UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

RISK ASSESSMENT REPORT
FOR
CHEMICAL LEAMAN TANK LINES, INC. SUPERFUND SITE
OPERABLE UNIT 1
LOGAN TOWNSHIP, NEW JERSEY

JULY 1989

PREFACE

This document represents the Risk Assessment for the first operable unit of the Chemical Leaman Tank Lines, Inc. Superfund site located in Logan Township, New Jersey. This document supersedes the one entitled "Final Draft Risk Assessment Report" prepared by Environmental Resources Management, Inc. and dated February 24, 1989.

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EXECUTIVE SUMMARY

This Final Draft Risk Assessment Report has been prepared in conjunction with the Remedial Investigation/Feasibility Study (RI/FS) for the Chemical Leaman Tank Lines, Inc. (CLTL) active terminal site in Bridgeport, New Jersey. The purpose of this RA is to evaluate the magnitude of the risk to public health posed by the No-Action Alternative conditions at the CLTL terminal.

Background

The CLTL Bridgeport terminal is located in Logan Township, Gloucester County, New Jersey, approximately two miles south of the Delaware River and one mile east of Bridgeport. The site consists of an active terminal used for the dispatching, storage, maintenance, and cleaning of tractors and trailers; fallow farmland adjacent to the terminal; and wetlands bordering the terminal to the southeast. The CLTL terminal has been in operation at the site since the early 1960s.

Prior to 1975, rinse water generated in the cleaning of tank trailers was impounded in a series of unlined settling lagoons and aeration lagoons. These lagoons were taken out of operation in August 1975 when CLTL was required by the New Jersey Department of Environmental Protection (NJDEP) to install a new rinse water containment system at the terminal. In early 1977, liquid remaining in the settling and aeration lagoons was drained into the adjacent wetlands and accumulated sludge in the bottoms of the settling lagoons was vacuumed prior to backfilling with clean fill and construction debris. Accumulated sludge in the aeration lagoons and the final settling lagoon was not removed, and the

lagoons were filled with perimeter diking materials and construction debris. In 1982, CLTL excavated visible sludge and contaminated soil from the former settling lagoons. Soil was removed to an approximate depth of 12 feet below the surface, and the excavation was backfilled with clean sand.

In 1985 the U.S. Environmental Protection Agency (EPA) included the CLTL site on the National Priorities List as a Superfund site and contracted NUS to prepare a Work Plan for an RI/FS of the site. CLTL agreed to conduct the RI/FS and contracted Environmental Resources Management, Inc. (ERM) to perform the work. An Administrative Order of Consent (ACO) was signed in July 1985, and ERM began to work at the CLTL site in February 1986. EPA withdrew the RI/FS study from CLTL on June 15, 1989 and unilaterally developed the final RI/FS and Risk Assessment documents. This Risk Assessment has been assembled by EPA using data submitted by CLTL and ERM. These data are attached as Appendices A through E.

Remedial Investigation

The Remedial Investigation (RI) was performed to assess the nature and extent of site-related contamination on the local ground water, soil, surface sediment, and surface water at the CLTL site.

The Final Draft Remedial Investigation Report for the Active Terminal Area of the CLTL site presents the results of the hydrogeologic investigation, ground water sampling, and soil sampling at the CLTL site. A separate RI/FS and Record of Decision, under a new Administrative Consent Order, will be required for an investigation of the wetlands surrounding the CLTL terminal.

Results of the ground water sampling indicate that the highest concentrations of site-related Priority Pollutant contaminants occur in the shallow and intermediate subzones. Solvents,

including trichloroethene, trans-1,2-dichloroethene, and other volatile organic compounds (VOCs) and metals are the contaminants present at highest concentrations in these subzones. Low concentrations of site-related Priority Pollutant contaminants occur in the deep subzone downgradient from the site. Elevated concentrations of semivolatiles (mainly base neutrals) and metals (most commonly chromium, arsenic, zinc, and lead) generally occur in wells with high concentrations of total VOCs. The former settling and aeration lagoons are the primary sources of ground water contamination beneath the site.

Results of the soil sampling indicate that soil with concentrations of Priority Pollutant inorganic and organic constituents above background levels occur in the vicinity of the former settling and aeration lagoons, in the overflow area east of the former final settling lagoon, and in the truck parking lot/driveway area. Additional sampling of surface soils is required to fully determine the extent of contamination in the truck parking lot/driveway area.

Risk Assessment

As part of the RI/FS process, the Risk Assessment (RA) is considered together with the RI to determine the remedial objectives at NPL sites. In this report, the RA will evaluate the magnitude of the public health impact assuming that no remediation has occurred or will occur at the site. The RA process, as derived from EPA guidance documents, involves: 1) definition of site-specific indicators, 2) definition of potential exposure points and intakes, 3) calculation of potential noncarcinogenic hazard indices and carcinogenic risks, and 4) comparison of actual site concentrations of compounds with applicable, or relevant and appropriate requirements (ARARs).

Nine indicators were identified for this RA. They were arsenic; 1,2-dichloroethane; trichloroethene; vinyl chloride; benzene,

trans-1,2-dichloroethene; lead; zinc; and 1,2-dichlorobenzene.

The residents living along Cedar Swamp Road and Oak Grove Road, and workers involved in the CLTL trailer rinsing operation at the active terminal are the two potentially exposed populations identified at this site. The media examined in this RA were shallow/intermediate/deep subzone ground water and vapors from the truck rinsing operation at the CLTL Production well. Additional surface soil sampling is necessary to fully determine the extent of contamination in the truck parking lot/driveway area. A preliminary assessment of the health risk due inhalation of fugitive dusts from the truck parking lot/driveway area is presented in Appendix D.

Exposures are likely to be different for adults and children living in the residential areas because of different behavioral patterns. For this reason, exposures were calculated separately for three age groups: adults, children ages 2 to 6, and children ages 6 to 12. Lifetime-weighted exposures were then calculated by combining exposures for all age groups in order to estimate the risk posed to an individual who might live near the site for a lifetime.

Five exposure pathways were evaluated in this RA for residents living near the CLTL site, including:

- Inhalation of volatilized compounds from ground water (i.e., the CLTL production well) during trailer rinsing operations;
- Inhalation of and dermal contact during bathing activities with compounds detected in the shallow/intermediate subzone ground water;
- Ingestion of compounds detected in shallow/intermediate subzone ground water;
- Inhalation of and dermal contact during bathing activities with compounds detected in the deep subzone ground water;
- Ingestion of compounds detected in the deep subzone ground water; and

TABLE 1

SUMMARY OF THE RISKS ASSOCIATED WITH
THE CLTL BRIDGEPORT, NJ TERMINAL

CONDITIONS	DESCRIPTION	LIFETIME WEIGHTED CARCINOGENIC RISK *
Resident	Ambient air from the ground water from the CLTL production well used for trailer rinsing.	6E-07
	Groundwater from the shallow/ intermediate subzones used for bathing and drinking purposes	6E-02
	Groundwater from the deep subzone used for bathing and drinking purposes	3E-04
Worker	Ambient air from the groundwater from the CLTL production well used for trailer rinsing (inhalation and dermal contact)	1E-04

		LIFETIME WEIGHTED NONCARCINOGENIC HAZARD INDEX**	SUBCHRONIC NONCARCINOGENIC HAZARD INDEX**
Resident	EXPOSURES EXCLUDING DEEP GROUNDWATER SUBZONE	**Total 4.16E+01**	**1.15E+02**
	trans-1,2-dichloroethene	**4.07E+01**	**9.65E+01**
	1,2-dichlorobenzene	5.53E-01	**1.13E+00**
	zinc	3.09E-01	**1.17E+01**
	lead	***	***
	EXPOSURES TO DEEP GROUNDWATER SUBZONE	Total 9.93E-02	4.67E-01
	trans-1,2-dichloroethene	4.06E-02	2.80E-02
	1,2-dichlorobenzene	0	0
	zinc	3.55E-02	4.39E-01
	lead	***	***
Worker	trans-1,2-dichloroethene	2.90E-01	NA
	1,2-dichlorobenzene	0	NA
	zinc	4.87E-05	NA
	lead	***	NA

Bold values indicate that the calculated risk is greater than EPA's acceptable ranges.
Carcinogenic recommended guidelines - 1.00E-04 to 1.00E-07 (EPA)
Hazard Index - less than one (EPA)

* Indicators evaluated: trichloroethene, vinyl chloride, arsenic, benzene and 1,2-dichlorobenzene
** Indicators evaluated: trans-1,2-dichloroethene, 1,2-dichlorobenzene, zinc and lead
*** EPA has withdrawn the reference dose for lead for reconsideration. The hazard index for lead could not be evaluated. This does not imply an absence of health risk due to lead exposure at the CLTL site.
NA = Not Applicable

Two exposure pathways were examined for CLTL workers. These were the inhalation of and dermal contact with compounds detected in the ground water from the CLTL production well during trailer rinsing operations.

Conclusions

The RA evaluated potential exposures of CLTL related carcinogenic and noncarcinogenic constituents to nearby residents and CLTL employees. The results of this assessment are presented in table 1.

Carcinogenic risk is expressed as the lifetime excess cancer risk associated with site-related exposure to the indicator compounds. Noncarcinogenic hazard is expressed as an index, which is the ratio of the calculated subchronic or chronic intake to an acceptable exposure level or reference dose. A hazard index of less than one is normally considered acceptable, while a hazard index greater than one indicates that adverse health impacts may be associated with the exposure.

