone else had a question.

MR. COSTELLO: My name is John Costello. I have some questions about this site. On the excavation are you excavating Lot 1-B or both 1B and 1A?

MR. ROBINSON: Most of the soil will come from Lot 1-B. Some of the excavation will come from Lot 1-A also.

MR. COSTELLO: Just the part of 1A around 1B basically?

MR. ROBINSON: Basically.

MR. COSTELLO: How far down are you going to excavate?

MR. ROBINSON: Well, --

MR. COSTELLO: You are saying 18,600 cubic yards. I am not sure what that is going to translate into.

MR. ROBINSON: It varies from area to area basically based on soil testing that we have done and for each particular area and it is all in the remedial investigation.

For some areas we might to go two feet, for some areas four feet and other areas six feet. It varies.

MR. COSTELLO: Would it be fair to say six feet is the deepest you are planning to go?

MR. ROBINSON: Basically, yes.

MR. COSTELLO: About how long after the excavation is done would houses potentially start going up if approvals were made?

How quickly after you finish the excavation could houses be built or would we have to wait for the 30 years for the ground groundwater also?

MS. JACKSON: There would not be a restriction on time. I do not think there is any way I could guess the timeframe. My guess it would be

difficult to have an attractive piece of
property while the treatment plant is
operating so it is really impossible for
me to give you an answer to that
question.

MR. COSTELLO: Well, then the
allotted time is 30 years, then would it
be fair to say that it probably would
not be off the NPL list until 30 years
from now or sometime or would it
probably be off sometime before that.

MS. JACKSON: Let me clarify one
point. The 30 years in the plan for
groundwater pumping and treatment is not
an estimate of how long it will take to
clean up the site.

Because of the fractured bedrock
underneath it, it is really rock with
cracks and fissures running through it,
contaminants get trapped in spaces. it
does not take a lot of contamination to
detect a part per billion or two.

So what we have tried to do
here, and I think it is a very important

point, I have been kind of itching to say, in our objectives is to pump as much of the water from the site facility as we can very aggressively and we are saying five wells could be worked out in design to try to remove the contamination but also to insure that the contamination does not leave those facility's boundaries.

It is very difficult for our scientists and Mr. Billimoria could probably speak for hours. He said he could probably write another dissertation on it to come up with a timeframe. While MCL's are important, our first goal is to try to pump it and try to see what response we get.

It could be longer than 30 years or it could be shorter than 30 years.

MR. COSTELLO: You have no way of knowing until you have done the process and you will check every five years. If it is done in five years then it would be ready for the houses.

MS. JACKSON: It would be ready to start the deletion from the NPL list.

MR. COSTELLO: How long does that take to delete it?

MS. JACKSON: It requires by law we publish notice in the public register and allow for 60 days of public comments and final notice where we hereby notify one and all this site is hereby off the list.

MR. COSTELLO: That process about six months.

MS. JACKSON: About.

MR. COSTELLO: How deep is the contamination, how far down?

MR. HACKLAR: The contamination goes down several hundred feet, the groundwater contamination.

MR. COSTELLO: What about the soil contamination?

MR. HACKLAR: The soil there is roughly 10 feet or less of soil throughout the site and we are looking at contamination, like I said, roughly

probably six feet or so.
MR. COSTELLO: Up to six feet is what you are planning to excavate?
MR. HACKLAR: Roughly.
MR. COSTELLO: Say it is all cleaned up and off the priorities list and houses are ready to be built, there are going to be basements, holes dug in the ground for basements.
Okay, and I believe that they would be going down more than the six feet. What happens to the another four feet that you are talking about? There is 10 feet of soil, you know, where the contamination is.
MR. HACKLAR: What we have observed at the site is that when you are talking about the subsurface you get infiltration through rain and then what you really get, you get a flushing of contaminants into the groundwater because the site has been around for so long.
What we are finding is

relatively speaking that the groundwater is more contaminated than the soil. When the groundwater pumps and treatment is expanded and is running what you will essentially find is really almost a dewatering of the area. In effect any water that is coming in will most likely migrate downward and will be captured by the pump and treat system, so the potential threat from contaminated basements would obviously be from any of the groundwater, but the groundwater would be controlled.

MR. COSTELLO: Let me see if I understand this now. Basically you are going to take out the excavated soil, a certain amount of soil?

MR. HACKLAR: That is correct.

MR. COSTELLO: You are going to remove or treat the groundwater?

MR. HACKLAR: Right.

MR. COSTELLO: As you have less and less contamination in the groundwater is it safe to assume there

is less and less contamination in the
subsoil?
MR. HACKLAR: We will be removing all the soil that would have posed a threat. One of the pathways we looked at in the risk assessment was any risks to construction workers out at the site or workers that would be digging holes for whatever reason, for basements or whatever, and we feel that through what we are proposing today, that any of those risks would be addressed before anything would be built on site.
MR. COSTELLO: So like all this contaminated stuff that would be left in the subsoil would tend to filter down to the groundwater?
MR. HACKLAR: There would not be a contamination that would pose a risk.
MR. COSTELLO: I understand that. What happens to all these things as it continues to filter down?
MR. HACKLAR: Whatever minimal amount would be in the subsurface would

continue to basically migrate downward as rain water and filtration would percolate there.

MR. COSTELLO: That is about it since we talked in great detail on the groundwater and I kind of understand that now.

I would also like to say the more you can do to protect the site the better. That is what I want to say.

MS. MASON: My name is Phyllis Mason I am running for Assembly in this district and giving myself a quick crash course on toxic sites because we seem to have several of them.

I have a few questions and I will be as fast as I can. First of all, your plan shows Stream 1A and Stream 1B all flowing, merging through the site and presumably continuing north. Where do they go?

MR. HACKLAR: Ultimately the streams and ditches could be tributaries to the Bound Brook. They ultimately go

to, I believe it is here. You can
correct me if I am wrong. It Goes to
New Market Lake, which really down
stream ultimately goes to the Raritan
River.

MS. MASON: I figured that was perhaps where they went if they were going north. The reason I am asking that question is I know with the PCB's from South Plainfield flowing into the Bound Brook they are testing far beyond the borders of the site and in fact the boarders past New Market Pond for PCB's and I am wondering before you clean it up if you will also extend and do some testing beyond this site of the Bound Brook and along it to make sure nothing has gotten out there.

MS. JACKSON: I am thinking, the areas of the Bound Brook -- you are asking for sampling of areas of the Bound Brook that are not being sampled. We are doing an extensive sampling along the Hamilton Industrial Park site.

MS. MASON: At least up to it.

MS. JACKSON: We will know, I guess, whether there are PCB's in the Bound Brook. I think we suspect there are.

MS. MASON: This stream or network of streams following the stream, following up to the Brook, I do not know where it really goes.

MS. JACKSON: If these were streams and ran above ground and we could say they were running into the Bound Brook and contributing to it I would say of course it would have been part of the study.

The levels of PCB's found in those ditches and streams were very low. They did not pose a threat to warrant us taking an action in the stream. Now, I suppose the only other question is in the past were there any levels.

What I would like to is sit down with the guys. We actually scheduled a meeting a couple of days ago. Once they get the results back from their Bound Brook samples, we will sit down and look at it. We are thinking along those lines and I do not know what the answer is to the question.

MS. MASON: My second question has to do with risk and the concept of potential risk. This has already been raised, but the plan talked several times about potential risk to humans and also potential risk to wildlife in particular three different species of birds.

I do not remember which they were. I remember there were three of them. Now, since this plant has been in existence since the 50's and these toxic chemicals have been produced and flowing wherever they go and going wherever they go, although you do not take surveys does anybody look at medical records for higher incidents of cancer in this area?

No. 2, are there any kind of records of an abnormally large number of dead birds, mutated birds, anything like that that might indicate if you are going to assess the risk and come up with an alternative to solve the problem I would think that you really have to try to find out what has taken place so far, what harm has actually taken place.

MS. JACKSON: The agency I mentioned before would do the evaluation of that. We are going to petition to see what they can do at this site. On the fish and wildlife side I do not have any specifics because again I am an engineer, but the sites I have worked on where we have had severe impacts to fish and wildlife, in those cases you can do studies of fish living in the stream and wildlife living around the area. Because of the type of area this is we are not talking about a lot of species so I could not see it doing it.

MS. MASON: My last two questions have to do with disposal and I think they are pretty fast. This is a really genuine question. When you talk about the MCUA might not accept this flow why might they not accept it? Is it because of their capacity or because of the toxicity or what?

MR. HACKLAR: I cannot speak for MCUA. I am not sure at this point whether it is a capacity issue. In other utility authorities there are capacity issues. It could be that.

They are under a discharge permit to discharge their water and they could possibly be concerned about levels of effluents or in their treatment plant they have to deal with the sludge they generate. They could be concerned with that or it could possibly be a perception issue, just-accepting waste water.

I do know as of several years ago, and again I have not had contact with personnel from MCUA in recent times, but their policy on Superfund waste water or groundwater is if there was another option for the groundwater then they would be very reluctant to take the water themselves?

For example, if there was the option to discharge in a surface water body they would be reluctant to take the water themselves. That is why the system that is out there today was designed to basically go either way.

We are currently discharging to the sewer system. The whole treatment process and the outflow pipe is in place to discharge to the stream if that were to be the case.

MS. MASON: My final question is somebody raised a concern earlier about dirt removal and dirt blowing off trucks and through residential neighborhoods and so forth.

It occurred to me looking at the map since you have a railroad going right by the site have you considered putting the dirt in closed cars and taking it out of the my cars and to the railroad.

MS JACKSON: That was my question and they laughed at me because it must been looked at and it is not an inexpensive proposition. 18,000 cubic yards sounds like a lot of dirt. It is not a huge amount compared to some places, so trucking would be much more economical and would probably be the best way.

I can't remember when you walked the rails what was your final determination?

MR. BILLIMORIA: it can be done but there is a lot of steps you would have to go through. You would have to consider rail accidents like the one that occurred not very far from that location just a few weeks ago.

MS. MASON: That is true, but of course there could be a truck accident

MR. BILLIMORIA: I know that.

MR. HACKLAR: I walked with Meyhear the railroad that day.

Theoretically it is doable. It would be expensive. It would take a lot of coordination with the railroad itself.

We would probably have to build a new site. There would be issues in terms of bringing, of actually digging the soil out, putting it on let it say a truck to transport it to the site that we would build and loading it on a car there. There would be a lot of intermediate steps before you would get it onto the railroad car.

MS. MASON: What if it were done with containers?

MS. SEPPI: It would still be the same problem. You would have to truck it to the site, put it in the rail cars, put it into another truck to get it to your permitted landfill.

MR. HACKLAR: Also where the site, just by necessary would need to be placed, would it be located close to when the land areas which would entail building a good access road to the site.

It is an alternative that could be done, but it is not easily inplementable. The trucking alternative is much more implementable.

MS. SEPPI: Okay, just keep it in mind. Before we go on could I just have a show of hands of how many more people want to speak? Our court stenographer probably needs a break.

(A short recess was taken.)

MS. SEPPI: If everyone is ready let us go on with the rest of the questions.

FREEHOLDER FERNICOLA: I am Camille Fernicola, Freeholder and former Piscataway Councilwoman. I become a Councilwoman in 1979 and right after that I remember a young man came to us who lived in the neighborhood around the Chemsol site and his name is was Ralph Magliette and he is now our Environmental chairman and he has been for many years and Ms. Wolfskehl brought to us the problem of leaching and all the chemicals at that time a housing development was proposed and they as ordinary citizens were very concerned about their neighborhood and township and brought it to our attention and Assemblyman Smith was a Councilman at the time and he later become Mayor and we have been dealing with this obviously for many years.

The first ten years or so nothing was done physically on the site. It was going around in the courts. The lawyers were sending their grandchildren to college and it just went on and on and I remember the voters also adopted the Chemsol Site as their own and made it a point to have an annual program. It was about seven or eight years ago we really saw movement.

Several years ago the Mayor and council had the opportunity, we were invited to view the site and the transformation was wonderful. Many people are still upset, and I cannot blame them, for the health of their family, especially the ones that have been there for many years, but like I said the transformation that we see now, there is grass growing, the plant is cleaning up the water.

Yes, it may take 30 more years, but at least something is being done and I thank you for coming tonight. You are a very fine team that I can see and it looks like you are on top of everything. You are working hard at making the Chemsol Site a Superfund Site of the past and back in 1979 nobody ever heard the term Superfund and now it rolls off everybody lips. Soon we hope that this Superfund Site will die a death and we will all have a party.

Thank you, very much for all the information you have given us tonight.

MS. SEPPI: Thank you. One thing I would like to say is Superfund become a law in 1980. That is why no one heard of it in 1979.

That is why we did not do anything. EPA did not start until 1970 and Superfund 1980 and 1984. It still has been a long time but your right some things have been accomplished and hopefully this will be the end of things

FREEHOLDER BRADY: I am Jane Brady, Freeholder/Director of Middlesex County. I want to thank you for being here and straightforward with all of your information.

You have to understand, of course, Middlesex County has 12 Superfund Sites. We have more than any county. We are greatly concerned about not only Chemsol but the other sites as well, also quite honestly the length of time that it is taking for the EPA to get around to these sites and the damaged is around the county.

I encouraged you to move as quickly as possible to make sure everything is taken care of. We are gravely concerned. So many of our sites, some of them have been removed from the priority list. I urge you to please use your influence to encourage more cleanup in Middlesex County so we can feel more comfortable to use them for recreational purposes or whatever might be the best use. The MCUA have they indicated to you they will not accept this water, or is this just a possibility? I would like that clarified, if possible.

MR. HACKLAR: At this point we have not had direct contact with them on this matter. At this point it is a possibility.

FREEHOLDER BRADY: They have not said no?

MR. BACKLAR: We have not had contact with them.

FREEHOLDER BRADY: Thank you, very much.

COUNCILMAN STEWART: I just had one final comment I wanted to make and I remember making the same point at the time Ms. Fernicola went to visit the brand new facility cleaning up the site. As you pointed out your agency did not really exist until 1970 and the Superfund Law did not go into effect until 1980.

This plant was there in the 1950's causing that contamination. That was sort of a heyday of industrial growth with little or no regulations. I know Assemblyman Smith when his party was in the majority party and he worked very hard too make sure that New Jersey had adequate regulations to prevent that sort of thing, but I know more recently there has been more talk of deregulation and certain feelings that maybe industry is regulated too much, there is over regulation and it is more than necessary, but as a counter argument all I have to do is point to the Superfund Site in my ward.

Whereas the Freeholder Director was pointing out the 12 sites in

Middlesex County I would like to put on to the official record my hope that the taxpayers take these Superfund Sites as a message that we in fact need regulations, government regulations at the state and federal level to insure the quality of our environment and the quality of all of our lives and children's lives so never again will we have to listen to the impassioned please, my children played there and about township picnics, on that how could this be.

This came about because of the lack of adequate regulations. I just want to make sure I get that on to the record. Thank you, very much.

MR. COSTELLO: I had one final question. After you excavate the soil you are going to put new soil down, I presume. Where are you going to be getting that soil from?

MR. ROBINSON: The soil WILL be coming from some off-site facility. We do not know where yet, but wherever it comes from the soil will be tested to make sure it is clean before it is brought to the site.

MR. COSTELLO: Could it be soil that had been previously contaminated and now officially clean, could that be a possibility?

MR. ROBINSON: Highly unlikely. We basically do not go through that route. We normally just go to an area and take virgin soil, but we test it before we bring it to the site.

MR. COSTELLO: Take part of a mountain and put it there?

MS. SEPPI: There are plenty of facilities in New Jersey that we get soil from for our sites, let alone going to another site if we had to.

MR. COSTELLO: If it is deemed really hazardous this soil that you are going to be excavating from the site where exactly does it go?

MR. ROBINSON: If it is deemed

really hazardous it will end up at what
we call a RCRA facility, which is
regulated by the State and Federal
government.

MR. COSTELLO: Where is the
closest one to Piscataway?

MR. ROBINSON: I am not sure.

MR. BILLIMORIA: We did not use
any particular one.

MS. JACKSON: Just estimated
distance.

MR. BILLIMORIA: I understand
there is possibly one in Pennsylvania.

MR. COSTELLO: I heard there is
a large one in Alabama.

MS. JACKSON: Yes. Thank you.

MR. SCHANCK: I just have a
couple of questions. Thank you. My
flame is Garrett Schanck. I am a home
owner and I just have a couple of
questions for clarification on that
business of the statistical analysis
here of 2.2 per thousand.

If a person, such as a child,

people are concerned about that were
playing on that for a few years, okay,
how does that compare to this risk
assessment here which the way I
interpret it, if I am not wrong here, if
you have 2.2 per thousand over 70 years,
is that a continual 70 years exposure?

MS. SEPPI: Yes.

MR. SCHANCK: Let us say you had
a homeless guy sitting out there for say
70 years, two of them statistically
would get cancer?

MR. HACKLAR: Yes.

MR. SCHANCK: That is what you
are saying to is the risk to that site?

MS. JACKSON: Yes

MR. SCHANCK: It seems kind of
small. Obviously if someone gets cancer
they are very concerned. The other
thing is the last time I was here and
this time there was a lot of information
or a lot of discussion on why it took so
long. There is a woman out there almost
in tears going out of here very upset

about why it took so long, lawyers haggling about what-have-you, is it a possibility why this took so long, one of reasons was because you had to find a person to pay for this thing like Tang Realty?

Did it take so long because by law you had to find somebody at fault or could this money just come straight out of the Superfund money and been taken care of 20 years ago.

MR. HACKLAR: What happens is that the site was placed on EPA's National Priorities List in 1983. Once that happens the government can spend money on the site to investigate and to clean up the site.

Now, what happened during the 1980's the site was being investigated initially by the site owner, Tang Realty and the NJ DEP was overseeing that investigations. Data was collected, material was removed from the site, but because it was taking the site owner a very long time to do their investigations, both DEP and EPA jointly decided it would be in the best interest of the project to get it really moving along to basically transfer the site to EPA and have EPA perform the studies itself.

MR. SCHANCK: What year was that?

MS. SEPPI: That was 1990.

MR. SCHANCK: Okay, I understand. I guess the last question I have, a LOT of people are concerned about transportation of soil in case a dump truck dumps it on the ground. I am kind of curious I guess PCB's is the biggest concern?

MR. HACKLAR: PCB's and lead.

MS. WOLFSKEHL: If this soil overturns what is the risk if you are talking 70 years to be a problem, if a dump trucks dumps over accidentally for whatever reason, an accident or whatever it is a big two tons of soil being picked up in a matter of what, a couple of hours?

That is a far cry from 70 years. I mean it seems to me maybe we are a little bit over concerned there. It just seems to me, that is just my opinion on that. That is it. Thanks very much. I appreciate your time.

MS. SEPPI: Thank you.

Are there any other questions?

(No response.)

MR. SEPPI: All right. Well, we thank you again for coming. You have the names and phone numbers on the proposed plan. Do not hesitated to call any of us at any time.

If anybody has information they want to give us about a well they need tested please come up and if anybody is interested in the ATSDR we can give you that number also. Thank you.

(Whereupon, at 9:30 o'clock p.m. the proceedings were concluded.)

C E R T I F I C A T E

STATE OF NEW YORK)
) ss.
COUNTY OF NEW YORK)

I, TINA DeROSA, a Shorthand (Stenotype) Reporter and Notary Public of the State of New York, do hereby certify that the foregoing Proceedings, taken at the time and place aforesaid, is a true and correct transcription of my shorthand notes.

I further certify that I am neither counsel for nor related to any party to said action, nor in any wise interested in the result or outcome thereof.

<IMG SRC 98141D2>

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - B

Written comments received by EPA during the public comment period

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October 10, 1997

VIA HAND DELIVERY

Nigel Robinson
Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York, 10007

Re: Comments on Remedial Investigation, Feasibility Study, and Proposed Plan Chemsol, Inc. Superfund Site, Piscataway, New Jersey

Dear Mr. Robinson:

Enclosed, on behalf of the Chemsol PRP Group (the "Group"), are a Technical Review of the Remedial Investigation Report 1 and Comments on the Feasibility Study ("FS") and Proposed Plan for the Chemsol, Inc. Superfund Site (the "Site"). The comments address the proposed remedies for both soil and groundwater at the Site. Also, an Evaluation of Groundwater Extraction Alternatives is appended in support of the comments.

Upon review of the RI, FS and Proposed Plan, the Group concludes that the proposed soil remedy of excavation and disposal will not achieve the remedial action objective to allow for future site use without restrictions. Furthermore, the proposed remedy is not supported by the administrative record. In contrast, the selection of soil capping as the remedial alternative is supported by the administrative record. In particular, capping is protective of human health and the environment, would satisfy federal and state soil cleanup criteria, is recommended by USEPA guidance, and is consistent with realistic options for any future site use based on development constraints.

If the USEPA rejects the recommendation of the Group that capping be selected as the remedial alternative for soils, as supported by these comments, at a minimum, the USEPA should consider a soil remedy composed of selective excavation, a soil cap, and deed restriction. Such a remedy would remove those soils perceived by the community to present a risk, cap soils above federal and state cleanup criteria, and restrict site access to preserve the Site's use as open space. The Group believes that the State of New Jersey and the Township of Piscataway may prefer such a remedy, which would meet their objectives. In particular, by capping the site, the State's PCB criterion would be satisfied. By retaining restrictions on the Site, inappropriate residential use could be avoided, so that future site use would be recreational, as preferred by the Township.

The comments regarding the proposed groundwater remedy, in part, similarly address the inability of the proposed remedy to achieve the remedial action objectives. Specifically, as acknowledged by the FS, geologic and contaminant-related factors indicate that aquifer restoration is highly unlikely at the Site. Consequently, a waiver of ARARs based on the technical impracticability of restoring groundwater should be granted. Because groundwater cannot be restored, the remedial action objective should be to contain contaminated groundwater to protect human health and the environment. Under a containment remedial action objective, extraction geared to achieve mass reduction would result in no additional protection of human health and the environment beyond that provided by a system designed for containment alone. Accordingly, the remedial action objectives should be revised to delete any requirement to restore the groundwater and to remove mass, beyond that removed by containment.

The comments regarding the proposed groundwater remedy also identify several deficiencies in the administrative record that render the proposed remedy unsupported. In particular, because the proposed remedy is based on a "preliminary" groundwater model, the description of the remedy selected in the Record of Decision ("ROD") should permit adequate flexibility to allow the incorporation of the findings of a refined, calibrated groundwater flow model into design of the extraction system, adequate capture zones, the long-term monitoring program, and the off-site delineation investigation.

Finally, the comments address certain requirements of the proposed groundwater treatment system. First, the proposed remedy fails to consider the significant discharge constraints presented by the current discharge permits. If the proposed remedy is selected in the ROD, the ROD should provide adequate flexibility in the design of the extraction system to allow for discharge within the existing permit limits. Second, the requirement to operate the biological treatment plant if the treated groundwater is discharged to surface water is unnecessary. In the groundwater treatment plant's current configuration, there have been no exceedences of the surface water discharge standards for soluble organics. In addition, the concentrations of soluble organics in the plant effluent have decreased substantially. Based on these factors, as further detailed in the comments, the biological treatment plant does not need to be operated to achieve discharge to surface water standards and the requirement to operate the biological treatment plant should be eliminated.

The Group would be pleased to meet with you to discuss these comments or to provide any assistance required to select an appropriate remedy. Provided the final remedy selection reflects a consideration by USEPA of these comments, the Group, or a significant number of its current members, would expect to offer to perform and pay for that remedy in the context of a negotiated consent decree. We look forward to the opportunity to work with you to implement such a remedy.

<IMG SRC 98141D3>

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October 10, 1997

Paul Harvey
New Jersey Department of Environmental Protection
401 East State Street
Trenton, New Jersey 08625

Re: Comments on Remedial Investigation, Feasibility Study and Proposed Plan
Chemsol, Inc. Superfund Site, Piscataway, New Jersey

Dear Mr. Harvey:

Enclosed is a copy of the comments provided on behalf of the Chemsol PRP Group to the USEPA regarding the above-referenced documents. This copy is being provided directly to you as a courtesy to the NJDEP and the USEPA.

Very truly yours,

WILLIAM H. HYATT, JR.

cc: L. Jackson, USEPA
N. Robinson, USEPA
P. Seppi, USEPA
A. Wagner, USEPA

COMMENTS ON THE FEASIBILITY STUDY AND PROPOSED PLAN

CHEMSOL, INC. SUPERFUND SITE
PISCATAWAY, NEW JERSEY

Prepared on behalf of:
Chemsol Site PRP Group

September 1997

CONTENTS

1.0 INTRODUCTION

A Feasibility Study ("FS"), dated June 1997, was prepared by CDM Federal Programs ("CDM") on behalf of the USEPA for the remediation of contaminated groundwater, soils, surface water and sediments at the Chemsol, Inc. Superfund Site (the "Site" or "Chemsol site"), located in Piscataway, New Jersey. As stated in the FS, the "primary objective of the FS [was] to provide [the United States Environmental Protection Agency ("USEPA") and the New Jersey Department of Environmental Protection "NJDEP")] with sufficient data to select feasible and cost-effective remedial alternatives that protect public health and the environment from potential risks posed by contamination in groundwater, soils, surface water and sediments" at the Chemsol site. Accordingly, the FS included a presentation of the results of the Remedial Investigation ("RI"), as well as an identification, screening, and evaluation of remedial alternatives. Based on the FS, in August 1997, USEPA issued a Proposed Plan for the Chemsol site.

The Proposed Plan recommends preferred alternatives to address soil and groundwater at the Site. The proposed alternative for soil consists of excavating contaminated soil and disposing of it at an approved disposal facility. This alternative was preferred by USEPA over a soil capping alternative, which includes covering the site with a layer of clean soil to prevent contact with contaminated soils. The proposed alternative for groundwater consists of extracting and treating groundwater at an extraction rate in excess of that of the interim remedy. Treated water would be discharged either to the Middlesex County Utilities Authority ("MCUA") or to a nearby The National Contingency Plan ("NCP") requires the reconsideration of the preferred alternative if:

> [a]fter publication of the proposed plan and prior to adoption of the selected remedy in the record of decision ... new information is made available that significantly changes the basic features of the remedy with respect to scope, performance, or cost, such that the remedy significantly differs from the original proposal in the proposed plan and the supporting analysis. 40 C.F.R. º 300.4310(f)(3)(ii).

Further, principles of administrative law require that agency "engage in 'reasoned decision making.'" United States v. Garner, 767 F.2d 104, 118 (5th Cir. 1985). Decisions must be "based on a consideration of the relevant factors" and will be reversed for a "clear error in judgment." Citizens to Preserve Overton Park Inc. v. Volpe, 401 U.S. 402, 416 (1971). The agency must not:

> rel[y] on factors which Congress has not intended it to consider, entirely fail[] to consider an important aspect of the problem, offer[] an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." Motor Vehicle Mfr. Assoc. of the United States, Inc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 43 (1983).

Instead, the agency must consider all relevant facts, information and alternatives, Citizens to Preserve Overton Park Inc., v. Volpe, 401 U.S. at 416, comply with its own regulations and procedures, 2 Montilla v. Immigration and Naturalization Serv., 926 F.2d 162, 166-67 (2d Cir. 1991); Frisby v. United States Dept of Housing and Urban Dev. (HUD), 755 F-2d 1052, 1055 (3d Cir. 1985), and adequately explain its decisions by providing a rational connection between the facts and the resultant decision. Sierra Club v. United States Army Corps of Engineers, 772 F.2d 1043, 1051 (2d Cir. 1985).

Similarly, the Ninth Circuit held that the agency should have reexamined the remedy selection when the volume of hazardous material was underestimated by 160%. Washington State Dept. of Transportation v. Natural Gas Co., 59 F.3d 793, 804 (9th Cir. 1995). An agency may not disregard its own rules and regulations during the course of agency decision-making. See, eg., Frisby v. United States Dept. of Housing and Urban Dev. (HUD), 755 F.2d 1052, 1055 (3d Cir. 1995) ("[T]he agency itself is bound by its own regulations. Failure on the part of the agency to act in compliance with its own regulations is fatal to such action. Such actions are 'not in accordance with law.'"); Simmons v. Block, 782 F.2d 1545, 1550 (11th Cir. 1986) and cases cited therein. Moreover, an agencys failure to comply with its own prescribed procedures, including those not attaining the status of formal regulations, has been determined to be arbitrary and capricious. See Montilla v. Immigration and Naturalization Serv., 926 F.2d 162, 166-67 (2d Cir. 1991) (quoting Morton v. Ruiz, 415 U.S. 199, 235 (1974); D'Torio v. County of Delaware, 592 F.2d 681, 695 n.2 (3d Cir. 1978). Accordingly, when an agency departs from its precedents, the agency must provide a reasoned explanation, in particular why the original reasons for adopting the rule or policy are no longer applicable, or the decision will be vacated as arbitrary and capricious. See Graphic Communications Int'l Union, Local 554 v. Salem-Gravure Div. of World Color Press, Inc., 843 F.2d 1490, 1493 (D.C. Cir. 1998), cert. denied 489 U.S. 1011; New York Council, Ass'n of Civilian Technicians v. Federal Labor Relations Auth., 757 F.2d 502, 508 (2d Cir. 1985), cert. denied 474 U.S. 846.

This document provides, comments on behalf of the Chemsol PRP Group 3 on the FS and Proposed Plan. 4 In accordance with the NCP and principles of administrative law, the comments presented below support re-evaluation of certain components of the proposed remedies based on errors in the record and the failure to consider USEPA guidance and certain facts and reconsideration of several remedial objectives to provide for flexibility in the Record of Decision ("ROD") regarding the design of the remedy. Failure to re-evaluate certain components of the proposed remedies or to reconsider the remedial action objectives based on the errors in the FS and Proposed Plan and the information presented herein, which "significantly changes the basic features of the remedy with respect to scope, performance, or cost," would render the USEPA's decision in a subsequent ROD arbitrary and capricious. The comments are summarized below.

Comments on Proposed Soil Remedy

- The remedial action objective to allow for future site use without restriction cannot be achieved by the proposed soil remedy.
    - The FS and the Proposed Plan state that one of the remedial action goals is to address soil contamination so as to allow for unrestricted residential or recreational use of the Site. However, the PCB cleanup criterion of 1 ppm applied by the Proposed Plan does not meet the State's standards. Consequently, even after excavation and disposal of approximately 18,500 cubic yards of soil, a deed restriction, likely with some other control such as capping, would be required by the NJDEP and, therefore, the proposed remedy would not achieve the remedial action objectives.
    - Excavation to the State's criterion has not been analyzed as an alternative. Accordingly, the ROD cannot impose this requirement without performing another remedial alternatives analysis, as excavating to the State's criteria may substantially increase the volume of soil to be excavated, which translates into significantly higher costs and increased risks to human health and the environment, such as risks associated with excavation-related air emissions, truck traffic through residential neighborhoods, and short-term risks to site workers.
    - The current and future physical constraints located on the Site prohibit future site use without restrictions. Wetlands cover a large percentage of the Site, severely limiting the acreage of usable land. Further, the majority of the uplands is located in the vicinity of the groundwater treatment plant. The operation of the plant and the presence of the appurtenances associated with the plant further restrict available acreage and ability to develop.
- The selection of the proposed remedy is not supported by the administrative record.
    - Errors in the cost estimating require reconsideration of the appropriateness of the proposed remedy. In particular, the Proposed Plan requires excavated soil to be disposed of as hazardous waste; while the FS assumes disposal as nonhazardous waste. The ROD cannot require disposal as a hazardous waste, because disposal costs will significantly increase beyond those presented in the FS and, in accordance with the NCP and principles of administrative law, the USEPA will have to consider those higher costs prior to remedy selection. However, no representative waste characterization has been performed to determine the RCRA waste classification. Consequently, the ROD should state that disposal requirements will be determined by sampling and analysis conducted during implementation of the remedial action. If, as a result of this sampling and analysis, a majority of the soil is classified as hazardous, the costs will increase substantially and, in accordance with the NCP, the remedy selection will have to be reconsidered.

- The RI sampling did not adequately define the soil excavation contours. In accordance with the NCP, USEPA must "collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives." 40 C.F.R. º 300.430(d)(1). To this end, USEPA must:

characterize the nature of and threat posed by the hazardous substances and hazardous materials and gather data necessary ... to support the analysis and design of potential response actions by conducting, as appropriate, field investigations to assess the following factors: ..(iii) The general characteristics of the waste, including quantities, state, concentration, toxicity, propensity to bioaccumulate, persistence, and mobility; ... 40 C.F.R. º 300.430(d)(2).

Accordingly, the ROD should allow for additional investigation or re-analysis of the data. Further, given the uncertainty in the soil sampling, increases in both excavated volume and remedial cost may occur. Should the volume required to meet the remedial action objectives significantly increase beyond that anticipated in the Proposed Plan, in accordance with the NCP and principles of administrative law, the USEPA will have to reconsider the remedy selection.

The FS and Proposed Plan require disposal of soils stockpiled on Site. However, if analysis demonstrates that these soils comply with New Jersey soil cleanup criteria, the ROD should permit these soils to be used as backfill if demonstrated to be acceptable for that purpose.

! The selection of soil capping as the remedial alternative is supported by the administrative record, as it is protective of human health and the environment, complies with ARARs, is recommended by USEPA guidance, and is consistent with realistic options for any future site use.

- The proposed soil cleanup standards are not supported by the guidance referenced as their source, and no further explanation is provided to support the selection of the cleanup standards. Moreover, the guidance documents referenced do not support the selection of the remedial alternative. These guidance documents acknowledge the appropriateness of capping for sites with contamination at the levels present at the Chemsol site. Because no reason for departing from the guidance purportedly relied upon is provided, the soil cleanup goals and remedy must be re-evaluated based on the guidance. Moreover, consistent with the guidance, capping should be the selected remedy in the ROD.

- Errors in the cost estimating for soil capping require reconsideration of the appropriateness of the proposed remedy. These errors overestimate the extent of the remedial action and cost for soil cover. Also, the cost estimate arbitrarily assumes stockpiled soils cannot be used as soil cover. As detailed herein, because the cost estimate for the capping alternative is grossly overestimated, the selection of the proposed remedy is based on faulty assumptions regarding the costs of the remedial alternatives. Consequently, there has not been a valid cost comparison of the remedial alternatives as required by the NCP and, therefore, the remedy selection must be re-evaluated.

Comments on Proposed Groundwater Remedy

! As recognized in the FS and various USEPA guidance documents, there is a high degree of certainty that aquifer restoration and significant mass reduction cannot be achieved at the Chemsol site based on hydrogeologic and contamination-related factors, specifically the presence of DNAPL in fractured bedrock. Consequently, the ROD should waive ARARs for groundwater restoration based on the technical impracticability of restoring the aquifer. 40 C.F.R. º 300.430(f)(1)(ii)(C)(3). Moreover, the ROD should not require extraction of groundwater to achieve mass reduction, to the extent it can be achieved at all, because it will provide no additional protection of human health and the environment. The remedial action objectives should be mvised to require hydraulic containment of the groundwater plume.

! The groundwater flow model used in the FS, which forms the basis for the selection of the remedy in the Proposed Plan, is described as "preliminary" because of a limited calibration and the existence of data gaps. The preliminary groundwater flow model should not have been used for predictive purposes. Consequently, the ROD should embrace the recommendations set forth in the groundwater modeling report which state, "[T]he model should be upgraded from 'preliminary' status to 'predictive' status by resolving data gaps and uncertainties and performing additional calibration." Because the preliminary model is based on inadequate and, at times, inaccurate data, the ROD must be written in such a manner to allow for the incorporation of the findings of a refined, calibrated groundwater model into the design of the groundwater extraction system, including the number of extraction wells, the well locations, the well extraction rates, and the aggregate extraction rate.

! The proposed alternative requires pumping from all groundwater zones up to a saturation depth of approximately 375 feet. No justification is provided for requiring extraction of certain uncontaminated portions of the aquifer, either on-site or beyond the Site boundaries. The agency has defined the extraction boundaries based on a only a preliminary groundwater model. The ROD should not specify the extent of the capture zone; rather, the capture zone should be identified as the contaminated area defined by the RI, and any additional investigations conducted as part of remedial design, and be determined using a refined, calibrated groundwater model.

! Off-site groundwater plume delineation should be limited to the downgradient area of the Site. Further, the definition of the downgradient area should be determined using a refined, calibrated groundwater model.

! The existing MCUA permit and NJDEP surface water discharge permit equivalent present significant constraints on the effluent discharge, as they are based on a discharge flow rate of 30 gpm. These discharge limitations are not considered in the evaluation of the remedial alternatives. By failing to do so, the agency has entirely failed to consider an important aspect of the problem. Due to this oversight, the ROD must be written to permit flexibility in the extraction system design to conform to these limitations.

! There is no technical basis for the requirement in the FS and Proposed Plan to operate the biological treatment plant if the treatment plant effluent is discharged to surface water. Currently, the plant effluent discharged to the MCUA would exceed surface water discharge standards for only barium, manganese and total dissolved solids ("TDS"). In its current configuration, there have been no exceedences for soluble organics. Operation of the biological treatment plant will not assist in reaching the standards for those criteria exceeded. Moreover, the influent concentrations of soluble organics have decreased significantly. Accordingly, the requirement of operating the biological treatment plant should not be an explicit element of the selected alternative in the ROD.

! A refined, calibrated groundwater model should be used to structure any long-term monitoring program, including the number and location of wells to be sampled. Similarly, the long-term monitoring sampling parameters should be developed during remedial design based on site contaminants.

2.0 COMMENTS REGARDING PROPOSED SOIL REMEDY

2.1 The remedial action objective to allow for future site use without restrictions cannot be achieved by the proposed soil remedy.

2.1.1 Because the proposed soil remedy would not achieve the State soil cleanup criteria, it cannot satisfy the remedial action objective to allow for future site use without restrictions.

Two of the remedial action objectives for soil remediation are in direct conflict and require revision by the USEPA. These objectives are:

! restoring the soil at the Site to levels which will allow for residential/recreational use (without restrictions); and

! prevent human exposure to surface soils contaminated with PCB concentrations above 1 part per million (ppm) and lead concentrations above 400 ppm.

The Proposed Plan's goal of "restoring the soil at the Site to levels which would allow for residential/recreational use (without restrictions)" apparently ignores the fact that by not remediating to New Jersey's soil cleanup standard, future Site use would continue to be subject to restrictions. As the USEPA recognized in the Proposed Plan, the State of New Jersey has developed a state-wide soil cleanup criterion for PCBs of 0.49 ppm. (USEPA, 1997b) The USEPA further recognized that, "if the remedy does not achieve the State [criterion], the State will require that restrictions be placed on the property to prevent future direct contact with soils above 0.49 ppm." (USEPA, 1997b) Indeed, "the State of New Jersey cannot concur on the preferred remedy unless its soil direct contact criteria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria." (USEPA, 1997b) Consequently, even after excavation and disposal of approximately 18,500 cubic yards of soil at an estimated cost of $5.5 million, the Proposed Plan acknowledges that a deed restriction, and possibly other institutional controls or engineering controls, such as a cap, would still be required by the NJDEP. The remedial action objective to allow for future site use without restrictions cannot be achieved under these circumstances.

To remedy this error, the USEPA should delete the "without restrictions" requirement in the remedial action objective so it is revised to read:

- restoring the soil at the Site to levels which will allow for residential/recreational use.

2.1.2 If the remedial action objectives are revised to consider the State soil cleanup criterion, a new remedial alternatives analysis must be performed to comply with the NCP, as at remedial alternative which complies with the State's soil cleanup criterion was not previously evaluated and is expected to result in significantly greater costs and increased risk to human health and the environment.

The proposed remedial alternative of excavation and disposal of contaminated soils will have to be revised to achieve the State soil cleanup criterion if the remedial action objective of unrestricted future use of the property is to be achieved. If additional excavation is to be considered to achieve the State criterion, the remedy selection would have to be re-evaluated as it is not evaluated by the FS or Proposed Plan.

The additional excavation work required to achieve the New Jersey criterion is likely to be significant. The proposed remedy addresses only surface (0-2 feet) soil. (USEPA, 1997a) Based on the analytical results presented in the RI, some areas of the Site may require up to six (6) feet of excavation to meet the New Jersey criterion. (USEPA, 1996) The RI data indicate that additional excavation volumes could be more than 25% greater than USEPA estimates, depending on the vertical distribution of soil constituents at the Site. (Affidavit of Willard F. Potter dated October 10, 1997 [hereinafter, "Potter Affidavit"]) As a result, if the remedy is altered to meet this goal, significant costs and increased risks to human and health and the environment would ensue.

Depending on the classification of the excavated soil for off-site disposal (see Section 2.7), the actual cost of the proposed remedy could increase to $6.7 million up to $18.4 million. (Potter Affidavit) Should costs increase, review by the National Remedy Review Board may be required as the estimated cost of the proposed remedy would be expected to exceed $10 million and, if so, would be 50% greater than the least costly, protective, ARAR-compliant alternative.

Furthermore, increased risks would result from any additional excavation. In particular, the additional excavation would result in larger volumes for excavation, which translates, into proportionately higher truck traffic through residential neighborhoods and on the roads and highways, increased potential for excavation-related air emissions, and greater short term risks to site workers.

Because the additional excavation would significantly increase costs, resulting in this alternative being materially different from the proposed remedy, a new remedial alternatives analysis would have to be performed before the ROD is issued to satisfy the requirements of the NCP.

2.1.3 The proposed soil remedy cannot satisfy the remedial action objective to allow for future site use without restrictions based on the significant present and anticipated future environmental and physical development constraints located on the Site.

The remedial action objective to "restore the soil at the Site to levels which will allow for residential/recreational use (without restrictions)" cannot be achieved due to development restrictions posed by the presence of wetlands and the groundwater treatment facility on Site.

Wetlands cover a large percentage of the Site. (USEPA, 1997a (Figure 1-31); USEPA, 1996) Indeed, only approximately three (3) to four (4) acres will be available for use without causing impact to the designated onsite wetlands. (USEPA, 1997a; USEPA, 1996) This fact is not considered by the FS or Proposed Plan in the analysis of the alternatives. Furthermore, no cost for mitigation of wetlands disturbed by the proposed soil remedy has been considered.

Moreover, the majority of the uplands is located in the vicinity of the groundwater treatment plant. (USEPA, 1996) Consequently, any development would be restricted to a relatively small area in the vicinity of the groundwater treatment plant. However, the appurtenances associated with the plant, such as underground lines, extraction wells, and monitoring wells, would further reduce the acreage available for development and would restrict the type of development. In fact, the presence and operation of the groundwater treatment plant may entirely preclude any development or site use until the groundwater remedial action is complete.

In consideration of these significant constraints on development, the "without restrictions" requirement should be deleted from the remedial action objective, so it is revised to read:

- restoring the soil at the Site to levels which will allow for residential/recreational use.

2.2 The selection of the proposed remedy is not supported by the administrative record.

2.2.1 By requiring the soil be disposed as a hazardous waste, the Proposed Plan proposes a remedy not evaluated by the FS, contrary to the requirements of the NCP.

The Proposed Plan states that the excavated soil "would be disposed at a facility which is licensed under RCRA to accept hazardous waste." (USEPA, 1997b) This statement is inconsistent with the conclusions reached in the RI that were adopted by the FS. (USEPA, 1996; USEPA, 1997a) In fact, disposal at a hazardous waste landfill would result in the FS cost estimate being grossly understated. (Potter Affidavit) The RI/FS Guidance states that FS cost estimates "are expected to provide an accuracy of +50 percent to -30% and are prepared using data available from the RI." (USEPA, 1988) Requiring disposal as a hazardous waste results in the estimated cost for the proposed alternative being underestimated by more than $9.1 million (Potter Affidavit), well beyond the accepted cost estimating tolerance prescribed in USEPA guidance. (USEPA, 1988)

The excavated soil transportation and disposal costs for a RCRA landfill can be more than four (4) times higher than the comparable costs for nonhazardous soils used in the FS. (Potter Affidavit) The estimated cost for the excavation and disposal alternative may increase by as much as $9 million, for a total estimated cost of over $14.5 million. (Potter Affidavit) Consequently, the ROD cannot require disposal as a hazardous waste as, in accordance with the NCP and principles of administrative law, the USEPA would have to consider those higher costs prior to such a remedy selection.

However, none of the samples analyzed for hazardous characteristics by the TCLP testing procedures specified at 40 C.F.R. º 261.24 are within the extent of the proposed excavation. While none of soil samples leached hazardous constituents in excess of the RCRA hazardous waste criteria, because none are in the within the extent of excavation, the RI's conclusion that the soil is nonhazardous is unsupported.

The ROD should state that the soil disposal facility will be determined by soil sampling and classification conducted during the implementation of the selected remedy. However, if a majority of the soil is classified as hazardous, and the costs increase substantially, the remedy selection in the ROD would have to be re-evaluated in accordance with the NCP.

2.2.2 Should soil sampling during remedial design reveal a larger volume of soil requiring excavation, the remedy must be re-evaluated as the selection would not be based on all relevant facts, information, and alternatives.

If the USEPA retains the proposed remedy of excavation and disposal of soil, the ROD should be written to allow additional soil sampling during the remedial design to determine more accurately the volume of material that is required to be excavated. Neither the PCB contamination contours nor the lead contamination contours are well-defined by the RI sampling. For example, the lead contamination contours are based on only three soil borings. (USEPA, 1997a) Moreover, the areas to be excavated appear to include sediments near the confluence of the Northern Ditch and Stream IB. The Proposed Plan determines remediation of these sediments is not warranted at this time. (USEPA, 1997b)

However, as a result of this additional delineation, significantly greater quantities of soils may be identified as requiring excavation and disposal under the Proposed Plan, thereby greatly increasing cost. If the volumes significantly increase, the assumptions in the Proposed Plan would be materially incorrect and the NCP will compel reconsideration of the remedy selection. 40 C.F.R. º 300.435(c)(2).

2.2.3 Stockpiled soils meeting the criteria for backfill should not be required to be disposed of, but should be permitted to be used as backfill.