The lifetime-weighted carcinogenic risk to the residents (excluding exposure to the deep ground water subzone) is 6×10^{-2}. Ingestion and inhalation of vinyl chloride and ingestion of arsenic detected in the shallow/intermediate subzone ground water generate most of the cancer risk.

The risk to residents who might use the deep ground water subzone in the future for potable water is 3×10^{-4}. Ingestion of arsenic accounts for most of the risk. However, it should be noted that the deep ground water subzone is well below the MCL for arsenic.

The lifetime-weighted cancer risk to workers due to contact with compounds present in groundwater from the CLTL production well is

1×10^{-4}.

The subchronic and chronic hazard indices evaluate exposure to noncarcinogens. The indices were calculated for each noncarcinogenic indicator compound and then totaled. [Note: EPA has withdrawn the reference dose for lead for reconsideration. The noncarcinogenic hazard index for lead at the CLTL site could not be quantitatively evaluated. This does not imply an absence of health risk due to lead at the CLTL site.] For residents exposed to shallow/intermediate subzone ground water (but excluding exposure to the deep subzone ground water), the total subchronic and chronic hazard indices were substantially greater than one, which indicates that there is potential for adverse health impacts associated with these exposures.

When the chronic hazard indices were evaluated separately for each indicator, the index from exposure to trans-1,2-dichloroethene was greater than one, while the indices for exposure to 1,2-dichlorobenzene and zinc were both less than one. The exposure routes responsible for the exceedance by trans-1,2-dichloroethene were ingestion and inhalation.

The lifetime-weighted total chronic hazard index for potential deep subzone ground water use was less than one when all of the indices were summed. Also, the total hazard index for worker exposure was less than one when all the indices were summed.

The subchronic hazard indices for all of the indicator compounds contained in the shallow/intermediate groundwater exceed one. The HI for 1,2-dichloroethene exceeds one in all age groups for inhalation while bathing and ingestion. The HI for 1,2-dichlorobenzene exceeds one due to childhood exposure to the compound through inhalation while bathing. The HI for zinc exceeds one for ingestion of groundwater by all age groups.

A comparison of ARARs with actual concentrations of compounds in the various media shows exceedance of ARARs for the shallow/intermediate subzone ground water. A comparison of TBCs (criteria to be considered) with actual concentrations of compounds detected in soils at the CLTL site indicated exceedance of TBCs.

The results of the comparison for the deep subzone ground water indicated more limited ARAR exceedance. It must be kept in mind that there are no deep subzone ground water sampling results available in the immediate vicinity of the former lagoons. Three compounds were detected in excess of ARARs: chromium, trans-1,2-dichloroethene, and DDT. Each of these exceedances occurred in a different monitoring well.

In order to put the calculated risk and hazard values into perspective, consideration should be given to the following:

- EPA conducted a ground water monitoring program of the residential wells in the vicinity of the Bridgeport Rental and Oil Service site from March 1983 to December 1986. This monitoring included residences located north, west, south, southwest, and east of the CLTL site. Residential wells immediately north of CLTL and Cedar Swamp Road were found to be contaminated by CLTL site-related contaminants in excess of State drinking water standards.

- Until 1987, most of the residents in the vicinity of the site maintained individual water supply wells. During 1987, the homes north of the site along Rt. 44 were connected to an extension of the Bridgeport Municipal Water System (Gloucester County Health Department, personal communication). In the interim, between the late 1970s and the date of completion of the Bridgeport municipal water line, CLTL provided, upon request, bottled water from Pureland Water Company at no cost to some homes in the area.

- Approximately 20 homes are located within 2000 feet of the CLTL site boundary. Several of the homes are using groundwater from private wells for household uses. The most recent residential well sampling (March, 1989) detected TCE in excess of the Federal MCL in one private well. There is potential for current and future exposures to CLTL-related groundwater contaminants in the vicinity of the CLTL facility.

- A preliminary assessment of the health risks related to inhalation of fugitive dusts from the CLTL truck parking lot area is presented in Appendix D. Additional surface soil sampling is necessary prior to complete determination of the health risks related to contaminated soils at the CLTL site. These risk levels will be in addition to those determined for groundwater use at CLTL.

SECTION 1
INTRODUCTION

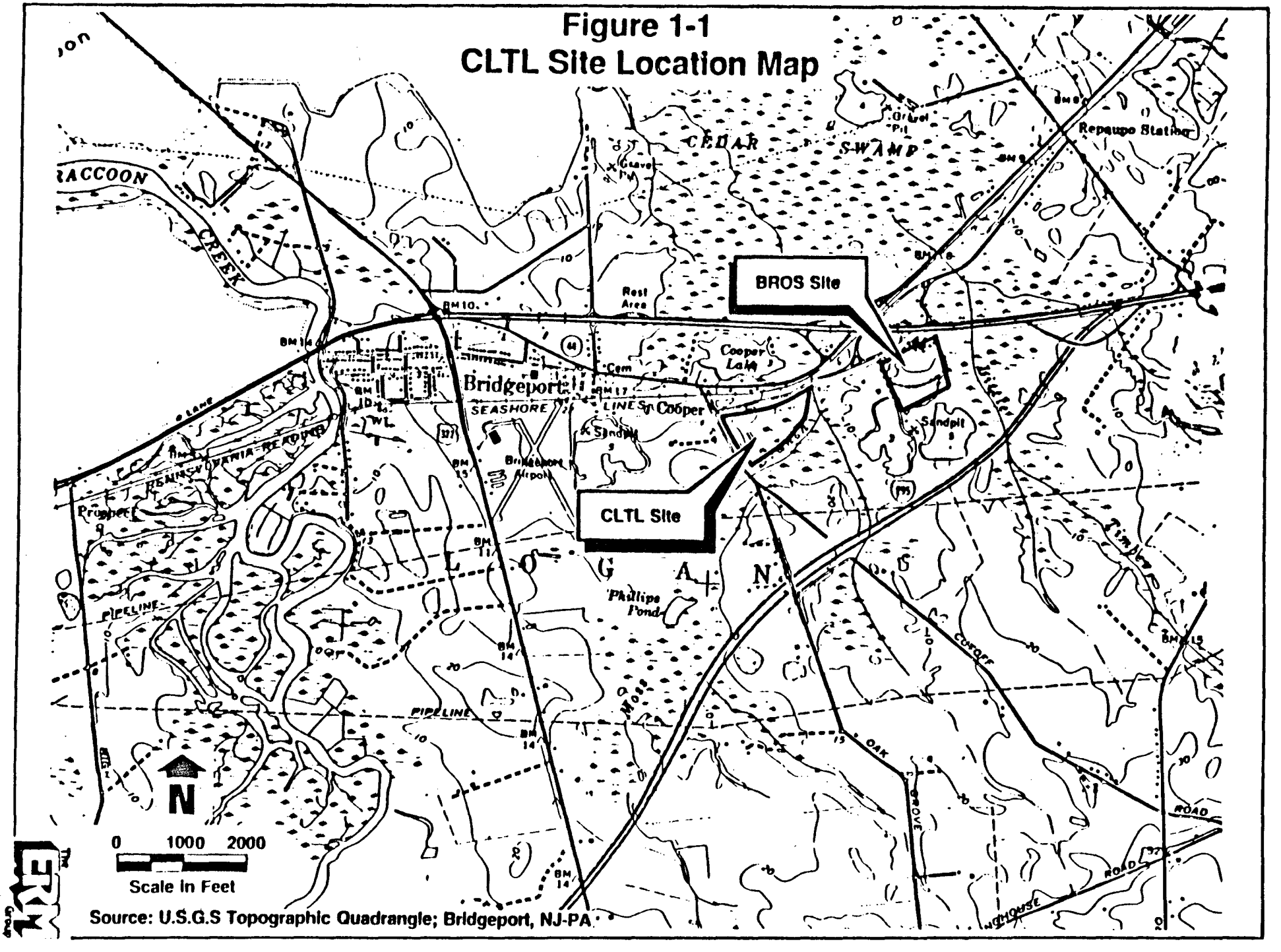
1.1 Objective of the Risk Assessment (RA)

This risk assessment (RA) has been prepared to evaluate the level of health risk at the Chemical Leaman Tank Lines, Inc. (CLTL) Bridgeport, New Jersey terminal due to site-related contaminants under conditions of a No-Action Alternative as described in the site Feasibility Study (FS) (EPA 1989). This RA considers the health risk from site-related potential carcinogens and noncarcinogens, and compares actual concentrations of contaminants with Applicable or Relevant and Appropriate Requirements (ARARs). Risks associated with potential contaminant exposure pathways at the CLTL site were examined. The risks evaluated for the No-Action Alternative will be used in the Feasibility Study (FS) in discussing the degree and type of remediation required at the site.

1.2 Site Description

Figure 1-1 shows the location of the CLTL Bridgeport terminal in Logan Township, Gloucester County, New Jersey. The CLTL terminal lies approximately two miles south of the Delaware River and one mile east of the nearest town, Bridgeport, New Jersey. The Pennsylvania Reading Seashore Lines Railroad borders the facility to the north and separates it from several private homes. Route 44 and Cedar Swamp Road parallel the railroad on its north and south sides, respectively. A reach of the Great Cedar Swamp and Moss Branch flank the terminal to the south and east, and Oak Grove Road runs along the western boundary of the terminal. Cooper Lake, a small, privately owned lake, lies just north of the CLTL terminal between Rt. 44 and Rt. 130. The Bridgeport Rental and Oil Service (BROS) property, a U.S. Environmental Protection Agency (EPA) Superfund site, is located approximately one-half mile east of the CLTL terminal.