The Proposed Plan requires that the soil presently stockpiled on-site be disposed of off-site. However, the requirement for off-site disposal presently is confirmed only for the soils excavated in connection with the removal of the underground storage tank. (USEPA, 1997a (Appendix C)) The other two soil stockpiles were excavated from the area in the vicinity of the groundwater treatment plant building, which area is believed not to be contaminated. The RI sampling supports this conclusion, as samples collected in the vicinity of the treatment plant do not exhibit contamination above the cleanup standards set forth in the Proposed Plan. (USEPA, 1996) If sampling confirms that these soils do not contain contaminants above the New Jersey soil cleanup criteria, the ROD should permit the use of these soils as acceptable backfill or cover material.

2.3 A selection of soil capping as the remedial alternative is supported by the administrative record.

In accordance with USEPA guidance, the FS states that, based on its proposed future use, capping is an appropriate remedial action for the levels of contamination present at the Chemsol site. (USEPA, 1997a) The Proposed Plan assumes that the most probable future use of the site would be for residential or recreational purposes, stating that the municipality has expressed a preference for recreation use for the property. (USEPA, 1997b) As discussed in Section 2.3.1, USEPA Guidance expressly recommends capping for residential-use sites with contamination levels equivalent to those detected at the Chemsol site. (USEPA, 1994b; USEPA, 1990) Further, for the Chemsol Site, the FS states that capping will allow for "many residential type uses of the property, such as for recreational purposes as a park or a playground among others." (USEPA, 1997a)

Capping is protective of human health and the environment, recommended by USEPA guidance, and consistent with realistic options for any future site use based on site development constraints. Further, capping would satisfy not only the cleanup levels set forth in the Proposed Plan, but also would satisfy the State PCB cleanup criterion. The proposed remedy should be re-evaluated in consideration of these significant facts, as soil capping is supported by the administrative record.

2.3.1 The Proposed Plan is not consistent with the USEPA guidance on which soil cleanup levels were based; consequently, the remedy selection should be reconsidered as these guidance documents recommend capping for sites with contaminant concentrations at the levels present at the Chemsol site.

2.3.1.1 The Proposed Plan does not follow USEPA's Guidance on Remedial Actions for Superfund Sites with PCB Contamination which states that, for sites with future residential use scenarios, capping is typically the preferred remedial alternative where PCB concentrations are below 100 ppm.

In the Proposed Plan, USEPA states, "Soil cleanup levels for PCBs at the Site were obtained from EPA's 1990 'Guidance on Remedial Actions for Superfund Sites with PCB Contamination.'" (USEPA, 1997b) This guidance, in part, "summarizes the primary considerations associated with determining the appropriate response action for a PCB contaminated Superfund site in terms of the nine evaluation criteria used in the detailed analysis." (USEPA, 1990) In doing so, the guidance provides USEPA's interpretation of the requirements of the NCP at Superfund sites with PCB contamination. However, without explanation, the Proposed Plan did not follow the guidance and, correspondingly, did not satisfy the requirements of the NCP.

In the guidance, USEPA acknowledges that a cap is the preferred remedial alternative for sites where only "low-threat" concentrations of PCBs are present. The guidance recognizes an action level of 1 ppm for sites with unlimited exposure under residential land use scenarios; however, this 1 ppm standard is a "starting point action level," not a cleanup standard. (USEPA, 1990) Instead, the guidance requires that final cleanup levels reflect all relevant exposure pathways and be defensible on a site-specific basis. (USEPA, 1990)

According to the guidance, the expectation of the Superfund program that "principal threats at a site will be treated wherever practicable and that low-threat material will be contained and managed" should be followed in determining an appropriate cleanup standard and remedial action for a Site. (USEPA, 1990) The guidance defines principal threats to include "soil contaminated at 2 to 3 orders of magnitude above the [1 ppm] action level," or "[f]or sites in residential areas, ... soil contaminated at concentrations exceeding 100 ppm. PCBs." (USEPA, 1990) The guidance states that material above action levels not constituting a principal threat (less than 100 ppm for residential areas) should be "contained to prevent access." (emphasis added) (USEPA, 1990) Moreover, "where low concentrations of PCBs will remain on site and direct contact risks can be reduced sufficiently, minimal long term management controls are warranted." (USEPA, 1990) The USEPA estimates that a ten (10) inch soil cover will reduce risks by approximately one order of magnitude. (USEPA, 1990) Accordingly, the PCB Spill Cleanup Policy recommends a 10 ppm cleanup level with a 10 inch cover for residential areas. 40 C.F.R. º 761.125(c)(4)(v).

Based on the detected PCB concentrations at the Chemsol site, the guidance recommends capping as the preferred remedial alternative. For surface soils, PCBs are detected below 5 ppm in 73% of the screening samples from the RI, while PCBs are detected below 5 ppm in 84% of the laboratory-analyzed samples. (USEPA, 1996) For subsurface soils, PCBs are detected below 5 ppm in 90% of the screening samples, while PCBs are detected below 5 ppm in 98% of the laboratory-analyzed samples. (USEPA, 1996) Only one laboratory-analyzed sample detected PCBs in excess of 50 ppm, while the geometric mean of all laboratory-analyzed samples is 0.099 ppm (0.177 ppm for surface soils). (USEPA, 1996) The Proposed Plan fails to apply the guidance to these data and, therefore, fails to comply with USEPA's interpretation of the requirements of the NCP at Superfund sites with PCB contamination. As a result, the proposed alternative should be re-evaluated to conform with the USEPA guidance. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

2.3.1.2 The lead cleanup standard adopted in the Proposed Plan is not consistent with the procedures set forth in USEPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilties, upon which the cleanup standard is purportedly based, and, therefore, the remedy selection should be reevaluated to conform with the guidance.

The Proposed Plan states, "The 400 ppm lead cleanup level is based on EPA's 1994 'Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.'" (USEPA, 1997b) The guidance, in part, "establishes a streamlined approach for determining protective levels for lead in soil at CERCLA Sites," thereby providing USEPA's interpretation of the requirements of the NCP at Superfund sites with lead contamination in soils. (USEPA, 1994b) Similar to the PCB guidance, the Proposed Plan, without explanation, does not follow the guidance and, correspondingly, does not satisfy the requirements of the NCP.

The guidance recommends using 400 ppm as a screening level for lead in soil at residential sites. However, the guidance specifically states:

> Screening levels are not cleanup goals. Levels of contamination above the screening level would NOT automatically require a removal action, nor designate a site as 'contaminated.'" (emphasis in original) (USEPA, 1994b)

In fact, residential preliminary remediation goals of "more than twice the screening level have been identified," and "[a]fter considering other factors such as costs of remedial options, reliability of institutional controls, technical feasibility, and/or community acceptance, still higher cleanup levels may be selected." (USEPA, 1994b) No such analysis has been performed for the Chemsol site. Indeed, no justification for the selection of the cleanup goals has been provided.

Moreover, the guidance goes on to state that exceedence of an appropriate cleanup standard does not necessarily require excavating soil. Instead, intervention measures (e.g., capping, institutional controls) may be more appropriate than excavation at many sites. (USEPA, 1994b)

The Proposed Plan fails to consider the guidance correctly and, therefore fails to comply with the USEPA's interpretation of the requirements of the NCP at Superfund Sites with lead contamination. As a result, if the proposed alternative should be re-evaluated to conform with the USEPA guidance. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

2.3.2 The FS and Proposed Plan overestimate the costs of capping, resulting in an invalid cost comparison of remedial alternatives.

The cost for the capping alternative is overestimated by up to $1.15 million, which is 60% of the cost presented in the FS and relied upon by the Proposed Plan. (Potter Affidavit) The RI/FS Guidance states that FS cost estimates "are expected to provide an accuracy of +50 percent to - 30% and are prepared using data available from the RI." (USEPA, 1988) However, as detailed below, the cost estimate for the capping alternative misinterprets the data generated as part of the RI and, as a consequence,) overestimates the costs beyond the tolerances acceptable to USEPA. These effors in the cost estimating dictate that the proposed remedy must be reconsidered as there has not been a valid cost comparison of remedial alternatives as required by the NCP. Moreover, because the costs for the capping alternative are significantly lower than estimated by the FS, the proposed alternative becomes significantly more expensive without a corresponding increase in protection of human health and the environment.

The unit cost for soil cover in the capping alternative exceeds the unit cost for backfill under the excavation alternative by $10.67 per cubic yard. (USEPA, 1997a) The record states no reason, nor is there any justifiable reason, why more expensive soils/backfill would be required for the capping alternative. In fact, the FS requires that "clean common fill ... satisfy[ing] New Jersey soil cleanup criteria for residential use" be used for both alternatives. (USEPA, 1997a) Consequently, the estimated cost for capping of 12 acres is overstated by over $0.4 million (including multipliers). (Potter Affidavit)

In addition, the FS and Proposed Plan state that 5.73 acres would be disturbed by excavation, while 12 acres would have to be capped. Again, the record contains no explanation or justification for this difference. The areal extent of soil exceeding cleanup levels is defined by the excavation alternative to be 5.73 acres; there is no reason to require a soil cap for any area not presenting an alleged risk. Further, constructing a soil cap over 12 acres would impact on-site wetlands. No cost for mitigation of the impacted wetlands is included in the FS cost estimate. Using the correct unit cost for soil cover, without even considering the cost for mitigation of any impacted wetlands, the cost for constructing the capping alternative is overstated by over $0.9 million. (Potter Affidavit) Therefore, the more accurate cost estimate for the capping alternative is $959,938, as compared to the FS estimate of $1,894,275.

Furthermore, if analytical results of the stockpiled soil demonstrate that the soil is acceptable for use as cover material (i.e., meets the New Jersey soil cleanup criteria), the total cost of the capping alternative (including capping and disposal of drums and stockpiled soil) is reduced by an estimated additional $216,000, for a total reduction of $1.15 million. (Potter Affidavit)

3.0 COMMENTS REGARDING PROPOSED GROUNDWATER REMEDY

3.1 Geologic and contaminant-related factors dictate that a Technical Impracticability ARAR waiver should be granted and the remedial action objective be revised accordingly to seek containment of the contaminated groundwater.

USEPA guidance and extensive experience demonstrate that two of the groundwater remedial action objectives in the Proposed Plan are unachievable based on the hydrogeologic conditions and contamination present at the Chemsol site. The groundwater remedial objectives in the Proposed Plan seek, in part, to "remove and treat as much contamination as possible from the fractured bedrock." and to "restore remaining affected groundwater to State and federal drinking water standards." (USEPA, 1997b) However, based on the investigations conducted during the RI, dense, nonaqueous phase liquid (DNAPL") is present across the site in fractured bedrock.

(USEPA, 1996) The FS expressly acknowledges that "[a]quifer restoration is highly unlikely in this fractured bedrock." (USEPA, 1997a) Accordingly, an ARAR waiver, based on the technical impracticability of restoring groundwater, should be granted. 40 C.F.R. º 300.430(f)(l)(ii)(C)(3). Moreover, in conformance with the NCP, USEPA guidance, and the FS remedial action objectives, the remedial action objectives for groundwater remediation at the Chemsol site should be revised correspondingly to seek only hydraulic containment of the groundwater plume. Extraction for mass reduction has little, if any, utility because groundwater ARARs are impossible to achieve in a reasonable timeframe.

When DNAPL is present in a fractured rock media, little in the way of meaningful groundwater restoration can be accomplished through efforts to remove contaminant mass by groundwater extraction. (USEPA, 1993) In summary, the science has demonstrated over the years that removal of DNAPL in fractured bedrock is complicated by inaccessibility (e.g., in dead-end fractures in bedrock), flow mechanics independent of groundwater flow, complex flow patterns, and difficulties in locating DNAPL accumulations. (Parker, Gillham and Cherry, 1994) USEPA recognizes these difficulties in its various guidance documents, including the Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration, OSWER Directive 9234.2-25 (September 1993) ("TM Guidance"). Indeed, it has been demonstrated time and again that attempts of any kind to remove contaminant mass in the conditions present at the Chemsol site would be futile. (Parker, Gillham and Cherry, 1994) Accordingly, the currently accepted practice under these conditions is to contain groundwater to protect downgradient receptors. (Parker, Gillham and Cherry, 1994; see also USEPA, 1993)

The RI concludes that DNAPL exists in numerous overburden and bedrock wells at the Chemsol site. (USEPA, 1996) This conclusion is based primarily on a comparison of groundwater quality data to constituent solubilities, the methodology described in Estimating Potential for Occurrence of DNAPL at Super Sites (USEPA, 1992). USEPA guidance identifies "concentrations of DNAPL-related chemicals in groundwater [that] are greater than 1% of pure phase solubility or effective solubility" as a condition indicating the potential for DNAPL. (USEPA, 1992) For example, historical groundwater quality data for monitoring well C-1 at the Chemsol site indicate that trichloroethene was present in concentrations in excess of 20% of its solubility, clearly demonstrating the presence of DNAPL. (USEPA, 1991) The RI provides additional evidence of the presence of DNAPL in that material resembling "tar balls" has been observed during maintenance of the groundwater extraction system. (USEPA, 1996)

The importance of the presence of DNAPL in the remediation of contaminated sites has been recognized since the early 1980s. (Freeze and Cherry, 1979) More recently, the USEPA has acknowledged the problems presented by the presence of DNAPL:

> Once in the subsurface, it is difficult or impossible to recover all of the trapped residual DNAPL. The conventional aquifer remediation approach, groundwater pump-and-treat, usually removes only a small fraction of trapped residual DNAPL. Although many DNAPL removal technologies are currently being tested, to date there have been no field demonstrations where sufficient DNAPL has been successfully recovered from the subsurface to return the aquifer to drinking water quality. (USEPA, 1992)

The presence of DNAPL contamination within the rock matrix itself is of particular importance to the ability to achieve groundwater restoration within a reasonable time frame. The entrance to and eventual release of contaminants from the rock matrix are diffusion controlled processes. (Parker, Gillham and Cherry, 1994) As contaminated groundwater moves through the fractures of a bedrock aquifer, diffusion of contaminants will occur into the essentially stagnant matrix pore water of the rock, as illustrated in Figure 3-1. (Parker, Gillham and Cherry, 1994) The extent of the diffusion and its hydrogeologic significance will depend upon the concentration gradient, the matrix diffusivity and porosity, the fracture spacing of the rock, and the duration of exposure. (Parker, Gillham and Cherry, 1994)

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The diffusion of contaminants into the rock matrix can be considered beneficial in that it retards the advance of a contaminants plume through the fractured rock. (Lever and Bradbury, 1985) However, when the objective is to purge contamination from an aquifer, the diffusion-controlled release of contaminants from the rock matrix can greatly prolong aquifer cleanup efforts over what would be possible in a simple porous medium of equivalent hydraulic conductivity. Consequently, contaminants in the rock matrix become a long-term source of groundwater contamination for which there is no remedial measure currently available. (USEPA, 1993) One would expect groundwater remediation time within rock aquifers contaminated with DNAPL chemicals to be measured in hundreds of years. (USEPA, 1993) The failure to discuss adequately the significance of DNAPLs and matrix diffusion as they relate to overall site remediation is a fatal flaw in the FS.

Furthermore, the significance of matrix diffusion to groundwater restoration is not limited to the DNAPL zone. In fact, the diffusion process will play a similar role in substantially delaying the removal of mass in the area of the aqueous plume downgradient of the DNAPL zone. (USEPA, 1993) USEPA has also acknowledged the significance of this phenomenon:

> EPA recognizes, however, that there are technical limitations to ground-water remediation technologies unrelated to the presence of a DNAPL source zone. These limitations, which include contaminant-related factors (e.g., slow desorption of contaminants from aquifer materials) and hydrogeologic factors (e.g., heterogeneity of soil or rock properties), should be considered when evaluating the technical practicability of restoring the aqueous plume. (USEPA, 1993)

In the TI Guidance, the USEPA recognizes the foregoing and states that hydrogeologic and contaminant-related factors can inhibit groundwater restoration. The TI Guidance further states that the presence of fractured bedrock and DNAPL "makes extraction or in-situ treatment of contaminated groundwater extremely difficult," specifically noting that DNAPL "generally is not capable of migrating or being displaced by normal groundwater flow." (USEPA, 1993)

A front-end TI decision is; appropriate where "adequate site characterization data [is] present[]to demonstrate, not only that [a known remediation] constraint exists, but that the effect of the constraint on contamination distribution and recovery potential poses a critical limitation to the effectiveness of available technologies." (USEPA, 1993) Based on the groundwater characterization conducted during the RI and the groundwater model presented in Appendix A, the site has been characterized adequately to support a TI decision.

The TI guidance provides:

> [C]ertain types of source contamination are resistant to extraction and can continue to dissolve slowly into ground water for indefinite periods of time. Examples of this type of source constraint include certain occurrences of NAPLs, such as where the quantity, distribution, or properties of the NAPL render its removal from, or destruction within, the subsurface infeasible or inordinately costly. (USEPA, 1993)

Furthermore,

> Geologic constraints...also may critically limit the ability to restore an aquifer...Some geologic constraints, however, may be defined sufficiently during site characterization so that their impacts on restoration potential are known with a relatively high degree of certainty. An example of this type of constraint includes complex fracturing of bedrock aquifers, which makes recovery of contaminated ground water or DNAPLs extremely difficult. (USEPA, 1993)

The RI concludes that indications of DNAPL are present in at least 23 wells on the Chemsol site. (USEPA, 1996) In addition, fractured bedrock is present across the Site. (USEPA, 1996) Based on the presence of DNAPL in fractured bedrock, a front-end TI decision is appropriate for the Site.

The NCP requires restoration of groundwater only "wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site." 40 C.F.R. º 300.430(a)(l)(iii)(F). USEPA has determined 100 years to be a "very long restoration timeframe.". (USEPA, 1993) The USEPA acknowledges that "[DNAPL] compounds...are often very difficult to locate and remove from the subsurface environment and may continue to contaminate ground water for many hundreds of years despite best efforts to remediate them." (emphasis added) (USEPA, 1993) USEPA concludes that "in cases where there is a high degree of certainty that cleanup levels cannot be achieved, a final ROD that invokes a TI ARAR waiver and establishes an alternative remedial strategy may be the most appropriate option." (USEPA, 1993) "Where it is technically impracticable to remove subsurface DNAPLs, EPA expects to contain the DNAPL zone to minimize further release of contaminants to the surrounding ground water, wherever practicable." (USEPA, 1993)

Similarly, in the USEPA's Superfund Administrative Reforms, USEPA has promoted updating remedy decisions where "significant new scientific information or technological advancement will achieve the same level of protectiveness." (USEPA, 1995) In particular:

> By the 1990s, experience indicated that sites contaminated with [DNAPLs] could require an inordinate amount of time to restore the ground water to drinking water levels using conventional pump and treat technology alone. ...[C]urrent policy is to isolate and contain the DNAPL source, removing the source only to the degree practicable. (USEPA, 1995)

Based on the hydrogeologic and contaminant factors at the Chemsol site, there is a high degree of certainty that the attainment of the remedial action objectives in the Proposed Plan is not technically practicable. As discussed above, both the USEPA and experts recognize that the use of groundwater extraction for the purpose of contaminant mass removal has little overall effect on groundwater quality under the geologic and contaminant conditions present at the Chemsol site. Specifically, because of the presence of DNAPL in fractured bedrock, groundwater restoration cannot be achieved at the Chemsol site, particularly within a reasonable timeframe. Consequently, a TI ARAR waiver should be granted.

Because groundwater restoration is not achievable at the Site, the remedial action objective should be revised, in conformity with the objective set forth in the FS, to seek the containment of the groundwater. References in the remedial action objectives to groundwater restoration and/or mass removal should be removed. Because groundwater cannot be restored, mass reduction pumping is unnecessary. Accordingly, the remedial action objective should be revised, as follows:

- prevent migration of the contaminated groundwater in the fractured bedrock aquifer; augment the existing groundwater system to contain the contaminated groundwater from all depth zones.

Even if USEPA were not to grant a TI waiver or revise the remedial action objectives, groundwater pumping scenarios should be optimized to achieve containment of the groundwater rather than to be geared toward mass reduction, as it is the hydraulic containment that will serve to protect human health and the environment. An extraction system that contains the groundwater will prevent downgradient migration and, thereby, protect human health and the environment by eliminating the contributing source. Based on the presence of fractured bedrock and DNAPL, the potential for achieving additional significant mass reduction at this Site beyond that provided by containment is extremely low. The goal to achieve mass reduction should not dictate the location of extraction wells. As groundwater extraction will not stimulate matrix diffusion, and may actually decrease the diffusion of contaminants into groundwater, a source reduction pumping scheme is no more effective in providing mass reduction than the recommended containment scheme. (National Research Council, 1994)

3.2 The remedial action objectives in the Proposed Plan must conform to those in the FS because the remedy selection is based on the screening and evaluation of alternatives presented in the FS.

It is erroneous for the Proposed Plan to rely on the remedial alternatives analysis conducted in the FS, but alter the remedial action objectives. The entire FS remedy evaluation, from the screening to the detailed evaluation, relies on the remedial action objectives set forth in the FS. The Proposed Plan cannot arbitrarily change these objectives, but rely on the analysis.

In particular, the remedial action objectives in the FS seek to:

- Prevent/minimize offsite migration of groundwater contamination in the fractured bedrock aquifer. Contain the contaminated groundwater (that is above Federal and State MCLs) from all depth zones and, as an element of this containment, reduce the mass of contaminants to the maximum extent possible. Augment the existing interim remedy as necessary, in order to achieve these goals. Aquifer restoration is highly unlikely in this fractured bedrock. (USEPA, 1997a)

In contrast, the remedial action objectives in the Proposed Plan seek to:

- augment the existing groundwater system to contain that portion of contaminated groundwater that is unlikely to be technically practicable to fully restore and restore remaining affected groundwater to State and federal drinking water standards

- remove and treat as much contamination as possible from the fractured bedrock. (USEPA, 1997b)

Because the FS concludes that "[a]quifer restoration is highly unlikely in this fractured bedrock," the FS remedial action objectives do not seek to restore the groundwater to drinking water standards. The remedial action objectives in the Proposed Plan should be revised to conform to those presented in the FS, with the appropriate revisions discussed above, as follows:

- prevent migration of the contaminated groundwater in the fractured bedrock aquifer; augment the existing groundwater system to contain the contaminated groundwater from all depth zones.

3.3 The USEPA uses a "preliminary" groundwater model in its remedy selection, resulting in misinterpretation of key model parameters and, consequently, a remedy selection process based on incomplete and, at times, inaccurate information.

The groundwater flow model used in the FS as the basis for the selection of the remedy in the Proposed Plan has been acknowledged to be "preliminary" and, therefore, cannot serve as a basis for a properly conducted remedial selection. The groundwater modeling report (FS, Appendix A at 1) states that "the model is . . . preliminary because it was developed using the existing database which contains data gaps." As the model has not been sufficiently developed and calibrated for use, its predictions relative to groundwater extraction rates and capture zones are highly speculative. Accordingly, using this model as the basis for remedial selection is improper since the proposed remedy is evaluated based on incomplete information.

Proper modeling protocol requires the development of a sound conceptual model, calibration, sensitivity analysis, and a discussion of the uncertainty of the predictions. (Anderson, 1991) The conceptual model incorrectly interprets the water-bearing zones beneath the Site and admittedly contains data gaps. (USEPA, 1994a) Consequently, the groundwater model uses inaccurate assumptions for key model input parameters. Further, only a limited calibration was conducted, with no formal analysis of the sensitivity of the various input parameters. Finally, there is no discussion of the uncertainty of the predicted extraction rate or well placement. The failure to do each of these tasks thoroughly renders the groundwater flow model inappropriate for predictive use. Using the model for predictive use, such as for determining the number of extraction wells, the well locations, the well extraction rates, and aggregate extraction rate, is improper and a remedy should not be selected on the basis of such a model.

As explained in the ECKENFELDER, INC.'s Technical Review of the Remedial Investigation Report, Chemsol, Inc. Site, Piscataway, New Jersey, which was submitted to the USEPA on April 9, 1997, the most significant error in the conceptual model concerns the interpretation of the water-bearing zones beneath the site and the related implications regarding the directions of groundwater flow. Interpretation of the site hydrogeologic conditions is based on a faulty assumption regarding the grouping of wells for mapping purposes. Specifically, the wells have been grouped on the basis of equal elevation rather than on the basis of stratigraphic position within the dipping bedrock units. Experience has shown that this type of approach results in the incorrect determination of groundwater flow directions. (USEPA, 1994a) Indeed, USEPA recognizes that "it is critical that potentiometric surface maps be developed using hydraulic heads measured in comparable stratigraphic intervals to avoid misinterpreting horizontal flow directions, especially where significant vertical gradients are present.... Potentiometric surface maps developed from wells completed in different geologic units may result in misleading interpretations and containment." (USEPA, 1994a)

As recognized in the FS report, the results of the packer tests should be used to group the wells for the purpose of potentiometric mapping. The following statement is made on page 1-41 leading to the discussion regarding well grouping:

Based on the results of the packer tests, it appears that:

- the bedrock that lies stratigraphically above the [upper] gray shale is near isotropic and homogeneous conditions [sic](but flow is still controlled by fractures),
- the [upper] gray shale appears to be a hydraulic barrier,
- the bedrock below the [upper] gray shale is near isotropic and homogeneous conditions [sic](but flow is still controlled by fractures), and
- the deep gray unit may have some hydraulic control, but the collected data are not significant enough to make any conclusion regarding this unit. (USEPA, 1997a)

However, these conclusions, which should have been used as the basis for well grouping for potentiometric mapping, are then not used as wells are subsequently grouped entirely on the basis of elevation. The result of grouping wells based on elevation yields the comparison of data from wells that are in disparate water-bearing zones. As a result, the conceptual model, for example, assumes that groundwater from wells located below the upper gray shale are hydraulically connected to wells at similar elevation above the upper gray shale, even though the FS concludes the upper gray shale acts as a hydraulic barrier that would prohibit this flow. See Figure 3-2. This misinterpretation precludes the preliminary model's ability to accurately model flow in the Site's complicated geologic units. The geology of the Chemsol site is complicated because of the significantly complex hydrostratigraphic vertical relationships, such as the dipping of the bedrock units and the presence of hydraulic barriers with the associated effects on hydraulic head. Further, groundwater flow at the Site demonstrates a significant downward, vertical flow component due, in part, to the presence of hydraulic barriers. Because the FS model compares wells in disparate water-bearing zones (FS Figures 1-15 through 1-19), thus, not taking into account the complicated groundwater flow regime at the Site, it misinterprets the direction and magnitude of groundwater flow, which renders the model unable to depict site conditions, predict capture: zones, or design an appropriate long-term monitoring program.

Regarding data gaps, one of the most significant is the uncertainty of the influence of the "car wash" well. On page 21, the groundwater modeling report states, "[D]uring calibration, it was discovered that the car wash well exerts a major influence on the direction of groundwater gradients on-site and it was important that it be included. However, the actual pumping rate is unknown. Therefore, it was assumed that the average pumping rate is half the capacity of the well." (USEPA, 1997a) It is improper to include this assumption in the groundwater model. First, the basis for this; assumed flow rate is not provided. The data from which the "capacity" of the well is estimated is not identified, nor is the rationale for assuming a car wash would be active often enough to account for half of the maximum yield of the well. Any data relied upon must be in the administrative record. Second, according to a representative of the Piscataway Township Department of Public Works, the car wash uses municipal water for its operation and thus the well is not currently in operation. (Potter Affidavit) Mr. Evans further stated that the Department of Public Works has inspected the well on a number of occasions to verify it is not operating. (Potter Affidavit) Accordingly, the influence of the car wash well should not have been considered in the model. Since each of the simulations contained in the FS includes the influence of this well, the model predictions of groundwater extraction rate and capture zone are incorrect.

Another concern with the preliminary model is the assumption that is used regarding the hydraulic conductivity of the bedrock. Overestimating the hydraulic conductivity will correspondingly overestimate the extraction rate necessary to achieve containment. (Freeze, 1979) The preliminary model is "calibrated" using hydraulic conductivities ranging from 20 to 50 ft/day for the "shallow and deep conductive zones," respectively, and 25 May for the intervening "general shale" (Table 9). These values are reportedly based on an analysis of packer test data. ECKENFELDER INC. has subsequently conducted a more in-depth review of the packer test results, as well as data previously collected by AGES in 1987 and McLaren-Hart in 1993. (Attachments A and B, Appendix A) The results indicate that the hydraulic conductivity for a comparative depth interval (principal aquifer) is approximately 10 ft/day. Since the groundwater extraction rate necessary for containment is generally proportional to hydraulic conductivity (Freeze, 1979) and the preliminary model uses overestimated hydraulic conductivities, it over-predicts the pumping rates required for containment. This supposition is supported by the results of the MODFLOW model presented in Appendix A to these comments.

Another shortcoming of the preliminary model is the limited calibration that was conducted. On page 11 the groundwater modeling report states, "Since this is a preliminary model application, a limited calibration was performed. This calibration was limited because there are data gaps and because assumptions and interpretations as discussed above had to be made." Model calibration should include "history matching" or simulating the measured response to a known stress, such as the pumping of well C-1 by McLaren-Hart in 1993. (Konikow, 1992) The MODFLOW Model presented in Appendix A is calibrated with "history matching."

As indicated above, the model that forms the basis for the selection of the groundwater extraction remedy is preliminary and should be refined prior to final selection of the number and pumping rate of individual extraction wells. At a minimum, refinement should include:

Re-grouping of monitoring wells into similar hydrostratigraphic zones, re-contouring groundwater elevations based on this distribution, and using these data for re-calibration. One of the concerns regarding the conceptual basis of the model is the decision to map groundwater elevations as a function of depth below ground surface rather than on the basis of hydrostratigraphic zones. (USEPA, 1994a) When groundwater elevations are contoured based on their appropriate hydrostratigraphic position, as discussed in Section A-1 (Appendix A), groundwater flow is shown to be to the north in each groundwater zone, including the upperzone above the gray shale in which the FS model predicts groundwater flow to the south. Groundwater quality data support this groundwater flow scenario, as dissolved VOCs are detected to the north of the former source area(s). (USEPA, 1996 (Appendix T))

! Refining the assumptions used in the model regarding the operation and pumping rate of the adjacent "car-wash" well. This well is reported not to be in operation and thus both the calibration and prediction runs will need to be revised.

! Revising the boundary conditions. Due to the variable nature of individual water-bearing zones within the Passaic Formation (Michalski, 1990) and the regional dip of approximately 12 degrees (Drake, 1995), the hydrostratigraphic units present onsite do not extend to the regional boundary features used in the model. As a consequence, the influence of these boundaries is over-stated by the model simulations. Considering the relatively small and localized nature of the stress to be simulated, both in calibration and prediction (ie., pumping several closely spaced wells at relatively small flow rates), a smaller model domain with closer boundaries would more accurately model actual conditions. (Anderson, 1991) The regional boundaries used in the model may be one reason why the on-site flow direction has been incorrectly simulated to the west and south, rather than to the north.

! Revising estimates of hydraulic head based on all the available data. This analysis will yield more accurate estimates of the key aquifer properties (transmissivity) than the current analysis of packer test data. Unlike individual borehole packet tests that measure aquifer properties in the immediate vicinity of the well, the aquifer test induces a more regional (site-wide) stress that, in turn, provides estimates of the bulk hydraulic conductivity of the bedrock. (Freeze, 1979)

! Conducting a transient calibration of the model using the results of the C-1 aquifer test. The closer the predicted stress (in terms of the length of the simulation, number of wells, flow rate, etc.) is to the calibrated stress, the more accurate the predicted response will be. (Konikow, 1992) By calibrating the refined model to accurately simulate the measured response of the C-1 aquifer test, the refined model will be able to more accurately predict the response to slightly different, but similar stresses such as those that would be imposed in operating the proposed remedy.

! Re-evaluating various remedial scenarios using the revised model. Specifically, the simulations should strive to define the optimum number and placement of extraction wells to achieve the containment objective. As discussed above, pumping additional groundwater for the purpose of mass removal should not be a remedial action objective. Due to the effects of matrix diffusion, it is clear that mass removal will not have an appreciable impact on groundwater quality, nor shorten the duration of the operation of the extraction system. Thus, scenarios that involve the installation and pumping of extraction wells for the sole purpose of mass removal should not be considered, and optimal containment should be the objective of the extraction system.

The modeling report recommends (FS, Appendix A at 22) that "the model should be upgraded from 'preliminary' status to 'predictive' status by resolving data gaps and uncertainties and performing additional calibration. . . . As more specific data is obtained for calibration, it should be used for both remedial design and remediation action activities." (USEPA, 1997a) To this end, the ROD should incorporate these recommendations and provide the necessary flexibility in describing the pumping scenarios to allow a refined model to be developed to optimize the various components of the groundwater extraction system, such as the number of extraction wells, the well locations, the well extraction rates, and aggregate extraction rate.

A modified conceptual hydrogeologic model has been prepared by ECKENFELDER INC., as presented in Section A-1 (Appendix A) of this document. In accordance with USEPA guidance (USEPA, 1994a), this model utilizes well groupings based on hydrostratigraphic units defined on the basis of observed stratigraphic conditions and based on response to the packer pump testing. Finally, this model presents a revised set of the potentiometric surface contour maps for the August 29, 1994 measurement date, which, based on the model refinements, represent more accurately the site conditions than the maps presented in the FS.

On page 9, the groundwater modeling report states that the numerical code used in the Feasibility Study (DYNFLOW) is "certified by the International Groundwater Modeling Center (IGWMC)." However, based on personal communication with Ms. Judith Schenk of the IGWMC (September 16,1997), the IGWMC does not "certify" groundwater models. Since DYNFLOW is proprietary to CDM, it is not readily available for independent testing or review. It is inappropriate for the USEPA to allow the use of a proprietary model that cannot be scrutinized by the public, as using such a proprietary model provides no meaningful opportunity for public comment.

Nevertheless, since the DYNFLOW code is not available, ECKENFELDER, INC. has used the USGS finite-difference code MODFLOW to incorporate the various refinements recommended in the preliminary modeling report and described above. As further discussed in Section A-2 (Appendix A), the model consists of 5 layers, each representing an individual hydrostratigraphic layer. The boundary conditions are chosen to reproduce the observed groundwater flow direction and gradient at the site. Calibration is conducted both for steady-state, non-pumping conditions, and under transient conditions to simulate the pumping test at C-1. Calibration statistics are developed using the appropriate well grouping described above and in Section A-2. Last, predictions are made using the refined model to evaluate various containment scenarios.

Using the refined model, two predictions have been made to evaluate groundwater containment. Extraction scenario 1 evaluates the extraction from three (3) on-site wells screened at various depths within the formation. Using these three wells, the model predicts a capture zone similar to CDM's at an estimated flow rate of 25 gpm. This scenario results in capture down to the Lower Bedrock Aquifer. Extraction scenario 2 evaluates the same three wells plus two additional extraction wells located in areas of high contamination in the Upper Bedrock aquitard. Again, this scenario predicts a capture similar to CDM's at an estimated flow rate of 27 gpm. These results are detailed in Section A-3 (Appendix A).

As recited above, the remedy selection process described in the FS and Proposed Plan is based on a "preliminary" model with limited calibration. Because the model relied upon is admittedly "preliminary" and would have to be upgraded to be used for "predictive" purposes, the remedy selection process in the FS and Proposed Plan is based on insufficient and, at times, inaccurate information. At a minimum, the ROD should be written in such a manner to allow for the incorporation of the findings from a refined, calibrated groundwater model.

3.4 The capture zones should be defined by a refined, calibrated groundwater model.

The remedial action objectives set forth in the Proposed Plan seek containment of that portion of the groundwater that is contaminated. The preferred alternative requires groundwater extraction from all groundwater bearing zones up to a saturation depth of approximately 375 feet. The capture zones defined in the FS and Proposed Plan are unnecessarily large to achieve the remedial action objectives, as certain areas within the capture zone are not contaminated. While it is certainly acceptable to provide a buffer zone to ensure adequate capture, no justification is provided in the record for such a large capture zone.

Consequently, the ROD should not specify the extent of the capture zone; instead, the capture zone should only be identified as the contaminated area defined by the RI and any additional investigations conducted as part of remedial design and be determined using a refined, calibrated groundwater model.

3.5 Off-site delineation sampling should be limited to the area downgradient of the Site, as defined by the refined groundwater model.

The Proposed Plan states that additional off-site sampling is required to define the extent of any off-site contamination. As described in Section 3.3 and Appendix A, mapping the groundwater elevations based on stratigraphic position in conformance with USEPA guidance shows groundwater flow to be to the north in each groundwater zone, including the upperzone above the gray shale in which the FS model predicts groundwater flow to the south. The ROD should allow refined groundwater modeling to demonstrate the correct groundwater flow direction and limit the off-site delineation sampling to areas downgradient of the site.

3.6 The final remedy must consider the significant constraints on the groundwater treatment plant discharge.

The Proposed Plan states the preferred groundwater remedial alternative would operate at twice the pumping rate of the Interim Remedy; however the FS and Proposed Plan fail to consider the constraints on the discharge from the groundwater treatment plant. While it is true that the capacity of the groundwater treatment plant is 50 gpm, the existing MCUA permit and the NJDEP surface water discharge permit equivalent are based on a discharge flow rate of 30 gpm. These limitations must be considered, as it is anticipated that it is not feasible to discharge 50 gpm to either discharge point.

The MCUA does not favor groundwater treatment plant discharges in its system. Accordingly, the MCUA presently seeks to have the discharge from the Chemsol site removed from its system. In fact, the Chemsol Facility Coordinator has been advised that the MCUA would not approve any increase in flow to its plant from the Site. (Potter Affidavit)

Further, surface water discharge standards are based on surface water quality criteria. Should the flow to the stream be increased, the discharge standards can be expected to decrease to allow for the increased load to the stream. The plant may be unable to meet these lower standards, particularly for inorganics, such as barium and manganese, which are naturally present in the formation.

The final remedy selection must consider the discharge constraints. At a minimum, the ROD should be written in such a manner that the configuration of extraction wells can be designed to achieve the remedial action objectives while minimizing the volume of water to be discharged so that it may be discharged within the capacity of the existing permits. To achieve this, extraction for mass reduction, in particular, should be eliminated as a remedial action objective. As described in Section 3.1, no significant benefit would be realized by targeting extraction to achieve mass reduction, to the extent it can be achieved at all. The Superfund Administrative Reforms require source removal "only to the degree practicable," not to the degree "possible," as sought in the Proposed Plan's remedial action objectives. (USEPA, 1995) The discharge constraints make any additional pumping targeted for mass reduction impracticable. Further, as described in Section 3.3 and Appendix A, refined modeling demonstrates that the pumping rate need not be twice that of the Interim Remedy to achieve containment. Consequently, the remedial action objectives should be revised to eliminate any reference to mass reduction and to seek containment. At a minimum, the remedial action objectives should be revised to "remove and treat as much contamination as practicable from the fractured bedrock."

3.7 The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis.

The USEPA's requirement to operate the biological treatment plant has no technical basis. The proposed remedy requires that the biological treatment plant be operated if the treatment plant effluent is discharged to surface water. In the first place, the operation of the biological treatment plant would not assist in reaching discharge standards; second, the biological treatment plant cannot be effectively operated based on influent concentrations. Moreover, the current plant discharge passes aquatic toxicity testing, indicating further that the requirement is unnecessary.

Presently, the groundwater treatment plant effluent does not meet surface water discharge limits for only barium, manganese and total dissolved solids (TDS). However, aquatic toxicity testing demonstrates the effluent is not toxic to aquatic life. (See attached results) Operation of the biological treatment plant would not assist in reaching the standards for those criteria currently exceeded. As previously stated, the only surface water discharge standards that are exceeded in The plant effluent are for barium, manganese and TDS; there have been no exceedences for soluble organics.

Moreover, the influent concentrations of soluble organics have decreased significantly. Consequently, to successfully operate the biological treatment plant, a supplemental food source would have to be added to, establish adequate biofilm growth. The cost estimates in the FS do not consider these excess costs. The current treatment plant operating configuration consistently provides equivalent removal of soluble organics as was forecasted for the biological treatment plant. Consequently, the requirement to operate the biological treatment plant should be eliminated from the proposed remedy as it is not necessary to achieve the discharge to surface water standards.

3.8 A refined, calibrated groundwater model should be used to develop any long-term monitoring program.

The ROD should state that the long-term groundwater monitoring program will be based on a refined, calibrated groundwater model. The FS recommends twenty (20) existing monitoring wells be used to conduct an annual groundwater monitoring program. The groundwater samples collected as part of this program would be analyzed for TCL organics and TAL inorganics, while stream samples would be analyzed for TCL organics, TAL inorganics, and conventional water quality parameters. However, as previously discussed, any long-term monitoring program must be based on an accurate understanding of the hydrogeologic system. Consequently, the refined groundwater model should be used to structure any long-term monitoring program, including the number and location of wells to be sampled. Further, it is unnecessary to analyze samples collected for select TCL organics, TAL inorganics and, in the case of stream samples, conventional water quality parameters. These requirements are unnecessary in consideration of the site contaminants and, accordingly, should be eliminated.

4.0 CONCLUSION

On behalf of the Chemsol PRP Group, this document comments on the FS and Proposed Plan for the Chemsol site. The comments are summarized below.

! The remedial action objective to allow for future site use without restriction cannot be achieved by the proposed soil remedy. First, because the proposed remedy would not meet the State's PCB soil cleanup criterion, future Site use would continue to be subject to restrictions. Second, current and anticipated future environmental and physical constraints located on the Site prohibit future Site use without restrictions. Consequently, the remedial action objectives should be revised to delete the "without restrictions" requirement.

! A remedial alternative that complies with the State PCB soil cleanup criterion is expected to result in significantly greater costs and increased risk to human health and the environment. Accordingly, if additional excavation is to be considered to achieve the State criterion, the remedy selection would have to be re-evaluated.

! The selection of the proposed soil remedy is not supported by the administrative record.

  - The Proposed Plan requires disposal of soil as hazardous waste; however, in estimating the cost of the proposed alternative, the FS adopts the conclusion reached in the RI that the soil is nonhazardous. Consequently, the ROD cannot require disposal as a hazardous waste because the associated significantly higher disposal costs would have to be considered prior to such a remedy selection.

  - None of the samples analyzed for hazardous characteristics during the RI are within the areal extent of excavation; thus, the RI's conclusion that the soil is nonhazardous is unsupported. The ROD should state that the soil disposal facility would be determined by soil sampling and classification conducted during the implementation of the remedy.

- Should soil sampling conducted during remedial design indicate a much greater volume of soil requires excavation and disposal to satisfy the remedial action objectives, the remedy must be re-evaluated.

- Stockpiled soil meeting the criteria for backfill or soil cover should not be required to be disposed of, but should be permitted to be used as acceptable backfill or soil cover.

! A selection of soil capping as the remedial alternative is supported by the administrative record.

- USEPA guidance, on which soil cleanup levels are based, recommends capping for sites with contaminant concentrations at the levels present at the Chemsol site. Without explanation, the remedy selection process does not follow these guidance documents. The remedy selection should be re-evaluated to correctly apply these guidance documents. Furthermore, in accordance with the guidance, a soil cap should be selected as the remedy in the ROD.

- The FS grossly overestimates the cost for a soil cap. Consequently, there has not been a valid cost comparison of remedial alternatives, as required by the NCP. The remedy selection must be re-evaluated to consider the significantly lower cost estimate.

! The presence of DNAPL in fractured bedrock at the Chemsol site indicates that aquifer restoration is highly unlikely. Accordingly, an ARAR waiver on the basis of technical impracticability should be granted. Furthermore, because groundwater cannot be restored, extraction for mass reduction provides no protection of human health and the environment beyond that achieved by a containment extraction system. In conformance with the NCP, USEPA guidance, and the FS remedial action objectives, the remedial action objectives should be revised to seek hydraulic containment, and references to restoration and mass reduction should be eliminated.

! Because a "preliminary" groundwater model is used as the basis for remedy selection, the proposed groundwater remedy is evaluated based on incomplete and, at times, inaccurate information. As a consequence of the limited calibration and data gaps, the preliminary model misinterprets key model parameters, resulting in an unsupported remedy selection. The ROD should be written in such a manner to allow for the incorporation of the findings from a refined, calibrated groundwater model into the design of the extraction system, the determination of adequate capture zones, the structure of a long-term monitoring program, and the scope of the off-site delineation.

! The final remedy must consider the critical limitations on effluent discharge. In particular, the current discharge permits are based on a discharge flow rate of 30 gpm, and it is anticipated that it would be infeasible to discharge in excess of these limits. At a minimum, the ROD should be written in such a manner that the configuration of the extraction system can be designed to discharge the effluent within the capacity of the existing permits. To achieve this, extraction for mass reduction, in particular, should be eliminated as a remedial objective as it would provide no additional protection of human health and the environment beyond that achieved by containment.

! The requirement to operate the biological treatment plant if the groundwater treatment plant discharges to surface water has no technical basis. The operation of the biological treatment plant would not assist in reaching discharge standards. Also, the biological treatment plant cannot be effectively operated based on influent concentrations. Accordingly, the requirement should be eliminated from the proposed remedy.

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APPENDIX A
EVALUATION OF GROUNDWATER
EXTRACTION ALTERNATIVES
CHEMSOL, INC. SITE
PISCATAWAY, NEW JERSEY

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October 1997

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A1.0 INTRODUCTION

A numerical groundwater flow model was constructed for the Chemsol Inc. Superfund Site both as an interpretative tool and as a tool to evaluate potential groundwater extraction remedies. The interpretative modeling process produced a calibrated base case simulation of existing hydrogeologic conditions, which was then used to evaluate potential remedial scenarios for the Site. The model was used to establish the locations and pumping rates of potential groundwater extraction remedies.