Figure 1-1
CLTL Site Location Map



Source: U.S.G.S Topographic Quadrangle; Bridgeport, NJ-PA

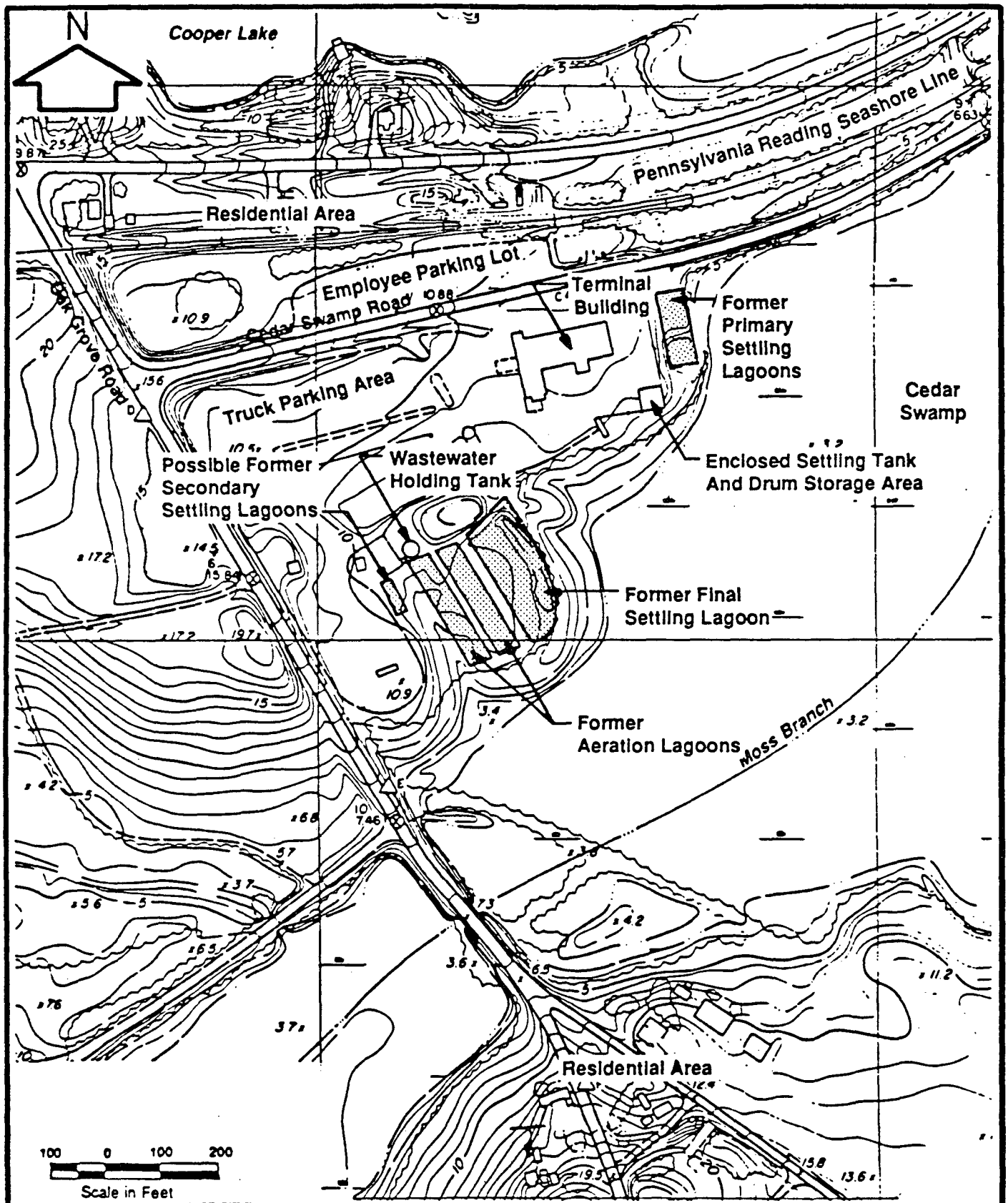
The CLTL site encompasses 31.4 acres including the CLTL terminal and the surrounding farmland and wetlands. The CLTL terminal occupies the 14.1-acre cleared area south and east of the intersection of Cedar Swamp Road and Oak Grove Road on which truck parking and cleaning activities occur. Figure 1-2 shows the various buildings, parking areas, cleaning facilities, and rinse water containment system of the CLTL terminal.

A chain-link fence lining Oak Grove and Cedar Swamp Roads adjacent to the facility restricts access to the CLTL terminal; Cedar Swamp limits access from south and east of the terminal. Employees of the CLTL terminal park their vehicles in the employee parking area, on the north side of Cedar Swamp Road, between the road and the railroad tracks.

A truck parking lot/driveway area covers approximately two-thirds of the CLTL terminal, between Oak Grove Road and Cedar Swamp Road. An on-site fuel station is located at the eastern edge of the truck parking lot/driveway area. The fuel station contains three diesel pumps and one unused gasoline pump. Beneath the fuel station lie three underground storage tanks filled with diesel fuel and one former gasoline storage tank, now filled with water.

The terminal building, containing administrative offices and the tractor service bays, lies near the center of the facility. A truck washing area is located on the eastern end of this building and houses two open and three covered cleaning bays.

The enclosed settling tank and drum storage area contains a 3,000-gallon, stainless steel settling tank and a sump pump located below grade. This building, which has a concrete floor, also houses drums containing residuals from trailers. The drums remain in the building until they can be disposed of off site. Clean empty drums are stored outside the building.



EPA
Environmental Protection Agency

CDM
Camp Dresser & McKee

Figure 1-2

Chemical Leaman Tank Lines Site Map

In the western portion of the CLTL terminal, a 50,000-gallon, concrete rinse water holding tank equipped with a mixing device is located next to a curbed and drained concrete rinse water loading pad. The containment area for the rinse water holding tank is a four-foot-deep, unlined, excavated area with raised earthern walls, located east of the tank. This unlined basin was not constructed under a New Jersey Department of Environmental Protection (NJDEP) permit and does not meet NJDEP requirements for a holding basin.

Currently, rinse water from the trailer cleaning operation runs into the rinse water drain system located beneath the cleaning bays. Once in the rinse water drain system, the water flows by gravity through an underground pipe to the settling tank in the enclosed settling tank and drum storage area. A sump pump then pumps the rinse water through an underground pipe to the rinse water holding tank. The distance between the enclosed settling tank and the rinse water holding tank is approximately 500 feet (Figure 1-2). Rinse water contained in the holding tank is loaded into empty tank trailers parked on the concrete pad, which in turn transport the rinse water to the E.I. DuPont Chambers Works facility in Deepwater, New Jersey, or the Chem Clear facility in Chester, Pennsylvania, for off-site treatment and disposal. Presently, CLTL transports approximately 15,000 gallons of rinse water per day for off-site treatment and disposal.

1.3 History of Site Operations

CLTL is a common carrier, transporting chemical commodities in bulk quantities, some of which are classified as hazardous. Table 1-1 lists some of the hazardous materials transported by CLTL. Records of all materials transported by CLTL throughout the existence of the Bridgeport facility no longer exist. The terminal has served, and continues to serve, a vast number of industrial clients, since beginning operations at the Bridgeport terminal in 1961. The

TABLE 1-1

LIST OF MATERIALS POSSIBLY TRANSPORTED BY CLTL

Allyl alcohol
2-sec-Butyl-4,6-dinitrophenol
p-Chloroaniline
Ethylenediamine
Acrylic acid
Aniline
Benzene
n-Butyl alcohol
Chlorobenzene
Chloroethene
Chloroform
Chloromethane
2-Chlorophenol
Cresote
Creosols
Cresylic acid
Cumene
Cyclohexane
Cyclohexanone
Di-n-butyl phthalate
1,2-Dichlorobenzene
1,1-Dichloroethene
Diethyl phthalate
Dimethylamine
Dimethylcarbamoyl chloride
1,1-Dimethyl hydrazine
Dimethyl phthalate
Tetrachloromethane
Toluenediamine
Toxaphene
1,1,2-Trichloroethane
Urethane
2,3-Dinitrophenol
2,4-Dinitrotoluene
Di-n-octyl phthalate
Dipropylamine
Ethyl acetate
Ethyl acrylate
Ethyl ether
Ethyl methacrylate
Formaldehyde
Formic acid
Furfural
Hydrazine
Isobutyl alcohol
Maleic anhydride
Maleic hydrazide
Methanol
Methyl ethyl ketone (MEK)
Methyl isobutyl ketone
Methyl methacrylate
Naphthalene
Nitrobenzene
Paraldehyde
Phenol
Phthalic anhydride
N-Propylamine
Pyridine
1,1,1,2-Tetrachloroethane
Toluene
Toluene diisocyanate
Tribromomethane
Trichloroethene
Xylene

facility operates 24 hours a day, Monday through Friday, with one shift on Saturday.

Rinse water is generated from the washing and rinsing of the tank trailers used to transport liquid and dry commodities. When tank trailers arrive at the CLTL terminal, CLTL personnel inspect the trailers for undelivered product remaining in the tanker. If more than three to five gallons remain in the trailer, CLTL attempts to redeliver the material to the customer; quantities less than three to five gallons are drained into appropriate 55-gallon drums, which are then stored in the enclosed settling tank and drum storage area. Next, the trailer interior is washed in a recirculatory system with a solution consisting of sodium hydroxide, sequestration agents, and defoaming agents. The tanker then is rinsed with water, and the rinse water is discharged to the rinse water containment system, as previously described.