The body of information used to develop the groundwater model was derived from a site-wide Remedial Investigation (RI) which was conducted for Operable Unit I of the Chemsol Inc. property located in Piscataway Township, New Jersey. The field investigation portion of the RI was conducted from October 1992 through November 1994 by CDM Federal Programs Corporation for the U.S. Environmental Protection Agency. The results of the RI were reported in a document titled "Remedial Investigation Report, Chemsol Inc. Superfund Site" (hereinafter referred to as the RI report), dated October 1996.

The RI has been reviewed by ECKENFELDER INC. on behalf of the Chemsol Site PRP Group. The results of this review have been used to support this groundwater modeling effort. ECKENFELDER INC. has performed further analysis of the hydrogeologic data beyond that presented in the RI. This includes a quantitative analysis of pump test data obtained during the RI and previous investigations (See Attachments A and B) and a re-interpretation of the conceptual hydrogeologic model for the site (Section A2.0). The re-interpretation of the conceptual hydrogeologic model serves as the bases for the numerical model presented Section A3.0.

A2.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL

The hydrostratigraphic setting beneath the Chemsol Superfund site is complex, being characterized by a dipping, multi-layered bedrock system. Numerous monitoring wells have been installed at various depths during previous investigations in an effort to evaluate the hydrogeologic and water quality conditions.

A review of the existing hydrogeologic data for the site has been conducted by ECKENFELDER INC. to develop a refined conceptual model of the groundwater flow regime. This conceptual model represents a fundamental departure from that described by CDM in the RI report in that it groups the wells for mapping purposes on the basis of stratigraphic position rather than on the basis of depth (Table A2-1). The current conceptual model was developed based on an analysis of the data from the RI report (CDM, 1996) and further review of previous site investigation data by both McLaren/Hart and AGES Corporation. A quantitative analysis of available pump test data is presented in Attachment A.

The site is conceptually subdivided into six units that have been identified on the basis of site stratigraphy and the observed aquifer response to the various pump tests that have been performed at the site.

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)
- Principal Aquifer
- Deep Bedrock Unit

TABLE A2-1

WELL GROUPINGS BY HYDROSTRATIGRAPHIC UNIT
Chemsol Inc. Superfund Site

Overburden Water-Bearing Zone

OW-1	OW-10	OW-12	OW-14
OW-2	OW-11	OW-13	OW-15
OW-4			

Upper Bedrock Aquitard

TW-1	TW-3	TW-5A	TW-11
TW-2	TW-4	TW-10	TW-12

Upper Permeable Aquifer

C-6	C-8	C-10
C-7	C-9	

Principal Aquifer

Upper Zone

TW-6	TW-13	C-1	DWM-9
TW-7	TW-14	C-3	DMW-10
TW-8	TW-15	C-4	
TW-9		C-5	

Lower Zone

DMW-1	DMW-5	DMW-7	C-2
DMW-3	DMW-6	DMW-11	MW-103

Deep Bedrock Unit

DMW-2	DMW-4	MW-101	MW-104
DMW-3	DMW-8	MW-102	

The hydrostratigraphic units are depicted in the generalized cross section presented on Figure A2-1. Figure A2-1 also depicts the spatial relationship between well screen depth and hydrostratigraphic units. Conceptual geologic cross sections are presented on Figures A2-2 and A2-3.

Based on the well grouping presented in Table A2-1, generalized plan-view potentiometric maps (Figures A2-4 through A2-7) have been prepared that depict static pre-pumping conditions using data obtained on August 29, 1994 (Table A2-2). These include maps for the hydrostratigraphic zones in which horizontal flow predominates including the Overburden zone, Upper Permeable aquifer, and the upper and lower portions of the Principal Aquifer.

The hydrostratigraphic units are described briefly, as follows:

- Overburden Water-Bearing Zone - represents the uppermost water-bearing unit at the site. This zone is contained within the composite unit represented by the thin overburden soils and the upper veneer of highly weathered bedrock. Groundwater within this unit flows laterally toward the northeast (Figure A2-4), generally in response to ground surface topography. The overburden zone is likely to be in hydraulic communication with the small ditches and streams, which flow toward the northeast across the site.

- Upper Bedrock Aquitard - is represented by the bedrock below the overburden zone that is characterized by relatively low hydraulic conductivity. The upper portion of this unit represents weathered bedrock within which the joints and fractures are filled with silt or clay serving to reduce the hydraulic conductivity. As a result, considerable vertical head loss is observed within this unit downward to the underlying Upper Permeable Aquifer. For example, the vertical head difference between well TW-10 screened in the upper portion of this unit with well C-7 screened in the underlying Upper Permeable Aquifer is over 4 feet. The vertical hydraulic conductivity of this unit has been estimated to range from 1.1 x 10 -4 to 6.4 x 10 -5 cm/sec on the basis of a Neuman-Witherspoon analysis of aquifer test data, described in Attachment A. This is over two orders of magnitiude less than the hydraulic conductivity of the underlying Upper Permeable Aquifer. This high permeability contrast results in a predominantly vertical hydraulic gradient within the Upper Bedrock formation.

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<IMG SRC 98141D8>
<IMG SRC 98141D9>
<IMG SRC 98141E>
<IMG SRC 98141E1>
<IMG SRC 98141E2>

TABLE A2-2

GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY

Well	Reference Elevation (ft., msl)	Zone (b.)	Ground Elevation (ft., msl)	Coordinates (c.) Northing	Easting	29-Aug-94 DTW (ft.)	Elev. (ft., msl)
C-1	79.83	3/4	77.60	629,997	2,062,281	--	58.50
C-2	86.24	5	--	629,865	2,061,790	--	58.36
C-3	80.52	4	78.40	629,642	2,062,565	--	58.39
C-4	80.96	4	79.00	629,636	2,062,307	--	58.20
C-5	80.10	4	78.00	629,815	2,062,297	--	58.37
C-6	76.12	3	--	630,574	2,062,609	--	59.21
C-7	80.20	3	--	630,534	2,061,803	--	59.10
C-8	81.40	3	--	630,140	2,061,554	--	59.32
C-9	85.33	3	--	629,925	2,061,589	--	59.41
C-10	80.71	3	--	630,292	2,061,975	--	59.11
DMW-1	85.40	5	82.90	629,867	2,062,117	--	58.36
DMW-2	85.07	6	83.40	629,670	2,062,085	--	57.86
DMW-3	80.49	6	78.70	629,656	2,062,566	--	58.36
DMW-4	80.44	6	78.60	629,660	2,062,532	--	57.86
DMW-5	78.89	5	77.10	630,166	2,062,022	--	58.28
DMW-6	79.23	5	77.70	630,138	2,062,030	--	58.21
DMW-7	76.62	5	75.60	630,132	2,062,439	--	58.32
DMW-8	77.77	6	76.00	630,121	2,062,428	--	57.85
DMW-9	76.35	4	--	630,578	2,062,618	--	58.18
DMW-10	79.58	4	--	630,540	2,061,816	--	58.42
DMW-11	85.04	5	--	629,918	2,061,792	--	58.31
MW-101	79.80	6	77.40	629,995	2,062,253	--	58.02
MW-102	78.69	6	77.50	629,863	2,062,471	--	57.81
MW-103	81.09	5	80.00	630,144	2,061,572	--	58.30
MW-104	88.58	6	89.00	628,957	2,062,510	--	58.42
OW-1	78.37	1	76.20	630,036	2,062,275	--	73.57
OW-2	81.64	1	79.70	629,898	2,062,206	--	78.04
OW-4	79.96	1	77.60	629,921	2,062,332	--	75.61
OW-10	79.06	1	78.30	629,660	2,062,549	--	76.83
OW-11	75.08	1	74.70	630,592	2,062,609	--	69.34
OW-12	84.65	1	--	629,888	2,061,897	--	79.61
OW-13	82.96	1	--	629,988	2,061,673	--	78.17
OW-14	92.14	1	--	629,643	2,061,657	--	83.99
OW-15	75.08	1	73.00	630,390	2,062,545	NM	NM
PZ 1	76.62	1	74.90	630,157	2,062,437	NM	NM
PZ 1D	77.05	1	--	630,172	2,062,437	NM	NM
PZ 2	76.45	1	74.50	630,051	2,062,474	NM	NM
PZ 2D	75.94	1	--	630,066	2,062,475	NM	NM
PZ 3	78.65	1	74.30	629,919	2,062,438	NM	NM
PZ 4	78.03	1	76.00	630,280	2,062,084	NM	NM
PZ 4D	78.25	1	--	630,289	2,062,090	NM	NM
PZ 5	76.68	1	74.90	630,250	2,062,208	NM	NM
PZ 5D	76.86	1	--	630,251	2,062,193	NM	NM

TABLE A2-2

GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY

Well	Reference Elevation (ft.,msl)	Zone (b.)	Ground Elevation (ft., msl)	Coordinates (c.) Northing	Easting	29-Aug-94 DTW (ft.)	Elev. (ft., msl)
PZ 6	76.15	1	74.20	630,227	2,062,373	NM	NM
PZ 6D	76.14	1	--	630,227	2,062,389	NM	NM
PZ 7	75.71	1	73.80	630,229	2,062,459	NM	NM
PZ 8	77.57	1	75.70	629,971	2,062,477	NM	NM
PZ 8D	77.51	1	--	629,986	2,062,477	NM	NM
PZ 9D	75.98	1	--	630,295	2,062,410	NM	NM
PZ 10D	79.08	1	--	630,086	2,062,273	NM	NM
SG@PZ 4	71.67	1	--	630,267	2,062,067	NM	NM
SG@PZ 8	73.95	1	--	629,983	2,062,495	NM	NM
TW-1	90.15	2	89.10	629,638	2,061,637	--	59.56
TW-2	85.81	2	84.20	629,900	2,061,591	--	59.98
TW-3	81.59	2	79.60	630,160	2,061,538	--	59.56
TW-4	78.31	2	76.60	630,218	2,062,010	--	59.37
TW-5	76.24	2	74.30	630,175	2,062,475	--	62.98
TW-5A	75.98	2	74.30	630,166	2,062,470	--	62.28
TW-6	78.88	4	76.70	629,894	2,062,490	--	58.76
TW-7	80.16	4	78.10	629,655	2,062,399	--	61.46
TW-8	85.11	4	83.30	629,647	2,062,102	--	59.15
TW-9	80.29	4	78.60	629,662	2,062,557	--	58.17
TW-10	79.96	2	78.50	630,549	2,061,809	--	63.45
TW-11	75.76	2	75.00	630,594	2,062,620	--	67.21
TW-12	75.73	2	73.60	630,594	2,063,195	--	65.27
TW-13	78.17	4	76.30	630,092	2,063,250	--	59.76
TW-14	89.23	4	88.60	629,332	2,061,661	--	62.01
TW-15	82.90	4	82.20	629,380	2,062,367	--	62.15

Notes:

a. Abbreviations are as follows:
"NE" - no entry to well
"NM" - not measured

b. Wells are screened in the following zones:
1. Overburden Water-Bearing zone
2. Upper Bedrock Aquitard
3. Upper Permeable Aquifer
4. Upper of portion of Principal Aquifer
5. Lower of portion of Principal Aquifer
6. Deep Bedrock Zone

c. Northings & Eastings were obtained from surveyors coordinates, except for "PZ" wells which were obtained from a map by McLaren/Hart.

d. Elevations for PZ wells with D suffix were derived from McLaren/Hart database.

e. Reference elevation for Staff Gauges PZ-4 and PZ-8 are for the 0 ft. mark. DTW reading is above the 0 mark.

- Upper Permeable Aquifer - is a highly fractured bedrock zone of relatively high hydraulic conductivity that lies immediately above the upper gray shale. The presence of this unit was initially revealed in boreholes drilled during the RI. These data indicate that this zone ranges from 15 feet to 40 feet thick.

The transmissivity of the Upper Permeable aquifer has been estimated to be approximately 12,650 gpd/ft on the basis of aquifer testing described in Attachment A. Groundwater flow within this unit is predominantly horizontal with a relatively flat hydraulic gradient to the northeast, as shown on Figure A2-5.

- Upper Gray Shale (Aquitard) - Analysis of aquifer test data indicate that the Upper Gray shale provides hydraulic separation between the Upper Permeable Aquifer and the Principal Aquifer. This separation is also observed in the vertical head losses observed between the two aquifers across the Upper Gray shale.

- Principal Aquifer - is comprised of the bedrock zone between the upper and deep gray shale beds with a thickness of approximately 180 feet. The transmissivity of this unit has been shown to be typically on the order of 12,700 gpd/ft with a storativity of approximately 2×10^{-4}, as described in Attachment A.

Slight downward gradients are observed within the Principal aquifer, based on a comparison of wells screened in its upper and lower portions. To evaluate the horizontal components of flow, this unit has been subdivided into an upper and lower portion for mapping purposes, based on the vertical heterogeneity observed during the quantitative analysis (Attachment A). Wells screened in the contiguous upper and deep gray shale units have been observed to be in sufficient hydraulic communication with the Principal aquifer that they have been included in the potentiometric mapping of this unit. Potentiometric maps for the upper and lower portions of this unit (Figures A2-6 and A2-7, respectively) reveal a northerly direction of groundwater flow.

- Deep Bedrock Unit - includes the bedrock below the deep gray shale. The deep gray shale provides some hydraulic separation between the Principal aquifer and the deep bedrock, determined on the basis of aquifer testing. Insufficient data are available in this unit to determine the horizontal direction of flow.

A3.0 GROUNDWATER FLOW MODEL

A numerical groundwater flow model was constructed for the Chemsol Inc. Site both as an interpretative tool and an evaluation tool for design of the final groundwater remedy. The interpretative modeling process produced a calibrated base case simulation of existing hydrogeologic conditions, which was then used to evaluate potential remedial scenarios for the Site. The model was used to evaluate the capture zones produced by various combinations of extraction well locations and pumping rates.

A3.1 GROUNDWATER MODEL SETUP

The modular, three-dimensional, finite difference groundwater flow model code, typically referred to as MODFLOW, was used for this project. The original code was developed by the U.S. Geological Survey (McDonald and Harbaugh, 1988); however, a slightly modified version of the code marketed by Boss International Inc. was used for this Site. This version is designed to interact with the Groundwater Modeling System (GMS), a pre- and post-processor developed by Boss International Inc.

As presented in Section A2.0, the hydrostratigraphic setting beneath the Chemsol Superfund site is complex being characterized by a dipping, multi-layered bedrock system. Based on the quantitative analysis (Attachment A) and the stratigraphic regrouping of monitoring wells, the site has been conceptually subdivided into six hydrostratigraphic units. The units are as follows:

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)

- Principal Aquifer
- Lower Gray Shale (Aquitard)
- Deep Bedrock Unit

Each of these hydrostratigraphic units dips to the north-northwest and subsequently sub-crop on, or within the vicinity of, the site (see Figures A2-2 and A2-3). The regional model grid used in this analysis is superimposed over the project area on Figure A3-1. The grid is centered around the site and consists of 43 rows and 87 columns. The model grid is bounded to the north by Bound Brook and extends approximately 7,770 feet southwest, and 5,220 feet northeast from the Chemsol Inc. Site. The grid was limited in extent in the southwest and northeast directions due to the lack of geologic information available off site. The grid extends to the southeast, corresponding to the sub-crop of the associated hydrostratigraphic units. The dimensions of individual cells range from 10 feet by 10 feet at extraction well C-1 within the central portion of the project area, to 810 feet by 720 feet near the perimeter of the grid. The finer grid spacing was selected to provide a more refined depiction of conditions at and near the Site, whereas larger cells were used beyond the project area which is not likely to be influenced by the proposed remedial activities and where little field data exists for comparison. The grid has been oriented to the north-northwest so that the X-axis of the grid parallels the sub-crops of the primary hydrostratigraphic units.

Vertically, the grid consists of five layers:

Layer 1 - Upper Bedrock Aquitard
Layer 2 - Upper Permeable Aquifer
Layer 3 - Upper Principal Aquifer
Layer 4 - Lower Principal Aquifer
Layer 5 - Lower Bedrock Aquifer

Setup of dipping layers within MODFLOW can be accomplished by representing the dipping hydrostratigraphic units as horizontal grid layers (Anderson, 1991). The vertical grid configuration used to represent the hydrostratigraphic units is presented on Figure A3-2. the stair-step grid configuration represents the hydrostratigraphic sub-crops. Areal recharge is applied to the upper most active layer within the model. That is, recharge will be applied to the entire surface of layer 1, and only to exposed portions of the grid for Layers 2, 3, 4, and 5, representing recharge to the sub-crop areas. The Shallow Gray Marker Unit and the Deep Gray Marker Unit are represented as leakance terms. The Overburden Water-Bearing Zone was not represented in the model due to its limited vertical extent.

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Layer 1 simulates groundwater flow within the Upper Aquitard which overlies the primary water bearing units. Although layer thickness is not entered into the model directly, transmissivity was used to represent the pinching oout of Layer 1 on site.

Layer 2 represents groundwater flow within the Upper Permeable aquifer. The thickness of the Upper Permeable aquifer was estimated to range from a pinch-out to approximately 40 feet.

Layer 3 represents groundwater flow within the Upper Principal Aquifer. The thickness of this unit was estimated to range from a pinch-out to approximately 91 feet. Layer 4 represents the Lower Principal Aquifer. The thickness of Layer 4 was assumed to be the same as Layer 3. This division of the Principal aquifer is based on the observed head differences between the top and bottom of the unit and the vertical heterogeneity observed within the unit as part of the quantitative analysis (see Attachment A).

Layer 5 represents groundwater flow within the Lower Bedrock Aquifer. Although little information is available for this unit, its thickness was assumed be approximately 150 feet.

A3.2 MODEL BOUNDARY CONDITIONS

Based on the observed groundwater flow directions on-site (generally to the north-northeast) Bound Brook is considered to be the natural hydraulic boundary for model Layer 1 through Layer 5 and has been simulated using "river" cells. An approximate elevation of the surface water (specified head) in these cells was obtained from the USGS topographic map.

The southwest and northeast model perimeter is simulated using "general head" boundary (GHB) cells. These boundary cells simulate the extension of the aquifer beyond the model boundary by allowing water to enter or exit the model domain as a function of the local gradient, transmissivity, and cell dimensions. The specific head values used were estimated by projection of groundwater elevation data collected from the Site on April 29, 1994 and by the elevation Bound Brook.

The southeastern perimeter of the model domain represents the pinch-out associated with the sub-crops of the water-bearing units. Consistent with a pinch-out, the southeastern perimeter is represented as a no-flow boundary.

A3.3 AREAL RECHARGE

CDM Federal Programs Corporation (March 1996) completed a water budget for the area associated with Chemsol Inc. Site. The results of the water budget suggest that area recharge is likely to range between 4 and 7.5 inches pre-year. However, since the current model configuration does not include the Overburden Water-Bearing Zone. The "effective' recharge to the bedrock units will be considerably less than the estimated 4 to 7.5 inches per year.

A3.4 EXTERNAL INFLUENCES

A well record survey was conducted in the area surrounding the Chemsol Site to identify potential discharges that may be influencing groundwater conditions associated with the site. Searches for high capacity wells (greater than 100,000 gpd) and lower capacity wells have been completed. The results of this well record survey are presented in Attachment C and indicate 12 high capacity wells are located within 1 to 2 miles of the site. A review of the screened intervals and relative position to the site, as related to our understanding of the area hydrogeology, indicates that their influence on the site would likely be small. Additionally, all identified well locations fell out-side of the model domain. Numerous low capacity wells were also identified (see Attachment C). The closest well to the site that would likely have an impact was the "car wash" well. However, information provided by Piscataway Township indicates that this well is not currently in operation.

A3.5 MODEL CALIBRATION

For this report, the term calibration refers to the standard approach (Anderson, 1991) of matching measured heads to model heads at steady-state conditions and adjusting input parameters within reasonable limits until an acceptable match is achieved. However, this process alone may not result in a unique set of parameters because different combinations of parameters may produce an equally good match with measured heads. The steady-state calibration process, therefore, was supplemented by the simulation of a measured hydraulic response to a known stress (aquifer test data). Data were collected from an aquifer test conducted McLaren/Hart in 1993 and used in the transient calibration.

The first step in the calibration process is the selection of initial input parameters. The values used for the initial run were obtained from the results of the RI and quantitative analysis (see Attachment A) and are summarized below.

! Layer 1 (Upper Bedrock Aquitard) was simulated as a MODFLOW aquifer type 3 (confined). A Neuman-Witherspoon analysis was completed of this unit. The results of this analysis indicated that the vertical hydraulic conductivity ranges from 0.18 ft/day to 0.31 ft/day. The horizontal hydraulic conductivity is estimated to be 1 ft/day to 4 ft/day, assuming that the horizontal hydraulic conductivity. For the initial run, a hydraulic conductivity of 2.5 ft/day was used. These values of hydraulic conductivity are consistent with the conceptual view that this unit is an aquitard.

! Layer 2 (Upper Permeable Aquifer) was simulated as a MODFLOW aquifer type 3 (unconfined/confined). Two-packer tests were completed in this unit resulting in a transmissivity of 1,644 ft/day and 1,737 ft/day. A hydraulic conductivity of 1,690 ft/day was used in the initial run.

- Layer 3 (Upper Principal Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). As presented in the quantitative analysis (see Attachment A) transmissivity was found to range from 668 ft/day to 3,877 ft/day. The transmissivity of this unit has been shown to be typically on the order of 1,700 ft/day with a storativity of approximately 2 x 10 -4. The vertical hydraulic conductivity was estimated to be 0.99 ft/day. These parameter values were used in the initial run.

- Layer 4 (Lower Principal Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). The initial aquifer characteristics and parameters are consistent with that estimated for Layer 3 (Upper Principal Aquifer).

- Layer 5 (Lower Bedrock Aquifer) was simulated as a MODFLOW aquifer type 3 (confined). The aquifer characteristics and parameters are consistent with that estimated for Layer 3 (Upper Principal Aquifer). As a result, a transmissivity value of 1,425 ft/day was used in the initial run.

- As discussed in Section A3.3, the "effective" aeral recharge is expected to be less than the 4 to 7.5 inches per year estimated in the water budget. Based on previous experience, an initial estimate of 4 inches per year was chosen to begin the model calibration process. Areal recharge rate at the various sub-crop areas is likely to be greater than that associated with the lower permeability, Upper Aquitard. Therefore, aeral recharge associated with the Upper Aquitard was considered approximately 50 percent less than that of the aquifer sub-crops.

- The quantitative analysis (see Attachment A) indicated that the Upper Gray Shale and the Deep Gray Shale provided hydraulic separation between the associated aquifers. Therefore, these aquitards are represented in the model as leakance terms. Since quantitative estimates of leakance are not available from the field data, an initial leakance value of 0.0001/day was selected to begin the model calibration process based on experience.

Once the initial input parameters were selected, the initial base case simulations were conducted and results were evaluated using a head residual analysis. A head residual is the difference between the measured head in a well and the model-predicted head in the cell that represents the location and depth of the well. Positive residuals indicate the predicted head is lower than the measured value, whereas negative residuals indicate the predicted head is higher than the measured value. The sum of the residuals is an indicator of an overall bias (heads generally too high or too low) in the prediction. If, for example, the predicted heads were quite close to the measured heads but most were slightly higher, this term would be elevated in the negative direction. The average of the absolute residuals is an indicator of the accuracy of the match and, as a general rule, should be less than 10 percent of the steady-state head change across the project area. Depending on the layer, head changes across the site range from 12 feet in the Overburden to less than 0.2 feet in the Lower Principal Aquifer. A target residual of 0.5 feet was selected for this site as it represents a head change in the middle of this range (5 feet) and is consistent with the head change of the Upper Principal Aquifer.

During the steady-state calibration process, the various input parameters were adjusted within reasonable limits and the results noted. This process was continued until an acceptable match (as defined above) was made with head values measured on April 29, 1994. Table A3-1 presents the results of the calibration simulation. Of the 28 measured values, the sum of all residuals is -4.89 feet and the average of the absolute residuals is 0.47 feet which meets the 10 percent guideline defined previously.

The simulation using the calibrated, steady-state base case model parameters was further evaluated by comparing the computed head configuration with the contoured groundwater elevation data collected on April 29, 1994. The comparisons for the model heads versus measured heads for the Upper Permeable Aquifer, the Upper Principal Aquifer and the Lower Principal Aquifer are provided on Figures A3-3, A3-4, and A3-5, respectively. Considering the uncertainty associated with fractured bedrock flow systems, the comparisons of measured head contours to modeled head contours indicate a reasonable match to field conditions.

An additional observation, with respect to groundwater elevation data, relates to the additional potentiometric surface map developed from groundwater elevation data collected in April 1997. This potentiometric surface represents groundwater conditions within the Upper Principal Aquifer following approximately two years of pumping C-1 at approximately 22 gpm. As shown on Figure A3-6, the general configuration of the observed head distribution was reproduced by the calibrated model.

To further test the calibrated model, a transient calibration was conducted using aquifer test data collected by McLaren/Hart in 1993. McLaren/Hart conducted an aquifer test by pumping C-1 at approximately 22.5 gpm for 72 hours. The transient calibration was completed by comparing measured drawdown to modeled drawdown. Figures A3-7 through A3-10 present the comparison of measured versus modeled drawdown for the available data from the Principal Aquifer. These plots illustrate that the predicted drawdown tracks close to the observed drawdown in each of the observation wells.

The calibrated model parameters are presented on Table A3-2.

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TABLE A3-1
CHEMSOL INC. SITE GROUNDWATER MODEL
CALIBRATION STATISTICS

Well ID	Measured Head (ft.)	Modeled Head (ft.)	Residual (ft.)
Upper Bedrock Aquitard			
TW-3	59.56	59.14	0.42
TW-4	59.37	59.06	0.31
TW-2	59.98	59.28	0.7
Upper Permeable Aquifer			
C-7	59.1	58.78	0.32
C-8	59.32	59.01	0.31
C-10	59.11	58.9	0.21
C-6	59.21	58.71	0.5
C-9	59.41	59.12	0.29
Upper Principal Aquifer			
DMW-10	58.42	58.53	-0.11
DMW-9	58.18	58.43	-0.25
C-1	58.5	58.74	-0.24
C-5	58.37	58.84	-0.47
TW-6	58.76	58.78	-0.02
TW-8	59.15	58.93	0.22
C-4	58.2	58.92	-0.72
TW-13	59.76	58.59	1.17
C-3	58.39	58.88	-0.49
Lower Principal Aquifer			
MW-103	58.3	58.7	-0.4
DMW-5	58.28	58.67	-0.39
DMW-6	58.21	58.69	-0.48
DMW-7	58.32	58.77	-0.45
DMW-1	58.36	58.91	-0.55
Lower Bedrock Aquifer			
DMW-8	57.82	58.62	-0.8
MW-101	58.02	58.69	-0.67
DMW-2	57.83	58.85	-1.02
MW-102	57.81	58.72	-0.91
DMW-4	57.86	58.8	-0.94
DMW-3	58.36	58.79	-0.43
		Average of Absolute Residual =	0.477
		Sum of Residual =	-4.89

A3.6 MODEL SENSITIVITY ANALYSIS

A sensitivity analysis was performed to identify the relative importance of the various parameters and to evaluate the degree to which the base case represents a unique solution. The analysis was performed by changing the value of one input parameter at a time and comparing the results (head residuals) to the base case simulation. The sum of the residuals and the average absolute residual were calculated for each sensitivity run and compared to the corresponding values for the base case simulation. To provide a standard point of comparison, each input parameter value was increased (and decreased) until a change of at least 10 percent of the average absolute residual was observed.

The input parameters that were evaluated are shown in the first column of Table A3-3. The "factor" represents the direction and magnitude of the change from the base case value. The results indicate that the least sensitive parameters are the leakance values between the layers. For these parameters, changes of at least an order of magnitude were required to alter the base case match by 10 percent. The most sensitive parameters were the transmissivity of the Upper Principal Aquifer and effective recharge. Altering the base case value of transmissivity by a factor of less than 2x achieved the 10 percent criterion for change. (Although an increase in the transmissivity indicates a slightly better match than the base case values, these higher values did not produce an acceptable match with the drawdown data when used to simulate the aquifer test.) These results are generally consistent with our conceptual model in that the most permeable unit typically controls the elevation of water levels and thus the direction of groundwater flow.

TABLE A3-2
CALIBRATION PARAMETER
CHEMSOL GROUNDWATER MODEL

Water-bearing Zone	Model Layer	Model Parameter	Value
Upper Aquitard	Layer 1	Hydraulic Conductivity	2.5 ft/day
Upper Permeabel Aquifer	Layer 2	Transmissivity	878 ft 2/day
Upper Principal Aquifer	Layer 3	Transmissivity	849 ft 2/day
Lower Principal Aquifer	Layer 4	Transmissivity	849 ft 2/day
Lower Bedrock Aquifer	Layer 5	Transmissivity	1710 ft 2/day
Upper Bedrock Aquitard	Layer 1/Layer 2	Leakance	1.0 e -3/day
Upper Gray Marker Unit	Layer 2/Layer 3	Leakance	1.4 e -5/day
Lower Gray Marker Unit	Layer 4/Layer 5	Leakance	6.5 e -4/day
		Recharge	0.7/2 in/year a

a - Indicates Arial recharge and recharge over the subcrop areas.

TABLE A3-3
SENSITIVITY ANALYSIS
CHEMSOL GROUNDWATER MODEL

Water-bearing Zone	Model Parameter	Base Case Value Factor	Sensitivity Value Factor	Sensitivity Analysis Average Absolute Residual (ft)	Sensitivity Analysis Sum of Residual (ft)	Average Absolute Residual (ft)	Sum of Residual (ft)
Upper Aquitard	Hydraulic Conductivity Layer 1	2.5 ft/day	12.5 ft/day x5	1.09	15.97	0.47	-4.89
Upper Aquitard	Hydraulic Conductivity Layer 1	2.5 ft/day	0.5 ft/day /5	0.64	-15.32	0.47	-4.89
Upper Permeabel Aquifer	Transmissivity Layer 2	878 ft 2/day	1756 ft 2/day x2	0.75	3.61	0.47	-4.89
Upper Permeable Aquifer	Transmissivity Layer 2	878 ft 2/day	220 ft 2/day /4	0.72	-17.69	0.47	-4.89
Upper Principal Aquifer	Transmissivity Layer 3	849 ft 2/day	1953 ft 2/day x2	0.36	0.92	0.47	-4.89
Upper Principal Aquifer	Transmissivity Layer 3	849 ft 2/day	340 ft 2/day /2	0.59	-9.89	0.47	-4.89
Lower Principal Aquifer	Transmissivity Layer 4	849 ft 2/day	1953 ft 2/day x2	0.35	1.29	0.47	-4.89
Lower Principal Aquifer	Transmissivity Layer 4	849 ft 2/day	340 ft 2/day /2.5	0.61	-10.37	0.47	-4.89
Lower Bedrock Aquifer	Transmissivity Layer 5	1710 ft 2/day	8550 ft 2/day x5	0.37	9.39	0.47	-4.89
Lower Bedrock Aquifer	Transmissivity Layer 5	1710 ft 2/day	342 ft 2/day /5	1.12	-27.85	0.47	-4.89
Upper Aquitard	Leakance Layer 1/2	1.0 e -3/day	1.0 e -2 /day x10	0.53	-3.29	0.47	-4.89
Upper Aquitard	Leakance Layer 1/2	1.0 e -3/day	1.0 e -4 /day /10	0.56	-12.92	0.47	-4.89
Upper Gray Marker Unit	Leakance Layer 2/3	1.4 e -5/day	1.0 e -4 /day x10	0.48	-0.76	0.47	-4.89
Upper Gray Marker Unit	Leakance Layer 2/3	1.4 e -5/day	1.0 e -6 /day /10	0.52	-6.27	0.47	-4.89
Lower Gray Marker Unit	Leakance Layer 4/5	6.5 e -4/day	6.5 e -3 /day x10	0.49	-5.76	0.47	-4.89
Lower Gray Marker Unit	Leakance Layer 4/5	6.5 e -4/day	6.5 e -5 /day /10	0.48	-6.67	0.47	-4.89
	Recharge	0.7/2 in/year a	2/5 in/yeaar x2.5	3.89	-108.91	0.47	-4.89
	Recharge	0.7/2 in/year	.4/1 in/year /2	0.89	23.74	0.47	-4.89

a - Indicates Areal recharge and recharge over the subcrop areas.

Recharge was also a sensitive parameter in that a change of approximately 30 percent met the sensitivity criterion of 10 percent of the average absolute residual. This suggests that heads within the bedrock will respond quickly to precipitation events, but that the effects will be relatively short lived.

A4.0 CAPTURE ZONE SIMULATIONS

The development and calibration of the groundwater flow model for the Site not only provides a tool to predict the impact of future events, but also supports and ties together the conclusions derived from the quantitative hydrogeologic analysis (see Attachment A). Based on the model calibration and sensitivity analysis described in Sections A3.4 and A3.5, the calibrated base case groundwater flow model developed for the Chemsol Inc. Site provides a reasonable representation of the existing hydrogeologic conditions. In this section, the calibrated model is used to develop and evaluate extraction simulations for the groundwater remedy.

A4.1 EXTRACTION SCENARIOS

Extraction of groundwater and treatment has been selected by USEPA as the remedy for the Site. Some of the objectives of this remedy are to:

- Prevent/minimize off-site migration of groundwater contamination in the fractured bedrock aquifer.

- Contain the contaminated groundwater (that which is above Federal and State MCLs) from all depth zones and, as an element of this containment, reduce the mass of contaminants to the maximum extent possible.

- Augment the existing interim remedy, as necessary, in order to achieve these goals.

To design an extraction system to satisfy these objectives, the groundwater flow model was used to predict the effects of pumping from the bedrock aquifer system. A number of simulations were completed as part of this process. Based on this evaluation two scenarios are presented. In Scenario 1 the objective was to optimize the location and pumping rate of extraction wells to achieve the containment criteria. In Scenario 2, the objective was to locate extraction wells that would achieve the containment criteria and pump from the portions of the site that have historically shown elevated levels of groundwater contamination. A detailed discussion of these scenarios follows:

EXTRACTION SCENARIO 1

Extraction Scenario 1 provides a scenario in which containment is achieved within the contaminated portion of the site. This scenario includes the existing interim remedy extraction well C-1 pumping at 15 gpm and the addition of extraction wells EX-1 (Upper Permeable Aquifer) and EX-2 (Lower Bedrock Aquifer) pumping at 5 gpm each. The total extraction rate of this scenario is estimated to be 25 gpm. A particle tracking routine (MODPATH) was used to demonstrate capture within the individual aquifers. To simplify the particle tracking plots, the outline of the capture zone has been presented. Capture with the Principal Aquifer is presented on Figure A4-1. The capture zone developed is as result of pumping C-1 at a rate of 15 gpm. As shown, the developed capture zone encompasses the estimated area of groundwater contamination with in the principal aquifer.

Figure A4-2 shows the capture zone developed by pumping Extraction well EX-1 at 5 gpm within the Upper Permeable Aquifer. This scenario demonstrates that a low extraction rate within the Upper Permeable Aquifer can effectively capture the contaminated groundwater associated with this zone.

Figure A4-3 shows the capture zone developed by pumping Extraction well EX-2 at 5 gpm within the Lower Bedrock Aquifer. Although the extent of contamination is not well defined within the Lower Aquifer, the capture zone developed by extraction well EX-2, captures an area which is believed to encompass the potentially impacted area.

EXTRACTION SCENARIO 2

Extraction Scenario 2 provides a scenario in which containment objective is achieved and mass removal is enhanced within the Upper Bedrock Aquitard. This scenario includes the wells and pumping rates presented in Scenario 1 with the addition of two Upper Bedrock Aquitard wells EX-3 and EX-4. These Upper Aquitard wells are simulated to pump at 1 gpm each, for a total extraction rate for Scenario 2 of 27 gpm. Figure A4-4 presents the location of EX-3 and EX-4 and the estimated capture zone.

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A4.2 MODEL LIMITATIONS

The groundwater flow model developed for the Chemsol Site provides a reasonably accurate representation of the hydrogeologic conditions and groundwater flow processes in the project area. However, by definition, all models are approximations or simplifications of the real system (Anderson, 1991). They cannot simulate the small-scale variations in soil or rock properties such as local changes in hydraulic conductivity and thickness, or the presence of individual fractures. As a result, the natural heterogeneity of the subsurface materials is manifested in a degree of uncertainty in the model results. The magnitude of the uncertainty will vary both spatially within the model domain, and with respect to the intended use. For example, the uncertainty relative to bedrock hydraulic conductivity is much greater at the model boundaries than within the vicinity of the site proper. Thus, the model's ability to predict the response of the groundwater flow system to pumping will be most accurate near the site, and progressively less accurate downgradient.

For this project, one of the primary objectives of the model was to evaluate the location of extraction wells and predict the pumping rate necessary to achieve containment. The simulated extraction wells shown on Figures A4-1 through A4-4 are located on site, and in close proximity to the stresses imposed by the pumping of well C-1, which were successfully reproduced by the model during calibration. Thus, based on this close proximity of measured and predicted stresses, and the results of the sensitivity analysis, a model uncertainty of plus or minus 30 percent is estimated and has been applied to the model predictions. Therefore, the total extraction rate for Scenario 1 required to maintain the capture zones predicted in Figures A4-1, A4-2, and A4-3 is expected to be within the range of approximately 17.5 gpm to 32.5 gpm. The total pumping rate for Scenario 2 is estimated to range from 19 to 35 gpm.

ATTACHMENT A

QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM

ATTACHMENT A
QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM

A quantitative analysis of the available hydrogeologic data has been conducted for the Chemsol Site. This analysis included a review of data from the RI as well as a revisit of data by AGES and McLaren/Hart to determine if additional information could be extracted from their efforts. The available data include aquifer test, slug test, and packer testing data.

This evaluation provides as much of a quantitative understanding of the hydrogeologic system as is reasonably feasible given the complex hydrogeologic system. By the term "quantitative understanding", we mean the ability to subdivide the hydrogeologic system into functional hydrostratigraphic units and assign hydrogeologic properties to these units, such as transmissivity, hydraulic conductivity, and storativity. This type of quantitative understanding of the system will be vital as a foundation for the numerical modeling of the system, even if the properties are modified (as they almost certainly will be) during the calibration of the model.

PRE-RI PUMP TESTING

In 1987, AGES Corporation performed a hydrogeologic assessment of the Chemsol site. As part of their work, they conducted a step-drawdown test of Well C-1, and a subsequent aquifer test using the same well. Extraction of much usable hydrogeologic data from the AGES work is problematic since the aquifer test at Well C-1 was begun shortly after the conclusion of the step-drawdown test and before sufficient time had elapsed for the aquifer to fully recover from the drawdown produced by the step-drawdown test.

In 1993, McLaren/Hart conducted a hydrogeologic study of the Chemsol site. As part of their work, they performed an aquifer test using Well C-1 as the pumping well and a number of wells as monitoring points. While procedurally, the work of McLaren/Hart is a considerable improvement over the earlier AGES work, analysis of the data from the aquifer test is hindered by the fact that the open interval of Well C-1 actually spans two distinct water-bearing zones and an intervening hydrostratigraphic unit (the Gray Shale), which generally acts as an aquitard. This was not recognized in 1993. Consequently, the well likely draws an indeterminate amount of water from each zone, thus confounding precise definition of the hydrogeologic properties of either zone. However, some useful data can be drawn from this test since apparently most of the water is drawn from the Principal Aquifer.

INITIAL OBSERVATIONS

Before embarking upon an in-depth assessment of the aquifer tests, slug tests, and packer tests, several general observations are made about the hydrogeologic system as a conceptual foundation for the subsequent analyses:

1. The observed vertical hydraulic head losses at the site are indicative of moderate to low vertical hydraulic conductivity in some zones.

2. The above observation, coupled with the relatively high yields observed in various pumping wells and packer tests, suggests a hydrogeologic system composed of interlayered aquifers and aquitards.

3. Vertical anisotropy is also indicated on a system-wide basis and probably within individual strata as well.

4. A degree of heterogeneous hydrogeologic behavior is evident in virtually all the data. This heterogeneity significantly complicates the effort to precisely model the system. Nonetheless, the generalized behavior of the system should be subject to modeling and reasonably accurate predictive analysis.

5. The heterogeneity has particular implications to the implementation of a groundwater extraction system at the site. No matter how thoroughly one probes the hydrogeologic data for insight into the properties of the system or how diligently one strives to calibrate a numerical groundwater flow model based on those calculated properties, performance of a groundwater extraction system will require careful verification. It is likely that the Observational Method, in one form or another, will have to be utilized to design and construct a cost-effective system.

ANALYSIS OF THE HYDROGEOLOGIC DATA

In analyzing the hydrogeologic system at the Chemsol site, principal emphasis has been placed upon the aquifer test and packer test conducted by CDM and McLaren/Hart. In particular, CDM conducted a packer test of some duration, which they termed the long-term test. This packer test was, in essence, an aquifer test and the data from tghis packer test are quite useful. The aquifer test conducted by McLaren/Hart in 1993 of Well C-1 is also useful. ECKENFELDER INC. has carefully evaluated all of the packer test data to see what quantitative information can be extracted from this considerable body of data. While the packer tests were primarily conducted to determine the interconnectedness of various zones, nonetheless, some of the tests lend themselves to quantitative analysis.

The packer test data were first evaluated as to whether analyses could be conducted using the Theis type curve match technique on the drawdown data. Analysis of the drawdown data, however, was not feasible due to the variable pumping rate employed in the early phase of the packer test. In most cases, the flow rate during the packer test was increased in step-wise fashion during the early part of the test, and then held relatively constant throughout the remainder of the test. While the early stepped pumping rate makes time-drawdown analysis infeasible, analysis of time-recovery data is possible since water level recoveries react more to the average pumping rate, particularly during the later phases of the test, than they do to early fluctuations in pumping rate. Distance drawdown analyses were also employed to analyze the drawdown at the conclusion of the packer test pumping. Lastly, packer test recovery data were also used to conduct Neuman-Witherspoon ratio method analyses of the upper bedrock zone above the upper permeable zone. Each of these methods of analysis is briefly described below. A summary of the results of the aquifer test analyses is presented in Table 1.

Long-Term Test of CDM

CDM performed what they termed the "Long-Term Test" as part of their packer testing activities. During the long-term test, drawdown was measured in a number of monitoring wells, and the results analyzed by CDM using the AQTESOLV computer program. Three tests, in particular, provide insight into the transmissivity and storativity of the principal aquifer. These tests are the analyses conducted based upon the drawdowns observed in Wells DMW-1, DMW-5 and MW-103. These particular wells are well suited stratigraphically to determine the aquifer parameters. The results of CDM's analyses are presented in Table 1.

TABLE 1
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-1	CDM	14,500	2.1×10^{-4}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-5	CDM	8,800	7.8×10^{-5}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-5	CDM	8,800	2.2×10^{-4}	---
Principal Aquifer	Packer Test: Round 3, Test 2 Distance - Drawdown Analysis	ECKENFELDER INC.	>5,000	2.3×10^{-4}	---
Principal Aquifer	Neuman-Witherspoon	ECKENFELDER INC.	---	---	3.5×10^{-4}

TABLE 1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match - TW-9	McClaren-Hart	8,500	9.9 x 10 -5	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match - DMW-5	McClaren-Hart	10,300	4.1 x 10 -4	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-3	McClaren-Hart	10,800	1.7 x 10 -4	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-5	McClaren-Hart	29,000	2.1 x 10 -4	---
Upper Permeable Aquifer	Packer Test: Theis Type Curve Match of time-recovery data Round 3, Test 3, Well C-6	ECKENFELDER INC.	12,300	1 X 10 -4	---

TABLE 1 (cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Test	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Upper Permeable Aquifer	Packer Test: Distance-Drawdown Analysis of Round 3, Test 3	ECKENFELDER INC.	13,000	6 x 10 -6	---
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test	ECKENFELDER INC.	---	---	1.1 x 10 -4
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-10, TW-4	ECKENFELDER INC.	---	---	6.5 x 10 -5

Distance Drawdown Analyses of Packer Test Round 3, Test 2

Efforts were undertaken by ECKENFELDER INC. to determine whether any of the packer test data would be suitable for a distance drawdown analyses using the Cooper-Jacob method. This methodology is particularly useful in defining transmissivity. However, most of the packer tests do not lend themselves to this type of analysis for two reasons. First, there are generally not a sufficient number of wells at different radial differences from the pumped interval to define the shape of the distance drawdown curve. Secondly, the pumped interval typically cannot be used in the analysis because of excessive well losses. Nonetheless, one packer test, specifically Round 3, Test 2, provided some insight into the transmissivity in that well losses in the pumped interval in Well DMW-10 appeared to be more modest. Drawdown in the pumped interval was only 4.8 feet (compared to many tens of feet in some of the other packer tests). An analysis of this packer test using the Cooper-Jacob distance drawdown method, and assuming the drawdown in the pumped interval is reflective of actual drawdown in the formation, yields a transmissivity of 5,000 gallons per day per foot and a storativity of 2.3 x 10 -4. In all likelihood the transmissivity is higher than this figure since well losses likely occur. For example, if well losses accounted for one-half of the observed drawdown, the transmissivity would be approximately 10,000 gallons per day per foot. The plot of the data and the associated calculations are provided in Attachment B-1.

Aquifer Test of Well C-1 by McLaren/Hart

McLaren/Hart conducted an aquifer test of Well C-1 measuring drawdown in a number of monitoring wells. The analyses of the drawdowns observed in Wells TW-9, DMW-5, C-3, C-4, and C-5 are particularly appropriate as these wells are well positioned stratigraphically to define the aquifer parameters of the principal aquifer. These analyses, which are presented in McLaren/Hart's report, yielded transmissivities ranging from 8,500 to 29,000 gallons per day per foot and storativities ranging from 9.9 x 10 -5 to 4.1 x 10 -4, as presented in Table 1.

As mentioned earlier, the aquifer test conducted by McLaren/Hart of Well C-1 is limited in its accuracy due to the fact that the well is likely pumping an indeterminate amount of water from both the principal aquifer and the upper permeable zone. However, based upon the results of the analyses and a comparison to more recent aquifer tests conducted by CDM, it is likely that the majority of the water being pumped from Well C-1 is being drawn from the principal aquifer. Consequently, it can be concluded that the calculated transmissivity is reasonablyy reflective of the Principal Aquifer.

Neuman-Witherspoon Ratio Method Analysis of McLaren/Hart Aquifer Test

In order to gain some insight into the vertical hydraulic conductivity of the principal aquifer, ECKENFELDER INC. conducted a Neuman-Witherspoon Ratio Method Analysis of the data from the McLaren/Hart Aquifer Test. A vertical hydraulic conductivity of 3.5 x 10 -4 centimeters per second was estimated for the lower portion of the principal aquifer. These data and associated calculations are presented in Attachment B-2.

Theis Type Curve Matching of Time Recovery Data from Packer Test

ECKENFELDER INC. conducted Theis type curve analysis of recovery data from aa number of the packer tests. One test in particular generated data permitting a Theis type curve match analysis. These data were the packer test recovery data from Round 3, Test 3 for Well C-6. This analysis permits estimation of the aquifer parameters of the upper permeable zone. The analysis resulted in an estimated transmissivity of 12,300 gallons per day per foot and a storativity of 1 x 10 -4. The data, type curve match and associated calculations are included in Attachment B-3.

Distance Drawdown Analysis of Packer Test Round 3, Test 3

The data from the Round 3, Test 3 packer test also lent itself to a distance drawdown analysis using the Cooper-Jacob method. In this packer test, Well C-7 in the upper permeable zone was pumped and drawdowns in Wells C-6, C-8, C-9 and C-10 were measured in the upper permeable zone. In this analysis Well C-6 and C-10 provide the most useful data since they are at significantly different radial distances from the pumped interval. This test suggests some degree of areal anisotropy with a slightly higher transmissivity along the strike of the formation. Similar anisotropy is not observed in other data sets, however, and the apparent areal anisotropy observed in Round 3, Test 3 is probably coincidental. The distance drawdown analysis results in an average transmissivity of 13,000 gallons per day per foot and a geometric mean storativity of 6×10^{-6}. The data plots and calculations are included in Attachment B-4.

Neuman-Witherspoon Ratio Method Analysis of Packer Test Round 3, Test 3

In order to get some information as to the vertical hydraulic conductivity of the upper bedrock zone, ECKENFELDER INC. conducted Neuman-Witherspoon ratio method analyses of the Round 3, Test 3 packer test. The analysis specifically involved analysis of Wells C-8 and TW-3, and C-10 and TW-4. These analyses were done using recovery data for the reasons described earlier. The time recovery plots and calculations of both ratio method analyses are presented in the appendices. The analyses resulted in estimated vertical hydraulic conductivity values of 1.1×10^{-4} and 6.5×10^{-5} centimeters per second. These analyses would be representative of order of magnitude estimates. The data plots and calculations are presented in Attachment B-5.

SUMMARY OF QUANTITATIVE ANNALYSES

In connection with the principal aquifer, the average transmissivity calculated from the three Theis type curve match analyses conducted by CDM and the five Theis type curve match analyses conducted by McLaren/Hart is approximately 12,700 gallons per day per foot. Similarly, the average storativity is approximately 2×10^{-4}. The average transmissivity of the upper permeable zone, calculated from the values obtained from the Theis type curve match of time recovery data from packer test, Round 3, Test 3 of Well C-6 and the distance drawdown analyses of packer test Round 3, Test 3 is 12,650 gallons per day per foot. The storativity is on the order of 1×10^{-4} as estimated from the time recovery analysis of Well C-6. The much lower value calculated from the distance drawdown analyses is probably unrepresentative. Although some indication of areal anisotropy was observed in the drawdowns of Packer Test, Round 3, Test 3, generally, areal anisotropy is not indicated in the preponderance of the data. The spatial differences in drawdown are more likely attributable to typical fractured rock heterogeneity than to a systematic areal anisotropy.

ATTACEMENT B

AQUIFER TEST PLOTS AND CALCULATIONS

ATTACHMENT B-1

DISTANCE DRAWDOWN ANALYSES OF
RI PACKER TEST DATA
WELL DMW-10(ROUND 3,TEST 2)

<IMG SRC 98141F6>

ATTACHMENT B-2

NEUMAN-WITHERSPOON ANALYSES OF
McCLAREN-HART AQUIFER TEST DATA

<IMG SRC 98141F7>
<IMG SRC 98141F8>
<IMG SRC 98141F9>

ATTACHMENT B-3

THEIS TYPE-CURVE ANALYSES OF RECOVERY
DATA FROM RI PACKER TEST
WELL C-6 (ROUND 3, TEST 3)

<IMG SRC 98141G>

ATTACHMENT B-4

DISTANCE-DRAWDOWN ANALYSES OF
RI PACKER TEST DATA
WELL C-7 (ROUND 3, TEST 3)

<IMG SRC 98141G1>

ATTACHMENT B-5

NEUMAN-WITHERSPOON ANALYSES OF
RI PACKER TEST DATA
(ROUND 3, TEST 3)

<IMG SRC 98141G2>
<IMG SRC 98141G3>

ATTACHMENT C

WELL SURVEY

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft)	Capacity (gpm)	NJDEP Locator	Easting (ft)	Northing (ft)
1	2512153	1964	Hall, Eugene B	New Market	NA	100	15	33042	2047858	627082
2	261721	NA	Dichl, John K. Jr.	S. side of Carpathia St., 200 ft of New Brunswick Ave.	NA	138	10	33473	2030480	635082
3	256775	1957	Campenella, Dominick	New Market, Middlesex County	NA	130	10	33665	2053991	637750
3	2510586	1962	Spadafors, Fred	New Market	Domestic	115	10	33665	2053991	637750
3	2516248	1972	Mason Candlelight Co.	820 Lincoln Blvd, Middlesex, N.J.	NA	210	40	33665	2053991	637750
3	2536222	1990	Polon, Art	341 High St., Dunellen, NJ	NA	51	8	33665	2053991	637750
4	2523596	1983	Swarm, John	Lot 16 Block:55 Muncipality: Dunellen Boro	NA	75	15	33666	2055013	637750
5	2518766	1975	Dobusz, Gregory	Lot 53-54-55, Bl. 292, Pluscataway, Middlesex	Na	150	12	33668	2053991	636416
5	2522656	1982	Design Molding Services, Inc.	Lot 1-15-32-47	NA	450	125	33668	2053991	636416
5	4500252	1969	Design and Molding Services, Inc.	25 Howard St. Piscataway	NA	390	120	33668	2053991	636416
6	2511162	1963	Max Scheefer & Sons	Grant Ave. off Country Club Rd., S. Madison Ave	NA	123	25	33669	2055013	636416
6	2511288	1963	Beavers, Rose	Clay Ave., New Market NJ	NA	110	50	33669	2055013	636416
6	2521575	1980	Bybel, Robert	Lot 1. Bl. 161, Piscataway Twp., Middlesex City	Na	100	60	33669	2055013	636416
7	251125	1951	Viviano, John F.	Box 196 Blackford Avenue, New Market, NJ	NA	100	4	33685	2050924	633750
7	257340	NA	Russonanm, Jerry	New Market, NJ	NA	200	50	33685	2050924	633750
7	257910	1958	Lane, Russell	Mountain Ave, New Market	NA	109	35	33685	2050924	633750
8	259223	1960	Wood Song. Inc	Pescalaway Twsp.	NA	100	20	33688	2050924	632416
9	256823	1957	Mr. Wilson	NA	NA	104	10	33691	2052969	635082
9	259770	NA	Freile, Herbert	North side of 3rd St., 200 ft W of Blackford Ave.	NA	120	15	33691	2052969	635082
9	2520865	1979	Breslin, Elaine	Lot 25-28,Bk, 156 Piscataway, Middlesex, NJ	NA	130	25	33691	2052969	635082
10	2511765	1964	Haas, George	Leunellen, New Jersey	NA	125	20	33693	2055013	635082
11	258632	1959	Alberino, August	E Side of Davis St., 200 Ft S of Williams St.	NA	113	15	33694	2052969	633750
11	259771	NA	Klein, Anderson	W side of Plainfield Ave, 500ft N of First Ave.	NA	115	15	33694	2052969	633750
12	258904	NA	Osborn, Hollis	East side of No. Randolph Rd., 1500 ft South of New Market NJ	NA	130	10	33697	2052969	632416
12	2536281	1990	Warger, Robert	172 Middlesex Ave, Piscataway, NJ	NA	52	10	33697	2052969	632416
13	2519037	1978	Global Development	Piscataway-Somerset	NA	130	20	33922	2050924	631082
13	2520085	1978	Solvato, Leonard	Lot, 26, Block 350, Piscataway Middlesex	NA	90	10	33922	2050924	631082
13	2520411	1978	Zazzora, Tony	Lot 4, Block 365, Piscataway, Middlesex	NA	100	10	33922	2050924	631082
13	2525600	1984	Kiernan, James	Lot 5-D bl. 364	NA	200	10	33922	2050924	631082
14	2519038	1977	Global Development	Piscataway, Somerset Co.	NA	120	10	33923	2051946	631082
14	2526144	1985	Perm Const. Co. Inc.	Lot: 9194 Block: 452 Muncipality: Piscataway Twp.	NA	125	10	33923	2051946	631082
15	2517258	1973	J.Middlesex Builders Inc.	Hillsborough Twp., Somerset, Camplain Rd, Lot: 40 Bl: 141	NA	140	40	33925	2051946	629750
15	2517258	1973	J.Middlesex Builders Inc.	Hillsborough Twp., Somerset, Camplain Rd, Lot: 40 Bl: 141	NA	140	40	33926	2051946	626750
16	2527118	1986	Pelmont Builders	Lot:6.01 Block: 823	NA	225	40	33928	2050924	628416
17	251208	1951	Green, earl	Piscataway Twp., Middlesex County	NA	115	16	33935	2053991	629750
18	222750	1958	Union Steel Corp.	Piscataway NJ	NA	300	120	33936	2055013	629750
19	2523677	1983	Captive Plastics	Lot: 11 Bl: 457B Municipality: Piscataway Twp.	NA	50	200	33937	2052969	628416

19	2515990	1971	Captive Plastics Inc.	Piscataway, Middlesex	NA	240	100	33937	2052969	628416
19	2519951	1978	Vocisano, Louie	Middlesex Ave.	NA	125	10	33937	2052969	628416
20	257478	1958	Koenig, Shirley A.	Possumtown Rd. Possumtown, NJ	NA	40	30	33939	2055013	628416
21	2525656	1985	Petmont Builders	Lot:8 Block: 376 Municipality: Piscataway Twp.	NA	150	30	33952	2050924	627082
21	2525657	1985	Permont Builders	Lot: 5 Block: 376 Municipality: Piscataway Twp.	NA	175	30	33952	2050924	627082
22	257561	1958	Newton, Clinton	NA	NA	98	10	33953	2051946	627082
22	257562	1958	Newton, Clinton	NA	NA	93	10	33953	2051946	627082
22	2516900	1973	Marx, Peter	Lot: 8 Blk: 352 Blackford Rd., Piscataway Twp., Somerset	NA	145	40	33953	2051946	627082
22	2527774	1986	Pelmont Builders	Lot:6B Block: 823 Municipality: Piscataway Twp.	NA	200	0.71	33953	2051946	627082

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft)	Capacity (gpm)	NJDEP Locator	Easting (ft)	Northing (ft)
23	2527976	1986	Koba Corporation	Lot:4 Block:361 Municipality: Middlesex Boro	NA	300	80	33956	2051946	625750
23	2527975	1986	Koba Corporation	Lot:4 Block:361 Municipality: Middlesex Boro	NA	300	150	33956	2051946	625750
23	25321978	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ 08854	NA	48	25	33956	2051946	625750
23	2532198	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ 08854	NA	12	NA	33956	2051946	625750
23	25321994	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	13	NA	33956	2051946	625750
23	25322001	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	48	5	33956	2051946	625750
23	25322010	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	15	NA	33956	2051946	625750
23	25322028	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	48	12	33956	2051946	625750
23	25322036	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	20	NA	33956	2051946	625750
23	25322044	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	58	20	33956	2051946	625750
23	25322052	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	53	2	33956	2051946	625750
23	25322061	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	41	0.75	33956	2051946	625750
23	25322079	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	15	<1	33956	2051946	625750
23	25322087	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	51	<2	33956	2051946	625750
23	25322095	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	50	10+	33956	2051946	625750
23	25322109	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	11.5	NA	33956	2051946	625750
24	258389	1959	Puzio, Walter	Bridgewater Twp.	NA	170	10	33959	2051946	624416
25	257557	1958	Piluso, Steve	NA	NA	97	10	33961	2052969	627082
25	257560	1958	Winklehoiz, Charles	NA	NA	107	10	33961	2052969	627082
25	2510303	1961	Jay R. Smith MFG. Co.	NA	NA	166	60	33961	2052969	627082
25	2527466	1986	Rosamelia, Tony	Lot: 1-6 Block:363 Municipality: Piscataway, NJ	NA	150	10	33961	2052969	627082
25	25300741	1987	L.Tech Welding	239 Old New Brunswick Rd.,Piscataway, NJ	NA	24	NA	33961	2052969	627082
25	25300750	1987	L.Tech Welding	239 Old New Brunswick Rd.,Piscataway, NJ	NA	45	NA	33961	2052969	627082
25	256463	1957	Gubernat, John	Stelton, Middlesex Co.	NA	130	10	33961	2052969	627082
26	251145	1951	Kulak, Joseph	Old New Brunswick Rd. Piscataway, NJ	NA	112	13	33962	2053991	627082
26	2534669	1989	Bedell, Dan	480 Sidney Rd., Piscataway, NJ	NA	250	20	33962	2053991	627082
27	25176	1948	Pastuck, Patrick	Piscataway, Twp.,Middlesex Co.	NA	89	20	33964	2052969	625750
27	2532241	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	10	NA	33964	2052969	625750
27	2532242	1988	Beecham Labs	101 Possumtown Rd.,Piscataway, NJ	NA	10	NA	33964	2052969	625750
27	2533622	1989	L-Tec	239 Old New Brunswick Rd.,Piscataway, NJ	NA	50	NA	33964	2052969	625750
27	253623	1989	L-Tec	239 Old New Brunswick Rd.,Piscataway, NJ	NA	10	NA	33964	2052969	625750
28	2530319	1987	Inst. of Electrical Electronics	Hoes Lane Piscataway, NJ	NA	20	NA	33967	2052969	624416
28	2530320	1987	Inst. of Electrical Electronics	Hoes Lane Piscataway, NJ	NA	21	NA	33967	2052969	624416
29	251261	1951	Hoegberg, Otto	Piscataway Twp. Middlesex Co.	NA	87	16	33991	2052969	623082
29	2532371	1988	Pelmont Builders	31 Stelton Rd. Suite 5, Piscataway, NJ	NA	200	10	33991	2052969	623082
30	2520861	1979	Tina Construction Co.	27 Franklin St. Piscataway N.J.	NA	185	20	33992	2053991	623082
30	25375	1948	Kistler, Esther	RD#2, New Brunswick, NJ	Domistic	198.5	16	33995	2053991	621750

31	NA	1968	National Starch & Chemical Corp.	1735 W. Front Street, Plainfield NJ	Industrail	600	NA	34418	2057058	640416
31	25677	1950	Asphalt & Mineral Corp.	NA	Industrial	200	250	34418	2057058	640416
31	2520864	1979	William & VEE Hamilton	171 Mountain Ave.Piscataway, NJ	Domistic	100	10	34418	2057058	640416
32	25762	1950	Art Color Printing CO.	South & Wasthington Ave.	Industrial	325	226	34418	2058080	640416
32	2512498	1964	DeMatteo, Poi	Sunlit Dr. Watching, NJ	Domistic	92	6	34419	2058080	640416
33	257609	1958	Gray, Douglas	252 Pearl Place, Dunellen, NJ	Domistic	102	10	34419	2059102	640416
34	2534508	1958	DeMatteo, Poi	586 Warfield Ave, North Plainfield, NJ	Domisiic	115	10	34428	2060124	640416
34	25213248	1971	Elizabethtown Water	1341 North Ave, Plainfield, NJ	Public Sup	350	400	34428	2060124	640416
34	2518634	1976	Nesler, J.	NA	Domestic	125	10	34428	2060124	640416

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WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

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53	2522257	1981	Atlantic Richfield Co.	Southeast corner f station property, 10'Wof sidewalk	NA	10	<1	34555	2069324	637750
53	252258	1981	Atlantic Richfield Co.	17'W of Guard on Lakeview Ave., between creek & asphalt	NA	20	<1	34555	2069324	637750
54	2512829	1965	Keystone Plastics Inc.	S. Clinton Ave., S. Plainfield	NA	300	200	34557	2068302	636416
54	2521571	1980	Mastrianni, Patric	Lot 3, Block 348, S. Plainfield, Middlesex Co.	NA	50	30+	34557	2068302	636416
54	2525751	1984	Campagna, Phillip	Lot:9-10, Block:427, Municipality:South Plainfield Boro	NA	150	25	34557	2068302	636416
55	2529539	1987	Barietta, Alex	700 delmore Ave., Middlesex S. Plainfield, NJ	NA	140	25	34559	2070346	636418
56	2541529	1992	Pulsafeeder Co.	2387 south Clinton Ave.	NA	71.4	12	34571	2065236	635082
56	41530	1992	Pulsafeeder Co.	2387 south Clinton Ave.	Na	76.7	14	34571	2065236	635082
56	2541531	1992	Pulsafeeder Co.	2389 South Clinton Ave.	NA	74.8	15	34571	2065236	635082
56	2541532	1992	Pulsafeeder Co.	2387 South Clinton Ave.	NA	75	12	34571	2065236	635082
56	258617	NA	Calvin, Frank H.	S. side of Sage St.; 250ft W of South Clinton Ave.	Na	113	Na	34571	2065236	635082
57	2521332	1980	Pellegrino, John	Lot:15-20, Block:498, So. Pld Middlesex	NA	125	25	34572	2066258	635082
58	259075	1959	Turi, Charles A.	South Plainfield NJ	NA	100	20	34574	2065236	633750
59	2524382	1983	Kays, Jane	Lot:5-8, Block:292	NA	170	<14	34575	2068258	633750
59	2530161	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2530162	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2534575	1987	Silverman, Ken	105 Sylvania Av. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2530164	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, NJ	NA	10	NA	34575	2066258	633750
59	2530165	1987	Silverman, Ken	105 Sylvania Ave. South Plainfield, NJ	NA	38	NA	34576	2067280	633750
60	25316991	1988	Atlantic tool & die Co.	Lot:2.03	NA	38	NA	34576	2067280	633750
60	2531700	1988	Atlantic Tool & Die	Lot:2.03, Block:447	NA	38	NA	34576	2067280	633750
60	2530565	1987	Atlantic Tool & Die	Lot:2.03	NA	12	NA	34576	2067280	633750
60	25316982	1988	Atlantic Tool & Die	Lot:2.03	NA	40	NA	34576	2067280	633750
60	2524448	1983	Celeniano, Julius	Lot: 74-7, Block:315 Municipality: South Plainfield Boro	NA	150	30+	34576	2067280	633750
60	2513094	1965	Ladis, William	South Plainfield, N.J.	NA	100	40	34576	2067280	633750
60	2522615	1982	Gian, Di D. & son	Lot: 73 Block: 315	NA	150	25	34576	2067280	633750
60	259517	1960	Turi, Charles A.	South Plainfield	NA	100	15	34576	2067280	633750
61	259646	NA	Yulick, Robert	NA	NA	130	15	34582	2069324	635082
61	2520170	1978	Global Development Company	Lot:11-12, Block:316,S. Old Middlesex Co	NA	110	30	34582	2069324	635082
61	25344056	1989	Wilmer, Ivan	375 Meluchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
61	25344064	1989	Wilmer, Ivan	375 Meluchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
61	255344072	1989	Wilmer, Ivan	375 Meluchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
61	25344072	1989	Wilmer, Ivan	374 Meluchen Rd., S. Plainfield, NJ	NA	13	NA	34582	2069324	635082
62	25844	1951	Kentile, Inc.	South Plainfield, N.J.	NA	461	310	34583	2070346	635082
62	2522109	1981	Wood Constriction Co.	Lot:49-53,Block:457,	NA	51	15	34583	2070346	635082
62	2523878	1983	Raritan Oil Co.	NA	NA	8	NA	34583	2070346	635082
62	2523879	1983	Raritan Oil Co.	NA	NA	24	NA	34583	2070345	635082

62	2523880	1983	Raritan Oil Co.	NA	NA	19	NA	34583	2070345	635082
62	2523880	1983	Raritan Oil Co.	NA	NA	19		34583	2070345	635082
62	2534528	1989	Sub Transit	601 Market Ave., South Plainfield, N.J.	Na	12	Na	34583	2070346	635082
62	2534529	1989	Suburban Trasit	601 Market Ave., South Plainfield, NJ	NA	13	NA	34583	2070346	635082
62	2534530	1989	Suburban Trasit	601 Market Ave., South Plainfield, NJ	NA	13	NA	34583	2070346	635082
63	258228	1959	Piscatelli, Michael	N. of New York., &W. of Hamillton Blvd.,South Plainfield NJ	NA	113	35	34584	2068302	633750
63	258978	NA	Zereconski, Mildred	N. side of New York Ave., 300ft W. of West Hamilton Blvd.	NA	200	12	34584	2068302	633750
63	2519393	1977	Global Development	Lot:13, Block:426, Camden Ave., South Plainfield	NA	120	15	34584	2068302	633750
63	2519392	1977	Global Development	Lot:14 Block:426 New York Ave., South Plainfield	NA	110	30	34584	2068302	633750

LOW CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft)	Capacity (gpm)	NJDEP Locator	Easting (ft)	Northing (ft)
35	2510160	1961	Hocke, Mary	Piscataway Twp., NJ	Domestic	95	10	34429	2061146	640416
36	251194	1951	Simmons, Raymond	Piscataway Twp., NJ	Domestic	100	6.25	34430	2064213	640416
37	256925	1957	De Censo, Emilio	NA	Domestic	110	10	34437	2062169	640416
37	257530	1958	Pillsbury, Samul	Smith Street, Middlebush, NJ	NA	125	24	34437	2062169	640416
37	258431	NA	Norman, Richard	North Side of Quincy Street; 400 East of Rock Avenue	Domestic	115	15	34437	2062169	640416
37	258821	NA	Panzarello, P.	South side of West 7th Street, approx. 100 feet east of New Brunswick Ave.	Domestic	143	15	34437	2062169	640416
37	258759	1959	Barra, Louis	NA	Domestic	107	12	34437	2062169	640416
38	258202	1959	DiDario, Armond	North of S. 10th St. & east of New Brunswick Ave.	Domestic	90	11	34438	2063191	640416
38	2521914	1961	Wedgie, Philip	Lot 24, Block 33,Dunellen, Piscataway Township, NJ	Domestic	175	100	34438	2063191	640416
39	259060	1959	Olechna, Clem	South Plainfield, NJ	Domestic	110	0.2	34439	2064213	640416
39	2431426	1988	Macedo Concrete Corp.	Parker Rd., South Plainfield, NJ	Industrial	160	0.3	34439	2064213	640416
40	251121	1951	Smith, M.	Lehigh St. Dunellen, NJ	Domestic	100	Na	34442	2057058	639082
40	259145	1960	Vescovi, T	1715 Meister St. Arbor, NJ	Domestic	130	15	34442	2057058	639082
41	2510225	1962	DeMatloo, Pio	Piscataway Twp. NJ	Domestic	100	7	34442	2058080	639082
42	258109	1958	Venturo, Emil	NA	Domestic	95	10	34445	2057058	637750
42	258311	1959	NA	New Market Rd.	Domestic	120	15	34445	2057058	637750
43	2532529	1989	Turner & Pacconi Constuction	Hall Street Piscataway, NJ	Domestic	150	0.3	34446	2058080	637750
44	2510256	1961	Hanzl, A.	42 Maple Street, Oaktree Edison, NJ	Domestic	125	10	34447	2056036	636416
45	254289	1963	Milets, Racco	New Market 11st. off Washington Ave.	Domestic	120	10	34449	2058080	636416
46	256984	1957	Beyerman, Vince	NA	Domestic	74	10	34452	2060124	639082
46	258037	1958	Shumsky, Peter	NA	Domestic	93	10	34452	2060124	639082
46	256984	1957	Beyerman, Vince	NA	Domestic	74	10	34442	2060124	639082
46	258037	1958	Shumsky, Peter	NA	Domestic	93	10	34452	2060124	639082
47	25653	1957	Beyerman	NA	Domestic	90	10	34453	2061146	639082
47	256716	1957	Papa, Barbara	NA	Domestic	104	10	34453	2061146	639082
47	256996	1957	Hahr, Arthur	South side of Brunelle St. west of New Brunswick Ave.	Domestic	120	10	34453	2061146	639082
47	257170	1957	Piluso, Steve	NA	Domestic	90	10	34453	2061146	639082
47	257342	1957	K.L.M. Buliders	NA	Domestic	99	10	34453	2061146	639082
47	27499	1958	Calloway, Cleveland	NA	Domestic	107	10	34453	2061146	639082
47	258623	NA	Muglia, Albert	North side of Quincy Street; 250 feet East of West 7th street	Domestic	100	15	34453	2061146	639082
47	258885	1959	Newton, Clinton	NA	Domestic	94	10	34453	2061146	639082
48	2511102	1963	Channin, Brown	Marion La. Plainfield Road, NJ	Domestic	128	8	34455	2060124	637750
49	256919	1957	Toshy, John	710 Delmore Ave. South Plainfield Ave, NJ	NA	95	10	34547	2065236	636416
49	257117	1957	Guaranteed Block Co.	East side of Clinton Ave., 200ft N. of New Market Ave.	NA	125	15	34547	2065236	636416
49	2535868	1990	Bratone, Arther	2364 S. Clinton Ave, South Clinton NJ	NA	12	NA	34547	2065236	636416
50	2532832	1989	Cillis, Joseph Jr.	1521 Sage St., South Plainfield, NJ	NA	61	1	34548	2066258	636416
51	254426	1963	Dodd, May	Planfield Ave &	Domestic	125	8	34550	2070346	636416
52	2540944	1992	Penske Truck Leasing	2364 South Clinton Ave. South Plainfield, NJ	NA	18	NA	34554	2068302	637750
52	25190	1949	Middlesex Water Co.	Borough of South Plainfield, NJ	NA	403	412	34554	2068302	637750
52	25421	1949	Middlesex Water Co.	South Plainfield, N.J.	NA	409	542	34554	2068302	637750
53	28490	1986	Recifro, Frank	222 Barone Ave. South Plainfield, NJ	NA	125	NA	34555	2069324	637750
53	252090	1952	Middlesex Water Co.	South Plainfield N.J.	NA	502	465	34555	2069324	637750
53	252091	1952	Middlesex Water Co.	South Plainfield NJ	NA	525	440	34555	2069324	637750
NA	525	440	34555 2069324 637750							
53	253969	1954	Middlesex Water Co.	Boro of South Plainfield	NA	526	NA	34555	2069324	637750
53	2522255	1981	Atlantic Richfield Co.	rear of Asphalt lot, 31ft North of Station Blvd.	NA	10	NA	34555	2069324	637750
53	2522256	1981	Atlantic Richfield Co.	385N of gas pump nearest Lakeview Ave.	NA	10	<1	34555	2069324	637750

LOW CAPACITY WELLS
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Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
63	259045	NA	Shinkle, Anne	N. side of New York Ave., 40Oft. W. of Hamilton Blvd.	NA	13	15	34584	2068302	633750
64	258203	1959	Butrico, charles F.	E. of Garbaldi Ave., & S. of Tremont Ave.	NA	140	18	34585	2069324	633750
65	2527382	1986	Wood, Sal	Lot:7 Block:350 Municipality: South Plaifield Boro	NA	170	15	34586	2070346	633750
66	2525605	1985	Knight, Frank	Lot:10 Block:428	NA	130	12	34586	2070346	633750
67	2534040	1989	Kentile floors. Inc.	Lot:10 Bolck255 S. Plainfield, N.J.	NA	8	NA	34591	2071369	635082
67	25745	1951	Kentile Inc.	south Plainfield, N.J.	NA	240	200	34591	2071369	635082
67	25725	1950	Cornell Dubilier Elec Corp.	South Plainfield, N.J.	NA	323.6	220	34591	2071369	635082
67	2514113	1966	Kentile, Inc.	Kentile Rd,. S. Plainfield, NJ	NA	250	250	34591	2071369	635082
68	2528345	1986	Di Gian & Son Const Co.	South Plainfield, N.J.	NA	50	28	34594	2071369	633750
68	2522763	1982	Chevron Chemical Co.	South Plainfield N.J.	NA	10	10	34594	2071369	633750
69	2534157	1986	Zwolak, Frank	Lot: 14 Block:354	NA	160	25	34597	2071369	632416
69	2510690	1962	Gordon, Earl C.	1003 Delmore Ave., S Plainfield N.J.	NA	50	30	34597	2071369	632416
69	2510227	1961	serido, Tony	Murih St., Dunlennel, N.J.	NA	150	15	34597	2071369	632416
69	258692	NA	Ronzo, Elizabeth	S side of Delmore Ave., 250 ft E. of Lorraine Ave.	NA	113	15	34597	2071369	632416
70	2534699	1989	Chomut, Dimitri & Maria	8 Davidson Ave. Piscataway, Twp	NA	150	0.17	34699	2082613	632416
71	2511433	1963	Nesler, Joseph	Plainfield, NJ	NA	125	10	34711	2056036	631082
72	259453	1960	Owens, John Evan	New Market, Piscataway Twsp.	NA	110	15	34713	2058080	631082
72	25550	1949	Westergard, C. J.	Old Brunswick Rd., New MArket, Middlesex Co.	NA	168	20	34713	2058080	631082
72	25453	1949	Roeth, Edward	New Market, Middlesex Co.	NA	153	45	34713	2058080	631082
74	25320611	1988	National Can Corporation	Lot:2, Block:461	Na	15	NA	34714	2056036	629750
74	25320602	1988	National Can Corporation	Lot:2 Block:461	NA	19	NA	34714	2056036	629750
75	258702	1959	Soden, John Edward	Edison Township, N.J.	NA	93	20	34715	2057058	629750
76	2543318	1994	Equity Associates	Stelton Rd., Piscataway Twp.	NA	300	35	34716	2058080	629750
77	2526281	1985	Rutgers State University	Electrical Engineering	NA	30	NA	34717	2056036	628416
77	2526280	1985	Rutgers State University	Electrical Engineering	NA	30	NA	34717	2056036	628416
77	2521986	1981	Boroughs Corp. CSG Division	S. Randolphville Rd. Lot:4A Block:460C	NA	300	200	34717	2056036	628416
78	2532941	1989	Wilson, William B.	120' S. of Montrose Ave.; 160' W. of Kennedy Rd.	Na	11	NA	34718	2057058	628416
78	2529074	1987	Nat'l Can Corporation	Lot:2 Block:461	NA	15	NA	34718	2057058	628416
78	2529073	1987	Nat'l Can Corporation	Lot:2 Block:461	Na	15	NA	34718	2057058	628416
78	2529072	1987	Nat'l Can Corporation	Lot:2 Block:461	NA	15	NA	34718	2057058	628416
79	25331230	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	Na	40	NA	34719	2058080	628416
79	25331223	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25331213	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330845	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330837	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	NA	34719	2058080	628416
79	25330829	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330811	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330802	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
79	25330799	1989	Huls America, Inc.	Turner Pl., Box 365, Piscataway, NJ	NA	40	2+	34719	2058080	628416
80	2512155	1964	Connelongo, Joseph	New Market, Piscataway, NJ	NA	135	15	34721	2059102	631082
81	2511468	1963	Colosi, Philip	300 Stelton Rd., New Market	NA	200	30	34721	2059102	631082
82	4500312	1950	National Starch	1735 West front st.	NA	300	350	34722	2060124	631082
82	25324888	NA	Texaco	Apgar Dr., South Plainfield, NJ	NA	300	350	34722	2060124	631082
82	35324870	NA	Texaco	Apgar Dr. South Plainfield, NJ	NA	10	NA	34722	2060124	631082
82	2522755	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	125	10	34722	2060124	631082
82	2522756	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	150	15	34722	2060124	631062

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Map Index	Permit No.	Date	Owner	Address	Use	Total Depth (ft.)	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
82	2522757	1982	Passaro Builders	437 Jassard St., Piscataway, NJ 08846	NA	150	15	34722	2060124	631082
82	25324845	NA	Texaco	Apgar Dr., Plainfield, NJ	NA	10	NA	34722	2060124	631082
82	258633	NA	Alberino August	E side of Maple Ave., 200ft N of Winans St.	NA	115	15	34722	2060124	631082
82	25324853	NA	Texaco	Apgar Rd., South Plainfield	NA	10	NA	34722	2060124	631082
83	4500313	1950	National Starch	1735 West Front St.	NA	304	350	34723	2061146	631082
83	2519144	1977	Huben, Robert	Lot:494, Block:10C, Piscataway	NA	195	40	34723	2061146	631082
84	258351	1959	Covallo, Joseph	NE corner of Eva St. & Cumberland Ave.	NA	113	15	34725	2060124	629750
84	259683	NA	Manzell, Vincent	S. side of Cumberland St., 250 ft W of Washington Ave.	NA	130	12	34725	2060124	629750
85	2526562	1985	Anastasatos, Demetrios	Lot:32B, Block:484	NA	210	5	34726	2061146	629750
85	25317296	1988	United Jersy Bank	1450 S. Washington Ave., Piscataway, NJ	NA	17	NA	34726	2061146	629750
86	2523891	1983	Fischer, Chris	Lot:388 Block:5 Municipality: S. Plainfield	NA	285	90	34731	2062169	631082
86	2526404	1985	Jersey Concrete	Lot:388 Block:5 South Plainfield Boro	NA	340	60	34731	2062169	631082
87	258903	1959	Crawford, Earl	W. side of New Brunswick Ave.; 1000ft N of R.R. tracks	NA	145	12	34732	2063191	631082
87	259064	1960	Robertson, Clarence	NA	NA	152	7	34732	2063191	631082
88	2533537	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway NJ 06854	NA	15	NA	34734	2062169	629750
88	2511101	1963	Chemsol, Inc.	Stelton Rd, Piscataway N.J.	NA	305	190	34734	2062169	629750
88	2533533	1989	United Jersey Commercial Trust	Stelton Rd. Piscataway, NJ	NA	10	NA	34734	2062169	629750
88	2533534	1989	Untied Jersey Commercial Trust	Stelton Rd., Piscataway, N.J.	NA	12	NA	34734	2062169	629750
88	2533535	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway, NJ	NA	10	NA	34734	2062169	629750
88	2533536	1989	United Jersey Commercial Trust	Stelton Rd., Piscataway	NA	10	NA	34734	2062169	629750
89	258616	NA	Formal Builders	S side Of Carpathia St; 170 ft W Of Franko St.	NA	200	15	34735	2063191	629750
90	257605	1958	Saunders, Bruce J.	Randolph Rd., Piscataway, NJ	NA	100	10	34736	2064213	629750
90	25309838	1988	768 Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	61	2+	34736	2064213	629750
90	25309846	1988	Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	75	2+	34736	2064213	629750
90	25309854	1988	Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	76	2+	34736	2064213	629750
91	2530824	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	250	3	34737	2062169	628416
91	2530825	1988	Tono Realty	Fleming St., Piscataway, NJ	NA	325	8	34737	2062169	628416
91	2530823	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	325	40	34737	2062169	628416
91	2520883	1979	Marra, A.	Lot:31-A2 Block:484, Piscataway, N.J.	NA	190	40	34737	2062169	628416
91	2530822	1988	Tano Realty	NA	NA	250	6	34737	2062169	628416
92	25316559	1988	76B Broad Corp.	3100 Hamilton Blvd., South Plainfield, NJ	NA	60	NA	34738	2063191	628416
92	25313367	1988	Tano Realty	Fleminono St., Piscataway, NJ	NA	80	1	34738	2063191	628416
92	25313223	1988	Tano Realty	Flemino St., NJ	NA	250	30	34738	2063191	628416
92	25313215	1988	Tano Realty	Flemino St., Piscataway, NJ	NA	340	7	34738	2063191	628416
92	25313207	1988	Tano Realty	Flemino St., Piscataway, NJ	NA	250	7	34738	206319l	628416
92	258615	NA	Formal Builders	N. side of St. Michael St., 175ft W of Franko St.	NAa	143	15	34738	2063191	628416
92	259156	1960	Parkway Plastics	New Market	NA	340	150	34738	2063191	628416
92	2510635	1962	All American Homes, Inc.	Piscataway Twp, Middlesex Co.	NA	122	8	34738	2063191	628416
92	2529291	1987	ARCO	Lot:9-12, Block:487; 780 Stelton St.	NA	19	1	34738	2063191	628416
92	2529292	1987	ARCO	Lot:9-12, Block:487; 780 Stelton St.	NA	18	1	34738	2063191	628416
92	25313193	1988	Tano Realty	Fleming St., Piscataway, NJ	NA	330	NA	34738	2063191	628416
93	2510572	1962	Brown, Raymond C.	583 S. Randolph Rd. New Market, NJ	NA	125	8	34742	2057058	627082
93	2525320	1984	Doryea, Jeannette R.	Lot:3 Block:500A Municipality:Piscataway Twp	NA	125	25+	34742	2057058	627082
94	2520884	1979	Marra, Anthony	Lot:31-Al Block:484, Piscataway NJ	NA	190	12	34756	2061146	625750
95	2510098	NA	Schreiber, Gilbert	S. side of Stelton Rd. 1000ft W. of Hamilton Blvd.	NA	130	10	34762	2063191	627082
96	2527597	1986	Sterling Extruder Corporation	Lot:4 Block: 550 Municipality: South Plainfield	Na	15	0	34764	2062169	625750

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96	252598	1986	sterling Extruder Corporation	Lot:4 Block:550 Minicipality: South Plainfield	NA	15	0	34764	2062169	625750
96	252144	1979	Dematio & Amato	Lot:27-33, Block:59, Muriel Ave, Piscataway NJ	NA	100	50	34764	2062169	625750
96	259089	1960	Westman, James	74 26' 37", 40 33'4"	NA	122	12	34764	2062169	625750
96	2527598	1986	Sterling Extruder Corporation	Lot:4 Block:550 Municipality: South Plainfield	NA	15	1	34764	2062169	625750
97	25284517	1986	sterling Extruder corporation	Lot:4 Block:550 Durham Ave., South Plainfield, NJ	NA	94	1	34767	2062169	624416
97	2528450	1986	sterling Extruder Corporation	Lot:4 Block:550 Durham Ave., S. Plainfield	NA	94	4	34767	2062169	624416
98	259896	1961	Olechna, Clem	Piscataway Twp.	NA	130	20	34769	2064213	624416
99	261406	1956	Schenck, Richard	New Market	NA	130	12	34773	2058080	623082
99	261406	1956	Schenck, Richard	New Market, NJ	NA	130	10	34773	2058080	623082
100	2516338	1972	Skladany, Edward T.	Piscataway, NJ	NA	170	15	34774	2056036	621750
101	256793	1957	Lake Nelson Memorial	Lake Nelson	NA	95	24	34775	2057058	621750
102	2534029	1989	Marinelei, Joseph P.	604 S. Randolphville Rd.	NA	250	15	34784	2059102	621750
103	2521533	1980	J. DiLeo Associates	120 Sylvan Ave., Block:496, Lot:12 Piscataway Twp., Somerset Co.	NA	200	20	34786	2061146	621750
104	2519501	1977	Gerictont, Theodore	Lot:9B Block:844C Middlesex Co.	NA	300	40	34791	2062169	623082
104	2511063	1962	Winkler, John	30 Lakeway St. New Market Ave.	NA	102	15	34791	2062169	623082
104	256886	1957	Szutlej, Henry	N. side of Woodlawn Rd., Lake Nelson Development, Piscataway, N.J.	NA	110	15	34791	2062169	623082
105	2543964	1993	Vocisano, Vincent	Woodlake Dr.	NA	170	20+	34795	2063191	621750
106	25322150	1988	Boyer Properties of NJ	Lot:15-16, Block:409	NA	20	NA	34813	2067280	631082
106	25322176	1988	Boyer Properties of NJ	Lot:15-16, Block:409	NA	20	NA	34813	2067280	631082
106	25304500	1987	Texize, Dow	Piscataway, No. 08554	NA	7	0	34813	2067280	631082
106	25322184	1988	Boyer Properties of NJ	Lot:15-16 BlockL:409	NA	17.5	NA	34813	2067280	631082
107	256715	1957	Bostas, James	Lot:18, Hamilton Blvd, Middlesex, NJ	NA	140	<5	34815	2066258	629750
108	2521522	1980	Janver Bldrs.	Woolworth Ave., S. Plfd Lot:5 Block:437	NA	125	40	34816	2067280	629750
108	2518953	1977	Global Development Cororation	South Plainfield, Middlesex Co.	NA	160	20	34816	2067280	629750
108	2518952	1988	Global Development	Lot:8 Block:437	NA	110	30	34816	2067280	629750
108	2518951	1977	Global Development	Lot:2D, Block:438	NA	100	20	34816	2067280	629750
108	2518950	1977	Global Development Corporation	Lot:2 Block:438	NA	140	30	34816	2067280	629750
108	2578949	1977	Global Development Corp.	Lot:1, Block:437	NA	130	25	34816	2067280	629750
108	2518948	1977	Global Development Corp.	Lot:09, Block:437	NA	50	20	34816	2067280	629750
108	259657	NA	Ice Palace, Co., Inc.	W. side of Hamilton Blvd., 1000' N of South Clinton Ave.	NA	310	75	34816	2067280	629750
108	454978	1996	DeGussa	3900 S. Clinton Ave., South Plainfield, NJ	NA	43	NA	34816	2067280	629750
109	2510547	1962	Coueelesia, Patrick	South Plainfield, Middlesex, NJ	NA	197	5	34818	2066258	628416
110	4549251	1996	L. R. Metal Treating	3651 S. Clinton Ave.	NA	200	120	34819	2067280	628416
111	2532921	1989	Platina Labs	3601 S. Clinton Ave. South Plainfield	NA	40	NA	34821	2068302	631082
111	2532920	1989	Platina Labs	3601 S. Clinton Ave. South Plainfield, NJ	NA	40	NA	34821	2068302	631082
111	2532191	1988	Platina Labs	3601 S. Clinton Ave. South Plainfield, NJ	NA	35	NA	34821	2068302	631082
112	2520350	1978	Gaster, John	Lot:4, Block:353, South Plainfield,; Middlesex Co.	Na	100	30	34822	2069324	631082
113	2511472	1963	Yulik, Joseph	916 Arlington Ave., s. Plainfield, N.J.	NA	95	25	34824	2068302	629750
114	2521010	1979	Rothberg, Louis	Lot:5678, Block:477, Ryan St.	NA	300	15	34825	2069324	629750
115	258231	1959	Risoli, John	W. of easton # Blvd., & South of Hamilton Blvd.	NA	113	18	34827	2068302	628416
115	2523303	1981	Kearney Industries	2624 Hamilton Blvd.	NA	750	5	34827	2068302	628416
115	2523304	1981	Kearney Industries	2624 Hamilton Blvd. South PLainfield	NA	75	3	34827	2068302	628416
115	2523305	1981	Kearney Industries	2624 Hamilton Blvd.	NA	75	2	34827	2068302	628416
116	25324	1997	Atlas Oil Company	318 Durham Ave. S. Plainfield B.	NA	300	40	34828	2069324	628416
116	2526179	1986	Development Corp.	Lot:41.23 Block:70 Naraticong Trail, Readington, Hunterdon	NA	150	50	34828	2069324	628416
116	2526181	1980	Screnda, Inc.	Lot:4127 Block: 70 Municipality:Readington	NA	NA	NA	34828	2069324	628416

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117	2533861	1989	Myrush, Sleve	101 West St. Middlesex	NA	50	10	34829	2070346	628416
118	2523946	1983	Sullivan, Sylvester	Lot:7-8, Block:55 Municipality: Somerville Boro	NA	175	60	34838	2072391	628416
119	2522849	1982	Rubino, Joseph	1328 Yurgel Dr., S. Plainfield, NJ	NA	320	20	34842	2066258	627082
120	253645	1954	Corp. of Engineers, U.S. Army	Plainfield, NJ	NA	281	27	34845	2066258	625750
121	258124	1958	Kowalski, Emil	Piscataway Township, Middlesex Co. N.J.	NA	123	15	34846	2067280	625750
122	2527530	1988	Gulf/Chevron, U.S.A.	Stelton and New Durham Rd., NJ	NA	10	NA	34848	2006258	624416
123	2526651	1985	Risoli, John F.	Lot:4 Block:537, Municipality: South Plainfield Boro	NA	275	15	34851	2068302	627082
123	2541341	1992	Seeman Development	86 Commonwealth Ave., Middlesex, NJ	NA	200	0	34851	2068302	627082
124	2520980	1979	Plfd. Curling Culb	McKinney St. Lot:1 Block:488 S. Plfd.	NA	200	20+	34852	2069324	627082
124	2527117	1986	Pelmont Bulders	Lot: 7679, Block:774, Municipality:Piscataway Twp	NA	200	30	34852	2069324	627082
125	256846	1957	Gollis, Robert	S. Ave Plainfield, NJ	NA	124	3	34853	2070346	627082
125	2510099	NA	Tufaro, Vincent	Northwest corner of Pleasant Ave and Monroe Ave.	NA	145	12	34853	2070346	627082
125	2510101	NA	Lynq. Ralph U.	East side of Chimney Rock, 700ft S. of Gilbride Rd.	NA	190	5	34853	2070346	627082
126	25310542	1988	L-R Metal Treating	3651 S. Clinton Ave., S. Plainfield	NA	24.25	NA	34855	2069324	625750
126	25310551	1988	L-R Metal Treating	3651 S. Clinton Ave, S. Plainfield	NA	25	NA	34855	2069324	625750
127	2522442	1981	Carney Ltd., Federal Carbide	Lot:2D,Bl:21 New Durham Rd. Edison, NJ	NA	550	30	34856	2070346	625750
127	2527324	1986	Arometics International Inc.	Lot:45 Block:734A Municipality:Piscataway	NA	505	4	34856	2070346	625750
127	25288750	1987	United States Land Resources	Lot:3A12 Block:55	NA	20	NA	34856	2070346	625750
127	25288768	1987	United States Land Resources	Lot:3A12 Block:55	NA	20	NA	34856	2070346	625750
127	2528877	1987	United States Land Resources	Lot:3A12 Block:55	NA	19	NA	34856	2070346	625750
128	2527116	1986	Pelmont Builders	Lot:52 Block:710 Municipality: Piscataway Twp.	NA	200	50	34858	2069324	624416
129	259733	1960	Tingley Rubber Co.	South Plainfield NJ	NA	428	266	34861	2071369	627082
129	256464	1957	Gubernat, John F.	Stelton, Middlesex	NA	150	10	34861	2071369	627082
130	2511197	1963	Biondella, David	Palisade Ave. Piscataway	NA	120	12	34872	2066258	623082
131	257251	1959	Lynor, E.M.	North Stelton, NJ	NA	440	<5	34876	2067280	621750
131	2516775	1973	Schwalje, Nicholas	School St., Piscataway Township, Middlesex Co., NJ Kilmerner Sub Station	NA	224	4	34876	2067280	621750
132	2517306	1974	Breslin, James	Lot:29-32, Block 156, Piscataway, Middlesex	NA	120	30	34882	2069324	623082
133	2520469	1979	Riedel Construction Co., Inc.	Lot:6, Block:705, Piscataway Twp., Somerset	NA	145	30	34884	2068302	621750
134	2518023	1975	De Paola, Joseph	Lot:1-B, B1, B1:74, Piscataway, NJ	NA	150	20	34885	2069324	621750
135	2519327	1977	Sparacio, Joseph	Wickley Ave., Piscataway, NJ	NA	135	10	44121	2059102	619082
135	2519608	1977	Sparacio, Joseph	Wickley Ave, Piscataway, NJ	NA	125	10	44121	2059102	619082
136	259901	1961	Black, Lafayette W.	Zircle Ave., New Market	NA	90	10	44122	2060124	619082
136	2521000	1979	Greco, D	Orris Ave., Piscataway, NJ	NA	180	10	44122	2060124	619082
136	2527518	1986	Vocisano, Vincent	Lot:13A Block:737: Municiplity: Piscataway, NJ	NA	190	30	44122	2060124	619082
136	2529446	1987	Vocisano, Dominick	Lot:9-10 Block:736	NA	50	10	44122	2060124	619082
137	2525868	1985	Vocisano, Antonio	Lot:13A Block:737 Municipality:Piscataway Twp.	NA	190	10	44123	2061146	619082
138	2520180	1978	Agel, Catherine	Sheldon Place, Piscataway, NJ	NA	165	10	44132	2063191	619082

HIGH CAPACITY WELLS
WITH IN 2 MILES OF THE CHEMSOL, INC. SITE

Map Index	Permit No.	Owner	Well Name	Distance (miles)	Total Depth (ft.)	Geologic Unit	Capacity (gpm)	NJDEP Locator	Easting (ft.)	Northing (ft.)
1	10215W	Captive Plastics	#1	1.9	240	GTRB	65	33929	2051946	628416
1	10215W	Captive Plastics	#2	1.9	230	GTRB	130	33929	2051946	628416
2	10247W	keystone Plastics	Well 2	1.9	300	GTRB	48	34654	2077502	637750
3	10660W	Jersey Concrete Co.	1	1.8	285	GTRB	87	34831	2071369	631082
3	10660W	Jersey Concrete Co.	2	1.8	340	GTRB	82	34831	2071369	631082
4	10929W	L.R. Metal Treating	1	1	200	GTRBP	100	34819	2067280	628416
5	2105P	Tingley Rubber Corporation	1	1.8	428	GTRB	200	34861	2071369	627082
6	2194P	Design and Molding Services	1	1.3	390	GRTB	120	34468	2063191	636416
6	2194P	Design and Molding Services	2	1.3	294	GTRB	120	34468	2063191	636416
7	5045	Elizabethtown Water Company Clinton Av.		2	350	GTRB	450	34439	2064213	640416
8	MI0028	Coppola, Frank	POND	1.8	17	GTRB	300	34858	2069324	624416
8	MI0028	Coppola, Frank	Well 1	1.7	310	GTRB	100	34858	2069324	624416

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<IMG SRC 98141G5>
<IMG SRC 98141G6>

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:

AFFIDAVIT OF
: WILLARD F. POTTER

:

STATE OF NEW JERSEY)
)SS.:
COUNTY OF MORRIS)

WILIARD F. POTTER, being duly sworn, upon his oath, deposes and says:

1. I am a Senior Project Director at de maximis, Inc., which firm is principally engaged in the business of environmental consulting.