Prior to August 1975, the rinse water containment system consisted of the following on-site facilities: three unlined, approximately 1,800-square-foot, 5-foot-deep primary settling lagoons in series; two unlined, approximately 8,100-square-foot, 5-foot-deep spray aeration lagoons in parallel; a smaller, unlined, approximately 1,100-square-foot lagoon of unknown depth; and an unlined, approximately 19,100-square-foot final settling lagoon, probably less than 5 feet deep. This system of lagoons was used between 1961 and 1975. The areal extent and locations of the former lagoons are based upon study of historical aerial photographs (Figure 1-2).

The rinse water from the cleaning operation was discharged into three primary settling lagoons. The supernatant from the settling lagoons then was pumped to the spray aeration lagoons. Overflow from the aeration lagoons was directed into the final settling lagoon. As the final step in the treatment process, rinse water was discharged into Cedar Swamp, via a T-pipe, probably located in

the northeast corner of the final settling lagoon.

In 1977, the settling lagoons east of the wash area were drained. Sludge which had accumulated in the bottom of the primary settling lagoons was partially vacuumed (over one foot of sludge remained in some areas) prior to backfilling with brickbat, sand, and concrete transported to the site from Philadelphia.

Also in 1977, after aerating and evaporating all possible liquid, openings were cut into the dikes of the aeration lagoons, allowing some runoff of stored liquids into the swamp; the rest of the liquid contents was pumped into a tanker truck and transported to a landfill. The lagoons then were backfilled with perimeter diking materials and construction debris.

In the summer of 1982, CLTL excavated the sludge and contaminated soil in the area of the former settling lagoons and the settling tank. Excavation proceeded until such time as the soil was virtually free of dark discoloration (as documented in the 1 October 1982 and 12 November 1982 correspondence between Environmental Resources Management, Inc. and NJDEP). Soil was excavated to an approximate depth of 12 feet using a backhoe. No soil samples were taken from the bottom of the excavated area. The excavated soil was placed on an adjacent concrete pad. After allowing the contaminated soil to dewater on the concrete pad, Browning-Ferris Industries, Inc. (BFI) transported approximately 145 truckloads of the soil to BFI's disposal facility in Baltimore, Maryland. The excavated area, which corresponds to the approximate areal extent of the former lagoons as shown on Figure 1-2, was backfilled with sand and gravel from the nearby Bridgeport Materials, Inc., sand and gravel company.

In July 1982, CLTL raised the walls of the settling tank and repaired the sump beneath the tank, as a leak had developed near the top of the sump, causing occasional discharges of rinse water

to the soil around the sump. In addition, CLTL installed a concrete pad around the tank and sump and enclosed the tank and sump in a building.

The entire operation from the initial lagoon enclosure in 1977 through the construction around the settling tank and sump was conducted under the continuous observation of CLTL personnel and with the knowledge and approval of NJDEP.

After backfilling the former primary settling lagoons with clean sand and gravel, CLTL excavated a shallow lagoon above the former primary settling lagoons. Between 1982 and 1985, CLTL unsuccessfully negotiated with NJDEP for a permit to operate this shallow lagoon as an air stripping pond. The pond above the former primary settling lagoons remains at the surface today, although it is very shallow (less than 2 feet) and largely obscured from view by dense vegetation.

EPA discovered two leaks in the concrete rinse water holding tank during a site visit in the spring of 1988. NJDEP ordered CLTL to temporarily shut down the holding tank and repair the leaks. CLTL coated the entire inside of the tank with 4 inches of gunite during the spring and summer of 1988.

1.4 Site Physical and Environmental Setting

1.4.1 Land Use

Logan Township encompasses approximately 15,360 acres in northwest Gloucester County, New Jersey. The township lies entirely within the Delaware River basin (Hochreiter and Kozinski, 1985) and consists of low, stream-dissected hills separated by broad swamps. Elevation in Logan Township ranges from just below sea level to approximately 60 feet above sea level (USGS, Bridgeport, NJ-PA Quadrangle).

Non-developed lands, including marshes, vegetated areas, and woodlands, cover slightly more than half, or roughly 8,000 acres, of Logan Township (NJDEP, 1982). Cedar Swamp, part of which flanks the CLTL site, has been designated by the Delaware Valley Regional Planning Commission as a unique environmental area. The "Tri-County 208 Waste Management Plan" recommends that the Great Cedar Swamp receive maximum protection against future development (NUS, 1985).

An additional 5,200 acres of Logan Township are covered by mostly privately owned farms which cultivate vegetable crops and fruit orchards (NJDEP, 1982). Two plots of farmland lie to the west of Oak Grove Road, adjacent to the CLTL Bridgeport Terminal. This land belongs to Chemical Leaman; however, it has not been planted in recent years. Several working farms border Cedar Swamp to the south of the site, and the Gaventa family maintains a peach orchard east of the site beyond Cedar Swamp.

Land devoted to residential use in Logan Township totals approximately 500 acres (NJDEP, 1982). The 1980 census lists the population of Logan Township at 3,078. While much of Logan Township is sparsely populated, its primary population centers include the town of Bridgeport and two newer developments, the Pureland and Beckett residential areas, to the south.

Until 1987, most of the residents in the vicinity of the site maintained individual water supply wells. Several of these wells have not been used for drinking water since levels of solvents and other chemicals above drinking water standards were detected in the ground water in the late 1970s. However, some of these homes continue to use ground water for showering, washing and irrigation. During 1987, the homes north of the site along Rt. 44 were connected to an extension of the Bridgeport Municipal Water System (Gloucester County Health Department, personal communication).

During the interim, between the late 1970s and the date of completion of the Bridgeport municipal water line, CLTL provided potable water from Pureland Water Company at no cost to those homes in the area requesting it.

Light industry accounts for the remainder of the land use in Logan Township. In addition to Chemical Leaman Tank Lines, Inc., three other industries represent the bulk of the light industry in Logan Township. These include Monsanto Chemical Company, in the western section of the township; Rollins Environmental Services, west of Route 322; and Bridgeport Rental and Oil Services, approximately one-half mile east of the CLTL Bridgeport Terminal.

The BROS property, an NPL-listed Superfund site, is a former oil processing and reclamation facility. The site measures roughly 30 acres and consists of 88 storage tanks and tank trucks and an unlined, 2.7-acre lagoon filled with a thick layer of waste oil and waste water, partially submerged construction debris, drums, garbage, and several large tanker trucks (Goltz et al., 1983; NUS, 1984). The site is under EPA-supervised remediation at the present time.

1.4.2 Climate and Meteorology

The climate in Gloucester County is humid and temperate (USDA, 1962). Most weather systems are driven to the area by prevailing westerly winds; however, during the summer months, southerly winds predominate.

Average rainfall is distributed evenly throughout most of the year. During the summer months, most precipitation falls during short, intense thunderstorms (USDA, 1962). Heavy snowfall infrequently blankets the area during the cold winter months. However, snow remains on the ground for only short periods and provides little protection against freezing (USDA, 1962).

TABLE 1-2

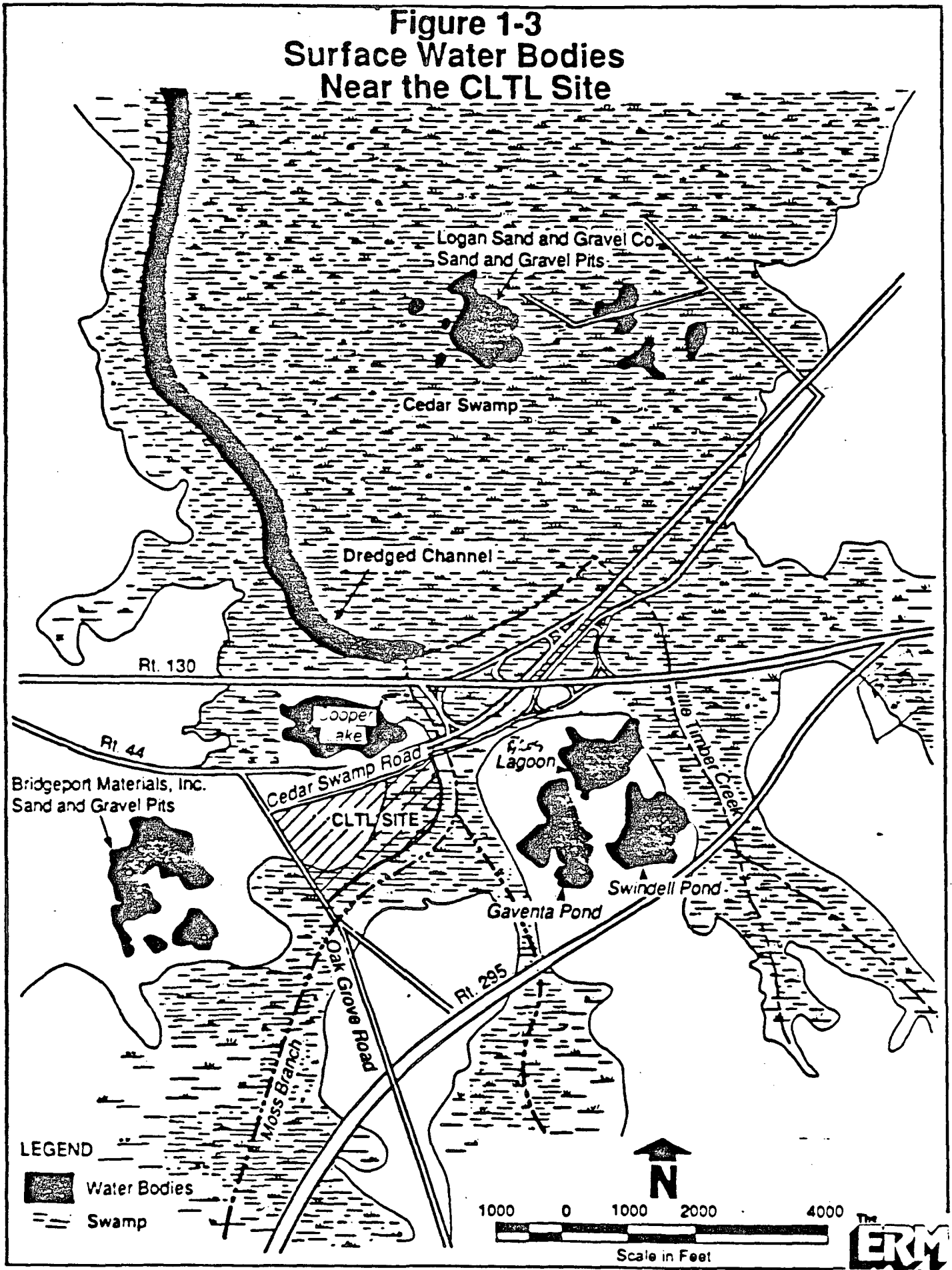
MONTHLY AVERAGE TEMPERATURE AND PRECIPITATION
AT THE PHILADELPHIA INTERNATIONAL AIRPORT
WEATHER STATION,
PHILADELPHIA, PENNSYLVANIA