2. In 1971, I obtained my B.S. in Chemical Engineering from the University of Virginia. A copy of my resume is attached hereto as Exhibit A.

3. I serve as the Facility Coordinator of the groundwater treatment plant at the Chemsol, Inc. Superfund Site (the "Site").

4. On or about October 30, 1996, Richard L. Fitament, Executive Director, and Kevin T. Aiello, Administrator, Environmental Quality, of the Middlesex County Utilities Authority ("MCUA") advised me that the MCUA would not accept any increased discharge flow from the groundwater treatment plant at the Site.

5. On or about March 10, 1997, Thomas Evans, Director, Piscataway Township Department of Public Works, advised me that use of the well located at the car wash on Stelton Road has been discontinued.

6. On or about September 3, 1997, Thomas Evans, Director, Piscataway Township Department of Public Works, advised me that, based on numerous site inspections of the well at the car wash on Stelton Road, the well continues not to be in use.

7. I have reviewed the proposed remedial actions evaluated in the Feasibility Study Report, Chemsol Inc. Superfund Site, June 1997 (the "FS") and described in the Superfund Proposed Plan, Chemsol, Inc. Superfund Site, Piscataway, Middlesex County, New Jersey, August 1997.

8. Attached hereto as Exhibit B is a cost estimate I prepared for Alternative S-2A (Capping with Soil) that was evaluated in the FS.

9. The FS requires that clean common fill meeting New Jersey soil cleanup criteria be used for cover material for Alternative S-2A.

10. The FS requires that clean common fill meeting New Jersey soil cleanup criteria be used for backfill for Alternative S-3 (Excavation and Disposal).

11. Exhibit B uses a unit cost of $5.33/cubic yard for soil cover material for Alternative S-2A, which unit cost was used for backfill in the cost estimate for Alternative S-3. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

12. Attached hereto as Exhibit C is a cost estimate prepared for constructing Alternative S-2A over 5.73 acres of the Site using $5.33/cubic yard for soil cover material. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating

tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

13. Attached hereto as Exhibit D is a cost estimate I prepared for disposal of the stockpiled soil excavated during the removal of the underground storage tank. The disposal quantit was obtained from the Feasibility Study Report, Chemsol, Inc. Superfund Site, June 1997, Appendix C. In my professional opinion, based on my experience, this cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

14. Attached hereto as Exhibit E is a cost estimate I prepared for constructing Alternative S-2A over 5.73 acres of the Site, using clean common fill at a unit cost of $5.33/cubic yard, disposing of those soils excavated during the removal of the underground storage tank, and using the remainder of the stockpiled soils as cover material. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

15. On or about September 26, 1997, I obtained a verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York, which estimate was $300/cubic yard for transportation and disposal.

16. Attached hereto as Exhibit F is a cost estimate I prepared for Alternative S-3 using the verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

17. Using the analytical data presented in the Remedial Investigation Report, Chemsol, Inc. Superfund Site, October 1996, including, but not limited to, the figures presented in Appendix H, I estimate the additional soil volume that would be required to be excavated to achieve the State of New Jersey's PCB cleanup criterion of 0.49 ppm to be approximately 6,000 cubic yards.

18. Attached hereto as Exhibit G is a cost estimate I prepared for Alternative S-3 for excavating soil to achieve the State of New Jersey's PCB cleanup criterion and disposing of that soil at a nonhazardous waste landfill. In my professional opinion, based on my experience, this revision to the FS cost estimate is reasonable and is within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

19. Attached hereto as Exhibit H is a cost estimate I prepared for Alternative S-3 for excavating soil to achieve the State of New Jersey's PCB cleanup criterion and disposing of that soil at a hazardous waste landfill, using the verbal cost estimate for disposal of RCRA hazardous soils at Chemical Waste Management, Inc.'s RCRA Subtitle C Hazardous Waste Landfill located in Model City, New York. In my professional opinion, based on my experience, these revisions to the FS cost estimate are reasonable and are within the cost estimating tolerances prescribed by the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988.

20. The foregoing statements are made to the best of my knowledge and belief.

Exhibit A
<IMG SRC 98141G8>

Willard F. Potter
Professional Qualificaions

Mr. Potter is a Chemical Engineer with twenty five (25) years of diversified environmental project management and engineering experience in the industrial, regulatory and consulting areas. Mr. Potter was formerly Corporate Director of Hazardous Waste Control for Allied-Signal. He was responsible for all Superfund site investigations and negotiations with regulatory agencies. Mr. Potter represented Allied on numerous industry lead potentially responsible party (PRP) groups for Superfund National Priority List (NPL) sites.

As Vice President of Technical Litigation Support Services for Dunn Gaoscience Corporation, Mr. Potter represented industrial clients during litigation involving environmental insurance coverage, acquisition and divestiture indemnification issues and agency negotiations.

Mr. Potter's project management experience includes Remedial Investigation/Feasibility Studies (RI/FS), waste minimization, remedial design, RCRA corrective action and development/implementation of an; experience also includes six (6) years with USEPA Region III in the NPDES permit program.

Education

B.S., Chemical Engineering, University of Virginia, Charlottesville, Virginia; 1971

Major Projects

! Primary Project Coordinator for PRP Group which conducted a RD/RA for a $3.5MM groundwater treatment facility at a NPL solvent recycling facility in Region II. Activities/responsibilities include coordination and negotiation of work plans, day-to-day management of general contractor, contracting, financial management/tracking and regulatory liaison for PRP Committee. The treatment facility, was completed on schedule and is now operating in compliance with permits. The facility design incorporated process automation and remote monitoring to minimize operator coverage.

! Primary Project Coordinator for PRP Group conducting a RD/RA of NPL municipal landfill in Region II. Activities include coordination of a supplemental hydrogeologic; investigation to support the design of a groundwater extraction and reinjection system.

! Primary Project Coordinator for a PRP Group conducting a RD/RA of two related NPL sites in the Now Jersey Pine Barrens Preservation District. Responsibilities; include coordination and communications with multiple contractors, the PRP Group and the NJDEPE. Coordination of ecological assessments, modeling of potential ecological impacts from groundwater extraction and remedial design optimization a major activity. Other significant responsibilities include financial management/invoice review, progress reports, strategy development and public relations program support.

! Technical litigation and case management support for a lawsuit involving over $50 million in environmental damage claims associated with contract of sale indemnification language. Activities include review and critique of proposed remedial activities and cost estimates, file searches, participation at depositions and expert witness testimony.

! Technical litigation and case management support in two (2) environmental insurance coverage lawsuits. Activities include file searches, regulatory research and interviews of potential expert witnesses.

! Original member of Chemical Manufacturer Association's Hazardous Waste Response Center Activities Included site inspections of six (6) NPL sites to provide EPA and State agencies with guidance on the conduct of Remedial Investigations. The group authored CMA's "Hazardous Waste Site Management Plan".

! Provided technical support to NJDEPE during remedial activities at an incineration facility on the

NPL. Developed waste compatibility protocol for bulking of containerized waste material.

! Responsible for eight (8) ECRA investigations in New Jersey resulting from major corporate acquisition.

! Responsible for in-house guidance manuals and associated training on Superfund contracting, selection of outside laboratories, assessment of emerging remedial technologies and RI/FS planning activities.

EXHIBIT B

COST ESTIMATE FOR ALTERNATIVE S-2A
CAPPING WITH SOIL

Item	Size or Quantity	Capital Costs ($)	O&M Costs($) Annual	Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	23,380		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Dumpsters	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,500		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and 'Dewatering	12 acres	36,000		
- Soil Cover	12 acres 12-in thick	103,200		
- Topsoil and Seed	12 acres 6-in thick	377,520	2,000	30,740
Subtotal		739,940	2,000	30,740
CONSTRUCTION SUBTOTAL		739,940	2,000	30,740
Health and Safety	10%	73,994		3,074
Bid Contingency	15%	110,991		4,611
Scope Contingency	30%	221,982		
CONSTRUCTION TOTAL		1,146,907	2,000	38,425
Permitting & Legal	5%	57,345		
Services During Construction `	10%	114,691		
TOTAL IMPLEMENTATION COSTS		1,318,943		38,425

Engineering & Design	10%	131,894	
TOTAL ESTIMATED COSTS		1,450,837	38,425
NET PRESENT WORTH OF COSTS		$1,489,262.36	

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.

2. Costs for soil cover are based on $5.33/cy used by USEPA in Alternative S-3.

EXHIBIT C

COST ESTIMATE FOR ALTERNATIVE S-2A CAPPING WITH SOIL

Item	Size or Quantity	Capital Costs ($)	O&M Costs ($) Annual	O&M Costs ($) Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well cuttings	167 drums	23,380		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Shooting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Dumpsters	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,000		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and'Dewatering	5.73 acres	17,190		
- Soil Cover	5.73 acres 12-in thick	49,300		
- Topsoil and Seed	5.73 acres 6-in thick	180,270	2,000	30,740
Subtotal		469,980	2,000	30,740
CONSTRUCTION SUBTOTAL		469,980	2,000	30,740
Health and Safety	10%	46,998		3,074
Bid Contingency	15%	70,497		4,611
Scope Contingency	30%	140,994		
CONSTRUCTION TOTAL		728,469	2,000	38,425
Permitting & Legal	5%	36,423		
Services During Construction	10%	72,847		
TOTAL IMPLEMENTATION COSTS		837,739		38,425

Engineering & Design	10%	83,774	
TOTAL ESTIMATED COSTS		921,513	38,425
NET PRESENT WORTH OF COSTS		$959,938.29	

5% discount

1. Costs for offsite disposal are based on assumption that all soil and waste are disposed of at a non-TSCA facility.

2. Costs for soil cover are based on S5.33/cy used by USEPA in Alternative S-3.

Exhibit D

EXHIBIT D
COST ESTIMATE FOR
DISPOSAL OF STOCKPILED SOIL

Item	Size or Quantity	cost (&)
Sampling and Analysis	2 Samples	4,000
Loading into Dumpsters	1 day	1,300
Transportation and Disposal	250 cy	17,500
TOTAL		$22,800

1. Cost for sampling and analysis based on $2,000 per sample and rate 1 sample per 145 cy used in Alternative S-2A by USEPA.

2. Cost for loading into dumpsters based on $1,300 per day and rate of 362.5 cy of soil loaded per day used in Alternative S-2A by USEPA.

3. Cost for transportation and disposal based on rate used in Alternative S-2A by USEPA and the excavated soil volume associated with the leaking underground storage tank (FS Appendix C).

EXHIBIT E

COST ESTIMATE FOR ALTERNATIVE S-2A CAPPING WITH SOIL

Item	Size or Quantity	Capital Costs ($)	Jam Costs($) Annual	Present Worth
1. DEED RESTRICTION	1LS	25,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	23,390		
- Baker Tank Sediment	95 drums	13,300		
- PPE	58 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	2	4,000		
- Loading onto Dumpsters	1 day	1,300		
- Transportation and Disposal	250 cy	17,500		
4. CAPPING WITH SOIL				
- Site Clearing and Grubbing, Rough Grading and Dewatering	5.73 acres	17,190		
- Soil Cover	5.73 acres 12-in thick	42,900		
- Topsoil and Seed	5.73 acres 6-in thick	180,270	2,000	30.740
Subtotal		359,680	2,000	30,740
CONSTRUCTION SUBTOTAL		359,680	2,000	30,740
Health and Safety	10%	35,968		3,074
Bid Contingency	15%	53,952		4,611
Scope Contingency	30%	107,904		
CONSTRUCTION TOTAL		557,504	2,000	38,425
Permitting & Legal	5%	27,875		
Services During Construction	10%	55,750		
TOTAL IMPLEMENTATION COSTS		641,130		38,425

Engineering & Design	10%	64,113		
TOTAL ESTIMATED COSTS		705,243		38,425
NET PRESENT WORTH OF COSTS		$743,667.56		

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.

2. Costs for soil cover are based on $5.33/cy used by USEPA in Alternative S-3.

3. Soil cover costs are reduced because 1,200 cy of stockpiled soil now assumed to be used as soil cover.

EXHIBIT F

COST ESTIMATE FOR ALTERNATIVE S-3 EXCAVATION AND OFFSITE DISPOSAL

Item	Size or Quantity	Capital Costs ($)	O&M Code($) Annual	Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/watering	1 ls	20,000		
- Excavation	18,500 cy	55,000		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Wall Cuttings	167 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	58 drums	7,840		
- Plastic Sheaft	22 drums	3,080		
- Hose/Wire/Polylubing	3 drums	420		
- Misc. Solid Wastes	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	435,000		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	225	450.000		
- Offsite Transportation & Disposal	18,500 cy	5,550,000		
6. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil and Seed	12 acres 6-in	377,520		
Subtotal		7,430,780	0	0
CONSTRUCTION SUBTOTAL		7,430,780		0
Health and Safety	10%	743,078		0
Bid Contingency	15%	1,114,617		0
Scope Contingency	30%	2,229,234		

CONSTRUCTION TOTAL		11,517,709	0	0
Permitting & Legal	5%	575,885		
Services During Construction	10%	1,151,771		
TOTAL IMPLEMENTATION COSTS		13,245,365		0
Engineering & Design	10%	1,324,537		
TOTAL ESTIMATED COSTS		14,569,902		0
NET PRESENT WORTH OF COSTS		$14,569,902		

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a RCRA facility @ $300/cy.

2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.

3. Apparent FS error in wall cuttings disposal cost maintained for consistency.

EXHIBIT G

COST ESTIMATE FOR ALTERNATIVE S-3 EXCAVATION AND OFFSITE DISPOSAL

Item	Size or Quantity	Capital Cost ($)	O&M costs($) Annual	Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/Dewatering	1 is	20,000		
- Excavation	24,600 cy	72,770		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well cuttings	187 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	101,500		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	298	596,000		
- Offsite Transportation & Disposal	24,500 cy	1,715,000		
5. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil and Seed	12 acres 6-in	377,520		
Subtotal		3,426,050	0	0
CONSTRUCTION SUBTOTAL		3,426,050		0
Health and Safety	10%	342,605		0
Bid Contingency	15%	513,908		0
Scope Contingency	30%	1,027,815		

CONSTRUCTION TOTAL		5,310,378	0	0
Permitting & Legal	5%	265,519		
Services During Construction	10%	531,038		
TOTAL IMPLEMENTATION COSTS		6,106,934	0	
Engineering & Design	10%	610,693		
TOTAL ESTIMATED COSTS		6,717,628		0
NET PRESENT WORTH OF COSTS		$6,717,628		

5% discount

1. Costs for offsite disposal are based on assumption that all soil and wastes are disposed of at a non-TSCA facility.

2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.

3. 6,000 cy additional soil for sampling and offsite disposal.

4. Apparent FS error in well cuttings disposal cost maintained for consistency.

EXHIBIT H

COST ESTIMATE FOR ALTERNATIVE S-3 EXCAVATION AND OFFSITE DISPOSAL

Item	Size or Quantity	Capital Costs ($)	O&M Costs ($) Annual	O&M Costs ($) Present Worth
1. EXCAVATION				
- Clearing and Grubbing	3 acres	9,240		
- Temporary Drainage/Dewatering	1 ls	20,000		
- Excavation	24,500 cy	72,770		
- Confirmatory Sampling	160	72,000		
2. OFFSITE DISPOSAL OF DRUMMED WASTE				
- Sampling and Analysis	10	20,000		
- Well Cuttings	167 drums	233,800		
- Baker Tank Sediment	95 drums	13,300		
- PPE	56 drums	7,840		
- Plastic Sheeting	22 drums	3,080		
- Hose/Wire/Polytubing	3 drums	420		
- Misc. Solid Waste	25 drums	3,500		
3. OFFSITE DISPOSAL OF SOIL STOCKPILE				
- Sampling and Analysis	10	20,000		
- Loading onto Trucks	4 days	5,200		
- Transportation and Disposal	1,450 cy	435,000		
4. OFFSITE DISPOSAL OF EXCAVATED SOIL				
- Sampling and Analysis	298	596,000		
- Offsite Transportation & Disposal	24,500 cy	7,350,000		
5. BACKFILLING				
- Imported Common Fill	12 acres 1.5-ft	154,880		
- Topsoil end Seed	12 acres 6-in	377,520		
Subtotal		9,394.550	0	0
CONSTRUCTION SUBTOTAL		9,394,550		0
Health and Safety	10%	939,455		0
Bid Contingency	15%	1,409,183		0
Scope Contingency	30%	2,818,365		

CONSTRUCTION TOTAL		14,561,553	0	0	
Permitting & Legal	5%	728,078			
Services During Construction	10%	1,456,155			
TOTAL IMPLEMENTATION COSTS		16,745,785		0	
Engineering & Design	10%	1,674,579			
TOTAL ESTIMATED COSTS		18,420,364		0	
NET PRESENT WORTH OF COSTS			$18,420,364		

1. Costs for offsite disposal are based an assumption that all soil and wastes are disposed of at a RCRA facility @ $300/cy.

2. Sample number for offsite disposal of excavated soil is based on NJDEP waste classification requirements consistent with FS.

3. 6,000 cy additional soil for sampling and offsites disposal.

4. Apparent FS error in well cuttings disposal cost maintained for consistency.

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - B

Written comments received by EPA during the public comment period

CHEMSOL TREATMENT SYSTEM

INITIAL STUDY - EFFLUENT CHRONIC TOXICITY

Prepared by

Bigler Associates, Inc.

September 9, 1996

Introduction

The purpose of this study, was to determine if the Chemsol Treatment Plant effluent could meet the proposed surface water discharge requirements for Chronic Toxicity, and what if any pretreatment of the effluent would be required to achieve compliance. Since start up of the facility, no Acute or Chronic Toxicity testing of the effluent has ever taken place. Aqua Survey, Inc. of Flemington, NJ was selected as the contract laboratory to run the Chronic Toxicity testing. Bigler Associates supervised the project, ran on site testing and pretreatment of the split samples.

Chronic Toxicity

The Chronic Toxicity test is used to determine the effect of the discharge on aquatic biota. Aquatic organisms are exposed to various concentrations of the treatment system effluent for a six or seven day period (depending on type of organism used). After the exposure, observations are made regarding the organisms' survival rate, weight gain, reproductive ability, and other indicators of health of the organism. The data is compared to a control group and statistical analysis is performed.

Measurement of the chronic toxicity is reported several ways as follows.

NOEC : No-observed-effect concentration - the highest toxicant concentration in which the values for the measured parameters (weight, survival, reproduction, etc.) are not significantly different from the control. A high NOEC value indicates low Chronic Toxicity.

LOEC : Lowest-observed-effect concentration - the lowest toxicant concentration in the values for the measured parameters are statistically significantly different from the control. A high LOEC value indicates low Chronic Toxicity.

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IC 25 : Incipient Concentration 25% - The concentration of effluent which produced a chronic toxic effect on 25% of the organisms as compared to the control group. A high IC 25 value indicates low Chronic Toxicity.

The proposed surface water discharge limitations include an NOEC limit of 100% (the lowest possible measured Chronic Toxicity) for two test organisms. The organisms tested are the Fathead minnow (Pimephales promelas) 7 day larval survival and growth test and Cladoceran (Ceriodaphnia dubia) 3 brood survival and reproduction test. Simultaneous split sample tests are run on both organisms and the more stringent results apply to the permit.

Chemsol Effluent Testing

In order to determine if the effluent could meet the strict requirements indicated in the permit equivalent, a full set of toxicity testing was run. Since the persistent presence of Hydrogen Sulfide (H_2S) in the effluent was a concern regarding the Chronic Toxicity, two sets of samples were run to determine if removal of the H_2S was necessary. One set was labeled "untreated effluent" and consisted of samples collected during the week period that were delivered to the lab untreated. The second set of samples labeled "treated effluent" consisted of samples that were treated with 0.5 mg/L Hydrogen Peroxide and 45 minutes of aeration to remove any Hydrogen Sulfide.

Routine testing of the over the past two years indicated that the H_2S concentration in the effluent is typically 2.5 mg/L. BAI performed bench testing of the effluent with Hydrogen Peroxide and aeration and determined the normal dosage requirements for oxidation of H_2S. Once the samples were collected for the Toxicity test, they were tested on site to determine the concentration of H_2S before treatment and delivery to the laboratory. The results indicated that no H_2S was present in the sample after collection, although a grab sample of the effluent was measured with 2.1 mg/L H_2S. This absence of Hydrogen Sulfide was attributed to the method of sample collection which relied on sample flowing at a slow rate into an open container. The long detention time in the shallow container allowed for atmospheric oxidation of the H_2S. It was decided to treat one set of samples with a minimum dosage of Hydrogen Peroxide and continue to determine if there would be any positive effect from the pretreatment since the peroxide would also oxidize many organic compounds that may remain.

Test Results

The following table summarizes the results of tests contained in the attached reports.

Sample	Organism	NOEC	LOEC	IC 25
Untreated Eff.	C. dubia	100.0%	>100%	>100%
Untreated Eff.	P. Promelas	100.0%	>100%	>100%
Treated Eff.	C. dubia	12.5%	25.0%	26.7%
Treated Eff.	P. promelas	100.0%.	>100%	>100%

<IMG SRC 98141H>

The above results indicate that the untreated sample demonstrated no Chronic Toxicity in either species tested. The treated sample showed no Chronic Toxicity in the Fathead minnow, but toxicity was indicated with the daphnia in this sample. It is likely that even at 0.6 mg/L the Hydrogen Peroxide concentration was too great for this organism, however based on this one test pretreatment of the effluent with Hydrogen Peroxide to remove Hydrogen Sulfide is not needed.

Recommendations

To verity the results, BAI recommends that the Chronic Toxicity test be repeated at least one more time on the untreated effluent. Consideration should also be given to running an additional test on effluent from a clean carbon bed to determine if the biological activity in the carbon unit is responsible for positive results. BAI would also recommend a post aeration system be added to the existing effluent tank to facilitate stripping of residual H_2S if discharge to surface water becomes a viable alternative.

<IMG SRC 98141H1>

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Pimephales promelas
(Untreated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

<IMG SRC 98141H2>

499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone (908)788-8700 FAX (908)788-9165

NJPDES BIOMONITORING REPORT FORM
CHRONIC TOXICITY TESTS

FACILITY NAME: Chemsol Plant

FACILITY LOCATION:

LABORATORY NAME: Aqua Survey,Inc. ACUTE TOXICITY ID./CERTIFICATION#: 10309

DATE OF LAST SRT TEST: 7/22/96 NOEC/IC 25: 0.5 ppt KCI /0.56

CONTROL CHART MEAN(NOEC/IC 25): 0.35/0.60 UPPER CONTROL LIMIT: 0.70/0.89
LOWER CONTROL LIMIT: 0.18/0.33

TEST START DATE: 8/13/96 TEST END DATE: 8/20/96

TEST TYPE AND RESULTS (Check applicable test and fill in NOEC and LOEC):

X	Fathead minnow, (CN/FM) Method 1000.0 (Pimephales promelas) 7 day Larval Survival and Growth Test)	NOEC: 100%	LOEC: >100%	IC 25: >100%
_	Cladoceran, (CN/CD) Method 1002.0 (Ceriodaphnia dubia) 3 brood Survival and Reproduction Test)	NOEC	LOEC	
_	Sheepshead minnow,(CN/SM) Method 1005.0 (Cyprinodon variegatus) 7 day Larval Survival and Growth Test)	NOEC	LOEC	
_	Inland Silverside, (CN/IS) Method 1006.0 (Menidia beryllina) 7 day Larval Survival and Growth Test)	NOEC	LOEC	
_	Mysid, (CN/MS) Method 1007.0 (Mysidopsis bahia) 7 day Survival, Growth and Fecundity Test)	NOEC	LOEC	
_	Alga, (CN/SC) Method 1003.0 (SelEnastrum capricornutum) Growth Test)	NOEC	LOEC	
_	Macroalga, (CN/CP) Method 1009.0 (Champia parvula) Sexual Reproduction Test)	NOEC	LOEC	

CONTROL MORTALITY (Percent): zero

Did the test meet the acceptability criteria for the test species as specified in Part M of the Chronic Methods Document?
Yes X No _
CERTIFICATION:
Accuracy of report certified by:

<IMG SRC 98141H3>

Number of Effluent Concentrations: 5
Number of Replicates per Test Concentration: 4
Number of Test Organisms per Replicate: 10
Number of Test Organisms per Test Concentration: 40
Test Chamber Size: 1000 ML Exposure Volume: 500 mL
Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite X Other _ Describe: _

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8-00 am	9/12 - 8:00 am	6.7	7.3	9/13-14	3:00 pm
8/13 - 8.00 am	8/14 - 8:00 am	5.7	7.2	8/15-16	2:30 pm
8/15 - 8:00 am	8/16 - 8:00 am	6.0	7.4	8/17-19	9:00 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory _
On-site Commercial Laboratory _
Remote Laboratory x

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water

If receiving water used as dilution water source, describe collection location and dates of collection:

<IMG SRC 98141H4>
499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone (908) 788-8700 FAX(908) 788- 9165

SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW,
INLAND SILVERSIDE AND MYSID TESTS

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	100.0	0.608	
6.25	90.0	0.565	
12.5	95.0	0.573	
25	92.5	0.555	
50	95.0	0.660	
1100	97.5	0.625	

Organism source: x Cultured Stock _ Commercial Supplier

Name of Supplier:

Hatch Dates: 8/12/96

Organism Age (days/hrs): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? X Yes _ No

Did the temperature in the test chambers vary by more than 15C each day?
x Yes _ No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
_Yes _ No

* How long after test termination were the mysids examined for eggs and sexes?

* Applies to mysid test only

<IMG SRC 98141H5>

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<IMG SRC 98141H6>
<IMG SRC 98141H7>

Chemsol 96-294 untreated P. promelas Survival
File: 294upps   Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D =   0.184

W =   0.967

Critical W (P = 0.05) (n = 24) = 0.916
Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley's test for homogeneity of variance
Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

TITLE: Chemsol 96-294 untreated P. promelas Survival
FILE. 294upps
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	1.0000	1.4120
1	Control	2	1.0000	1.4120
1	Control	3	1.0000	1.4120
1	Control	4	1.0000	1.4120
2	6.25	1	0.9000	1.2490
2	6.25	2	0.8000	1.1071
2	6.25	3	1.0000	1.4120
2	6.25	4	0.9000	1.2490
3	12.5	1	1.0000	1.4120
3	12.5	2	0.9000	1.2490
3	12.5	3	1.0000	1.4120
3	12.5	4	0.9000	1.2490
4	25	1	0.8000	1.1071
4	25	2	1.0000	1.4120
4	25	3	0.9000	1.2490
4	25	4	1.0000	1.4120
5	50	1	1.0000	1.4120
5	50	2	0.9000	1.2490
5	50	3	1.0000	1.4120
5	50	4	0.9000	1.2490
6	100	1	1.0000	1.4120
6	100	2	1.0000	1.4120
6	100	3	1.0000	1.4120
6	100	4	0.9000	1.2490

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	1.412	1.412	1.412
2	6.25	4	1.107	1.412	1.254
3	12.5	4	1.249	1.412	1.331
4	25	4	1.107	1.412	1.295
5	50	4	1.249	1.412	1.331
6	100	4	1.249	1.412	1.371

Chemsol 96-294 untreated P. promelas Survival
File: 294upps Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.000	0.000	0.000	0.00
2	6.25	0.016	0.125	0.062	9.93
3	12.5	0.009	0.094	0.047	7.07
4	25	0.022	0.147	0.073	11.35
5	50	0.009	0.094	0.047	7.07
6	100	0.007	0.081	0.041	5.94

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Control	1.412				
2	6.25	1.254	12.00	10.00	4.00	
3	12.5	1.331	14.00	10.00	4.00	
4	25	1.295	14.00	10.00	4.00	
5	50	1.331	14.00	10.00	4.00	
6	100	1.371	16.00	10.00	4.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

<IMG SRC 98141H8>

Shapiro - Wilk's test for normality

D = 0.053
W = 0.968

Critical W (P = 0.05) (n = 24) = 0.916
Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 3.53

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TITLE: Chemsol 96-294 Untreated P. promelas Dry Weight
FILE: 294uppdw
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.6100	0.6100
1	Control	2	0.6800	0.6800
1	Control	3	0.5500	0.5500
1	Control	4	0.5900	0.5900
2	6.25	1	0.5500	0.5500
2	6.25	2	0.4900	0.4900
2	6.25	3	0.5400	0.5400
2	6.25	4	0.6800	0.6800
3	12.5	1	0.5400	0.5400
3	12.5	2	0.5700	0.5700
3	12.5	3	0.5700	0.5700
3	12.5	4	0.6100	0.6100
4	25	1	0.5400	0.5400
4	25	2	0.5900	0.5900
4	25	3	0.4800	0.4800
4	25	4	0.6100	0.6100
5	50	1	0.6700	0.6700
5	50	2	0.6200	0.6200
5	50	3	0.7000	0.7000
5	50	4	0.6500	0.6500
6	100	1	0.6400	0.6400
6	100	2	0.5600	0.5600
6	100	3	0.6900	0.6900
6	100	4	0.6100	0.6100

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	0.550	0.680	0.608
2	6.25	4	0.490	0.680	0.565
3	12.5	4	0.540	0.610	0.573
4	25	4	0.480	0.610	0.555
5	50	4	0.620	0.700	0.660
6	100	4	0.560	0.690	0.625

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.003	0.054	0.027	8.95
2	6.25	0.007	0.081	0.041	14.34
3	12.5	0.001	0.029	0.014	5.02
4	25	0.003	0.058	0.029	10.45
5	50	0.001	0.034	0.017	5.10
6	100	0.003	0.054	0.027	8.71

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.033	0.007	2.223
Within (Error)	18	0.053	0.003	
Total	23	0.086		

Critical F value - 2.77 (0.05,5,18)
Since F < Critical F FAIL TO REJECT Ho: All equal

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.608	0.608		
2	6.25	0.565	0.565	1.103	
3	12.5	0.573	0.573	0.908	
4	25	0.555	0.555	1.363	
5	50	0.660	0.660	-1.363	
6	100	0.625	0.625	-0.454	

Dunnett table value - 2.41 (1 Tailed Value, P =0.05, df=18,5)

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	4			
2	6.25	4	0.093	15.3	0.04
3	12.5	4	0.093	15.3	0.033
4	25	4	0.093	15.3	0.053
5	50	4	0.093	15.3	-0.052
6	100	4	0.093	15.3	-0.017

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.61	.55	.54	.54	.67	.64
Response 2	.68	.49	.57	.59	.62	.56
Response 3	.55	.54	.57	.48	.7	.69
Response 4	.59	.68	.61	.61	.65	.61

*** Inhibition Concentration Percentage Estimate
Toxicant/Effluent: Effluent
Test Start Date: 8/13/96 Test Ending Date: 8/20/96
Test Species: P. promelas
Test Duration: 7
DATA FILE: 294uppdw.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.608	0.054	0.608
2	4	6.250	0.565	0.081	0.596
3	4	12.500	0.573	0.029	0.596
4	4	25.000	0.555	0.058	0.596
5	4	50.000	0.660	0.034	0.596
6	4	100.000	0.625	0.054	0.596

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

<IMG SRC 98141H9>
<IMG SRC 98141I>
<IMG SRC 98141I1>
<IMG SRC 98141I2>

YSI 6000 Time series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond US/cm	Salinity PPT	DO mg/L	pH
8/17/96	8:09:27	24.44	304.00	0.2	7.51	8.19
8/17/96	8:09:43	24.52	322.00	0.2	7.72	8.08
8/17/96	8:09:52	24.56	338.00	0.2	7.72	8.02
8/17/96	8:10:02	24.59	366.00	0.2	7.74	7.95
8/17/96	8:10:09	24.59	429.00	0.2	7.76	7.85
8/17/96	8:10:21	24.62	552.00	0.3	7.73	7.64

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond US/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:50:17	24.87	321.00	0.2	7.43	8.35
8/19/96	9:50:24	25.37	336.00	0.2	7.64	8.03
8/19/96	9:50:30	25.35	344.00	0.2	7.64	7.98
8/19/96	9:50:35	25.30	381.00	0.2	7.65	7.92
8/19/96	9:50:40	25.31	440.00	0.2	7.66	7.84
8/19/96	9:50:47	25.44	572.00	0.3	7.65	7.66

<IMG SCR 98141I4>
<IMG SCR 98141I5>
<IMG SCR 98141I6>

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond US/cm	Salinity PPT	DO mg/L	pH
8/17/96	7:45:12	25.06	323.00	0.2	7.12	6.84
8/17/96	7:45:28	25.07	347.00	0.2	6.84	6.91
8/17/96	7:45:36	25.51	363.00	0.2	6.51	6.90
8/17/96	7:45:41	25.65	397.00	0.2	6.31	6.90
8/17/96	7:45:50	25.75	462.00	0.2	6.00	6.87
8/17/96	7:45:58	25.72	596.00	0.3	5.60	6.88

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	cond US/cm	Salinity PPT	DO mg/L	pH
8/18/96	9:03:27	24.10	345.00	0.2	7.50	8.48
8/18/96	9:03:34	24.92	349.00	0.2	6.07	8.14
8/18/96	9:03:47	25.06	367.00	0.2	5.95	7.98
8/18/96	9:03:54	25.08	391.00	0.2	5.97	7.90
8/18/96	9:04:00	25.09	454.00	0.2	5.89	7.85
8/18/96	9:04:06	25.04	576.00	0.3	5.76	7.77

YSI 6000 Time series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:19:44	25.58	346.00	0.2	5.38	7.78
8/19/96	9:19:54	25.55	367.00	0.2	5.16	7.54
8/19/96	9:20:00	25.60	382.00	0.2	5.12	7.49
8/19/96	9:20:06	25.62	398.00	0.2	5.09	7.46
8/19/96	9:20:11	25.59	454.00	0.2	5.07	7.40
8/19/96	9:20:17	25.52	585.00	0.3	4.87	7.35

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/20/96	8:58:33	24.61	373.00	0.2	6.31	8.20
8/20/96	8:58:48	24.75	368.00	0.2	5.77	7.87
8/20/96	8:59:00	24.78	376.00	0.2	5.78	7.80
8/20/96	8:59:10	24.76	406.00	0.2	5.48	7.74
8/20/96	8:59:19	24.71	468.00	0.2	5.20	7.69
8/20/96	8:59:32	24.60	599.00	0.3	4.98	7.65

<IMG SCR 98141I7>

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Ceriodaphnia dubia
(Untreated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4,1996

JOB #96-294

<IMG SCR 98141I8>
<IMG SCR 98141I9>

TEST DESIGN

Number of Effluent Concentratiions: 5
Number of Replicates per Test Concentration: 10
Number of Tea Organism per Replicate: 1
Number of Test Organisms per Test Concentration: 10
Tea Chamber Size: 30 mL Exposure Volume: 15 mL
Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite x Other Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	6.7	7.3	8/13-14	11:30 am
8/13 - 8:00 am	9/14 - 8:00 am	5.7	7.2	8/15-16	11:10 am
8/15 - 8:00 am	8/16 - 8:00 am	6.0	7.4	8/17-18	9:30 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory
On-site Commercial Laboratory
Remote Laboratory x

DILUTION WATER

Effluent Receiving Water:
Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water
Describe any adjustment to the dilution water:
If receiving water used as dilution water source, describe collection location and dates of collection:
<IMG SCR 98141J>

SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST

Percent Effluent	Mean Percent Survial	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	18.0	70.0
6.25	100	24.0	100
12.5	100	21.8	77.8
25	100	24.6	90
50	100	21.8	60
100	100	27.0	80

Organism source: x Cultured Stock Commercial Supplier
Name of Supplier:
Organism Age at test start(hrs.): <24 hrs.

Test organisms all released with an 8 hour period? X Yes No

Neonates obtained from (check one):
Mass cultures
X individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood? x Yes No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippia

Percent Effluent	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrationsl influence the determination of the NOEC/IC25?
Yes No

<IMG SCR 98141J1>

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<IMG SCR 98141J2>
<IMG SCR 98141J3>
<IMG SCR 98141J4>

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
6.25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
12.5	9	0	9
TOTAL	19	0	19

CRITICAL FISHER'S VALUE (10,9,10) (p=0.05) IS 5. b, VALUE IS 9.
Since b is greater than 5 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
50	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
100	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
	CONTROL	10	0	
1	6.25	10	0	
2	12.5	9	0	
3	25	10	0	
4	50	10	0	
5	100	10	0	

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	3.953	14.278	22.538	14.278	3.953
OBSERVED	7	10	20	22	0

Calculated Chi-Square, goodness of fit test statistic = 12.0455
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 17.16

Bartlett's test using average degrees of freedom
Calculated B2 statistic = 16.86
Based on average replicate size of 8.83

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha - 0.05, df = 5)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.
Data FAIL B2 homogeneity test at 0.01 level. Try another transformation.

TITLE: Chemsol 96-2S4 untreated C. dubia Reproduction
FILE: 294ucdr
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	22.0000	22.0000
1	Control	2	21.0000	21.0000
1	Control	3	20.0000	20.0000
1	Control	4	23.0000	23.0000
1	Control	5	12.0000	12.0000
1	Control	6	23.0000	23.0000
1	Control	7	16.0000	16.0000
1	Control	8	12.0000	12.0000
1	Control	9	22.0000	22.0000
1	Control	10	9.0000	9.0000
2	6.25	1	26.0000	26.0000
2	6.25	2	25.0000	25.0000
2	6.25	3	25.0000	25.0000
2	6.25	4	22.0000	22.0000
2	6.25	5	21.0000	21.0000
2	6.25	6	24.0000	24.0000
2	6.25	7	21.0000	21.0000
2	6.25	8	25.0000	25.0000
2	6.25	9	26.0000	26.0000
2	6.25	10	25.0000	25.0000
3	12.5	1	24.0000	24.0000
3	12.5	2	12.0000	12.0000
3	12.5	3	13.0000	13.0000
3	12.5	4	26.0000	26.0000
3	12.5	5	24.0000	24.0000
3	12.5	6	21.0000	21.0000
3	12.5	7	23.0000	23.0000
3	12.5	8	26.0000	26.0000
3	12.5	9	27.0000	27.0000
4	25	1	24.0000	24.0000
4	25	2	23.0000	23.0000
4	25	3	25.0000	25.0000
4	25	4	21.0000	21.0000
4	25	5	26.0000	26.0000
4	25	6	22.0000	22.0000
4	25	7	28.0000	28.0000
4	25	8	22.0000	22.0000
4	25	9	27.0000	27.0000
4	25	10	28.0000	28.0000
5	25	1	29.0000	29.0000
5	50	2	22.0000	22.0000
5	50	3	10.0000	10.0000
5	50	4	24.0000	24.0000
5	50	5	24.0000	24.0000
5	50	6	26.0000	26.0000
5	50	7	29.0000	29.0000
5	50	8	25.0000	25.0000
5	50	9	14.0000	14.0000
5	50	10	15.0000	15.0000
6	100	1	33.0000	33.0000
6	100	2	28.0000	28.0000

6	100	3	29.0000	29.0000
6	100	4	28.0000	28.0000
6	100	5	30.0000	30.0000
6	100	6	29.0000	29.0000
6	100	7	30.0000	30.0000
6	100	8	10.0000	10.0000
6	100	9	30.0000	30.0000
6	100	10	23.0000	23.0000

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	10	9.000	23.000	18.000
2	6.25	10	21.000	26.000	24.000
3	12.5	9	12.000	27.000	21.778
4	25	10	21.000	28.000	24.600
5	50	10	10.000	29.000	21.800
6	100	10	10.000	33.000	27.000

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	28.000	5.292	1.673	29.40
2	6.25	3.778	1.944	0.615	8.10
3	12.5	30.944	5.563	1.854	25.54
4	25	6.711	2.591	0.819	10.53
5	50	43.067	6.563	2.075	30.10
6	100	42.000	6.481	2.049	24.00

WILCOXON'S RANK SUM TEST W/ BONFERRONI ADJUSTMENT - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	REPS	SIG
1	Control	18.000				
2	6.25	24.000	143.00	74.00	10	
3	12.5	21.778	114.50	61.00	9	
4	25	24.600	143.50	74.00	10	
5	50	21.800	129.00	74.00	10	
6	100	27.000	145.00	74.00	10	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	22	26	24	24	29	33
Response 2	21	25	12	23	22	28
Response 3	20	25	13	25	10	29
Response 4	23	22	26	21	24	28
Response 5	12	21	24	26	24	30
Response 6	23	24	21	22	26	29
Response 7	16	21	23	28	29	30
Response 8	12	25	26	22	25	10
Response 9	22	26	27	27	14	30
Response 10	9	25		28	15	23

*** Inhibition Concentration Percentage Estimate
Toxicant/Effluent: Effluent
Test Start Date: 8/13/96 Test Ending Date: 8/19/96
Test Species: C. dubia
Test Duration: 6

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	18.000	5.292	22.881
2	10	6.250	24.000	1.944	22.881
3	9	12.500	21.778	5.563	22.881
4	10	25.000	24.600	2.591	22.881
5	10	50.000	21.800	6.563	22.881
6	10	100.000	27.000	6.481	22.881

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

<IMG SCR 98141J5>
<IMG SCR 98141J6>

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/15/96	10:03:59	24.09	326.00	0.2	8.75	8.46
8/15/96	10:04:11	24.88	345.00	0.2	7.70	7.90
8/15/96	10:04:18	24.91	360.00	0.2	7.71	7.86
8/15/96	10:04:24	24.95	393.00	0.2	7.70	7.79
8/15/96	10:04:30	25.00	465.00	0.2	7.68	7.68
8/15/96	10:04:37	25.08	608.00	0.3	7.65	7.52

<IMG SCR 98141J7>

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/17/96	8:09:27	24.44	304.00	0.2	7.51	8.19
8/17/96	8:09:43	24.52	322.00	0.2	7.72	8.08
8/17/96	8:09:52	24.56	338.00	0.2	7.72	8.02
8/17/96	8:10:02	24.59	366.00	0.2	7.74	7.95
8/17/96	8:10:09	24.59	429.00	0.2	7.76	7.85
8/17/96	8:10:21	24.62	552.00	0.3	7.73	7.64

<IMG SCR 98141J8>
<IMG SCR 98141J9
<IMG SCR 98141K>

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/16/96	17:46:09	24.91	402.00	0.2	7.89	7.98
8/16/96	17:46:15	25.56	418.00	0.2	7.80	7.95
8/16/96	17:46:21	25.65	431.00	0.2	7.79	7.94
8/16/96	17:46:26	25.75	463.00	0.2	7.78	7.92
8/16/96	17:46:32	25.73	532.00	0.2	7.81	7.93
8/16/96	17:46:38	25.70	674.00	0.3	7.82	7.96

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/17/96	9:38:30	25.86	295.00	0.1	7.50	7.92
8/17/96	9:39:01	25.97	236.00	0.1	7.26	7.81
8/17/96	9:39:16	25.83	218.00	0.1	7.23	7.81
8/17/96	9:39:28	25.62	315.00	0.2	7.16	7.75
8/17/96	9:39:40	25.68	353.00	0.2	7.44	7.75
8/17/96	9:39:52	25.69	429.00	0.2	7.14	7.85

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/18/96	10:59:58	24.05	344.00	0.2	7.53	7.96
8/18/96	11:00:08	24.14	366.00	0.2	7.51	7.92
8/18/96	11:00:17	24.26	382.00	0.2	7.51	7.92
8/18/96	11:00:26	24.31	407.00	0.2	7.53	7.93
8/18/96	11:00:36	24.31	484.00	0.2	7.55	7.94
8/18/96	11:00:45	24.30	608.00	0.3	7.57	8.02

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond US/cm	Salinity PPT	DO mg/L	pH
8/19/96	16:29:16	25.13	368.00	0.2	7.64	8.01
8/19/96	16.29:27	25.11	393.00	0.2	7.54	7.99
8/19/96	16:29:38	25.07	401.00	0.2	7.53	7.98
8/19/96	16:29:46	25.11	418.00	0.2	7.50	7.98
8/19/96	16:29:55	25.04	481.00	0.2	7.50	7.99
8/19/96	16:30:05	25.09	613.00	0.3	7.50	8.03

<IMG SCR 98141K1>

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Pimephales promelas
(Treated)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

September 4, 1996

JOB #96-294

<IMG SCR 98141K2>

499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone (908)788-8700 FAX (908)788-9165

<IMG SCR 98141K3>

Number of Effluent Concentrations: 5
Number of Replicates per Test Concentration 4
Number of Test Organisms per Replicate: 10
Number of Test Organisms per Test Concentration: 40
Test Chamber Size: 1000 mL Exposure Volume: 500 mL
Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location:

Effluent Type:

Sample Type: 24 hour Composite x Other Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
8/11 - 8:00 am	8/12 - 8:00 am	7.9	7.9	8/13-14	3:30 pm
8/13 - 8:00 am	8/14 - 8:00 am	7.5	8.0	8/15-16	3:00 pm
8/15 - 8:00 am	8/16 - 8:00 am	8.3	8.2	8/17-19	8:15 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory
On-site Commercial Laboratory
Remote Laboratory x

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

<IMG SCR 98141K4>

SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW,
INLAND SILVERSIDE AND MYSID TESTS

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	97.5	0.457	
6.25	97.5	0.560	
12.5	100.0	0.515	
25	100.0	0.618	
50	92.5	0.605	
100	92.5	0.678	

Organism source: x Cultured Stock Commercial Supplier

Name of Supplier:

Hatch Dates: 8/12/96

Organism Age (days/hrs.): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? X Yes No

Did the temperature in the test chambers vary by more than 15C each day?
X Yes No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
Yes No

*How long after test termination were the mysids examined for eggs and sexes?