MONTH	AVERAGE TEMPERATURE (°F)	AVERAGE PRECIPITATION (IN.)
January	31.1	2.34
February	32.3	2.93
March	41.3	3.28
April	52.0	3.36
May	61.7	3.43
June	71.8	4.43
July	76.7	3.77
August	76.0	3.99
September	69.0	3.53
October	56.7	2.88
November	45.8	3.21
December	37.2	4.19
Annual	54.3	41.3

Period of Record: 1965-1974

Source: Climatography of the United States No. 90;
Airport Climatological Summary; Philadelphia International Airport

Figure 1-3
Surface Water Bodies
Near the CLTL Site



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Average temperatures hover near freezing during winter months. Hot, humid air masses reach the area during the summer months, causing temperatures to rise above 90°F (NUS, 1985). Table 1-2 lists the monthly average temperature and precipitation for the Philadelphia International Airport, approximately 8 miles northeast of the CLTL site.

1.4.3 Surface Water

Several water bodies are located within one-half mile of the CLTL site. These include Cedar Swamp, bordering the site to the south and east; Cooper lake, several hundred feet north of the site; Bridgeport Materials, Inc., water-filled sand and gravel pits, roughly one-half mile west of the site; and the three man-made ponds one-half mile east of the site. Figure 1-3 shows the water bodies in the vicinity of the CLTL site.

A reach of the Great Cedar Swamp flanks the site along its south and east margin. Moss Branch flows north through the swamp and eventually drains into a man-made channel in the Great Cedar Swamp, north of Route 130. This man-made channel also drains the Little Timber Creek, which flows adjacent to the BROS site. The width of Moss Branch ranges from as much as 800 feet adjacent to the site to less than 10 feet where the branch flows through narrow culverts beneath Oak Grove Road, Cedar Swamp Road, Route 44, and Route 130. Generally, the water depth in Moss Branch is less than two feet. Water levels in Moss Branch north of Cedar Swamp Road change briefly with the tidal cycle. During high tide, Moss Branch reverses direction and flows south for a short period in the culvert beneath Route 130, Route 44, and Cedar Swamp Road. This effect diminishes with distance from Route 130, and does not alter the overall direction of flow in Moss Branch south of Cedar Swamp Road.

A second, unnamed tributary discharges into Moss Branch near the southeastern margin of Cedar Swamp, adjacent to the CLTL site. Upstream, generally south of the confluence of these two tributaries, Moss Branch drains the reach of Cedar Swamp that extends southwest of the site adjacent to Oak Grove Road, while the unnamed tributary drains the much smaller reach of Cedar Swamp that extends to the south-southeast of the site. Much of the swamp outside these two loosely defined tributaries remains inundated with less than two feet of water throughout the year.

Cooper Lake, directly north of the site across Route 44, is a small (20 acres), privately owned body of water. Originally a sand and gravel pit during the construction of U.S. 130, the lake, which is tidally influenced, is now stocked with fish. At the eastern edge of the lake, a narrow channel connects Cooper Lake to Moss Branch and the Great Cedar Swamp. The width of the channel is approximately eight feet, and water depth within the channel and the adjacent submerged area in Cedar Swamp is generally less than one foot.

Bridgeport Materials, Inc., operates a sand and gravel surface mining operation just west of the CLTL property. The excavated sand and gravel pit, mostly filled with water, measures approximately 40 acres in areal extent and up to 50 feet deep in places. The facility pumps approximately 30,000 gallons of water per day from the pits to wash the sand and gravel. After use, the water is returned directly to the pits.

Three man-made ponds, approximately 12 acres each, lie approximately one-half mile east of the CLTL site, on the opposite side of Cedar Swamp and the Gaventa peach orchard. The ponds are referred to as the BROS Lagoon, Gaventa Pond, and Swindell Pond (Figure 1-3). The ponds are abandoned sand and gravel mining pits, excavated between 1940 and the late 1970s (NUS, 1984).

The northernmost pond, the BROS Lagoon, was a waste lagoon used to dispose of wastes beginning in the early 1940s (NUS, 1984). The depth of the BROS Lagoon averages 10 to 15 feet but reaches 60 feet in some places (Goltz et al., 1983). Thus, a significant portion of the lagoon remains in contact with the ground water beneath the site which subsequently contains levels of organic and inorganic chemicals above drinking water standards (NUS, 1984). In addition, lagoon overflows and dike breaches of the BROS Lagoon in the past have led to the contamination of local surface water bodies, including portions of the Little Timber Creek and the Great Cedar Swamp (NUS, 1984).

1.4.4 Site Soil Types and Drainage

Two general areas of associated soil types characterize the soil within roughly one mile of the CLTL site. These are the Downer-Woodstown-Sassafras-Kleg (DWSK) Association and the Muck-Alluvial Land-Falsington Pocomoke (MAFP) Association (USDA, 1962).

Soil of the DWSK Association occupies higher elevations in the vicinity of the CLTL site. The dominant soil of the DWSK consists of thick, well drained, sandy soil which overlies a clayey subsoil and sandy substratum. Regionally, the sandy soil of the DWSK Association occurs in a bank of sandy flats, up to four miles wide, which parallels the Delaware River, but generally is separated from the river by tidal marsh and Made Land (USDA, 1962).

Soil at the MAFP Association consists of inland wet soil which underlies tidal streams and drainage outlets. This soil consists of wet, poorly drained sandy and clayey loam to fully saturated, organic rich peat. In northern Gloucester County, soil of the MAFP occurs in the narrow wet areas that drain northward to the Delaware River.

In the vicinity of the CLTL terminal, the DWSK and MAFP Associations are further divided into specific soil types. The DWSK Association is divided into Sassafras loamy sand, 0 to 5 percent slopes (SfB); Sassafras sandy loam, 2 to 5 percent slopes (SrB); Sassafras sandy loam, 5 to 10 percent slopes (SrC); and Pits (Pg). The MAFP Association is divided into Falsington sandy loam (Fd) and Muck (Mu). Figure 1-4 shows the distribution of these soil types at the CLTL site.

Soils of the SfB, SrB, and SrC are grouped in the Sassafras Series, which consists of well-drained, coarse loamy sand to sandy loam which overlies a loose sandy substratum with well-drained gravel (USDA, 1962). These soil types occur along the higher elevations at the CLTL site.

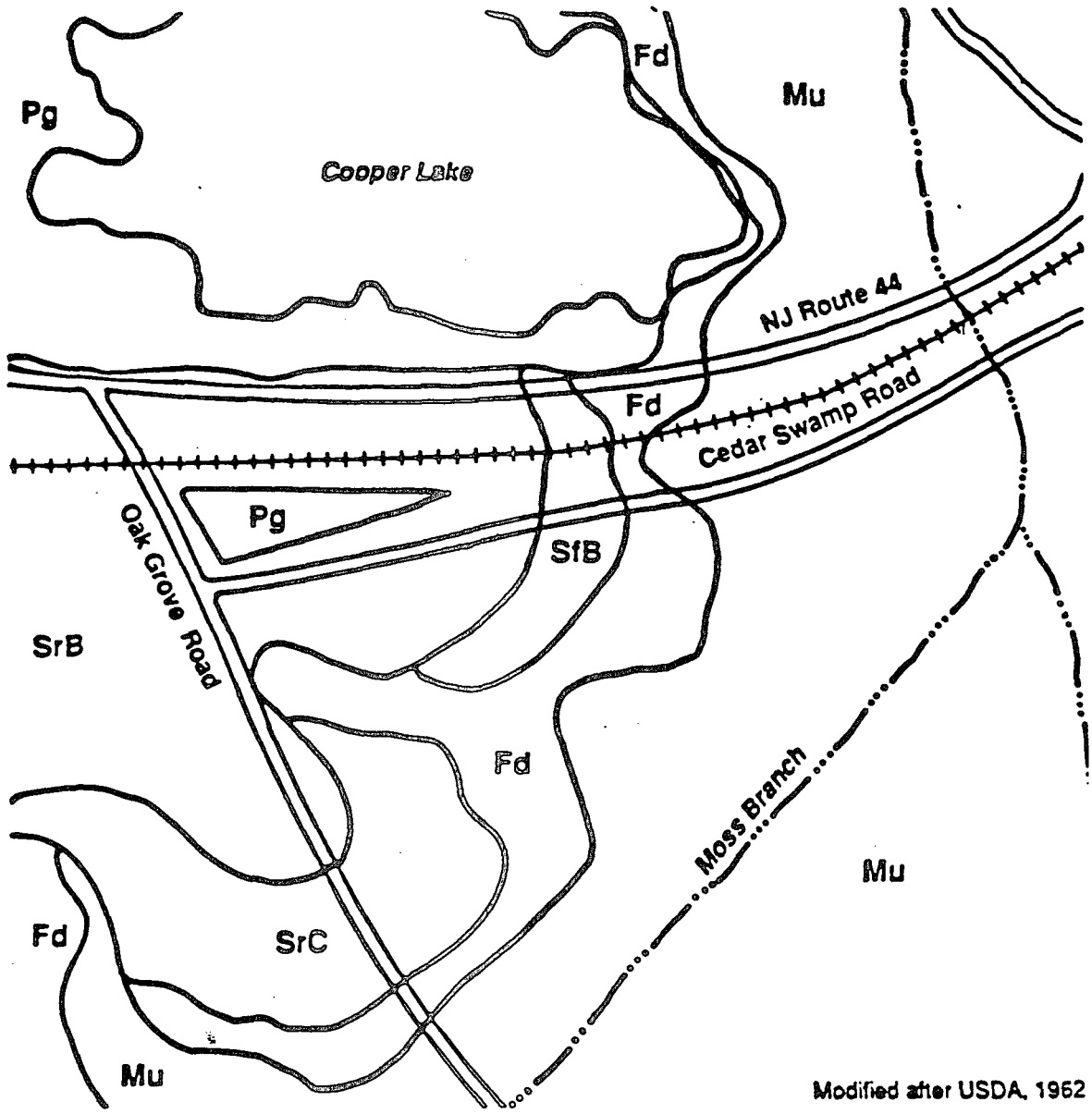
Pits (Pg) is a mappable unit representing pits greater than two feet deep excavated in the surface mining of sand and gravel beds (USDA, 1962). In the area surrounding the CLTL site, Pg occurs in areas mined for sand and gravel beds of the Sassafras and Downer series.

Soil of the Falsington sandy loam (Fd) consists of sandy clayey loam to loamy sand overlying sandy loam in the subsoil and substratum (USDA, 1962). This wet, poorly drained soil type occurs adjacent to the site along the gently sloping flats which border Cedar Swamp.

Muck (Mu) consists of fully saturated, dark brown to black, partially decomposed peat (USDA, 1962). Muck underlies much of the lower elevations adjacent to the CLTL site, including the area occupied by Cedar Swamp.

Surface water draining the CLTL site flows generally east to southeast into Cedar Swamp and eventually to Moss Branch. The highly permeable, commonly gravelly soil of the Sassafras Series,

Figure 1-4
Distribution of Soil Types in the Vicinity of the CLTL-Bridgeport Site



Modified after USDA, 1962

General Soil Association	Map Symbol	Name
Downer-Woodstown-Sassafras-Kleg (DWSK) Association	SfB	Sassafras loamy sand, 0-5 % slopes
	SrB	Sassafras sandy loam, 2-5 % slopes
	SrC	Sassafras sandy loam, 5-10 % slopes
	Pg	Pits
Muck-Alluvial land-Falsington-Pocomoc (MAFP) Association	Fd	Falsington sandy loam
	Mu	Muck

N

100 0 100 200 400

Approximate Scale in Feet

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TABLE 1-3

BIRDS KNOWN TO INHABIT THE DISTURBED UPLAND AREA
OF THE CLTL TERMINAL

Starling

Red Winged Blackbird

Song Sparrow

Robin

Purple Finch

Black and White Warbler

Yellow Rumped Warbler

Blue Jay

Dove

Mocking Bird

Goldfinch

Grackle

Brown Thrasher

TABLE 1-4

BIRDS KNOWN TO INHABIT THE PALUSTRINE FORESTED WETLAND AND THE PALUSTRINE OPEN WATER HABITAT IN THE VICINITY OF THE CLTL SITE

White Throated Sparrow

Red Winged Blackbird

Carolina Wren

House Wren

Tree Swallow

Common Yellowthroat

Rusty Blackbird

Wood Duck

Veery

Grackle

Starling

Flicker

Cardinal

Downy Woodpecker

Black Duck

Canada Goose

Woodcock*

* Sighted by EPA Oversight Contractor (CDM)

especially prevalent in the northern and western portions of the site, allows a considerable amount of surface water to infiltrate into the subsurface. The areas formerly occupied by the aeration and settling lagoons are located within the highly permeable, soil of the Sassafras series and moderately permeable soil of the Falsington series.

1.4.5 Regional Ecology

The United States Fish and Wildlife Service (USFWS) characterizes the CLTL site and surrounding area in the following manner: a Disturbed Upland Area, corresponding roughly to the CLTL terminal; Palustrine Forested Wetland, corresponding to the reach of the Great Cedar Swamp southeast of the CLTL terminal; and Palustrine Open Water Habitat, corresponding to Cooper Lake and its surrounding shoreline (USFWS National Wetlands Inventory Map).

Vegetation in the Disturbed Upland Area of the CLTL terminal is restricted to three areas. These include the area just west of the employee parking area, between Cedar Swamp Road and the railroad tracks; the area corresponding to the former aeration lagoons; and the area bordering the former aeration lagoons and Cedar Swamp. Vegetation adjacent to the employee parking area is dominated by rose bushes, crab apple, and cherry trees, with broom sedge, goldenrod, and various grasses. The area corresponding to the former aeration and final settling lagoons is sparsely vegetated with goldenrod, broom sedge, dogbane, phragmites, cattail, blue vervain, and unidentified grasses. The area bordering the former aeration and final settling lagoons in Cedar Swamp is covered with a variety of trees including black cherry, red maple, white oak, red oak, pin oak, honey locust, and black oak. The understory of shrubs and herbaceous plants includes phragmites, poison ivy, green brier, arrowwood viburnum, and jewelweed.

Wildlife in the Disturbed Upland Area of the CLTL terminal inhabit

the vegetated areas described above. Birds which are known to inhabit the area are listed in Table 1-3. Mammals include squirrels, rabbits, groundhogs, and an occasional raccoon.

The Palustrine Forested Wetland corresponding to the reach of Cedar Swamp flanking the CLTL terminal to the south and east is a tidal freshwater wetland. The vegetation in the low lying area of Cedar Swamp adjacent to the CLTL terminal is dominated by water hemp. Other vegetation within the low lying area includes poison ivy (shrub), pin oak, black willow, and several dead southern white cedar. The area covered by water hemp extends to the south and the east approximately 200 to 300 feet where the forested wetland begins. Ponded water, averaging 0.5 to 2.0 feet deep, is present throughout the forested wetland area. Vegetation in the forested wetland area is dominated by red maple with abundant poison ivy (shrub), skunk cabbage, sensitive fern, rose, green brier, arrowwood viburnum, jewelweed, water hemp, elderberry, water lily, and arrow-arum.

Wildlife observed in the non-forested and forested wetland area of Cedar Swamp adjacent to the CLTL terminal includes the birds listed in Table 1-4, whitetail deer, black snakes, and unidentified fish in Moss Branch. Other wildlife known to inhabit this area include amphibian and reptile species such as the green frog, tree frog, northern spring peeper, bull frog, box turtle, painted turtle, and snapping turtle. Mammals include whitetail deer, raccoon, muskrat, squirrel, rabbit, skunk, and red fox. Fresh water fish include bluegills, pumpkinseed, suckers, brown bullhead, and black and white crappies.

Cedar Swamp, which lies generally northeast of the CLTL site between Cedar Swamp Road and Route 130 and north of Route 130, is also a Palustrine Forested Wetland. The vegetation and wildlife in this area of Cedar Swamp are similar to the vegetation and wildlife noted in the forested wetland area south and east of the

CLTL terminal.

The Palustrine Open Water habitat adjacent to the CLTL site includes Cooper Lake and its surrounding shoreline, located between Routes 44 and 130. Vegetation surrounding Cooper Lake includes smooth alder, Japanese honeysuckle, green brier, red maple, arrowwood viburnum, dogbane, sensitive fern, and poison ivy (shrub). A variety of fresh water fish inhabit Cooper Lake, including minnows, carp, crappies, sunfish, catfish, and bass. Other wildlife known to inhabit the shoreline of the lake include snakes, salamanders, frogs, deer, raccoons, skunks, rabbits, foxes, and turtles.

Cedar Swamp and Cooper Lake provide a significant shelter for migratory bird species such as Canada goose, wood duck, mallard, black duck, coot, lesser scaup, and other waterfowl species.

EPA has been informed by the U.S. Department of the Interior's Fish and Wildlife Service that except for occasional transient species, no federally listed or proposed threatened or endangered flora or fauna are known to exist within the CLTL Superfund site.