*Applies to mysid test only

<IMG SCR 98141K5>

499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone (908)788-8700 FAX(908)788-9165

```
A

P

P

E

N

D

I

X

<IMG SRC 98141K6>
<IMG SCR 98141K7>

Shapiro - Wilk's test for normality
--------------------------------------------------------------------------------

D =   0.125

W =   0.915

Critical W (P = 0.05) (n = 24) = 0.916
Critical W (P = 0.01) (n = 24) = 0.884
------------------------------------------------------------------------------

Data PASS normality test at P=0.01 level. Continue analysis.

Hartley's test for homogeneity of variance
Bartlett's test for homogeneity of variance
----------------------------------------------------------------------

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

- - - - - - - - - - - - - - - - - - -- - -- - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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TITLE: Chemsol 96-294 Treated P. promelas Survival
FILE: 294tpps
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	1.0000	1.4120
1	Control	2	0.9000	1.2490
1	Control	3	1.0000	1.4120
1	Control	4	1.0000	1.4120
2	6.25	1	1.0000	1.4120
2	6.25	2	1.0000	1.4120
2	6.25	3	0.9000	1.2490
2	6.25	4	1.0000	1.4120
3	12.5	1	1.0000	1.4120
3	12.5	2	1.0000	1.4120
3	12.5	3	1.0000	1.4120
3	12.5	4	1.0000	1.4120
4	25	1	1.0000	1.4120
4	25	2	1.0000	1.4120
4	25	3	1.0000	1.4120
4	25	4	1.0000	1.4120
5	50	1	0.9000	1.2490
5	50	2	0.9000	1.2490
5	50	3	0.9000	1.2490
5	50	4	1.0000	1.4120
6	100	1	0.8000	1.1071
6	100	2	1.0000	1.4120
6	100	3	0.9000	1.2490
6	100	4	1.0000	1.4120

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	1.249	1.412	1.371
2	6.25	4	1.249	1.412	1.371
3	12.5	4	1.412	1.412	1.412
4	25	4	1.412	1.412	1.412
5	50	4	1.249	1.412	1.290
6	100	4	1.107	1.412	1.295

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.007	0.081	0.041	5.94
2	6.25	0.007	0.081	0.041	5.94
3	12.5	0.000	0.000	0.000	0.00
4	25	0.000	0.000	0.000	0.00
5	50	0.007	0.081	0.041	6.32
6	100	0.022	0.147	0.073	11.35

STEEL'S MANY-ONE RANK TEST Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK sum	CRIT. VALUE	df	SIG
1	Control	1.371				
2	6.25	1.371	18.00	10.00	4.00	
3	12.5	1.412	20.00	10.00	4.00	
4	25	1.412	20.00	10.00	4.00	
5	50	1.290	14.00	10.00	4.00	
6	100	1.295	15.50	10.00	4.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

<IMG SCR 98141K8>

Shapiro - Wilk's test for normality

D = 0.058

W = 0.930

Critical W (P = 0.05) (n = 24) = 0.916
Critical W (P - 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 1.78

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.4100	0.4100
1	control	2	0.4400	0.4400
1	Control	3	0.4900	0.4900
1	Control	4	0.4900	0.4900
2	6.25	1	0.5800	0.5800
2	6.25	2	0.4800	0.4800
2	6.25	3	0.5800	0.5800
2	6.25	4	0.6000	0.6000
3	12.5	1	0.4800	0.4800
3	12.5	2	0.4400	0.4400
3	12.5	3	0.6000	0.6000
3	12.5	4	0.5400	0.5400
4	25	1	0.5500	0.5500
4	25	2	0.6600	0.6600
4	25	3	0.6400	0.6400
4	25	4	0.6200	0.6200
5	50	1	0.6200	0.6200
5	50	2	0.5400	0.5400
5	50	3	0.6400	0.6400
5	50	4	0.6200	0.6200
6	100	1	0.6400	0.6400
6	100	2	0.7300	0.7300
6	100	3	0.7500	0.7500
6	100	4	0.5900	0.5900

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	4	0.410	0.490	0.457
2	6.25	4	0.480	0.600	0.560
3	12.5	4	0.440	0.600	0.515
4	25	4	0.550	0.660	0.618
5	50	4	0.540	0.640	0.605
6	100	4	0.590	0.750	0.678

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.002	0.039	0.020	8.63
2	6.25	0.003	0.054	0.027	9.67
3	12.5	0.005	0.070	0.035	13.59
4	25	0.002	0.048	0.024	7.75
5	50	0.002	0.044	0.022	7.33
6	100	0.006	0.075	0.038	11.14

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.123	0.025	7.642
Within (Error)	18	0.058	0.003	
Total	23	0.181		

Critical F value = 2.77 (0.05,5,18)
Since P > Critical F REJECT Ho: All equal

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.457	0.457		
2	6.25	0.560	0.560	-2.553	
3	12.5	0.515	0.515	-1.432	
4	25	0.618	0.618	-3.985	
5	50	0.605	0.605	-3.674	
6	100	0.678	0.678	-5.480	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL

1	Control	4			
2	6.25	4	0.097	21.1	-0.103
3	12.5	4	0.097	21.1	-0.058
4	25	4	0.097	21.1	-0.160
5	50	4	0.097	21.1	-0.148
6	100	4	0.097	21.1	-0.220

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.41	.58	.48	.55	.62	.64
Response 2	.44	.48	.44	.66	.54	.73
Response 3	.49	.58	.60	.64	.64	.75
Response 4	.49	.60	.54	.62	.62	.59

*** Inhibition Concentration Percentage Estimate ***
Toxicant/Effluent: Effluent
Test Start Date: 8/13/96 Test Ending Date: 8/20/96
Test Species: P. promelas
Test Duration: 7 day
DATA FILE: 294tppdw.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.457	0.039	0.572
2	4	6.250	0.560	0.054	0.572
3	4	12.500	0.515	0.070	0.572
4	4	25.000	0.618	0.048	0.572
5	4	50.000	0.605	0.044	0.572
6	4	100.000	0.678	0.075	0.572

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

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<IMG SCR 98141L5>
<IMG SCR 98141L6>
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YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/CM	Salinity PPT	DO mg/L	pH
8/17/96	7:46:33	24.54	318.00	0.2	7.35	7.39
8/17/96	7:46:40	25.15	347.00	0.2	6.08	7.27
8/17/96	7:46:48	25.40	364.00	0.2	6.03	7.21
8/17/96	7:46:56	25.58	393.00	0.2	5.68	7.15
8/17/96	7:47:10	25.74	460.00	0.2	5.47	7.14
8/17/96	7:47:17	25.76	589.00	0.3	5.38	7.19

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	8:51:20	24.16	326.00	0.2	7.29	7.21
8/18/96	8:51:27	24.42	346.00	0.2	6.54	7.12
8/18/96	8:51:33	24.58	359.00	0.2	6.72	7.11
8/18/96	8:51:40	24.76	385.00	0.2	6.63	7.10
8118196	8:51:47	24.84	453.00	0.2	6.42	7.10
8/18/96	8:51:53	24.88	581.00	0.3	6.47	7.15

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	9:15:24	25.31	378.00	0.2	6.63	7.93
8/19/96	9:15:55	26.95	389.00	0.2	6.92	7.84
8/19/96	9:16:14	24.92	391.00	0.2	7.50	8.11
8/19/96	9:16:35	24.99	407.00	0.2	7.22	8.10
8/19/96	9:17:25	24.32	467.00	0.2	7.27	8.08
8/19/96	9:17:45	24.43	602.00	0.3	6.81	7.97
8/19/96	9:18:42	25.43	345.00	0.2	5.44	7.89

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp C	Cond uS/cm	Salinity PPT	DO mg/L	PH
8/20/96	9:00:33	24.50	352.00	0.2	6.00	7.83
8/20/96	9:00:45	24.57	365.00	0.2	5.92	7.72
8/20/96	9:00:57	24.63	387.00	0.2	5.74	7.66
8/20/96	9:01:09	24.65	408.00	0.2	5.80	7.62
8/20/96	9:01:24	24.70	475.00	0.2	5.83	7.63
8/20/96	9:01:37	24.75	616.00	0.3	6.07	7.70

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CHROMC BIOMONITORING REPORT
Chemsol Plant
Ceriodaphnia dubia
(Treated)

BIEGLER ASSOCIATES
PO BOX 261
RlDGEFIELD PARK. NJ 07660

September 4, 1996

JOB #96-294

499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone(908)788-8700 FAX(908)788-9165

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<IMG SCR 98141M>
<IMG SCR 98141M1>

SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	23.7	70
6.25	100	21.6	100
12.5	100	20.4	70
25	100	19.1	70
50	0	0	0
100	0	0	0

Organism source: x Cultured Stock Commercial Supplier
Name of Supplier:
Organism Age at test start (hrs.): <24 hrs.

Test organisms all released with an 8 hour period? xYes No

Neonates obtained from (check one):
Mass cultures
x individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood?
xYes No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippla

Percent Effluent.	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrations], influence the determination of the NOEC/IC25?
Yes x No

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<IMG SCR 98141M4>
<IMG SCR 98141M5>

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
6.25, 12.5, 25	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	NUMBER OF ALIVE	NUMBER OF DEAD	TOTAL ANIMALS
CONTROL	10	0	10
50,100	0	10	10
TOTAL	10	10	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 0.
Since b is less than or equal to 6 there is a significant difference between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=.05)
	CONTROL	10	0	
1	6.25, 12.5, 25	10	0	
2	50,100	10	10	*

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.680	9.680	15.280	9.680	2.680
OBSERVED	3	8	13	15	1

Calculated Chi-Square goodness of fit test statistic = 4.6469
Table Chi-Square value (alpha - 0.01) = 13.277

Data PASS normality test. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.25

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)
Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	24.0000	24.0000
1	Control	2	22.0000	22.0000
1	Control	3	21.0000	21.0000
1	Control	4	26.0000	26.0000
1	Control	5	30.0000	30.0000
1	Control	6	26.0000	26.0000
1	Control	7	24.0000	24.0000
1	Control	8	23.0000	23.0000
1	Control	9	17.0000	17.0000
1	Control	10	24.0000	24.0000
2	6.25	1	26.0000	26.0000
2	6.25	2	24.0000	24.0000
2	6.25	3	21.0000	21.0000
2	6.25	4	16.0000	16.0000
2	6.25	5	22.0000	22.0000
2	6.25	6	20.0000	20.0000
2	6.25	7	22.0000	22.0000
2	6.25	8	19.0000	19.0000
2	6.25	9	25.0000	25.0000
2	6.25	10	21.0000	21.0000
3	12.5	1	24.0000	24.0000
3	12.5	2	10.0000	10.0000
3	12.5	3	14.0000	14.0000
3	12.5	4	21.0000	21.0000
3	12.5	5	25.0000	25.0000
3	12.5	6	25.0000	25.0000
3	12.5	7	22.0000	22.0000
3	12.5	8	24.0000	24.0000
3	12.5	9	26.0000	26.0000
3	12.5	10	13.0000	13.0000
4	25	1	22.0000	22.0000
4	25	2	21.0000	21.0000
4	25	3	15.0000	15.0000
4	25	4	15.0000	15.0000
4	25	5	23.0000	23.0000
4	25	6	14.0000	14.0000
4	25	7	22.0000	22.0000
4	25	8	22.0000	22.0000
4	25	9	18.0000	18.0000
4	25	10	19.0000	19.0000

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	10	17.000	30.000	23.700
2	6.25	10	16.000	26.000	21.600
3	12.5	10	10.000	26.000	20.400
4	25	10	14.000	23.000	19.100

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	11.789	3.433	1.086	14.49
2	6.25	8.711	2.951	0.933	13.66
3	12.5	34.044	5.835	1.845	28.60
4	25	11.656	3.414	1.080	17.87

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	114.600	38.200	2.308
Within (Error)	36	595.800	16.550	
Total	39	710.400		

Critical F value = 2.92 (0.05,3,30)
since F < Critical F FAIL TO REJECT Ho: All equal

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	23.700	23.700		
2	6.25	21.600	21.600	1.154	
3	12.5	20.400	20.400	1.814	
4	25	19.100	19.100	2.528	*

Dunnett table value = 2.15 (1 Tailed Value, P=0.05, df=30,3)

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	10			
2	6.25	10	3.912	16.5	2.100
3	12.5	10	3.012	16.5	3.300
4	25	10	3.912	16.5	4.600

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	24	26	24	22	0	0
Response 2	22	24	10	21	0	0
Response 3	21	21	14	15	0	0
Response 4	26	16	21	15	0	0
Response 5	30	22	25	23	0	0
Response 6	26	20	25	14	0	0
Response 7	24	22	22	22	0	0
Response 8	23	19	24	22	0	0
Response 9	17	25	26	is	0	0
Response 10	24	21	13	19	0	0

*** Inhibition Concentration Percentage Estimate ***
Toxicant/Effluent: Effluent
Test Start Date: 8/13/96   Test Ending Date: 8/19/96
Test Species: C. dubia.
Test Duration: 6 day
DATA FILE: 294tcdr.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	23.700	3.433	23.700
2	10	6.250	21.600	2.951	21.600
3	10	12.500	20.400	5.835	20.400
4	10	25.000	19.100	3.414	19.100
5	10	50.000	0.000	0.000	0.000
6	10	100.000	0.000	0.000	0.000

The Linear Interpolation Estimate: 26.7343   Entered P Value: 25

Number of Resamplings: 1000
The Bootstrap Estimates Mean: 25.7205 Standard Deviation: 3.6508
Original Confidence Limits: Lower: 11.7647 Upper: 29.2079
Resampling time in Seconds: 1.43 Random_Seed: 511093648

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<IMG SCR 98141M7>
<IMG SCR 98141M8>
<IMG SCR 98141M9>
<IMG SCR 98141N>
<IMG SCR 98141N1>
<IMG SCR 98141N2>
<IMG SCR 98141N3>

YSI 6000 Time Series Report   Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond uS/cm	Salinity PPT	DO mg/L	PH
8/16/96	17:45:11	24.65	383.00	0.2	7.79	7.76
8/16/96	17:45:17	25.30	398.00	0.2	7.72	7.79
8/16/96	17:45:24	25.48	419.00	0.2	7.72	7.83
8/16/96	17:45:30	25.54	451.00	0.2	7.72	7.84

YSI 6000 Time Series Report   Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/17/96	9:27:21	25.06	212.00	0.1	6.64	7.71
8/17/96	9:27:53	25.35	284.00	0.1	7.63	7.78
8/17/96	9:28:08	25.95	229.00	0.1	7.38	7.75
8/17/96	9:28:21	25.22	368.00	0.2	7.67	7.76

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/18/96	10:57:29	24.10	334.00	0.2	7.41	8.03
8/18/96	10:57:43	24.27	371.00	0.2	7.38	7.95
8/18/96	10:57:51	24.33	380.00	0.2	7.40	7.94
8/18/96	10:58:02	24.32	409.00	0.2	7.46	7.94

YSI 6000 Time Series Report Page 1

Date mm/dd/yy	Time hh:mm:ss	Temp c	Cond uS/cm	Salinity PPT	DO mg/L	pH
8/19/96	17:04:00	24.47	382.00	0.2	7.20	8.29
8/19/96	17:04:10	25.03	378.00	0.2	7.15	8.18
8/19/96	17:04:17	24.45	404.00	0.2	7.25	8.14
8/19/96	17:04:24	24.20	420.00	0.2	7.31	8.11

<IMG SRC 98141N4>
<IMG SRC 98141N5>

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Pimephales promelas
(Final)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

December 20, 1996

JOB #96-424

<IMG SRC 98141N6>
<IMG SRC 98141N7>

TEST DESIGN

Number of Effluent Concentrations: 5
Number of Replicates per Test Concentration: 4
Number of Test Organisms per Replicate: 10
Number of Test Organism per Test Concentration: 40
Test Chamber Size: 1000 mL Exposure Volume: 500 mL
Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location: Final effluent hose

Effluent Type: Final

Sample Type: 24 hour Composite x Other _ Describe: _

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
11/17 - 9:00 am	11/18 - 9:00 am	7.5	7.9	11/19-20	11:15 am
11/19 - 9:00 am	11/20 - 9:00 am	5.6	7.3	11/21-22	1:15 pm
11/21 - 9:00 am	11/22 - 9:00 am	8.1	7.4	11/23-25	11:40 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:_

Testing Location: On-site Mobile Laboratory_
On-site Commercial Laboratory_
Remote Laboratory x

DILUTION WATER

Effluent Receiving Water:

Dilution Water Source: 100% EPA Moderately Hard Reconstituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

<IMG SRC 98141N8>

499 Point Breeze Road ò Flemington, New Jersey 08822 ò Telephone (908)788-8700 FAX(908)788-9165

SUMMARY SHEET FOR THE FATHEAD MINNOW, SHEEPSHEAD MINNOW, INLAND SILVERSIDE, AND MYSID TESTS

Percent Effluent	Mean Percent Survival	Mean Dry Weight	Percent of Surviving Females with Eggs
Control	100.0	0.378	
6.25	95.0	0.378	
12.5	95.0	0.375	
25	100.0	0.468	
50	97.5	0.488	
100	90.0	0.420	

Organism source: x Cultured Stock _Commercial Supplier

Name of Supplier:

Hatch Dates: 11/18/96;1650

Organism Age (days/hrs.): <24 hrs.

Describe any aeration which was performed during the test: No aeration was required during the test period.

Describe any adjustments to the salinity of the test concentrations:

How long after test termination were the organisms prepared for weighing/drying? immediately

Was the average dry weight per test chamber determined by dividing the final dry weight by the number of original test organisms in the test chamber? X Yes _No

Did the temperature in the test chambers vary by more than 15C each day?
_Yes X No

Did the salinity in the test chambers vary more than 2ppt between replicates each day?
_Yes _No

*How long after test termination were the mysids examined for eggs and sexes? _

*Applies to mysid test only

<IMG SRC 98141N9>

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<IMG SRC 98141O>
<IMG SRC 98141O1>
<IMG SRC 98141O2>
<IMG SRC 98141O2A>

TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	1.0000	1.4120
1	control	2	1.0000	1.4120
1	control	3	1.0000	1.4120
1	control	4	1.0000	1.4120
2	6.25	1	0.9000	1.2490
2	6.25	2	1.0000	1.4120
2	6.25	3	0.9000	1.2490
2	6.25	4	1.0000	1.4120
3	12.5	1	0.9000	1.2490
3	12.5	2	1.0000	1.4120
3	12.5	3	1.0000	1.4120
3	12.5	4	0.9000	1.2490
4	25	1	1.0000	1.4120
4	25	2	1.0000	1.4120
4	25	3	1.0000	1.4120
4	25	4	1.0000	1.4120
5	50	1	0.9000	1.2490
5	50	2	1.0000	1.4120
5	50	3	1.0000	1.4120
5	50	4	1.0000	1.4120
6	100	1	0.8000	1.1071
6	100	2	0.9000	1.2490
6	100	3	0.9000	1.2490
6	100	4	1.0000	1.4120

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	4	1.412	1.412	1.412
2	6.25	4	1.249	1.412	1.331
3	12.5	4	1.249	1.412	1.331
4	25	4	1.412	1.412	1.412
5	50	4	1.249	1.412	1.371
6	100	4	1.107	1.412	1.254

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.000	0.000	0.000	0.00
2	6.25	0.009	0.094	0.047	7.07
3	12.5	0.009	0.094	0.047	7.07
4	25	0.000	0.000	0.000	0.00
5	50	0.007	0.081	0.041	5.94
6	100	0.016	0.125	0.062	9.93

STEEL'S MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK sum	CRIT. VALUE	df	SIG
1	control	1.412				
2	6.25	1.331	14.00	10.00	4.00	
3	12.5	1.331	14.00	10.00	4.00	
4	25	1.412	18.00	10.00	4.00	
5	50	1.371	16.00	10.00	4.00	
6	100	1.254	12.00	10.00	4.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

Chapiro - Wilk's test for normality

D = 0.043

r = 0.973

Critical W (P = 0.05) (n = 24) = 0.916
Critical W (P = 0.01) (n = 24) = 0.884

Data PASS normality test at P=0.01 level. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 2.94

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	0.4300	0.4300
1	control	2	0.3800	0.3800
1	control	3	0.3000	0.3000
1	control	4	0.4000	0.4000
2	6.25	1	0.3000	0.3000
2	6.25	2	0.3900	0.3900
2	6.25	3	0.3800	0.3800
2	6.25	4	0.4400	0.4400
3	12.5	1	0.3500	0.3500
3	12.5	2	0.4500	0.4500
3	12.5	3	0.3700	0.3700
3	12.5	4	0.3300	0.3300
4	25	1	0.4400	0.4400
4	25	2	0.5100	0.5100
4	25	3	0.4600	0.4600
4	25	4	0.4600	0.4600
5	50	1	0.5100	0.5100
5	50	2	0.4700	0.4700
5	50	3	0.5100	0.5100
5	50	4	0.4600	0.4600
6	100	1	0.3600	0.3600
6	100	2	0.3800	0.3800
6	100	3	0.4500	0.4500
6	100	4	0.4900	0.4900

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	4	0.300	0.430	0.378
2	6.25	4	0.300	0.440	0.378
3	12.5	4	0.330	0.450	0.375
4	25	4	0.440	0.510	0.468
5	50	4	0.460	0.510	0.488
6	100	4	0.360	0.490	0.420

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	0.003	0.056	0.028	14.73

2	6.25	0.003	0.058	0.029	15.35
3	12.5	0.003	0.053	0.026	14.03
4	25	0.001	0.030	0.015	6.39
5	50	0.001	0.026	0.013	5.39
6	100	0.004	0.061	0.030	14.42

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.050	0.010	4.118
Within (Error)	18	0.043	0.002	
Total	23	0.093		

Critical F value = 2.77 (0.05,5,18)
Since F > Critical F REJECT Ho: All equal

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	0.378	0.378		
2	6.25	0.378	0.378	-0.000	
3	12.5	0.375	0.375	0.072	
4	25	0.468	0.468	-2.592	
5	50	0.488	0.488	-3.168	
6	100	0.420	0.420	-1.224	

Dunnett table value = 2.41 (1 Tailed Value, P=0.05, df=18,5)

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	4			
2	6.25	4	0.084	22.2	-0.000
3	12.5	4	0.084	22.2	0.003
4	25	4	0.084	22.2	-0.090
5	50	4	0.084	22.2	-0.110
6	100	4	0.084	22.2	-0.043

Conc. ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	.43	.30	.35	.44	.51	.36
Response 2	.38	.39	.45	.51	.47	.38
Response 3	.30	0.38	.37	.46	.51	.45
Response 4	.40	.44	.33	.46	.46	.49

r** Inhibition Concentration Percentage Estimate ***
Toxicant/Effluent: 96-424
Test Start Date: 11/19/96 Test Ending Date: 11/26/96
Test Species: P.promelas
Test Duration: 7 days
DATA FILE: 96424p.icp

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	4	0.000	0.378	0.056	0.418
2	4	6.250	0.378	0.058	0.418
3	4	12.500	0.375	0.053	0.418
4	4	25.000	0.468	0.030	0.418
5	4	50.000	0.488	0.026	0.418
6	4	100.000	0.420	0.061	0.418

** No Linear Interpolation Estimate can be calculated from the Input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

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<IMG SRC 98141P6>

CHRONIC BIOMONITORING REPORT
Chemsol Plant
Ceriodaphnia dubia
(Final)

BIEGLER ASSOCIATES
PO BOX 261
RIDGEFIELD PARK, NJ 07660

December 20,1996

JOB #96-424

<IMG SRC 98141P7>
<IMG SRC 98141P8>

TEST DESIGN

Number of Effluent Concentrations: 5
Number of Replicates per Test Concentration: 10
Number of Test Organisms per Replicate: 1
Number of Test Organisms per Test Concentration: 10
Test Chamber Size: 30 mL Exposure Volume: 15 mL
Explain any deviations from the specified testing methodology:

EFFLUENT SAMPLING

Plant Sampling Location: Final effluent hose

Effluent Type: Final

Sample Type: 24 hour Composite x Other Describe:

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date/Time	Ending Date/Time	D.O.	pH	Date(s)	Time(s)
11/17- 9:00 am	11/18- 9:00 am	7.5	7.9	11/19-20	11:15 am
11/19- 9:00 am	11/20- 9:00 am	5.6	7.3	11/2l-22	11:40 am
11/21- 9:00 am	11/22- 9:00 am	8.1	7.4	11/23-24	8:55 am

Maximum holding time of any effluent sample 72 hrs.

Describe any pretreatment of the effluent sample:

Testing Location: On-site Mobile Laboratory
On-site Commercial Laboratory
Remote Laboratory x

DILUTION WATER

Effluent Receiving Water

Dilution Water Source: 100% EPA Moderately Hard Reconsituted Water

Describe any adjustment to the dilution water:

If receiving water used as dilution water source, describe collection location and dates of collection:

<IMG SRC 98141P9>

499 Point Breeze Road D Flemington, New Jersey 08822 D Telephone (908) 788- 8700 FAX(908) 788- 9165

SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control	100	14.7	70.0
6.25	90	16.4	70
12.5	100	15.5	90
25	100	15.3	100
50	100	16.7	60
100	100	15.5	60

Organism source: x Cultured Stock Commercial Supplier
Name of Supplier:
Organism Age at test start (hrs.): <24 hrs. 11/18/96; 1130

Test organisms all released with an 8 hour period? X Yes No

Neonates obtained from (check one):
Mass cultures
x individually cultured organisms

Was the test terminated when 60% of the surviving females in the controls had produced their third brood? x Yes No

Within how many hours after test termination were the test organisms counted? Immediately

Number of Males/Ephippia

Percent Effluent	Number of Males	Number of Ephippia
Control	0	
6.25	0	
12.5	0	
25	0	
50	0	
100	0	

Did the number of males in the controls and/or test concentrationsl influence die determination of the NOEC/IC25?
Yes x No

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<IMG SRC 98141Q3>

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
6.25	9	1	10
TOTAL	19	1	20

CRITICAL FISHER'S VALUE (10,10,10) (p=0.05) IS 6. b VALUE IS 9.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

FISHER'S EXACT TEST

IDENTIFICATION	ALIVE	DEAD	NUMBER OF TOTAL ANIMALS
CONTROL	10	0	10
12.5, 25, 50, 100	10	0	10
TOTAL	20	0	20

CRITICAL FISHER'S VALUE (10,10,10)(p=0-05) IS 6. b VALUE IS 10.
Since b is greater than 6 there is no significant difference between CONTROL and TREATMENT at the 0.05 level.

SUMMARY OF FISHER'S EXACT TESTS

GROUP	IDENTIFICATION	NUMBER EXPOSED	NUMBER DEAD	SIG (P=05)
	CONTROL	10	0	
1	6.25	10	1	
2	12.5, 25, 50, 100	10	0	

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-l.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	4.020	14.520	22.920	14.520	4.020
OBSERVED	0	22	20	11	7

Calculated Chi-Square goodness of fit test statistic = 11.3077
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 0.46

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)
Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS BI homogeneity test at 0.01 level. Continue analysis.

TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	control	1	24.0000	24.0000
1	control	2	11.0000	11.0000
1	control	3	10.0000	10.0000
1	control	4	15.0000	15.0000
1	control	5	12.0000	12.0000
1	control	6	9.0000	9.0000
1	control	7	12.0000	12.0000
1	control	8	19.0000	19.0000
1	control	9	22.0000	22.0000
1	control	10	13.0000	13.0000
2	6.25	1	9.0000	9.0000
2	6.25	2	13.0000	13.0000
2	6.25	3	13.0000	13.0000
2	6.25	4	26.0000	26.0000
2	6.25	5	13.0000	13.0000
2	6.25	6	23.0000	23.0000
2	6.25	7	25.0000	25.0000
2	6.25	8	14.0000	14.0000
2	6.25	9	12.0000	12.0000
2	6.25	10	10.0000	10.0000
3	12.5	1	10.0000	10.0000
3	12.5	2	12.0000	12.0000
3	12.5	3	10.0000	10.0000
3	12.5	4	21.0000	21.0000
3	12.5	5	15.0000	15.0000

3	12.5	6	16.0000	16.0000
3	12.5	7	13.0000	13.0000
3	12.5	8	11.0000	11.0000
3	12.5	9	25.0000	25.0000
3	12.5	10	22.0000	22.0000
4	25	1	10.0000	10.0000
4	25	2	13.0000	13.0000
4	25	3	17.0000	17.0000
4	25	4	24.0000	24.0000
4	25	5	12.0000	12.0000
4	25	6	14.0000	14.0000
4	25	7	12.0000	12.0000
4	25	8	12.0000	12.0000
4	25	9	13.0000	13.0000
4	25	10	26.0000	26.0000
5	50	1	21.0000	21.0000
5	50	2	15.0000	15.0000
5	50	3	17.0000	17.0000
5	50	4	14.0000	14.0000
5	50	5	14.0000	14.0000
5	50	6	11.0000	11.0000
5	50	7	23.0000	23.0000
5	50	8	10.0000	10.0000
5	50	9	28.0000	28.0000
5	50	10	14.0000	14.0000
6	100	1	7.0000	7.0000
6	100	2	19.0000	19.0000
6	100	3	12.0000	12.0000
6	100	4	21.0000	21.0000
6	100	5	18.0000	18.0000
6	100	6	25.0000	25.0000
6	100	7	14.0000	14.0000
6	100-	8	10.0000	10.0000
6	100	9	9.0000	9.0000
6	100	10	20.0000	20.0000

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	control	10	9.000	24.000	14.700
2	6.25	10	9.000	26.000	15.800
3	12.5	10	10.000	25.000	15.500
4	25	10	10.000	26.000	15.300
5	50	10	10.000	28.000	16.700
6	100	10	7.000	25.000	15.500

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	control	27.122	5.208	1.647	35.43
2	6.25	40.178	6.339	2.004	40.12
3	12.5	29.167	5.401	1.708	34.84
4	25	29.567	5.438	1.719	35.54
5	50	32.011	5.658	1.789	33.88
6	100	35.389	5.949	1.881	38.38

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	21.683	4.337	0.135
Within (Error)	54	1740.900	32.239	
Total	59	1762.583		

Critical F value = 2.45 (0.05,5,40)
Since F < Critical F FAIL TO REJECT Ho: All equal

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	control	14.700	14.700		
2	6.25	15.800	15.800	-0.433	
3	12.5	15.500	15.500	-0.315	
4	25	15.300	15.300	-0.236	
5	50	16.700	16.700	-0.788	
6	100	15.500	15.500	-0.315	

Dunnett table value = 2.31 (1 Tailed Value, P=0.05, df=40,5)

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	10			
2	6.25	10	5.866	39.9	-1.100
3	12.5	10	5.866	39.9	-0.800
4	25	10	5.866	39.9	-0.600
5	50	10	5.866	39.9	-2.000
6	100	10	5.866	39.9	-0.800

Conc.ID	1	2	3	4	5	6
Conc. Tested	0	6.25	12.5	25	50	100
Response 1	24	9	10	10	21	7
Response 2	11	13	12	13	15	19
Response 3	-10	13	10	17	17	12
Response 4	15	26	21	24	14	21
Response 5	12	13	15	12	14	18
Response 6	9	23	16	14	11	25
Response 7	12	25	13	12	23	14
Response 8	19	14	11	12	10	10
Response 9	22	12	25	13	28	9
Response 10	13	10	22	26	14	20

*** Inhibition Concentration Percentage Estimate ***
Toxicant/Effluent: 96-424
Test Start Date: 11/19/96 Test Ending Date: 11/25/96
Test Species: C. dubia
Test Duration: 6 days
DATA FILE:

Conc. ID	Number Replicates	Concentration %	Response Means	Std. Dev.	Pooled Response Means
1	10	0.000	14.700	5.208	15.600
2	10	6.250	15.800	6.339	15.600
3	10	12.500	15.500	5.401	15.600
4	10	25.000	15.300	5.438	15.600
5	10	50.000	16.700	5.658	15.600
6	10	100.000	15.500	5.949	15.500

*** No Linear Interpolation Estimate can be calculated from the input data since none of the (possibly pooled) group response means were less than 75% of the control response mean.

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TECHNICAL REVIEW OF THE
REMEDIAL INVESTIGATION REPORT
CHEMSOL,INC. SITE
PISCATAWAY, NEW JERSEY

Prepared for:

Chemsol Site PRP Group

Prepared by:

ECKENFELDER INC.
1200 MacArthur Boulevard
Mahwah. New Jersey 07430

April 1997

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1.0 INTRODUCTION

A site-wide Remedial Investigation (RI) was conducted for Operable Unit I of the Chemsol Inc. property located in Piscataway Township, New Jersey. The RI was conducted from October 1992 through November 1994 by CDM Federal Programs Corporation for the U.S. Environmental Protection Agency. The results of the RI were reported in a document titled "Remedial Investigation Report, Chemsol Inc. Superfund Site" (hereinafter referred to as the RI report), dated October 1996.

A stated objective of the RI was to provide a basis for the "technical development and detailed evaluation of the remedial alternatives in the FS [Feasibility Study]". Accordingly, the RI investigation included the installation and testing of additional monitoring wells and piezometers and the collection and analysis of samples to assess chemical constituents present within groundwater, surface water, stream sediment and soil. The RI report included a description of hydrogeologic conditions, an analysis of probable source areas and transport pathways, and a risk assessment to public health and the environment. The RI report is contained in a series of 15 volumes, which have been briefly summarized in Appendix A.

The RI has been reviewed by ECKENFELDER INC. on behalf of the Chemsol Site PRP Group. The results of this review are described in Section 2.0. In addition, a further analysis of the hydrogeologic data for the site has also been conducted, beyond that as presented in the RI. This includes a quantitative analysis of pump test data obtained during the RI and previous investigations (Section 3.0) and a re-interpretation of the conceptual hydrogeologic model for the site (Section 4.0). Finally, a discussion is presented in Section 5.0 regarding implications for groundwater remediation due to the effects of DNAPLs and matrix diffusion that should be considered in the upcoming FS.

This document is intended to facilitate a technical dialog between the USEPA and the Chemsol Site PRP Group (Group) regarding the issues related to site remediation. Specifically, it is particularly important to achieve technical concurrence regarding the conceptual hydrogeologic conditions of the site and the significance of DNAPLs and matrix diffusion as they relate to groundwater remediation. Agreement on these and other technical issues is critical in order to provide an objective analysis of the various remedial options that will be considered as a part of the Feasibility Study.

2.0 TECHNICAL REVIEW OF THE REMEDIAL INVESTIGATION REPORT

A technical review of the RI report has been performed. The RI report presents the results of a generally well implemented field investigation. However, the narrative report is somewhat limited by a rather cursory analysis of the data, particularly as it relates to the site bydrogeologic conditions. Furthermore, the RI report could be a more useful document if it had been structured to serve as a comprehensive presentation of both the newly collected and existing site data.

The intent of Otis review is not to provide a point-by-point critique of each of the 15 volumes that constitute the RI report. Rather, a brief discussion is provided regarding the highlights of the document review. Most of the technical comments are relatively minor and do have a critical bearing on use of the report as it relates to site remediation. A significant exception, however, is the interpretation of the water-bearing zones beneath the site and the related implications regarding the directions of groundwater flow. The critique is presented as follows.

2.1 CONCEPTUAL HYDROGEOLOGIC MODEL

Interpretation of the site hydrogeologic conditions is based on a faulty assumption regarding the grouping of wells for mapping purposes. Specifically, the wells have been grouped, by CDM, on the basis of equal elevation rather than on the basis of stratigraphic position within the dipping bedrock units. Our experience has shown that this type of approach results in the incorrect determination of groundwater flow directions.

It was correctly stated in the RI report that the results of the packer tests should be used to group the wells for the purpose of potentiometric mapping. The following statement was made on page 3-21 leading to the discussion regarding well grouping:

"Based on the results of the packer tests, it appears that:

- the bedrock that lies stratigraphically above the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures),
- the [upper] gray shale appears to be a hydraulic barrier,
- the bedrock below the [upper] gray shale is near isotropic and homogeneous conditions [sic] (but flow is still controlled by fractures), and
- the deep gray unit may have some hydraulic control, but the collected data are not significant enough to make any conclusion regarding this unit."

The aforementioned conclusions, which should have been used as the basis for well grouping for potentiometric mapping by CDM, were apparently ignored in that wells were subsequently grouped entirely on the basis of elevation. The result of grouping wells in this fashion yielded the comparison of data from wells that are in disparate water-bearing zones. This is a particular problem at this site because of the significantly complex hydrostratigraphic vertical relationships between the various units, which includes a significant downward, vertical flow component. Accordingly, much of the potentiometric mapping by CDM (RI Figures 3-23 through 3-40) has yielded misinterpretation regarding the direction and magnitude of groundwater flow.

Specific comments regarding the potentiometric surface contour maps are offered, as follows:

- TW-Series Wells Above and Below the Gray Shale (RI Figure 3-23) - This map is erroneous in that it employs wells that are screened both stratigraphically above and below the gray shale and which are, thus, in two different hydrostratigraphic units. Furthermore, the wells screened above the gray shale are in an aquitard which is characterized, predominantly by a vertical, downward flow system. Accordingly, it is inappropriate to use the TW-series wells above the gray shale for the purposes of mapping horizontal gradients.
- C-Series Wells Above the Gray Shale - (RI Figures 3-24 through 3-26) - These maps depict the highly fractured zone immediately above the gray shale. Use of data from Well C-7 would have provided a greater spatial data distribution that may have yielded a greater predominance in the direction of groundwater flow than is observed from the small changes in the waterlevel variations in the four closely spaced wells that were used. The RI report states that C-7 was not used because it is at a lower elevation even though it is at a stratigraphically similar position as the other C-series wells that were used.
- C-Series Wells Below the Gray Shale - (RI Figures 3-27 through 3-33) - The wells used to construct these maps are too small in number and are too closely spaced to yield useful information regarding groundwater flow direction at this interval. These wells can, however, be grouped with numerous other wells in a similar bydrostratigraphic zone (but at different depths) to a provide maps with considerably greater geographic coverage.
- Upper DMW/MW Series Wells (RI Figures 3-34 through 3-37) - These maps are problematic in that they include wells screened both above and below the lower gray shale which may, therefore, be in two separate hydrostratigraphic regimes.
- Lower DMW/MW Series Wells (RI Figures 3-38 through 3-40) - In a similar manner as the previous maps, these maps mix wells that are screened above and below the lower gray shale.

A modified hydrogeologic model has been prepared by ECKENFELDER INC., as presented in Section 2.0 of this document. This model utilizes well groupings based on hydrostratigraphic units defined on the basis of observed stratigraphic conditions and based on response to the packer pump testing. Finally, this model presents a revised set of the potentiometric surface contour maps for the August 29, 1994, measurement date that is believed to more accurately represent the site conditions than maps presented. in the RI.

2.2 GENERAL COMMENTS - VOLUME 1 (TEXT)

- The RI functions adequately as a data presentation report but lacks the depth of data analysis that is typically found in a report of this type.

- The packer testing was generally well implemented and provides invaluable data for the differentiation of the various hydrostratigraphic units. However, additional detail could have been provided regarding response to pumping if supplemental manual water level measurements were obtained from wells that were not instrumented with data loggers.

- Data are presented in various figures that are not supported in accompanying tables or in the appendices. Examples include tables that present well construction details for all (newly installed and existing) wells and water level data.

- Collection of additional full rounds of water level data prior to implementation of the interim remedy (pumping of Well C-1) would have been useful for the characterization of groundwater flow directions.

- The occurrence of DNAPLs at the site is critical to overall site remediation and should be more prominently presented in Volume I. Specifically, the text should present a more detailed discussion regarding the occurrence of DNAPLs rather than simple reference to the handwritten calculations in Appendix X. This discussion should be supported by tables and maps that describe the presence and distribution of the specific DNAPL constituents.

2.3 GENERAL COMMENTS - VOLUME 1A (13" x 20" RI FIGURES)

- The geophysical cross sections (natural gamma and caliper log) presented on RI Figures 3-5A and 3-5B have a vertical scale that is too small to adequately resolve details of the log. Furthermore, the cross sections would be much more informative if stratigraphic correlation and associated annotations were included.

2.4 GENERAL COMMENTS - OTHER APPENDICES

- The appendices should provide a comprehensive presentation of both new and historic boring and well construction logs.

- Logs of previously existing monitoring wells and piezometers should be included for reference to the newly installed wells.

- Water level data logger data tabulations (Appendix V) would be much easier to use if they were annotated with test details (e.g., test start, test stop, etc.) and if they had been provided in a computer format (on disk).

- The concentration contour maps (Appendix T-1) present a misleading depiction or the contaminant distribution for the following reasons:

  - It would be more appropriate to group the maps by hydrostratigraphic unit rather than by well depth for the same reasons as described previously for the potentiometric surface maps.

  - Complete reliance of computer contouring methods can result in misleading representations of contaminant distribution that are often too strongly controlled by individual data points (e.g., "bulls-eye" effect around individual data points). Manual contaminant contouring and the related application of professional judgment regarding the effects of groundwater flow would likely result in the preparation of maps that are more accurate.

  - The color concentration scale should be standardized for all maps. Use of the full range of colors for each map prevents the rapid visual comparison of the relative concentration differences by color. This fact obviates what is perhaps the greatest advantage in the use of color maps beyond that of simple physical attractiveness.

3.0 QUANTITATIVE ANALYSIS OF THE HYDROGEOLOGIC SYSTEM

A quantitative analysis of the available hydrogeologic data has been conducted for the Chemsol Site. This analysis included a review of data from the RI as well as a revisit of data by AGES and McClaren-Hart to determine if additional information could be extracted from their efforts. The available data include aquifer test, slug test, and packer testing data.

This evaluation provides as much of a quantitative understanding of the hydrogeologic system as is reasonably feasible given the complex hydrogeologic system. By the term "quantitative understanding", we mean the ability to subdivide the hydrogeologic system into functional hydrostratigraphic units and assign hydrogeologic properties to these units, such as transmissivity, hydraulic conductivity, and storativity. This type of quantitative understanding of the system will be vital as a foundation for the numerical modeling of the system, even if the properties are modified (as they almost certainly will be) during the calibration of the model.

3.1 PRE-RI PUMP TESTING

In 1987, AGES Corporation performed a hydrogeologic assessment of the Chemsol site. As part of their work, they conducted a step-drawdown test of Well C-1, and a subsequent aquifer test using the same well. Extraction of much usable hydrogeologic data from the AGES work is problematic since the aquifer test at Well C-1 was begun shortly after the conclusion of the step-drawdown test and before sufficient time bad elapsed for the aquifer to fully recover from the drawdown produced by the step-drawdown test.

In 1993, McClaren-Hart conducted a hydrgeoologic study of the Chemsol site. As part of their work, they performed an aquifer test using Well C-1 as the pumping well and a number of wells as monitoring points. While procedurally, the work of McClaren-Hart is a considerable improvement over the earlier AGES work, analysis of the data from the aquifer test is hindered by the fact that the open interval of Well C-1 actually spans two distinct water-bearing zones and an intervening hydrostratigraphic unit (the Gray Shale), which generally acts as an aquitard. This was not recognized in 1993. Consequently, the well likely draws an indeterminate amount of water from each zone, thus confounding precise definition of the hydrogeologic properties of either zone. Nonetheless, as will become clear subsequently, some useful data can be drawn from this test since apparently most of the water is drawn from the Principal Aquifer.

3.2 INITIAL OBSERVATIONS

Before embarking upon an in-depth assessment of the aquifer tests, slug tests, and packer tests, several general observations need to be made about the hydrogeologic system as a conceptual foundation for the subsequent analyses.

1. The observed vertical hydraulic head losses at the site are indicative of moderate to low vertical hydraulic conductivity in some zones.

2. The above observation, coupled with the relatively high yields observed in various pumping wells and packer tests, suggests a hydrogeologic system composed of interlayered aquifers and aquitard.

3. Vertical anisotropy is also indicated, certainly on a system-wide basis and probably within individual strata as well.

4. A degree of heterogeneous hydrogeologic behavior is evident in virtually all the data. This heterogeneity will certainly defy efforts to precisely model the system. Nonetheless, the generalized behavior of the system should be subject to modeling and reasonably accurate predictive analysis.

5. The heterogeneity has particular implications to the implementation of a groundwater extraction system at the site. No matter how thoroughly one probes the hydrogeologic data for insight into the properties of the

system or how diligently one strives to calibrate a numerical groundwater flow model based on those calculated properties, performance of a groundwater extraction system will require careful verification. It seems inescapable that the Observational Method, in one form or another, will have to be called upon to design and construct a cost-effective system.

3.3 ANALYSIS OF THE HYDROGEOLADGIC DATA

In analyzing the hydrogeologic system at the Chemsol site, principal emphasis has been placed upon the aquifer test and packer test conducted by CDM and McClaren-Hart. In particular, CDM conducted a packer test of some duration which they termed the long-term test. This packer test was, in essence, an aquifer test and the data from this packer test are quite useful. The aquifer test conducted by McClaren-Hart in 1993 of Well C-1 is also useful. ECKENFELDER INC. has carefully evaluated all of the packer test data to see what quantitative information can be extracted from this considerable body of data. While the packer tests were primarily conducted to determine the interconnectedness; of various zones, nonetheless, some of the tests lend themselves to quantitative analysis.

The packer test data were first evaluated as to whether analyses could be conducted using the Theis type curve match technique on the drawdown data. Analysis of the drawdown data, however, was not feasible due to the variable pumping rate employed in the early phase of the packer test. In most cases, the flow rate during the packer test was increased in step-wise fashion during the early part of the test, and then held relatively constant throughout the remainder of the test. While the early stepped pumping rate makes time-drawdown analysis infeasible, analysis of time-recovery data is possible since water level recoveries react more to the average pumping rate, particularly during the later phases of the test, than they do to early fluctuations in pumping rate. Distance drawdown analyses were also employed to analyze the drawdown at the conclusion of the packer test pumping. Lastly, packer test recovery data were also used to conduct Neuman-Witherspoon ratio method analyses of the upper bedrock zone above the upper permeable zone. Each of these methods of analysis is briefly described below. A summary of the results of the aquifer test analyses is presented in Table 3-1.

3.3.1 Long-Term Test of CDM

CDM performed what they termed the "Long-Term Test" as part of their packer testing activities. During the long-term test, drawdown was measured in a number of monitoring wells, and the results analyzed by CDM using the AQTESOLV computer program. Three tests, in particular, provide insight into the transmissivity and storativity of the principal aquifer. These tests are the analyses conducted based upon the drawdowns observed in Wells DMW-1, DMW-5 and MW-103. These particular wells are well suited stratigraphically to determine the aquifer parameters. The results of CDM's analyses are presented in Table 3-1.

TABLE 3-1
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Text	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Aquifer Test: Theis Type Curve Match - DMW-1	CDM	14,500	2.1×10^{-4}	---
Principal Acquirer	Aquifer Test: Theis Type Curve Match - DMW-5	CDM	8,800	7.8×10^{-5}	---
Principal Aquifer	Aquifer Test: Theis Type Curve Match - MW-103	CDM	8,800	2.2×10^{-4}	---
Principal Aquifer	Packer Test: Round 3, Test 2 Distance - Drawdown Analysis	ECKENFELDER INC.	>5,000	2.3×10^{-4}	---
Principal Aquifer	Neuman-Witherspoon Ratio method Analysis of McClaren-Hart Aquifer Test	ECKENFELDER INC.	---	---	3.5×10^{-4}

TABLE 3-1(cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Text	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Principal Aquifer	Acquirer Test of Well C-1 Theis Type Curve Match TW-9	McClaren-Hart	8,500	9.9×10^{-5}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match DMW-5	McClaren-Hart	10,300	4.1×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-3	McClaren-Hart	10,800	1.7×10^{-4}	---
Principal Aquifer	Aquifer Test of Well C-1 Theis Type Curve Match C-4	McClaren-Hart	10,800	1.9×10^{-4}	---
Principal Aquifer	Aquifer Teat of Well C-1 Theis Type Curve Match C-5	McClaren-Hart	29,000	2.1×10^{-4}	---
Upper Permeable Aquifer	Packer Test: Theis Type Curve Match of time-recovery data Round 3, Test 3, Well C-6	ECKENFELDER INC.	12,300	1×10^{-4}	---

TABLE 3-1(cont'd)
SUMMARY OF AQUIFER TEST ANALYSES

Water-bearing Zone	Nature of Text	Analysis Conducted by	Transmissivity (gpd/ft)	Storativity (dimensionless)	Vertical Hydraulic Conductivity (cm/sec)
Upper Permeable Acquirer	Packer Test: Distance-Drawdown Analysis or Round 3, Test 3	ECKENFELDER INC.	13,000	6 x 10 -6	---
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-8, TW-3	ECKENFELDER INC.	---	---	1.1 x 10 -4
Upper Bedrock	N-W Ratio Method Analysis of Round 3, Test 3 Packer Test: C-10, TW-4	ECKENFELDER INC.	---	---	6.5 x 10 -5

3.3.2 Distance Drawdown Analyses of Packer Test Data

Efforts were undertaken by ECKENFELDER INC. to determine whether any of the packer test data would be suitable for a distance drawdown analyses using the Cooper-Jacob method. This methodology is particularly useful in defining transmissivity. However, most of the packer tests do not lend themselves to this type of analysis for two reasons. First, there are generally not a sufficient number of wells at different radial differences from the pumped interval to define the shape of the distance drawdown curve. Secondly, the pumped interval typically cannot be used in the analysis because of excessive well losses. Nonetheless, one packer test, specifically Round 3, Test 2, provided some insight into the transmissivity in that well losses in the pumped interval in Well DMW-10 appeared to be more modest. Drawdown in the pumped interval was only 4.8 feet (compared to many tens of feet in some of the other packer tests). An analysis of this packer test using the Cooper-Jacob distance drawdown method, and assuming the drawdown in the pumped interval is reflective of actual drawdown in the formation, yields a transmissivity of 5,000 gallons per day per foot and a storativity of 2.3×10^{-4}. In all likelihood the transmissivity is higher than this figure since well losses likely occur. For example, if well losses accounted for one-half of the observed drawdown, the transmissivity would be approximately 10,000 gallons per day per foot. The plot of the data and the associated calculations are provided in Appendix B-1.

3.3.3 Aquifer Test of Well C-1 by McClaren-Hart

McClaren-Hart conducted an aquifer test of Well C-1 measuring drawdown in a number of monitoring wells. The analyses of the drawdowns observed in Wells TW-9, DMW-5, C-3, C-4, and C-5 are particularly appropriate as these wells are well positioned stratigraphically to define the aquifer parameters of the principal aquifer. These analyses, which are presented in McClaren-Hart's report, yielded transmissivities ranging from 8,500 to 29,000 gallons per day per foot and storativities ranging from 9.9×10^{-5} to 4.1×10^{-4}, as presented in Table 3-1.

As mentioned earlier, the aquifer test conducted by McClaren-Hart of Well C-1 is limited in its accuracy due to the fact that the well is likely pumping an indeterminate amount of water from both the principal aquifer and the upper permeable zone. However, based upon the results of the analyses and a comparison to more recent aquifer tests conducted by CDM, it seems likely that the majority of the water being pumped from Well C-1 is being drawn from the principal aquifer. Consequently, it is probably reasonable to conclude that the calculated transmissivity is reasonably reflective of the Principal Aquifer.

3.3.4 Neuman-Witherspoon Ratio Method Analysis of McClaren-Hart Aquifer Test

In order to gain some insight into the vertical hydraulic conductivity of the principal aquifer, ECKENFELDER INC. conducted a Neuman-Witherspoon Ratio Method Analysis of the data from the McClaren-Hart Aquifer Test. A vertical hydraulic conductivity of 3.5×10^{-4} centimeters per second was estimated for the lower portion of the principal aquifer. These data and associated calculations are presented in Appendix B-2.

3.3.5 Theis Type Curve Matching of Time Recovery Data from Packer Test

ECKENFELDER INC. conducted Theis type curve analysis of recovery data from a number of the packer tests. One test in particular generated data permitting a Theis type curve match analysis. These data were the packer test recovery data from Round 3, Test 3 for Well C-6. This analysis permits estimation of the aquifer parameters of the upper permeable zone. The analysis resulted in an estimated transmissivity of 12,300 gallons per day per foot and a storativity of 1×10^{-4}. The data, type curve match and associated calculations are included in Appendix B-3.

3.3.6 Distance Drawdown Analysis of Packer Test Round 3, Test 3

The data from the Round 3, Test 3 packer test also lent itself to a distance drawdown analysis using the Cooper-Jacob method. In this packer test, Well C-7 in the upper permeable zone was pumped and drawdowns in Wells C-6, C-8, C-9 and C-10 were measured in the upper permeable zone. In this analysis Well C-6 and C-10 provide the most useful data since they are at significantly different radial distances from the pumped interval. This test suggests some degree of areal an isotropy with a slightly higher transmissivity along the strike of the formation. Similar an isotropy is not observed in other data sets, however, and the apparent areal an isotropy observed in Round 3, Test 3 is probably coincidental. The distance drawdown analysis results in an average transmissivity of 13,000 gallons per day per foot and a geometric mean storativity of 6 x 10 -6. The data plots and calculations are included in Appendix B-4.

Neuman-Witherspoon Ration Method Analysis of Packer Test Round 3, Test 3

In order to get some information as to the vertical hydraulic conductivity of the upper bedrock zone, ECKENFELDER INC. conducted Neuman-Witherspoon ratio method analyses of the Round 3, Test 3 packer test. The analysis specifically involved analysis of Wells C-8 and TW-3, and C-10 and TW-4. These analyses were done using recovery data for the reasons described earlier. The time recovery plots and calculations of both ratio method analyses are presented in the appendices. The analyses resulted in estimated vertical hydraulic conductivity's of 1.1 X 10 -4 and 6.5 x 10 -5 centimeters per second. These analyses should probably be regarded only as order of magnitude estimates. The data plots and calculations are presented in Appendix B-5.

3.4 SUMMARY OF QUANTITATIVE ANALYSES

In connection with the principal aquifer, the average transmissivity calculated from the three Theis type curve match analyses conducted by CDM and the five Theis type curve match analyses conducted by McClaren-Hart is approximately 12,700 gallons per day per foot. Similarly, the average storativity is approximately 2 x 10 -4. The average transmissivity of the upper permeable zone, calculated from the values obtained from the Theis type curve match of time recovery data from packer test, Round 3, Test 3 of Well C-6 and the distance drawdown analyses of packer test Round 3, Test 3 is 12,650 gallons per day per foot. The storativity is most likely on the order of 1 x 10 -4 as calculated from the time recovery analysis of Well C-6. The much lower value calculated from the distance drawdown analyses is probably unrepresentative. Although some suggestion of areal anisotropy was observed in the drawdowns, of Packer Test, Round 3, Test 3, generally, areal anisotropy is not indicated in the preponderance of the data. The spatial differences in drawdown seem to be more attributable to typical fractured rock heterogeneity than to a systematic areal anisotropy.

4.0 CONCEPTUAL HYDROSTRATIGRAPHIC MODEL

The hydrostratigraphic setting beneath the Chemsol Superfund site is complex being characterized by a dipping, multi-layered bedrock system. Numerous monitoring wells have been installed at various depths during previous investigations in an effort to evaluate the hydrogeologic and water quality conditions.

A review of the existing hydrogeologic data for the site has been conducted by ECKENFELDER INC. to develop a refined conceptual model of the groundwater flow regime. This current understanding represents a revision of the preliminary conceptual model that was presented previously by ECKENFELDER INC. Moreover, this conceptual model represents a fundamental departure from that described by CDM in the RI report. Specifically, the current model, as presented, groups the wells for mapping purposes on the basis of stratigraphic position rather than on the basis of depth (Table 4-1).

The current conceptual model was revised on the basis of an analysis of the data from the RI report (CDM, 1996) and further review of previous site investigation data by both McClaren-Hart and AGES Corporation. A quantitative analysis of available pump test data has been presented previously in Section 3.0. This conceptual model may be subject to further revision based on the results of pending numerical modeling and/or additional field data that may be obtained in the future.

The site is conceptually subdivided into six units. This has been primarily accomplished on the basis of site stratigraphy and the observed aquifer response to the various pump tests that have been performed at the site.

- Overburden Water-Bearing Zone
- Upper Bedrock Aquitard
- Upper Permeable Aquifer
- Upper Gray Shale (Aquitard)
- Principal Aquifer
- Deep Bedrock Unit

TABLE 4-1

WELL GROUPINGS BY HYDROSTRATIGRAPECIC UNIT
Chemsol Inc. Superfund Site

Overburden Water-Bearing Zone

OW-1	OW-10	OW-12	OW-14
OW-2	OW-11	OW-13	OW-15
OW-4			

Upper Bedrock aquitard

TW-1	TW-3	TW-5A	TW-11
TW-2	TW-4	TW-10	TW-12

Upper Permeable Aquifer

C-6	C-8	C-10
C-7	C-9	

Principal Aquifer

Upper Zone

TW-6	TW-13	C-1	DWM-9
TW-7	TW-14	C-3	DMW-10
TW-8	TW-15	C-4	
TW-9		C-5	

Lower Zone

DMW-1	DMW-5	DMW-7	C-2
DMW-3	DMW-6	DMW-11	MW-103

Deep Bedrock Unit

DMW-2	DMW-4	MW-101	MW-104
DMW-3	DMW-8	MW-102	

The hydrostratigraphic units are depicted on Figure 4-1. Plan-view potentiometric maps (Figures 4-2 through 4-5) have been prepared that depict static pre-pumping conditions using data obtained on August 29, 1994 (Table 4-2). These include maps for the hydrostratigraphic zones in which horizontal flow predominates including the Overburden zone, Upper Permeable aquifer, and the upper and lower portions of the Principal Aquifer.

The hydrostratigraphic units are described briefly, as follows:

! Overburden Water-Bearing Zone - represents the uppermost water-bearing unit at the site. This zone is contained within the composite unit represented by the thin overburden soils and the upper veneer of highly weathered bedrock. Groundwater within this unit flows laterally toward the northeast (Figure 4-2), generally in response to ground surface topography. The overburden zone is likely to be in hydraulic communication with the small ditches and streams which flow toward the northeast across the site.

! Upper Bedrock Aquitard - is represented by the bedrock below the overburden zone. This unit is comprised of bedrock with relatively low hydraulic conductivity. The upper portion of this unit also likely represents weathered bedrock within which the joints and fractures are filled with silt or clay serving to reduce the hydraulic conductivity. Considerable vertical head loss is observed within this unit downward to the underlying Upper Permeable Aquifer. The vertical hydraulic conductivity of this unit has been determined to range from 1.1×10^{-4} to 6.4×10^{-5} cm/sec on the basis of a Neuman-Witherspoon analysis of aquifer test data, described in Section 3.0.

! Upper Permeable Aquifer - is a highly fractured bedrock zone of relatively high hydraulic conductivity that lies immediately above the upper gray shale. The presence of this unit was initially revealed in boreholes drilled during the RI. These data indicate that this zone is approximately 40 feet thick.

TABLE 4-2

GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY

Well	Reference Elevation (ft., Msl)	Zone (b.)	Ground Elevation (ft., Mal)	Coordinates (c.) Northing	Easting	29-Aug-94 DTW (ft.)	Elev. (ft., Msl)
C-1	79.83	3/4	77.60	629,997	2,062,281	--	58.50
C-2	86.24	5	--	629,865	2,061,790	--	58.36
C-3	80.52	4	78.40	629,642	2,062,565	--	58.39
C-4	80.96	4	79.00	629,636	2,062,307	--	58.20
C-5	80.10	4	78.00	629,815	2,062,297	--	58.37
C-6	76.12	3	--	630,574	2,062,609	--	59.21
C-7	80.20	3	--	630,534	2,061,803	--	59.10
C-8	81.40	3	--	630,140	2,061,554	--	59.32
C-9	85.33	3	--	629,925	2,061,589	--	59.41
C-10	80.71	3	--	630,292	2,061,975	--	59.11
DMW-1	85.40	5	82.90	629,867	2,062,117	--	58.36
DMW-2	85.07	6	83.40	629,670	2,062,085	--	57.86
DMW-3	80.49	6	78.70	629,656	2,062,566	--	58.36
DMW-4	80.44	6	78.60	629,660	2,062,532	--	57.86
DMW-5	78.89	5	77.10	630,166	2,062,022	--	58.28
DMW-6	79.23	5	77.70	630,138	2,062,030	--	58.21
DMW-7	76.62	6	75.60	630,132	2,062,439	--	58.32
DMW-8	77.77	6	76.00	630,121	2,062,428	--	57.85
DMW-9	76.35	4	--	630,578	2,062,618	--	58.18
DMW-10	79.58	4	--	630,540	2,061,816	--	58.42
DMW-11	85.04	5	--	629,918	2,061,792	--	58.31
MW-101	79.80	6	77.40	629,995	2,062,253	--	58.02
MW-102	78.69	6	77.50	629,863	2,062,471	--	57.81
MW-103	81.09	5	80.00	630,144	2,061,572	--	58.30
MW-104	88.58	6	89.00	628,957	2,062,510	--	58.42
OW-1	78.37	1	76.20	630,036	2,062,275	--	73.57
OW-2	81.64	1	79.70	629,898	2,062,206	--	78.04
OW-4	79.96	1	77.60	629,921	2,062,332	--	75.61
OW-10	79.06	1	78.30	629,660	2,062,549	--	76.83
OW-11	75.08	1	74.70	630,592	2,062,609	--	69.34
OW-12	84.65	1	--	629,888	2,061,897	--	79.61
OW-13	82.96	1	--	629,988	2,061,673	--	78.17
OW-14	92.14	1	--	629,643	2,061,657	--	83.99
OW-15	75.08	1	73.00	630,390	2,062,545	NM	NM

PZ 1	76.62	1	74.90	630,157	2,062,437	NM	NM
PZ 1D	77.05	1	--	630,172	2,062,437	NM	NM
PZ 2	76.45	1	74.50	630,051	2,062,474	NM	NM
PZ 2D	75.94	1	--	630,066	2,062,475	NM	NM
PZ 3	78.65	1	74.30	629,919	2,062,438	NM	NM
PZ 4	78.03	1	76.00	630,280	2,062,084	NM	NM
PZ 4D	78.25	1	--	630,289	2,062,090	NM	NM
PZ 5	76.68	1	74.90	630,250	2,062,208	NM	NM
PZ 5D	76.86	1	--	630,251	2,062,193	NM	NM

TABLE 4-2

GROUNDWATER ELEVATIONS
CHEMSOL INC., SITE
PISCATAWAY, NEW JERSEY

Well	Reference Elevation (ft., Msl)	Zone (b.)	Ground Elevation (ft., Mal)	Coordinates (c.) Northing	Easting	29-Aug-94 DTW (ft.)	Elev. (ft., Msl)
PZ 6	76.15	1	74.20	630,227	2,062,373	NM	NM
PZ 6D	76.14	1	--	630,227	2,062,389	NM	NM
PZ 7	75.71	1	73.80	630,229	2,062,459	NM	NM
PZ 8	77.57	1	75.70	629,971	2,062,477	NM	NM
PZ 8D	77.51	1	--	629,986	2,062,477	NM	NM
PZ 9D	75.98	1	--	630,295	2,062,410	NM	NM
PZ 10D	79.08	1	--	630,086	2,062,273	NM	NM
SG@PZ 4	71.67	1	--	630,267	2,062,067	NM	NM
SG@PZ 8	73.95	1	--	629,983	2,062,495	NM	NM
TW-1	90.15	2	89.10	629,638	2,061,637	--	59.56
TW-2	85.81	2	84.20	629,900	2,061,591	--	59.98
TW-3	81.59	2	79.60	630,160	2,061,538	--	59.56
TW-4	78.31	2	76.60	630,218	2,062,010	--	59.37
TW-5	76.24	2	74.30	630,175	2,062,475	--	62.98
TW-5A	75.98	2	74.30	630,166	2,062,470	--	62.28
TW-6	78.88	4	76.70	629,894	2,062,490	--	58.76
TW-7	80.16	4	78.10	629,655	2,062,399	--	61.46
TW-8	85.11	4	83.30	629,647	2,062,102	--	59.15
TW-9	80.29	4	78.60	629,662	2,062,557	--	58.71
TW-10	79.96	2	78.50	630,549	2,061,809	--	63.45
TW-11	75.76	2	75.00	630,594	2,062,620	--	67.21
TW-12	75.73	2	73.60	630,594	2,063,195	--	65.27
TW-13	78.17	4	76.30	630,092	2,063,250	--	59.76
TW-14	89.23	4	88.60	629,332	2,061,661	--	62.01
TW-15	82.90	4	82.20	629,380	2,062,367	--	62.15

Notes:

a. Abbreviations are as follows:

"NE" - no entry to well
"NW" - not measured

b. Wells are screened in the following zones:

1. Overburden Water-Bearing zone
2. Upper Bedrock Aquitard
3. Upper Permeable Aquifer
4. Upper of portion of Principal Aquifer
5. Lower of portion of Principal Aquifer
6. Deep Bedrock Zone

c. Northings & Eastings were obtained from surveyors coordinates, except for "PZ" wells which were obtained from a map by McLaren Hart

d. Elevations for PZ wells with D suffix were derived from McLaren Hart database.

e. Reference elevation for Staff Gauges PZ-4 and PZ-8 are for the 0 ft. mark. DTW reading is above the 0 mark.

<IMG SRC 98141R8>
<IMG SRC 98141R9>
<IMG SRC 98141S>
<IMG SRC 98141S1>
<IMG SRC 98141S2>

The transmissivity of the Upper Permeable aquifer has been determined to be approximately 13,000 gpd/ft on the basis of aquifer testing described in Section 3.0. Groundwater flow within this unit is predominantly horizontal with a relatively flat hydraulic gradient to the northeast, as shown on Figure 4-3.

! Upper Gray Shale (Aguitard) - Analysis of aquifer test data indicate that the Upper Gray shale provides hydraulic separation between the Upper Permeable Aquifer and the Principal Aquifer. This separation is also observed in the vertical head losses observed between the two aquifers across the Upper Gray shale.

! Principal Aquifer - is comprised of the bedrock zone between the upper and deep gray shale beds with a thickness of approximately 180 feet. The transmissivity of this unit has been shown to be typically on the order of 12,700 gpd/ft with a storativity of approximately 2 x 10 -4, as described in Section 3.0.

Slight downward gradients are observed within the Principal aquifer so that it has been subdivided into upper and lower portions for mapping purposes. Wells screened in the contiguous upper and deep gray shale units have been observed to be in sufficient hydraulic communication with the Principal aquifer that they have been included in the potentiometric mapping of this unit. Potentiometric maps for the upper and lower portions of this unit (Figures 4-4 and 4-5, respectively) reveal a northerly direction of groundwater flow.

! Deep Bedrock Unit-includes the bedrock below the deep gray shale. The deep gray shale provides some hydraulic separation between the Principal aquifer and the deep bedrock, determined on the basis of aquifer testing. Insufficient data are available in this unit to determine the horizontal direction of flow.

5.0 EFFECT OF DNAPL AND MATRIX DIFFUSION ON GROUNDWATER REMEDIATION

The primary objective of groundwater extraction, at the Chemsol site, should be to provide hydraulic containment of the groundwater plume for the prevention of further downgradient migration. Conversely, little in the way of meaningful groundwater restonition can be accomplished at this site through efforts to remove contaminant mass by groundwater extraction. This is due to the presence of dense non-aqueous phase liquids (DNAPL) and the significance of diffusion into the bedrock matrix to the practicability of groundwater restoration.

5.1 IMPACT OF DNAPLS ON GROUNDWATER RESTORATION

The RI report concluded that DNAPLs likely exist in numerous overburden and bedrock wells at the Chemsol site. This is based primarily on comparison of groundwater quality data to constituent solubilities using USEPA methodology described in its guidance "Estimating Potential for Occurrence of DNAPL at Superfund Sites" (USEPA, 1992). The fact that analysis of rock core samples by ultraviolet florescence (as a part of the RI) did not reveal NAPL is not surprising given the fact the that chlorinated organics typically do not fluoresce. However, the RI provides additional evidence of DNAPL in the presence of material resembling "tar balls" that have been observed during maintenance of the groundwater extraction treatment system.

Dense non-aqueous phase liquids (DNAPLs) are a class of chemicals with relatively low solubility in water which are therefore capable of moving as a separate phase through groundwater systems. In addition, they have densities greater than that of water so that they tend to sink vertically through aquifers. These factors, coupled with the fact that many of the DNAPL chemicals are considered potentially harmful at even low part per billion levels, dictate that even relatively small amounts of DNAPL can contaminate large portions of an aquifer.

Trichloroethylene (TCE) is shown, in the RI, to be one of the more prevalent DNAPL compounds at the Chemsol site. Of particular note is this compound's solubility. From one perspective, the solubility is sufficiently low that this chemical will, in fact, behave as a separate phase in groundwater before ultimately being solubilized. However, from another perspective, it can be seen that the solubility is six orders of magnitude higher than the groundwater cleanup standards. Consequently, in spite of the relatively low solubility compared to other chemicals, the solubility of TCE is sufficiently high to render groundwater non-potable even when concentrations are only a minute fraction of the solubility limits.

The importance of DNAPL, where present, has been recognized sinee the early 1980s regarding the ultimate remediation of sites. More recently, the regulatory agencies have begun to acknowledge the occurrence and problems presented by the presence of DNAPL chemicals at sites. One of the more important acknowledgments is presented in the 1992 USEPA guidance, as follows:

> "Once in the subsurface, it is difficult or impossible to recover all of the trapped residual DNAPL. The conventional aquifer remediation approach, groundwater pump-and-treat, usually removes only a small fraction of trapped residual DNAPL. Although many DNAPL removal technologies are currently being tested, to date there have been no field demonstrations where sufficient DNAPL has been successfully recovered from the subsurface to return the aquifer to drinking water quality."

The presence of DNAPL in bedrock further complicates site remediation through inaccessibility (e.g., in dead-end fractures of bedrock), flow mechanics independent of groundwater flow, complex flow patterns, and difficulties in locating DNAPL accumulations to name a few.

USEPA (1993) has reeognized these difficulties in the TI guidance document:

> "Delineation of the extent of the DNAPL zone may be difficult at certain sites due to complex geology or waste disposal practices. In such cases, the extent of the DNAPL zone may need to be inferred from geologic information (eg., thickness, extent, structure, and permeability of soil or rock units) or from interpretation of the aqueous concentrations of contaminants derived from DNAPL sources." (USEPA, 1993, p. 8)

The absence of the observation of large quantities of visible DNAPL (e.g., as "free product) during the RI and in previous investigations is completely consistent with the presence of DNAPL at the site. Recent research has shown that actual DNAPL would not likely persist in appreciable quantities in the fractures at the site given the time since manufacturing operations at the site were discontinued. The research indicates that DNAPL is likely to diffuse from the fractures into the matrix of the rock on a time scale that varies from as little as a few days to perhaps unlikely that significant DNAPL would remain in pooled form. The diffusion of contaminants into the rock matrix, both from DNAPL and from the dissolved phase, presents the single most significant limitation to aquifer restoration at the Chemsol site. The influence of matrix diffusion is discussed in more detail below.

5.2 THE SIGNIFICANCE OF MATRIX DIFFUSION

As noted above, the presence of contamination within the rock matrix itself is of particular importance to our ability to achieve groundwater restoration within a reasonable time frame. (USEPA [1993] has used a time period of 100 years or more in its discussions regarding what constitutes a reasonable time frame for aquifer restoration). The entrance to and eventual release of contaminants from the rock matrix is a diffusion controlled process. DNAPL chemicals in rock fractures and dissolved within groundwater establish the concentration gradients that drive diffusive transport into the rock matrix. The matrix diffusivity of the rock has the single most significant influence an the rate of movement of contaminants into and out of the bedrock matrix. Further, even after a source of contamination is removed, diffusion into the rock matrix can continue due to internal concentration gradients set up during the contamination phase. Contaminants in the rock matrix become a long-term source of groundwater contamination for which there is no remedial measure currently available. One would expect groundwater remediation time within rock aquifers contaminated with DNAPL chemicals to be measured in hundreds of years.

As contaminated groundwater moves through the fractures of a bedrock aquifer, diffusion of contaminants will occur into the essentially stagnant matrix pore water of the rock, as illustrated in Figure 5-1. The extent of the diffusion and its hydrogeologic significance will depend upon the concentration gradient, the matrix diffusivity and porosity, the fracture spacing of the rock, and the duration of exposure. From one perspective, the diffusion of contaminants into the rock matrix is beneficial in that it retards the advance of a contaminant plume through the fractured rock. Lever and Bradbury (1985) reported that matrix diffusion can lead to effective retardation factors in excess of 100 and can reduce peak concentrations by three to four orders of magnitude, provided that the groundwater velocity is relatively small. However, when the objective is to purge contamination from an aquifer, the diffusion-controlled release of contaminants from the rock matrix can greatly prolong aquifer cleanup efforts over what would be possible in a simple porous medium of equivalent hydraulic conductivity.

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It is important to recognize that the significance of matrix diffusion to groundwater restoration is not limited to the DNAPL zone. In fact, the diffusion process will play a similar role in substantially delaying the removal of mass in the area of the aqueous plume downgradient of the DNAPL zone. USEPA has also acknowledged the significance of this phenomena:

> "EPA recognizes, however, that there are technical limitations to ground-water remediation technologies unrelated to the presence of a DNAPL source zone. These limitations, which include contaminant-related factors (e.g., slow de-sorption of contaminants from aquifer materials) and hydrogeologic factors (e.g., heterogeneity of soil or rock properties), should be considered when evaluating the technical practicability of restoring the aqueous plume." (USEPA, 1993, p.9)

Groundwater extraction in fractured bedrock for the purpose of contaminant mass removal is likely to meet with only limited success in restoring the quality of water in a reasonable period of time. In particular, over-pumping to increase flow rates appreciably beyond those required to prevent further migration of the contaminant plume is not likely to result in significant benefits due to "rebound" effects that usually occur upon the cessation of pumping. In fractured rock aquifers, the rate of cleanup is controlled by the rate of contaminant diffusion from the rock matrix into the fractures--a process which cannot be significantly enhanced by increasing groundwater velocities in the fractures, since increasing fracture flow velocity generally only marginally increases the concentration gradient between the rock matrix and the fracture flow system and has no effect on the low diffusivity of the contaminant in the porous medium. Thus, the rate of diffusion and the rate of cleanup are increased only marginally by pump and treat operations under these conditions.