1.4.6 Regional Geology

The CLTL site lies in the Atlantic Coastal Plain physiographic province. The Atlantic Coastal Plain in New Jersey forms a wedge-shaped body of unconsolidated sediment that thickens from a feather edge at the Fall Line, separating the crystalline Piedmont from the Coastal Plain, to greater than 6,000 feet along the Atlantic Coast near Cape May, New Jersey (Gill and Farlekas, 1976). The Coastal Plain rests unconformably upon crystalline basement rocks of the Wissahickon Formation.

The CLTL site falls within the outcrop belt of the undifferentiated Potomac Group-Raritan Formation, just northwest of the contact

between the Potomac Group-Raritan Formation and the slightly younger Magothy Formation (Eckel and Walker, 1986). Figure 1-5 shows the location of the CLTL site in relation to this geologic contact. The Potomac Group and the Raritan and Magothy Formations range in age from early to late Cretaceous and are the basal units of the Coastal Plain in southern New Jersey (Gill and Farlekas, 1976). These units crop out in a northeast trending band that parallels the Delaware River in southern New Jersey. The strata dip to the southeast from 10 to 60 feet/mile (Zapecza, 1984). At higher elevations in the vicinity of the CLTL site, nearly flat-lying Quaternary age deposits of the Cape May Formation disconformably overlie the Potomac Group and the Raritan and Magothy Formations (Andres, 1984).

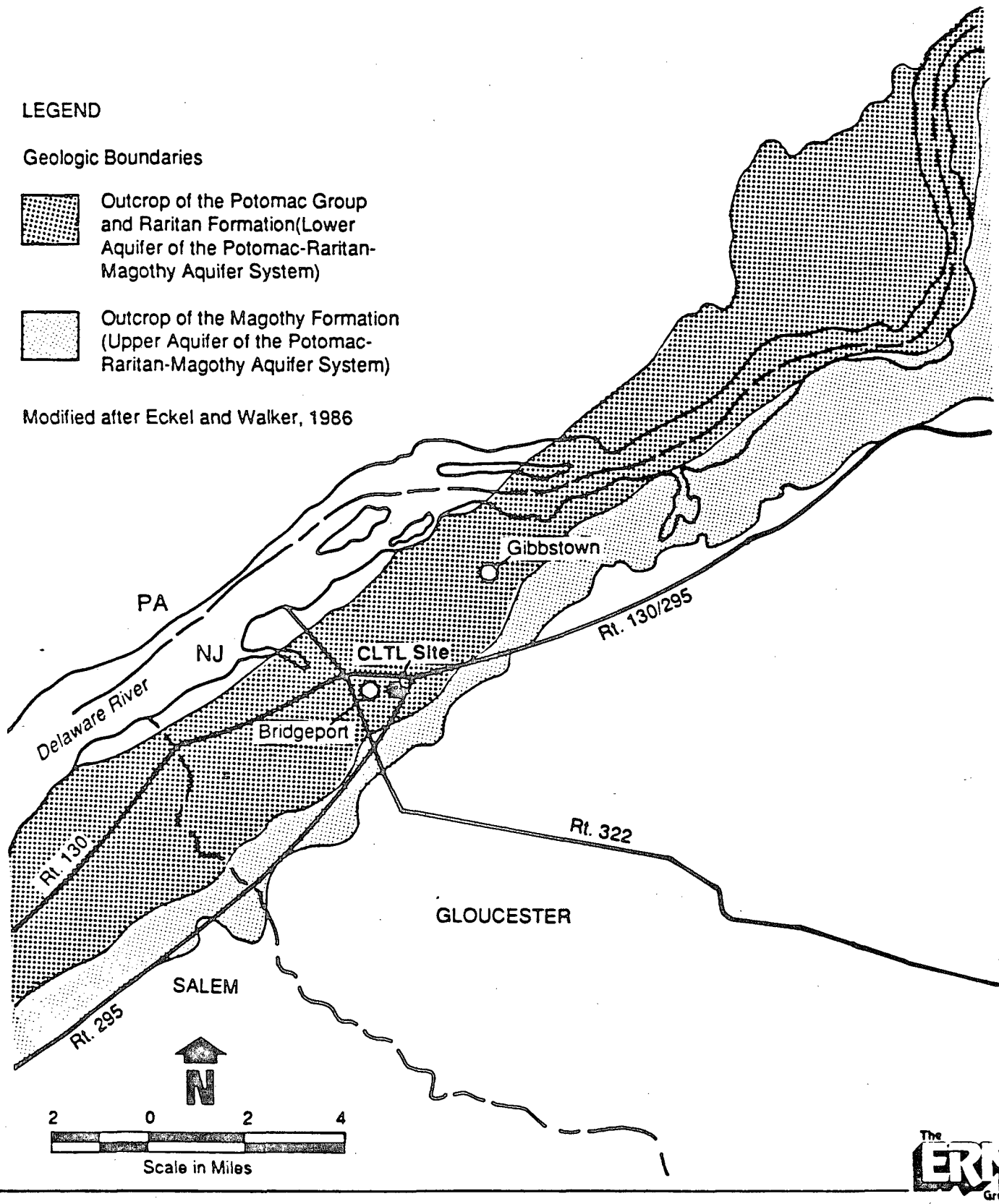
The Potomac Group consists of alternating variegated clay, silt, sand, and gravel. The overlying Raritan Formation is characterized by alternating light gray, reddish-white, and variegated clay and fine to coarse grained sand and silt. Interbedded light to dark gray clay and quartz sand characterize the Magothy Formation. The Cape May Formation consists of thick quartz sand and light colored clay (Walker, 1983).

Because of the lithologic similarity of these units and the laterally discontinuous nature of the beds, no attempt is made to differentiate between the Potomac Group and the Raritan Formation and, if present, the younger Magothy and Cape May Formations in the vicinity of the CLTL site. Deep boreholes installed by the USGS indicate the thickness of the Cretaceous and Quaternary strata beneath the site approaches 260 feet (USGS, in preparation).

1.4.7 Regional Hydrogeology

The interbedded clay, silt, sand, and gravel of the Potomac Group and the Raritan and Magothy Formations compose the Potomac-Raritan-Magothy aquifer system. In the outcrop area, the

Figure 1-5
Regional Geologic Setting of the CLTL Site



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The ERM Group

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Potomac-Raritan-Magothy aquifer system also includes the disconformable Quaternary deposits of the Cape May Formation, commonly present at the surface. The Potomac-Raritan-Magothy aquifer system is the primary water source for southern and central New Jersey (Luzier, 1980).

Published reports have veriously interpreted two, three, or four aquifers within the Potomac-Raritan-Magothy aquifer system. In part, the lateral heterogeneity of the sand, silt, and clay units within these strata is to blame for these various interpretations. This report will follow the interpretation given by Walker (1983), which identifies a lower and upper aquifer in the Potomac-Raritan-Magothy aquifer system.

In southern New Jersey, the lower aquifer of the Potomac-Raritan-Magothy aquifer system includes the interbedded gravel, sand, silt, and clay of the Potomac Group and the Raritan Formation and the disconformable Cape May Formation, which commonly caps the sequence in the outcrop area (Walker, 1983). According to published geologic maps, the CLTL site falls within the outcrop area of the lower aquifer of the Potomac-Raritan-Magothy aquifer system (Figure 1-5).

The upper aquifer of the Potomac-Raritan-Magothy aquifer system includes the sand, silt, and clay of the Magothy Formation and, in the outcrop area, younger surficial deposits of the Cape May Formation (Walker, 1983). The upper aquifer of the Potomac-Raritan-Magothy aquifer system crops out less than one mile southeast of the CLTL site (Figure 1-5).

Numerous studies have addressed the dramatic decline in water levels in the Potomac-Raritan-Magothy aquifer system over the last 30 years (Luzier, 1980; Vowinkel and Foster, 1981; Fusillo and Voronin, 1981: Walker, 1983; Eckel and Walker, 1986; and others). Each study recognizes large cones of depression centered in the

major industrial and population centers of the Camden and Middlesex-Monmouth County areas. These and other local significant withdrawals from the aquifer system have changed the flow direction of ground water within the system. Whereas the aquifer previously discharged into the Delaware River and streams dissecting the outcrop area, in many places, these water bodies now recharge the aquifer system (Fusillo and Voronin, 1981).

1.5 Conclusions of the Remedial Investigation Report

This section presents the conclusions of the Remedial Investigation for the active terminal area of the CLTL Bridgeport site.

1.5.1 Ground Water

- Three hydrogeologic subzones have been defined within the uppermost 150 feet of the undifferentiated Potomac-Group-Raritan Formation beneath the CLTL site: shallow subzone (land surface to approximately -20 feet MSL); intermediate subzone (approximately -20 to 100 feet MSL); and deep subzone (approximately -100 fet to -150 feet MSL).

- Discontinuous clay units separate the intermediate subzone into an upper and lower intermediate subzone beneath the central and eastern parts of the site.

- A general trend of decreasing head with depth indicates that there is a downward component of ground water flow within the area of investigation.

- Potentiometric surfaces in the various water-bearing subzones beneath the site show low horizontal gradients.

- Seasonal changes in areas of ground water discharge and recharge create seasonal variations in ground water flow patterns in the shallow subzone and possibly in the upper intermediate subzone at the site.

- Levels of Priority Pollutant inorganic and organic contaminants in excess of ARARs occur in ground water beneath the site.