In summary, the use of groundwater extraction for the purpose of contaminant mass removal will have little overall effect on groundwater quality conditions. This is due to the presence of DNAPLs in bedrock and the recognition of the significance of matrix diffusion in groundwater restoration efforts. Accordingly, the overall goal of groundwater extraction should be to achieve hydraulic containment of the migrating groundwater plume.

APPENDIX A

SUMMARY OF VOLUMES
RI REPORT

SUMMARY OF REMEDIAL INVESTIGATION REPORT
CHEMSOL INC. SUPERFUND SITE
CDM Federal Program Corporation
October 1996

An outline of the Remedial Investigation (RI) report prepared by CDM Federal Programs Corporation for USEPA is presented herein. In addition, text sections of the RI report have been briefly summarized.

Volume I-(RI Report text)

1.0 Introduction

2.0 Study Area Investigations

A description of the RI field investigation was provided, which included the following:

- Two (2) rounds of ambient air quality samples; 1993 and 1994
- Two (2) rounds of surface water and sediment quality samples; 1992 and 1993
- Bedrock core samples collected from six (6) boreholes
- Gridded soils samples taken at 102 locations
- Installation of eight (8) bedrock and three (3) overburden monitoring wells
- Downhole geophysical logging conducted in 30 new and existing wells
- Packer pump testing in three (3) rounds
- Two (2) rounds of water level measurements
- Two (2) rounds of groundwater quality samples in 1994
- Ecological Investigation of the Chemsol property and surrounding properties

3.0 Physical Characteristics of the Chemsol Site

A rather brief discussion of site characteristics including meteorology, air quality, surface water and sediment, geology, hydrogeology, soils biota, demographics and land use. The primary conclusions made by CDM regarding geologic and hydrogeologic conditions are summarized below:

- The site is underlain by the Brunswick formation with a strike and dip of N595 E and 95 NW, respectively.

- A gray shale bed and/or a highly fractured zone above it have the characteristics of a hydraulic barrier.

- Beds above and below the gray shale bed are described by CDM to be nearly isotropic and homogeneous even though groundwater flow is controlled by fracture orientation.

- It is not conclusive if a deep gray shale bed acts as a hydraulic barrier.

- Downward vertical gradients are observed across the site.

- Wells were grouped based on equal elevation on either side of the gray marker bed for the purpose of isopotentiometric mapping.

- Groundwater in the uppermost water bearing zone (OW- wells) flows to the northeast.

- The direction of groundwater flow in deeper zones is not well defined and is shown to flow in various directions, dependent upon the group of wells that is mapped.

- ! Residential water supply wells in the Nova-Ukraine neighborhood are not in hydraulic communication with the site

- ! Off-site groundwater pumping may influence the direction of groundwater flow.

4.0 Nature and Extent of Contamination

- ! Air sampling data indicate no clear evidence of significant off-site contamination from the Chemsol site.

- ! Surface water sediment data were reported to contain VOCs, SVOCs (primarily PAHs), pesticides, PCBs, and various metals.

- ! Surface water samples contained VOCs, low levels of several pesticides, and several metals.

- ! Soil data revealed exceedances of NJ proposed soil cleanup criteria for a number of constituents including PCBs, several VOCs, SVOCs, pesticides and metals including lead.

- ! Groundwater contamination consists largely of chlorinated VOCs. The highest concentrations are found in the center of the site. However, significant VOCs in the deeper bedrock are also found at the northeast edge of the property.

- ! VOC coneentrations exceed 1% of solubility at many locations indicative of the presence of DNAPLs.

5.0 Contaminant Fate and Transport

General discussion regarding various routes of contaminant migration and the persistence of various constituents in the environment.

6.0 Baseline Human Heallb Risk Assessment

The following exposures were determined by CDM to exceed the USEPA acceptable risk ranges:

- ! Carcinogenic risks due to potential future residential exposure to surface soil and groundwater

- ! Non-carcinogenic risks due to present and potential future exposure to surface soil and groundwater, and potential exposure to construction workers via groundwater ingestion.

7.0 Ecological Risk Assessment

The following conclusions are made by CDM regarding ecological risk:

- ! Exposure of ecological receptors to subsurface soil and groundwater contamination is not likely.

- ! A potential exists for adverse effects on selected indicator species, including shrews, robins and red-tailed hawks, due to exposure to surface soils.

- ! There is little or no ecological risk associated with surface water or sediment.

8.0 Summary and Conclusions

9.0 References

Volume IA

Set of 11" x 20" figures to accompany Volume I (text) of the RI.

Volume II

Appendix A - Drilling Logs
Appendix B - Coring Logs
Appendix C - Well Construction Logs
Appendix D - Downhole Geophysical Logging Data
Appendix E - Packer Testing Figures/AQTESOLV Graphs
Appendix F - Soil Boring Logs
Appendix G - PCB Field Screening Logs

Volume III

Appendix H - Sampling Trip Reports

Volume IV - (CLP data summary sheets)

Appendix I - Air Sampling Results - Form One
Appendix J - Surface Water/Sediment Sampling Results - Form One

Volume V & VI - (CLP data summary sheets)

Appendix K - Soil Sampling Results - Form One

Volume VII & VIII - (CLP data summary sheets)

Appendix L - Groundwater Sampling Results - Form One

Volume IX - (BHHRA & ERA backup)

Appendix M - 95 Percent Upper Confidence Limit Calculations
Appendix N - Toxicological Profiles
Appendix 0 - Spreadsheet Calculations
Appendix P - Central Tendency Calculations
Appendix Q - Threatened and Endangered Species/Significant Habitats
Appendix R - Ecological Exposure and Toxicity

Volume X - (formatted analytical data tables)

Appendix S - EDM Data Tables (Air, Surface Water, Sediment, Soil, & Groundwater)

*Volume XI - (11" x 17" color drawings)

Appendix T - GEOSOFT Concentration Contours - Groundwater
Appendix U - GEOSOFT Concentration Contours - Soil

Volume XII, XIII, XIV - (data logger data)

Appendix V-Packer Testing Data (Rounds 1,2,& 3)

Volume XV

Appendix W - Soil Averaging
Appendix X - Estimating Potential for Occurrence of DNAPL

Evaluation of exceedances of 1% of effective solubility of organic constituents per USEPA methodology revealed the likely presence of DNAPL in 23 wells, listed as follows:

OW-1	C-1	TW-1	MW-104	DWM-1
OW-2	C-2	TW-4		DWM-3
OW-4	C-5	TW-5		DWM-7
OW-12	C-7	TW-5A		DWM-8
	C-10	TW-7		DWM-9
		TW-8		DWM-11
		TW-15		

APPENDIX B

AQUIFER TEST ANALYSES

APPENDDIX B-1

Distance-Drawdown Analyses of RI Packer Test Data Well DW-10 (Round 3, Test 2)

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APPENDIX B-2

Neuman-Witherspoon Analyses of McClaren-Hart Aquifer Test Data

<IMG SRC 98141S5>
<IMG SRC 98141S6>
<IMG SRC 98141S7>

APPENDIX B-3

Theis Type-Curve Analyses of Recovery Data From RI Packer Test Well C-6 (Round 3, Test 3)

<IMG SRC 98141S8>

APPENDIX B-4

Distance-Drawdown Analyses of RI Packer Test Data Well C-7 (Round 3, Test 3)

<IMG SRC 98141S9>

APPENDIX B-5

Neuman Witherspoon Analyses of RI Packer Test Data (Round 3, Test 3)

<IMG SRC 98141T>
<IMG SRC 98141T1>

Chemsol, Inc. Superfund Site

Appendix - C

Proposed Plan

<IMG SRC 98141T2>

USEPA Region II
Superfund Document Center
290 Broadway -18th Floor
New York, NY 10007
By Appointment: (212) 637-4308
Monday-Friday: 9:00am. - 4:30pm

EPA, after consultation with NJDEP, will select a remedy for the Site only after the public comment period has ended and the information submitted during that time has been reviewed and considered. EPA is issuing this proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and Section 300.430(f) of the National Contingency Plan (NCP).

SITE BACKGROUND

Chemsol, Inc. (Chemsol) is located on a 40 acre tract of land at the end of Fleming Street, Piscataway, Middlesex County, New Jersey. The Site is comprised of two areas: an undeveloped parcel known as Lot 1A and a cleared area referred to as Lot 1B. Two small intermittent streams - (Stream 1A and Stream 1B) and a small trench, known as the Northern Ditch, drain northward across the Site into a marshy wetland area located near the northeastern property boundary (see Figures 1 and 2).

Land use in the vicinity of the Site is a mixture of commercial, industrial, and residential uses. The Port Reading Railroad is directly south of the Site. Single family residences are located immediately to the west and northwest of the Site. An apartment complex with greater than 1,100 units is located to the north. Industrial and retail/wholesale businesses are located to the south and east of the Site.

Approximately 180 private wells at residential and commercial addresses were reported by the local health departments to be potentially active (i.e., not sealed) within a radius of two miles of the Site. Twenty-two of these wells are located at a distance less than 1/2 mile from the Site. The nearest public water supply well is over two miles away in the Spring Lake area of South Plainfield.

Chemsol operated as a solvent recovery and waste reprocessing facility in the 1950's through approximately 1964. The facility was closed after a series of industrial accidents, explosions and fire. In 1978, the property was rezoned from industrial to residential. The Site is currently owned by Tang Realty Corporation. In September 1983, the Chemsol Site was formally placed on the National Priorities List (NPL) making it eligible for federal funds for investigation of the extent of contamination and, for cleanup activities.

From 1983 to 1990, NJDEP directed Tang Realty, under various enforcement actions, to perform, a series of Site investigations related to groundwater and soil contamination. Approximately 40 groundwater monitoring wells were installed on or in the vicinity of the Site by contractors for Tang Realty. Sampling results from these monitoring wells indicated that groundwater was contaminated with various volatile organic compounds (VOCs) including trichloroethylene, chloroform, chloroethane, toluene, carbon tetrachloride and methylene chloride. Furthermore, sampling and analyses of the soils (performed between 1980 and 1987) revealed the presence of polychlorinated biphenyls (PCBs) and other organic compounds.

In the Summer of 1988, Tang Realty removed approximately 3,700 cubic yards of PCB-contaminated soils for off-site disposal. During the soils excavation, several thousand small (less than 1 gallon) containers of unknown substances were discovered. These unknown substances were stored in a trailer on-site. As a part of an EPA removal action undertaken in 1990 and 1991,these unknown substances were analyzed, grouped with other compatible Site wastes, and transported off-site. Approximately 10,000 pounds of crushed lab pack bottles, 13,500 pounds of hazardous waste solids, 615 gallons of hazardous waste liquids and 150 pounds of sulfur trioxide were disposed of off-site during the removal action. This removal action was completed in October 1991 by EPA.

In the fall of 1990, EPA and the NJDEP agreed that EPA should fund the remainder of the investigatory work. Subsequently, EPA initiated a Remedial Investigation and Feasibility Study (RI/FS) in order to assess the nature and extent of contamination at the Site and to evaluate remedial alternatives. EPA determined that the RI/FS would be performed in two phases. The first phase consisted of development of a Focused Feasibility Study (FFS) to evaluate the usefulness of in interim remedy to restrict off-site migration of contaminated groundwater. The second phase was to determine the nature and extent of contamination at the Site.

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<IMG SRC 98141T3>
<IMG SRC 98141T4>

As part of the FFS, EPA sampled 22 on-site monitoring wells. The results of the FFS indicated that groundwater at the Site exists in a perched water zone (at depths of less than five feet), and also in the upper bedrock aquifer (to depths of at least 130 feet). Sampling results revealed that groundwater was highly contaminated with a wide variety of hazardous substances, including volatile organics, semi-volatile organics, as well as pesticides and inorganic compounds.

Based on the results of the FFS, EPA selected an interim remedy for the Chemsol Site in a Record of Decision (ROD) that was signed on September 20, 1991. The objective of this interim remedy was to restrict the migration of the contaminated groundwater until a more comprehensive Site-wide remedy could be performed. The interim remedy consists of pumping groundwater from well C-1, a former monitoring well installed by Tang Realty's contractors found to be highly contaminated with VOCs. The pumped groundwater from C-1 is then treated on-site through an air stripper, after which it is filtered, followed by treatment by activated carbon.

On March 9, 1992, EPA issued a Unilateral Administrative Order (UAO) to Tang Realty, Schering Corporation, Union Carbide Corporation and Morton International,Inc. (the Respondents) for performance of the interim remedy. Schering Corporation, Union Carbide Corporation and Morton International, Inc. were identified by EPA as potentially responsible for the contamination at the Site by having sent their waste to the Chemsol Site for reprocessing. And Tang Realty was identified as the owner of the property.

In November 1993, the Respondents requested that the interim remedy be modified so that water from the treatment system could be discharged into the sewer system that leads to the Middlesex County Utilities Authority (MCUA), instead of into an on-site surface water body, as specified in the ROD. As a result, in July 1994, EPA issued an Explanation of Significant Differences which modified the interim remedy to allow for discharge of treated groundwater to the sewer system. However, EPA also required that the Respondents design and build the biological portion of the treatment system so that, in the future, if the treated groundwater could not be sent to MCUA, the biological system could be brought quickly online to allow for direct discharge of treated groundwater to Stream 1A on-site.

Construction of the groundwater treatment plan was completed by the Respondents in June 1994 and the plant was brought into operation in September 1994. The well has been pumped at varying rates, averaging approximately 25 gallons per minute. The results of monthly monitoring indicate that the interim remedy has been partially effective in restricting the migration of highly contaminated groundwater from the Site.

REMEDIAL INVESTIGATION SUMMARY

The second phase of the RI, which was conducted to determine the nature and extent of the contamination at the Site, was completed in October 1996. During this phase, EPA's consultant installed groundwater monitoring wells, conducted sampling of the various media at the Site including air, sediment, surface water, surface soil, subsurface soil, and groundwater.

Soil Investigation

A soil sampling program was designed based on historical Site usage, aerial photographs and the findings of previous investigations. Samples were taken using an extensive grid system. Group A samples were collected at 200 foot grid spacing in Lot 1B and 400 foot grid spacing in Lot 1A. These samples were analyzed for a full range of organic and inorganic contaminants. Group B samples were collected from Lot 1B at 100 foot grid spacing and field screened for PCBs. Group C samples were collected from biased sampling locations based on aerial photographs and previous investigations and on a 50 foot grid spacing around those Group B samples which showed PCBs in their field screening results. In addition, samples from Lot 1B were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP), a test which is used to determine whether a material is a hazardous waste, regulated by specific federal and State hazardous waste regulations. In addition, subsurface soil samples were taken from 102 locations across the Site.

The results of the RI show that the surface and subsurface soils in Lot 1A and Lot 1B contain various contaminants. The contaminants found were: VOCs including carbon tetrachloride, trichloroethane, trichloroethene, tetrachloroethene, toluene, ethylbenzene, and xylenes, semi-volatile organic compounds (SVOCs) including polyaromatic hydrocarbons, phthalates, pesticides (such as aldrin, dieldrin, and DDE) and PCBs; and, inorganics including manganese and lead. The range of concentrations of certain contaminants detected in surface and subsurface soil is presented in Table 1.

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Of the contaminants found, PCBs contributed the most to the risks at the Site (see the section entitled "Summary of site Risk," below. The VOCs were found to be co-located with the PCBs and lead; therefore, any action taken to address PCBs and lead would also address the Vocs.

Groundwater Investigation

As a part of the RI, additional groundwater monitoring wells were installed. Two rounds of groundwater sampling were performed during the RI. Samples were collected and analyzed from the 49 wells on the Site. However, certain property owners adjacent to the Site continue to deny EPA access to install groundwater monitoring wells on their properties. EPA will try to resolve these access issues.

The geologic formation which underlies the Site is commonly referred to as the Brunswick formation and lies generally 3 to 14 feet below the ground surface. The Brunswick formation is generally referred to as bedrock and contains areas of red shale, gray shales and siltstones. A gay shale layer acts to preclude groundwater flow in some areas and separates the bedrock into an upper zone which is located above the gray shale, and a so-called "deep gray unit" and a deep gray unit bedrock zone. The Brunswick formation is overlain by a thin layer of overburden which consists of unconsolidated sand, silt, clay and cobble deposits and fill. This overburden was determined to be typically 3 to 6 feet thick.

TABLE -1
CONTAMINANTS IN SURFACE AND SUBSURFACE SOILS

Contaminants	Concentrations Surface Soil (parts per billion)	Concentrations Subsurface Soil (parts per billon)
V0LATILE ORGANICS		
Carbon Tetrachloride	0-5,000	680-1700
Trichloroethene	3,500-32,000	3-18,000
Tetrachlorothene	0-7,000	2-12,000
1,1,2,2,- Tetrachloroethane	15-110	4-9,000
Chlorobenzene	0-3,300	4-8,300
Xylene (Total)	56,000-110,000	2-40,000
Toluene	2-380,000	10-27,000
Ethybenzene	2,900-15,000	8-8,800
SEMI-VOLATILES		
Bis(ethylhexyl)phthalate	0,63,000	66-17,000
Naphthalene	29-18,000	44-3,800
1,2,-Dichlorobenzene	200-1,600	34-10,000
PESTICIDES/PCB		
Aldrin	58-8,300	0.3-2,000
Dieldrin	43-13,000	1.1-130
4,4-DDE	0-4,600	0.13-120
Toxaphene	0-3,400	-
PCBs	540-310,000	21-2,600
INORGANICS		
Manganese	30.4-1,840 (parts per million)	282-2,300 (parts per million)
Lead	7-1,920 (parts per million)	2.4-914 (parts per million)

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TABLE - 2
CONTAMINANTS IN GROUNDWATER

Contaminants	Concentrations (parts per billion)
VOLATILE ORGANICS	
Carbon Tetrachloride	2-35,000
Trichloroethene	0.9-180,000
Tetrachloroethene	1-5,700
Chlorobenzene	4-4,200
Xylene (Total)	1-5,700
Toluene	2-27,000
Ethylbenzene	1-1,600
Vinyl Chloride	3-3,310
Benzene	1-16,000
2-Butanone	270-21,000
Chloroform	1-55,000
1,2-Dichloroethene	0.5-39,000
SEMI-VOLATILES	
1,2,-Dichlorobenzene	2-3,300
PCBS	0-10
INORGANICS	6.1-19,100
Manganese	63.9-61,000
Aluminum	

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Groundwater flow at the Site is very complex. There is perched groundwater present in the overburden. However, the primary groundwater flow is through interconnected fractures in the bedrock. Due to the unpredictable nature and distribution of these fractures, the precise direction of flow and the rate of groundwater flow can be difficult to predict. In general, groundwater in the upper zone, above the gray shale, flows to the south. Below the gray shale, groundwater generally flows to the north. Near the southern boundary of the Site, groundwater is influenced by off-site commercial pumping activities to the south.

With regard to chemical contamination, the RI confirmed that well C-1 was by far the most contaminated of all on-site monitoring wells. The results also confirmed that VOCs are the primary contaminants in groundwater. The major VOC contaminants include benzene, carbon tetrachloride, chloroform, 1,2,-dichloroethane, 1,2-dichloroethene, tetrachloroethene, toluene and trichloroethene. The bedrock aquifer is contaminated far in excess of EPA's Safe Drinking Water Act maximum contaminant levels (MCLs) which are the federal regulatory standards for drinking water. The analytical results also indicate that MCLs for aluminum, iron and manganese have been exceeded in many wells at the Site. Although many pesticides were detected in the groundwater, no MCLs were exceeded. In the second round of sampling, PCBs slightly in excess of MCLs were found in two wells, C-1 and TW-4 (see Table 2).

Groundwater contamination is present in the bedrock aquifer at both the northern and southern boundaries of the Site. Evaluation of the hydrogeological data indicates that contaminated groundwater continues to migrate off-site. However, due to the influences of groundwater pumping from off-site sources and the limited amount of off-site groundwater sampling data, there remains uncertainty as to the extent of this migration. Additional off-site sampling is required to further define the extent and source of off-site contamination. EPA's consultant used mathematical modeling to help determine the optimum pumping plan which would best capture contaminated groundwater and minimize the amount of contaminated groundwater which leaves the Site. The modeling showed that, by pumping five additional wells, the contamination could be contained on-site except for the deep bedrock groundwater in the northwest corner of the Site.

In addition, during the RI, EPA conducted an assessment to determine whether contamination previously detected in the Nova-Ukraine section of Piscataway was related to the Chemsol Site. The Nova-Ukraine is a housing development whose nearest part is located approximately 900 feet south-southeast of the Chemsol Site. Residential wells in this development had been sampled several times since 1980 by various government, agencies and private consultants. Due to concentrations of VOCs in the wells, NJDEP delineated an Interim Groundwater Impart Area for a portion of the Nova-Ukraine area. This delineation made residents eligible for financial assistance to connect to a public water supply. All but four residences elected to be connected to a public water supply. Based on the results of the RI, EPA does not believe that the groundwater contamination of residential wells in the Nova-Ukraine areas is related to the Chemsol Site.

Surface Water and Sediment Investigation

The ground elevation at the Site is generally lower than the adjacent area. Surface water runoff is towards the Site during rain events. There are several wetland areas, one drainage ditch, and two streams present at the Site. During sampling for the FFS in 1991, Stream 1A was sampled and determined to be free of contamination from the Site. During the RI, two rounds of sampling were conducted in Stream 1B. Twelve sampling locations were selected. At each location, one surface water sample and two sediment samples were collected.

Surface water sampling has indicated that the Chemsol Site is contributing low levels of contamination including VOCS, pesticides and organics to Stream 1B. However, low levels of pesticides and inorganics appear to be entering the Site from off-site sources. Levels of several contaminants exceeded State Water Quality Criteria. As noted in the previous section, the area surrounding the Site contains many industrial/commercial establishments. Sediment sampling conducted in conjunction with the surface water sampling indicates the presence of VOCs, SVOCs pesticides, PCBs and metals.

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SUMMARY OF SITE RISK

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future Site conditions. The baseline risk assessment estimates the human health and ecological risk which could result from the contamination at the Site if no remedial action were taken.

Human Health Risk Assessment

The following four-step process was used to conduct the Risk Assessment:

1. Hazard Identification- identifies the contaminants of concern at the Site based on several factors such as toxicity, frequency of occurrence, and concentration.

2. Exposure Assessment- estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated groundwater) by which humans are potentially exposed.

3. Toxicity Assessment- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).

4. Risk Characterization- summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of Site-related risks.

The baseline risk assessment began with selecting contaminants of concern which would be representative of the contamination found in various media (surface soil, subsurface soil, surface water, sediment, and groundwater) at the Site. Due to the large number of chemicals detected at the Site, only those chemicals which were thought to pose the highest risk (based on factors such as frequency of detection and concentration detected) were retained as contaminants of concern. The contaminants of concern include: pesticides, PCBs and inorganics in surface soil; 1,1,2,2-tetrachloroethane, benzo(a)pyrene, pesticides, PCBs, and inorganics in subsurface soils; VOCs in groundwater; VOCs and SVOCs in surface water, and, polyaromatic hydrocarbons, PCBs, and inorganics in sediment.   Several of the contaminants of concern listed above are known or suspected of causing cancer in animals and/or humans or of causing non-cancer health effects in the liver, kidney, respiratory tract, and the central nervous system.

An important factor which drives the risk assessment is the assumed future use of the Site. Based on discussions with the town and the fact that the Site is now zoned for residential, rather than industrial use, EPA assumed that the most probable future use of the Site would be for residential or recreational purposes. The Town expressed a preference for recreational use as the property is one of the last parcels of open land available in the Township. The current land uses at this Site have the potential to impact nearby residents (adults and children) and possible trespassers onto the Site. In the future, it is possible that potential human receptors would include residents (adults and children), Site workers (employees), and construction workers.

Pathways of exposure evaluated for the Site include: 1) sediment and soil ingestion; 2) dermal contact with soil and sediment; 3) ingestion of contaminated groundwater and surface water 4) dermal contact with surface water, and, 5) Inhalation of VOCs and particulates. Because EPA assumed a future residential/recreational land use of the Site, the list of possible human receptors identified in the exposure assessment included trespassers, residents (adults and children), Site workers (employees), and construction workers. Exposure intakes (doses) were calculated for each receptor for all pathways considered.

EPA's acceptable cancer risk range is 10^{-4} to 10^{-6} which can be interpreted to mean that an individual may have a 1 in 10,000 to 1 in 1,000,000 increased chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site. The State of New Jersey's acceptable risk standard is one in one million (10^{-6}.

EPA found that contaminants in the surface soil at the Site posed an unacceptable total cancer risk (2.2×10^{-3}) to potential future residents through ingestion and dermal contact. In addition, ingestion and inhalation (during showering) of contaminants in groundwater also posed unacceptable cancer risks (maximum of 2.4×10^{-2}) to potential future residents and Site workers. Benzene, carbon tetrachloride, vinyl chloride, chloroform, 1,1-dichloroethene, trichloroethene, 1,2-dichloroethane, and PCBs are the predominant contributors to the estimated cancer risk.

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The other receptors/exposure routes (including ingestion or direct contact with subsurface soil, and dermal contact with surface water and sediment) have estimated cancer risks within or below EPA's acceptable risk range.

To assess the overall potential for non-carcinogenic effects posed by more than one contaminant, EPA has developed a hazard index (HI). This index measures the assumed exposures to several chemicals at low concentrations, simultaneously, which could result in adverse health effects. In accordance with this approach, a hazard quotient (i.e., the ratio of the level of exposure to an acceptable level) greater than 1.0 indicates a potential of noncarcinogenic health effects. The HI is summed for all media common to a particular receptor.

With regard to non-cancer effects, based on the calculated HIs, EPA found that several potential exposure pathways could have unacceptable health effects including: ingestion of surface soil by children (HI=6.2); ingestion of disturbed surface soil along the current effluent discharge line by children (HI=3.7); inhalation of particulates along the current effluent discharge line by children (HI=1.5); ingestion of contaminated groundwater by adults and children 340 for adults and 800 for children); and, ingestion of contaminated groundwater by Site workers (employees) and construction workers (HI=120 for employees and 17 for workers). No noncancer effects were associated with subsurface soils, surface water and sediment.

In summary, the Human Health Risk Assessment concluded that exposure to surface soil and ground water, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health or welfare. In contrast, exposure to subsurface soils, sediments, and surface water was determined not to pose a significant threat to human health.

Ecological Risk Assessment

The Ecological Risk Assessment involves a qualitative and/or semi-quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals. A four-step process is utilized for assessing site-related ecological risks: Problem Formulation - a qualitative evaluation of contaminant release, migration, and fate, identification of contaminants of concern,

receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment -a quantitative evaluation of contaminant release, migration, and fate characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. Ecological Effects Assessment - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization - measurement or estimation of both current and future adverse effects.

The environmental evaluation focused on how the contaminants would affect the Site's natural resources. Natural resources include existing flora and fauna at the Site, surface water, wetlands and sensitive species or habitats. A wetlands delineation performed on-site determined that wetlands cover approximately 22 acres in Lot 1A and 3 acres in Lot 1B. Uplands in Lot 1A are wooded. No federally listed or proposed threatened or endangered flora or fauna are known to occur at or near the Site. However, white-tailed deer, woodchucks, rabbits, frogs, turtles and birds are known to inhabit the Site.

Sources of exposures to ecological receptors considered for this ecological assessment include surface soil (generally collected from 0 to 2 feet below ground surface), surface sediment (generally collected from 0-6 inches), and surface water. Data from subsurface soils (soils under pavements or from depths greater than 2 feet) were not evaluated. These depths,are greater than those considered likely for potential contact with burrowing animal or roots of vegetation. Subsurface sediments (sediments from depths greater than 6 inches) also were not evaluated since fish and microinvertebrates are not likely to be exposed to contaminants at greater depths. Similarly, groundwater data were not used in this ecological assessment because it is unlikely that ecological receptors can contact contaminants associated with groundwater. Exposure may occur through; 1) ingestion of contaminated food items; 2) ingestion of contaminated surface water, 3) incidental ingestion of contaminated media (i.e. soil, sediment, or water ingested during grooming, eating, burrowing, etc.); 4) inhalation of contaminants; and 5) through adsorption upon contact with contaminated media.

Three receptor species were chosen for the Site to assess the Potential adverse ecological risk of Site chemicals in the surface soil. They are the northern short-tailed shrew, the American robin, and the red-tailed hawk.

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Aquatic biota and benthic invertebrates were selected as receptor species for surface water and sediment.

The chemicals of concern selected for the environmental risk assessment include: toluene, carbon tetrachloride, 1,1,1-trichloroethane, trichloroethene, chlorobenzene, xylenes, naphthalene, PCBs, pesticides, lead and manganese.

In Lot 1A and Lot 1B, the ecological risk assessment shows that the potential exists, for adverse effects to shrews, robins and red-tailed hawk. While Lot 1B is a disturbed habitat, Lot 1A exists in a relatively undisturbed state. Therefore, the ecological assessment included an analysis of the potential remedial impact to Lot 1A habitat. Sediment and surface water for Lot 1A were assessed using published ecological screening values designed to be protective of benthic and water-column receptors. The results of the assessment indicate that there is a potential for risk from surface soils to small mammal and birds, a potential for risk from sediment to benthic receptors, and no significant potential for risk from surface water to water column receptors.

Two tributaries join in Lot 1A before exiting the Site to the north. Elevated levels of PCBs were detected in portions of the streams. It is not clear if the PCB concentrations in the stream sediment represent actual source areas of contamination or indicate the presence of a migration pathway for contaminants from the more heavily contaminated Lot 1B. In addition, ecological risks associated with the PCBs are miminal. Therefore, remediation of the stream is not warranted at this time. Rather, monitoring is required to determine whether remediation of Lot 1B results in a lowering of PCB levels in the streams in Lot 1A.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk based-based levels established in the risk assessment.

The following objectives were established for the Chemsol Site:

! restoring the soil at the Site to levels which would allow for residential/recreational use

(without restrictions)

! augment the existing groundwater system to contain that portion or contaminated groundwater that is unlikely to be technically practicable to fully restore and restore remaining affected groundwater to State and federal drinking water standards

! remove and treat as much contamination as possible from the fractured bedrock

! prevent human exposure to contaminated groundwater, and

! prevent human exposure to surface soils contaminated with PCB concentrations above 1 pan per million (ppm) and lead concentrations above 400 ppm.

! eliminating, to the greatest extent practicable, continuing sources of ntamination to the groundwater.

Soil cleanup levels for PCBs at the Site were obtained from EPA's 1990 "Guidance on Remedial Actions for Superfund Sites with PCB Contamination." For residential land use, an action level of 1 ppm is specified for PCBs. The 400 ppm lead cleanup level is based on EPA's 1994 "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities." EPA estimates that there are approximately 18,500 cubic yards of surface soil (up to a depth of 2 feet) that contain PCBs at levels above 1 ppm, and/or lead at levels above 400 ppm.

The State of New Jersey his developed State-wide soil cleanup criteria for several of the contaminants found at the Chemsol Site, including several VOCs, SVOCs, lead (400 ppm) and PCBs (0.49 ppm). Based on the data collected to date, in meeting EPA's cleanup levels for PCBs and lead cited previously, EPA believes the remedy will achieve the State of New Jersey residential direct contact and impact to groundwater soil cleanup criteria. If the remedy does not achieve the State residential direct contact soil cleanup criteria of 0.49 ppm for PCB, the State will require that restrictions be placed on the property to prevent future direct contact with soils above 0.49 ppm.

Due to the complex geology and the possible presence of non-aqueous phase liquids at this Site, EPA believes that it may not be technically practicable to fully restore some portion of the contaminated on-site groundwater to State and federal water quality standards. By law, any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards require a waiver of such standards on the basis of technical impracticability. As will be discussed in subsequent sections, if after implementation of the remedy, it proves to be technically impracticable to meet groundwater quality standards, EPA would waive such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may require a technical impracticability waiver.

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SCOPE AND ROLE OF ACTION

This action is the second action taken to address the Site. The first action consisted of the interim groundwater containment system which is currently operational at the Site. This action will address on-site contaminated groundwater and soil. A third action or "operable unit" is necessary to investigate the extent of groundwater contamination outside the property boundaries.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and utilize permanent solutions and alternative treatment technologies and resource recovery alternative to the maximum extent practicable. In addition, the statue includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of hazardous substances.

Based on the remedial action objectives, EPA performed an initial screening process of potential alternatives that would address the soils and groundwater concerns at the Site. This Proposed Plan evaluates three Groundwater Remedial Alternatives and four Soil Remedial Alternatives for adding the contamination associated with the Chemsol Site.

CERCLA requires that if a remedial action is selected that results in hazardous substances, pollutants, or contammants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, EPA, must review the action no less often than every five years after initiation of the action. As such, all of the groundwater alternatives presented in this section include a five-year review and two of the four soil alternatives include a five-year review.

It should be noted that the estimated implementation times are for construction of the remedy only. The estimates do not include the time to negotiate with the Respondents, prepare design documents, or procure contracts which may be significantly longer (approximately 18 months) than the construction times shown.

The alternatives are:

SOIL

Alternative S-1: No Further Action

Estimated Capital Costs:	$388,660
Estimated Annual O&M Costs (30 years):	$0
Estimated Total Present Worth Value:	$388,660
Estimated Implementation Period:	3-6 months

The "No-Action" alternative is used as a baseline for comparison of other soil alternatives. Under this alternative, EPA would take no action at the Site. However, the No-Action alternative includes, as with the other soil alternatives, a single sampling event for drummed waste and soil stockpiled at the Site, along with their transportation and off-site disposal. The drummed waste were generated from the various investigations performed at the Site and the stockpiled soils were generated from construction activities performed at the Site. Since contaminants would remain on-site, institutional controls (e.g., a deed restriction) would be placed on the property that would restrict future use of the Site. A review of the Site conditions at the end of five years would be performed to determine whether or not the contamination in the soils has spread both horizontally or vertically.

Alternative S-2A: Capping with Soil

Estimated Capital Costs:	$1,855,850
Estimated Annual O&M Costs (30 years):	$2,000
Estimated Total Present Worth Value:	$1,894,000
Estimated Implementation Period:	3-6 months

This alternative includes the construction of a single layer (18 inches thick) soil cap covering 12 acres of the property which are contaminated above the soil cleanup levels. It would also require that no intrusive activities be performed on the capped area in order to ensure its integrity. This alternative would allow for many recreational uses of the property, such as park or playground, among others. However, a restriction would have to be placed on the property to ensure that the cap is not breached. A single sampling event of drummed waste and stockpiled soil along with their transportation and off-site disposial would be performed. After completion of the remedy, a review of Site conditions every five years would be performed as required under the Superfund law.

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Alternative S-3: Excavation and Off-Site Disposal

Estimated Capital Costs:	$5,573,001
Estimated Annual O&M Costs (30 years):	$0
Estimated Total Present Worth Value:	$5,573,000
Estimated Implementation Period:	6-12 months

This alternative includes excavation and off-site disposal of all surface soils contaminated with PCBs and lead that are above EPA's cleanup levels. Approximately 18,500 cubic yards of soil with PCBs levels greater than 1 part per million and lead levels greater than 400 parts per million will be disposed of at a licensed and approved disposal facility. The excavated areas would be backfilled with imported clean fill from an off-site location, and covered with topsoil and seeded with grass. The excavation and off-site disposal of the contaminated soils will allow for residential, or recreational use of the Site in the future. As with Alternative S-1, this alternative includes a single sampling event of drummed waste and stockpiled soil prior-to disposal off-site.

Alternative S-4A: Excavation and On-Site Low Temperature Thermal Desorption of PCB-Contaminated Soil with

On-Site Solidification of Lead Contaminated Soil.

Estimated Capital Costs:	$11,963,134
Estimated Annual O&M Costs (30 years):	$0
Estimated Total Present Worth Value:	$11,963,000
Estimated Implementation Period:	3-6 months

Alternative S-4B: Excavation and On-Site Low Temperature Thermal Desorption of PCB-Contaminated Soil with Off-Site Disposal of Lead Contaminated Soil.

Estimated Capital Costs:	$12,241,639
Estimated Annual O&M Costs(30 years):	$0
Estimated Total Present Worth Value:	$12,242,000
Estimated Implementation Period:	6-9 months

For both Option A and B, all surface soil contaminated with PCBs above 1 part per million (18,500 cubic yards) would be excavated. The excavated sod would be treated on-site by low temperature thermal desorption (LTTD) to remove PCBs. The treated soil would then be backfilled to the excavated areas, topsoil would be placed on the treated soils and seeded. As with the other soil Alternatives, Alternative S-4(A and B) includes a single sampling event of drummed waste and stockpiled soil prior to disposal off-site.

Under Option A, the lead contaminated soil would be solidified/stabilized on-site by mixing it with Portland cement. The area on-site where this contaminated soil is placed would be protected from future intrusion. Under Option B, the lead-contaminated soil would be excavated and transported off-site for disposal at 2 licensed and approved RCRA disposal facility. The excavated areas would be backfilled with clean fill, and seeded.

GROUNDWATER

Alternative GW-1: No Action

Estimated Capital Costs:	$0
Estimated Annual O&M costs(30 years):	$59,336
Estimated Total Present Worth Value:	$912,000
Estimated Implementation Period:	0 months

The Superfund program requires that the "No-Action" alternative be considered as a baseline for comparison with other alternatives. Under this alternative, EPA would cease actions at the Site to treat the contaminated groundwater and to restrict the off-site migration of contaminated groundwater. However, the No-Action alternative does include long-term monitoring of on-site groundwater, to monitor the concentrations of contaminants remaining at the Site.

Alternative GW-2(A and B): Continue Existing Interim Action - Extract Groundwater from Well C-1

OPTION - A

Estimated Capital Costs:	$45,097
Estimated Annual O&M Costs(30 years):	$452,738
Estimated Total Present Worth Value:	$7,000,300
Estimated Implementation Period:	0 months

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Under Option-A of this alternative, the current extraction of the groundwater from well C-1 would continue. The extracted groundwater first passes through an air stripper, after which it is filtered, followed by activated carbon adsorption. The treated water is then discharged to the Middlesex County Utilities Authority (MCUA) Publicly Owned Treatment Works (POTW). The capital cost of $45, 097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property.

Option - B
Estimated Capital Costs: $45,097
Estimated Annual O&M Costs(30 years): $726,336
Estimated Total Present Worth Value: $11,209,000
Estimated Implementation Period: 3 months

In addition to the treatment described in Option-A, a biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. This phase is a contingency in the event that in the future, treated groundwater cannot be sent to MCUA. The biological treatment will provide additional treatment so the groundwater will achieve federal and State surface water quality standards which would allow for discharge to Stream 1A. The capital cost of $45,097 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property.

Alternative GW-5(A and B): Extract Groundwater from Additional Wells - Use Existing Treatment Processes Air Stripping/Aerobic Mixed Growth Biotreatment/Filtration/Activated Carbon Adsorption

Option - A
Estimated Capital Costs: $390,189
Estimated Annual O&M Costs(30 years): $670,892
Estimated Total Present Worth Value:
$10,699,000
Estimated Implementation Period: 3 months

Option-A of this alternative is almost identical to Alternative GW-2A. They differ in that, in addition to well C-1, groundwater would be pumped from other on-site wells (EPA cost estimates are based on pumping five additional wells. However, the number of wells to be pumped will be determined during the remedial design.)

Pumping from these additional wells will allow for more effective on-site containment of the plume, and also allow for groundwater extraction from other contaminated areas on-site. As in Alternative GW-2A, the treated groundwater would be discharged to MCUA POTW. The capital cost of $390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs asociated with installation of additional extracting wells.

Option - B
Estimated Capital Costs: $390,189
Estimated Annual O&M Costs(30 years): $766,336
Estimated Total Present Worth Value: $12,169,000
Estimated Implementation Period: 3 months

A biological treatment phase would be added for Option-B. This would be done by starting up the existing (currently unused) biological treatment plant. Use of the biological treatment phase would allow for discharge to Stream 1A in compliance with federal and State standards. The capital cost of $390,189 includes costs for replacing the existing pipeline (which carries water from well C-1 to the treatment plant) with an underground pipeline in order not to restrict the future uses of the property as well as costs asociated with installation of additional extraction wells.

EVALUATION OF ALTERNATIVES

Each of the above alternatives was evaluated against specific criteria on the basis of the statutory requirements of CERCLA Section 121. A total of nine criteria are used in evaluating the alternatives. The first two criteria are threshold criteria which must be met by each alternative. The next five criteria are the primary balancing criteria upon which the analysis is based. The final two criteria are referred to as modifying criteria and are applied, following the public comment period, to evaluate state and community acceptance. The Glossary of Evaluation Criteria describes the nine criteria used in evaluating remedial alternatives.

A comparative analysis of these alternatives based upon these evaluation criteria is presented below.

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Overall Protection of Human Health and the Environment

Soil

Alternative S-1, No Action, would not be protective of human health and the environment because the Site would remain in its current condition. The soils would continue to pose a threat to potential future residents and trespassers. Therefore, Alternative S-1 has been eliminated from consideration and will not be discussed further.

Alternative S-2A relies on containment and institutional controls to provide, protection over time. Deed restrictions would have to be enforced to ensure that the cap is not breached in the future in order for this alternative to be protective.

Upon completion of Alternatives S-3 and Alternative S-4(A and B), all risks to human health and the environment from organic and inorgamc contaminants would be eliminated through off-site removal or treatment of contaminants in the surface soils to protective levels.

Groundwater

Alternative GW-1, No Action,would not be protective of human health and the environment because the groundwater would continue to migrate off-site continuing to pose a potential threat to users. Therefore, Alternative GW-1 has been eliminated from consideration and will not be discussed further.

Alternatives GW-2 (A and B) and GW-5 (A and B) would be protective of human health by controlling the migration of contaminated groundwater through pumping and by removing contaminants through treatment of pumped groundwater. GW-5 (A and B) captures and removes more contamination than GW-2 (A and B), and therefore best meets this criterion.

GLOSSARY OF EVALUATION CRITERIA

Threshold Criteria

Overall Protection of Human Health and the Environment: This criterion addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs: This criterion addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and requirements or provide grounds for a waiver.

Primary Balancing Criteria

Long-term Effectiveness: This criterion refers to the ability of a remedy to maintain protection of human health and the environment, once cleanup goals have been met.

Reduction of Toxicity, Mobility or Volume through Treatment: This criterion refers to the anticipated performance of the treatment technologies a remedy may employ.

Short-term Effectiveness: This criterion considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Implementability: This criterion examines the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Cost: This criterion includes capital and operation and maintenance costs.

Modifying Criteria

State Acceptance: This criterion indicates whether, based on its review of the RI/FS report and Proposed Plan, the state concurs, opposes, or has no comment on the preferred alternative.

Community Acceptance: This criterion will be addressed in the Record of Decision following a review of the public comments received on the RI/FS report and the Proposed Plan.

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Compliance with ARARs

Actions taken at any Superfund site must meet all applicable or relevant and appropriate requirements of federal and state law or provide grounds for invoking a waiver of these requirements. There are several types of ARARs: action specific, chemical-specific, and location specific. Chemical-specific ARARs are usually numerical values which establish the amount or concentrations of a chemical that may be found in, or discharged to, the ambient environment. Location-specific requirements are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in a special location. Action-specific ARARs are technology or activity-specific requirements or limitations related to various activities.

Soil

There are no federal or State promulgated soil cleanup standards. Alternative S-2A does not meet State soil cleanup criteria which, while not legally applicable, were considered by EPA as cleanup levels for the Site. If the State soil criteria were not met, institutional controls would be required by the State.

In addition, because a portion of the Site is classified as wetlands, all alternatives (soil and/or, groundwater) would need to comply with Section 404 of the Clean Water Act and federal Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Any actions which disturb or impact wetlands would additionally require development of a wetlands mitigation plan.

If implemented, Alternatives S-3 and S-4(A and B) would meet chemical-specific, location-specific and action-specific Federal and State ARARs: for the contamination in the soils. The major ARARs for Alternative S-3 are Federal and State Resource Conservation and Recovery Act (RCRA) requirements which control the transportation disposal of hazardous waste. For example, the soil excavated under Alternative S-3 would be disposed at a facility which is licensed under RCRA to accept hazardous waste. Alternatives S-4(A and B) would involve the use of an on-site treatment technology which would be subject to RCRA treatment regulations and Clean Air Act requirements regarding emissions from the treatment system. Air emissions will require air permit equivalences from the State of New Jersey.

Groundwater

Alternatives GW-2 (A and B) and GW-5(A and B) would meet the chemical-specific ARARs for the treated water before discharge. These include New Jersey Pollutant Discharge Elimination System requirements for discharges to surface water. In addition, air emissions from the treatment plant would need to comply with Federal and State emissions standards. Alternatives GW-2(A and B) and GW-5(A and B) produce a filter cake that might need to be disposed of as a RCRA hazardous waste. In accordance with State regulations, a classification exception area (CEA) will have to be established once the extent of contamination on associated with the

Chemsol Site has been determined.

Alternative GW-5(A and B) is more likely to achieve State and federal water quality standards in the aquifers than is GW-2. It is possible that it will be technically impracticable to restore all portions of the aquifers to meet State and federal standards. Any areas of contaminated groundwater which cannot be restored to meet State and/or federal groundwater quality standards require a waiver of such standards on the basis of technical impracticability. If after implementation of the remedy, it proves to be technically impracticable to meet water quality standards, EPA would waive such standards. Performance data from any groundwater system selected for the Site would be used to determine the parameters and locations (both vertically and horizontally) which may require a technical impractibility waiver.

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Long-Effectiveness and Permanence

Soil

Alternatives S-4(A and B) provide the highest degree of long-term effectiveness and permanence since the waste would be treated to permanently remove organic contaminants. Alternative 3 provides a high degree of long-term effectiveness by removing waste from the Site but does not provide a high degree of permanence since waste would not be destroyed but only contained off-site.

Under Alternative S-2A, contaminated soils would remain on-site and, therefore, this remedy would provide the least amount of long-term effectiveness and permanence. In addition, institutional controls would need to be employed and enforced in order to ensure the effectiveness.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) provide varying amounts of containment of the contaminated groundwater. Additional off-site investigations to determine the extent of groundwater contamination are necessary to ensure that risks to neighboring communities are minimized. Alternatives GW-5 (A and B) provide a higher degree of long-term effectiveness than Alternative GW-2 (A and B) by, increasing the amount of groundwater captured on-site and removing more contaminants from the extracted groundwater through treatment.

Short-Term Effectiveness

Soil

Alternatives S-2A, S-3, and S-4(A and B) do involve construction activities that would pose a low level risk of exposure to soils by ingestion, direct contact and inhalation to Site workers; however this risk can be managed by appropriate health and safety measures. All of the alternatives can be implemented relatively quickly, in less than a year, following completion of design.

Alternative S-3 involves a significant increase in dust, vapor, and noise generation during soil excavation. These would be minimized through the use of measures which would be undertaken to ensure that all activities are performed in such a way that vapors, dust, and other materials are not released to the surrounding community during excavation. In addition, Alternative S-3 includes off-site transportation of the excavated soil. This will increase truck traffic and noise in the community during the period when soil is being transported off-site. EPA will design transportation flow patterns to minimize traffic impacts on the community. EPA will also explore the use of constructing a road from the Site which will bypass residential areas.

Under Alternative S-4(A and B), a thermal desorber would be placed on-site, causing increases in noise and emissions from the unit. To minimize the risk from inhalation of vapors from the thermal desorber which is required, a secondary chamber would be utilized that would oxidize all organics compounds released from the LTTD process to carbon dioxide, water and hydrochloric acid.

Groundwater

All the groundwater alternatives provide short-term effectiveness in protecting the Site workers and neighboring communities from the risks due to ingestion and inhalation of VOCs. Alternatives GW-2(A and B) and GW-5(A and B) would pose a low level risk to Site workers during construction; however, this risk can be managed by the use of appropriate health and safety measures. Alternative GW-2 is a continuation of the existing system and is running now. Alternatives GW-5 (A and B) can be implemented very quickly (in approximately 3 months) since they are simply an addition to the current system.

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Reduction of Toxicity, Mobility or Volume Through Treatment

Soil

Alternatives S-4(A and B) provide for physical removal of the contaminated material and the maximum reduction in toxicity and mobility through treatment. Alternative S-2-A and Alternative S-3 do not include the use of treatment to reduce the toxicity, mobility or volume of contaminated soil. For Alternative S-2A, reduction in-the mobility of the contamination would be achieved through the use of containment. For Alternative S-3, reduction in toxicity, mobility and volume would be achieved through excavation and off-site disposal.

Groundwater

Alternatives GW-2(A and B) and GW-5(A and B) reduce the toxicity and volume of contamination from the extracted groundwater. However, Alternative GW-5(A and B) would operate at twice the pumping rate of Alternative GW-2(A and B). The mobility of the contaminants is completely controlled by the pump-and-treat alternatives to the extent that the groundwater is within the capture zone of the wells. Greater reduction of volume and toxicity of contaminated groundwater is achieved by GW-5 than GW-2. Alternative GW-5 also results in greater capture and containment of contaminated groundwater.

Implementability

Soil

All of the services and materials needed to implement the soil alternatives are readily available commercially. Each alternative utilizes standard technologies for excavation, capping and transportation of soils. However, due to the high demand for thermal desorption units, there may be a delay in Alternative S-4 (A and.B). All the alternatives are technically feasible but Alternatives S-4(A and B) require a treatability study to obtain design parameters for the full-scale system. Alternatives S-4(A and B) have complex administrative issues because of the quantity of equipment that needs to be set up at the Site and the need to provide substantive compliance with State air emissions permit requirements. Alternative S-3 is easily implementable using standard excavation technology possible, a temporary access road that would provide more direct and access from the Site to nearby highways, would be built, in order to minimize the number of trucks traveling through the community.

Groundwater

All of the services and materials needed to implement the groundwater alternatives am readily available commercially. All the alternatives are technically feasible but Alternatives GW-2(A and B) and GW-5(A and B) require skilled operators to successfully implement the remedy. The alternatives are also feasible from an administrative standpoint. The required activities for the pump-and-treat would occur on Chemsol property. The treatment plant for the interim remedy has already been built and has been in operation for the last two years with discharge to the MCUA POTW. The effluent line for the discharge to Stream 1A has also been installed even though it is not currently being used.

All the services needed to implement the alternatives already exist. The pump-and-treat alternatives require the most services since they require operation of the treatment plant and disposal of filtered waste from the plant.

Costs

The capital, annual operation and maintenance, and present worth costs are presented below for each alternative. Present worth costs for all the alternatives were calculated assuming a 5% interest raze and a 30-year operation and period.

Soil

Capital costs for Alternative S-1 are estimated to be $338,660 which includes costs for a single sampling event of drummed waste and stockpiled soils along with transporting and off-site disposal of the drummed waste and the stockpiled soil. There would be no operation and maintenance costs so that the total present worth is estimated to be $338,660.

Capital costs for Alternative S-2A are estimated to be $1,855,850. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of constructing and seeding the soil cap. Annual operation and maintenance costs are estimated to be $2,000. The total present worth is estimated to be $1,894,000.

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Capital costs for Alternative S-3 are estimated to be $5,573,000. This includes the cost of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and disposing of the contaminated soils off-site. There are no annual operation and maintenance costs so that the total present worth is estimated to be $5,573,000.

Capital costs for Alternative S-4A are estimated to be $11,963,000. This includes the costs of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site. There are no annual operation and maintenance costs since the treatment would be accomplished in less than a year so that the total present worth is estimated to be $11,963,000.

Capital costs for Alternative S-4B are estimated to be $12,241,000. This includes the cost of the sampling and off-site disposal described for Alternative S-1 plus the costs of excavating and treating the contaminated soils on-site and disposing the lead-contaminated soils off-site. There are no annual operation and maintenance costs since the work would be accomplished in less than a year so that the total present worth is estimated to be $12,241,000.

Groundwater

In the case of all groundwater alternatives, the costs presented below are in addition to those already incurred to install and operate the existing interim extraction and treatment system at the Site.

Alternative GW-1 does not have any capital cost. The annual operation and maintenance costs are estimated to be $59,336 and include costs for monitoring the groundwater. The total present worth cost is estimated to be $912,000.

Capital costs for Alternative GW-2A are estimated to be $45,097. These costs include costs associated with installation of underground piping from well C-1 to the treatment plant. The annual operation and maintenance costs are estimated to be $452,738. The total present worth is estimated to be $7,000,300.

Capital costs for Alternative GW-2B are estimated to be $45,097 and include costs associated with installation of underground piping from well C-1 to the treatment plant. Annual operation and maintenance costs are estimated to be $726,336. The total present worth is estimated to be $11,209,000.

Capital costs for Alternative GW-5A are estimated to be $390,189 and include costs associated with installation of underground piping from well C-1 to the treatment plant and costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be $670,892. The total present worth is estimated to be $10,699,000.

Capital costs for Alternative GW-5B are estimated to be $390,189 and include costs for installing piping to five additional extraction wells. Annual operation and maintenance costs are estimated to be $766,336. The total present worth is estimated to be $12,169,000.

State Acceptance

The State of New Jersey cannot concur on the preferred remedy unless its soil direct contact citeria are met or institutional controls are established to prevent direct contact with soils above direct contact criteria.

Community Acceptance

Community acceptance of the preferred alternative will be assessed in the Record of Decision following review of public comments received on the RI/FS report and the Proposed Plan.

PREFERRED ALTERNATIVE

Based upon an evaluation of the various alternatives, EPA recommends Alternative S-3 as the preferred alternative for the cleanup of the soil at the Site and Alternative GW-5 as the preferred alternative for the cleanup of the groundwater at the Site.

Soil

The preferred soil alternative, Alternative S-3, provides for excavation and off-site disposal of approximately 18,500 cubic yards of contaminated soils, followed by backfilling with clean fill and topsoil and seeding. The preferred remedy will allow for future unrestricted use of the Site. In addition, sediment and surface water monitoring would be conducted to determine whether remediation of Lot 1B results in a lowering of PCB levels in the streams in Lot 1A.

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The cost for the soil excavation is estimated at approximately $5,600,000 with no annual operation and maintenance. EPA prefers Alternative S-3 over Alternative S-4(A and B) because it would provide an equivalent level of protection at less than half the cost of Alternative 4(A and B) which is estimated at $11,963,134 - $12,242,000. The preferred alternative will also meet all ARARs.

Off-site disposal provides a higher degree of permanence and long-term effectiveness than on-site containment. While treatment would provide a higher degree of permanence than off-site disposal, the costs of treatment are high in comparison to those for off-site disposal. While there are short-term impacts associated with excavation and transportation of contaminated soil, these can be minimized through proper planning. For instance, during design, EPA would explore the feasibility of constructing a road from the Site which would minimize the amount of truck traffic through the surrounding neighborhood.

Groundwater

The preferred groundwater remediation alternative, Alternative GW-5, includes installation of additional extraction wells to contain the contaminated groundwater on the Site. The selection and number of additional extraction well to be pumped will be determined during the remedial design. The preferred alternative is similar to the existing interim groundwater remedy except that additional extraction wells would be pumped. The existing treatment facility would not need to be changed.

Based on groundwater flow modeling, the preferred alternative provides protection by capturing all contaminated groundwater from the upper water bearing zone (including some off-site areas) and most of the contamination within the middle and deep water bearing zones. The preferred remedy will extract groundwater at more than twice the current rate and provide greater protection by capturing, containing and treating the contaminated groundwater. The discharge from the treatment plant would continue to be sent to the MCUA POTW. However, if the discharge cannot be sent to MCUA, the biological treatment portion of the plant will be brought online. The biological treatment step, will allow for direct discharge to Stream 1A.

The present worth cost of the preferred groundwater alternative is $10,700,000 (assuming discharge to MCUA) which is $3,700,000 more than the present worth cost of the current interim remedy. These higher costs result from a higher capital cost due to the additional extraction wells and the higher operation and maintenance costs resulting from the increased pumping rate and the additional wells to be maintained. In the event the biological unit is brought on line, the total present worth for the preferred remedy will increase by $1,500,000 from the current interim remedy.

These cost estimates are based on an assumption that the system will operate for 30 years. However, it is possible that the system will operate for longer or shorter periods depending on the results of future monitoring. The groundwater system would be shutdown if ARARs are achieved or if monitoring results show that further operation of the system will not reduce the concentrations in groundwater and that contaminated groundwater will not migrate off-site at levels which are above health-based limits for the nearest receptors. EPA will undertake additional groundwater investigations to determine if contaminated groundwater is leaving the property boundaries.

The preferred alternatives will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. EPA believes that the preferred alternatives will be protective of human health and the environment, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

NEXT STEPS

After EPA has presented the preferred alternative at the public meeting and has received any comments and questions during the public comment period, EPA will summarize the comments and provide its responses in a document called the "Responsiveness Summary." The Responsiveness Summary will be appended to the Record of Decision, which will describe the final alternative selected by EPA and provide EPA's rationale for that selection.

<IMG SRC 98141TP>
<IMG SRC 98151TQ>
<IMG SRC 98141T5>

Chemsol, Inc. Superfund Site

Responsiveness Summary

Appendix - D

Public Notice
Printed in The Home News and Tribune
on
August 11, 1997

<IMG SRC 98141T6>

RECORD OF DECISION FACT SHEET
EPA REGION II

SITE:
Site name: Chemsol, Inc. Site
Site location: Piscataway, Middlesex County, New Jersey
HRS score: 42.,69
Listed on the NPL: September 1, 1983
Site ID #: NJD980528889

RECORD OF DECISION.
Date signed: September 18, 1998
Selected remedies: Soil Alternative 3: Excavation and off-site disposal of contaminated soil. Groundwater Alternative 5: Installation and pumping of additional wells to treat and contain contaminated groundwater within the property boundaries.
Operable Unit #: OU-2
Capital cost: Soil Alternative 3 - $5,573,000 (1998-$)
Groundwater Alternative 5 - $390,189
Anticipated Construction Completion: September 2002
O & M cost: Soil Alternative 3 - $0
Groundwater Alternative 5 - $670,892 (1998 dollars for 30 year period)
Present-worth cost: Soil Alternative 3 - $ 5,573,000
Groundwater Alternative 5 - $10,699,000
Total $16,272,000

LEAD:
Site is currently fund and PRP lead - EPA is the lead agency
Primary Contact: Nigel Robinson (212) 637-4394
Secondary Contact: Lisa Jackson (212) 637-4380
Main PRPs: Union Carbide, Schering-Plough, Morton International and Tang Realty
PRP Contact: William H. Hyatt, Jr., (973) 966-8041

WASTE:
Waste type: Volatile organics, semi-volatile organics, PCBs, pesticides, metals
Waste origin: Hazardous waste
Contaminated medium: Soil and Groundwater
Origin: Dumping and recycling
Est. Waste Quantity: 25,000 cubic yds. of PCB-contaminated soils