- The highest concentrations of Priority Pollutant contaminants in ground water occur in shallow and

intermediate subzone wells in the vicinity of the former settling and aeration lagoons.

- Priority Pollutant volatile organic compounds and zinc are the contaminants of highest concentration in the shallow and intermediate subzone ground water.

- Low concentrations of Priority Pollutant contaminants occur in deep subzone ground water downgradient from the contaminant source areas.

- Additional deep subzone monitoring wells will be necessary to better define the nature and extent of deep subzone ground water contamination.

- The former settling lagoons and the former aeration lagoons are the primary sources of Priority Pollutant contaminants occurring in ground water beneath the CLTL site.

- The concentrations of Priority Pollutant contaminants beneath the former settling lagoons increases with the depth in the shallow and intermediate subzones.

- The extent of the contaminant plumes in the shallow and intermediate subzones is adequately defined to begin with remedial action. The areal limit of contamination in the area generally south of the former aeration lagoons and in the area generally north and east of the former primary settling lagoons has not been determined.

- The Remedial Design phase of the investigation will include tasks to further delineate the extent of the contaminants beneath the site.

1.5.2 Soil

- The primary areas with soil contamination in the active terminal area of the CLTL site include the former settling lagoons, the former aeration lagoons, the former overflow area, and the truck parking lot/driveway area. Additional sampling is necessary to fully characterize the extent of contamination in the surface soils of the CLTL truck parking lot/driveway area.

- Levels of Priority Pollutant organic compounds and metals in soil samples exceed the NJDEP soil cleanup objectives at several locations.

- Priority Pollutant semivolatile organic compounds represent the majority of the contaminants present in soil in the active terminal area of the CLTL site.

- Soil contamination in the vicinity of the former primary

settling lagoons occurs in localized areas at the margins of the excavated former settling lagoons.

- Soil contamination in the vicinity of the former aeration lagoons occurs as deep as 12 feet below the ground surface.

- Localized contamination of shallow soil beneath the truck parking lot/driveway area may be attributed to poor housekeeping practices in this area.

- The routine discharge of wastewater from the final settling lagoons to the wetlands resulted in the contamination of soil east of the final settling lagoon with Priority Pollutant inorganic and organic contaminants.

- The former settling lagoons and the former aeration lagoons are the source areas of Priority Pollutant inorganic and organic contaminants in deeper soil at the site.

These conclusions form the basis for the Risk Assessment. This report will evaluate the potential hazard associated with exposures to contaminants at the CLTL site.

SECTION 2
METHODOLOGY

2.1 EPA's Risk Assessment Process for CERCLA Sites

This section provides a broad overview of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) risk assessment (RA) process. For a more detailed discussion of the CERCLA risk assessment process, please refer to the Superfund Public Health Evaluation Manual (US EPA, 1986a) and the Superfund Exposure Assessment Manual (USEPA, 1988), the Endangerment Assessment Handbook (US EPA, 1985a), and Toxicology Handbook (US EPA, 1986b).

There are four evaluations which must be completed in a CERCLA RA:

1. Identification of indicator contaminants which are representative of the carcinogenic risk and noncarcinogenic hazard at the site;

2. Exposure evaluation, which includes the estimation of chemical intakes to potentially exposed populations;

3. Toxicity evaluation of the potential carcinogenicity and noncarcinogenic potency and effects of site indicators; and

4. Characterization of the risks and hazards (under No-Action-Alternative conditions) caused by exposure to the indicator chemicals.

2.2 Indicators

Indicator chemicals are selected on a site-specific basis. These are the compounds that provide a representative analysis of risk

for the site.

The selection and ranking of indicators follows the procedure detailed in the Superfund Public Health Evaluation Manual (SPHEM) (US EPA, 1986a). As part of the indicator selection process, toxicological information about each compound was compiled using Appendix A of the SPHEM. This information includes the following:

1. Toxicologic class: Potential carcinogens (PC) or noncarcinogens (NC) (Exhibits A-3 and A-5, respectively);

2. Severity-of-effect ratings value (i.e., RVe) for noncarcinogens (Exhibit A-5);

3. Weight-of-evidence classification for carcinogens (Exhibit A-4); and

4. Toxicity constants for the various environmental media (Exhibits A-3 and A-5).

Also, as part of the indicator selection process, a range and representative concentration for each compound/constituent was calculated for each appropriate medium. The representative concentration of a compound per medium is the arithmetic mean. For determination of the arithmetic mean, concentrations of samples at the non-detect level were assumed to be one-half of the detection limit.

All data used in the selection of indicators were subjected to a comprehensive quality assurance and quality control (QA/QC) review. Samples from the CLTL Bridgeport active terminal area were analyzed by Lancaster Laboratories, Inc., and were in accordance with Environmental Resources Management, Inc.'s (ERM) normal QA/QC requirements, including:

- Chain-of-custody documentation;
- Use of split samples;
- Replication of analyses;
- Spiking of some samples with internal standards;
- Routine instrument calibration;
- Use of methodology (extraction) blanks; and
- Adherence to mandated sample holding times and storage temperatures.

For indicators selection, the CLTL site-related contaminants were first separated into two broad classes: potential carcinogens (PC) and noncarcinogens (NC). Each representative compound was assigned an indicator score (IS), the product of its concentration at the site and a medium-specific toxicity constant. The final IS for each potential indicator was the sum of individual ISs in each medium of concern. The final selection of indicators was based on the IS and physical parameters that are important in fate and transport, such as water solubility and vapor pressure.

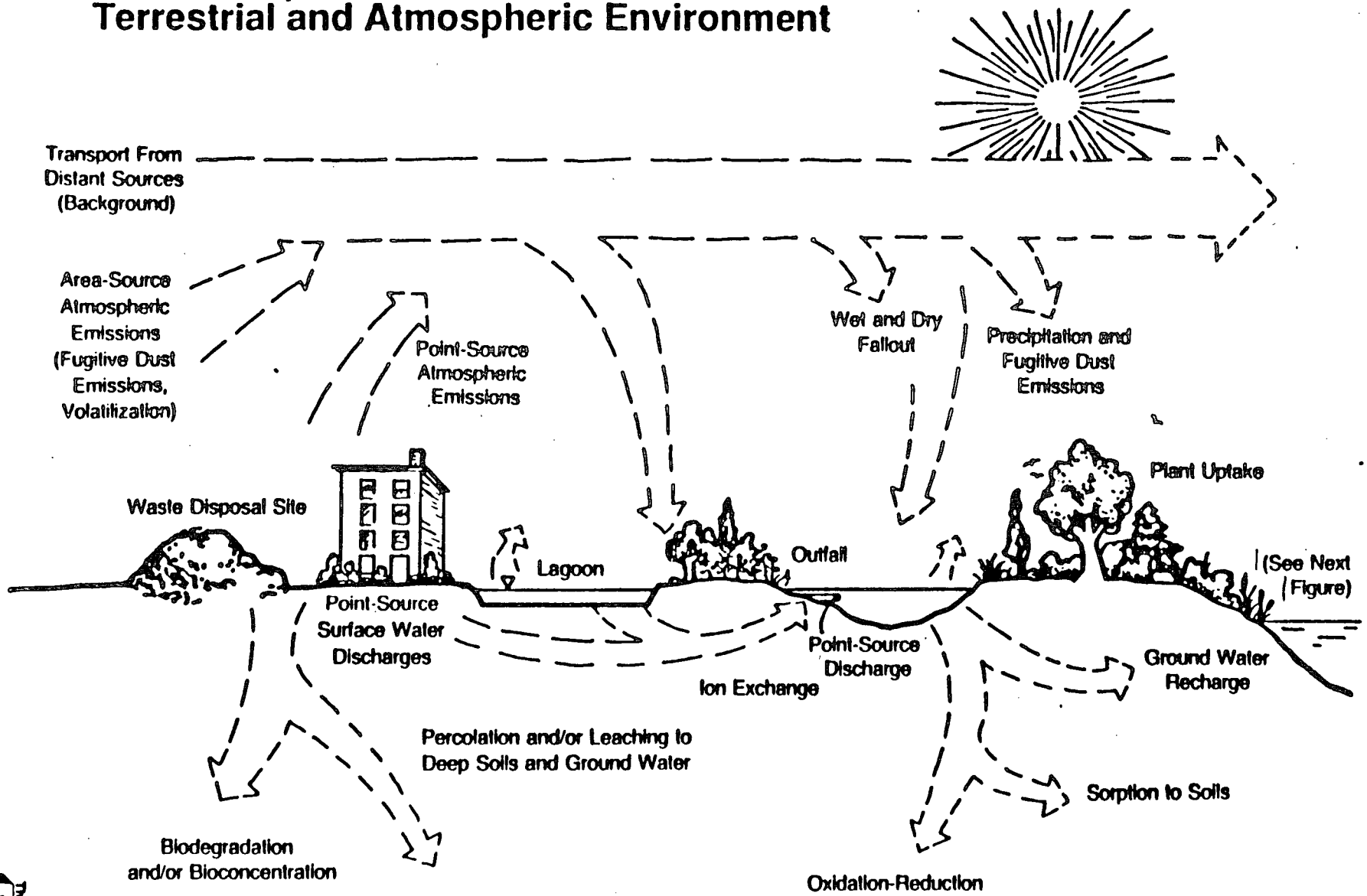
2.3 Exposure Evaluation

The purpose of an exposure evaluation is to estimate the potential intake of each indicator compound by an exposed or potentially exposed population.

Exposure evaluation involves the following tasks:

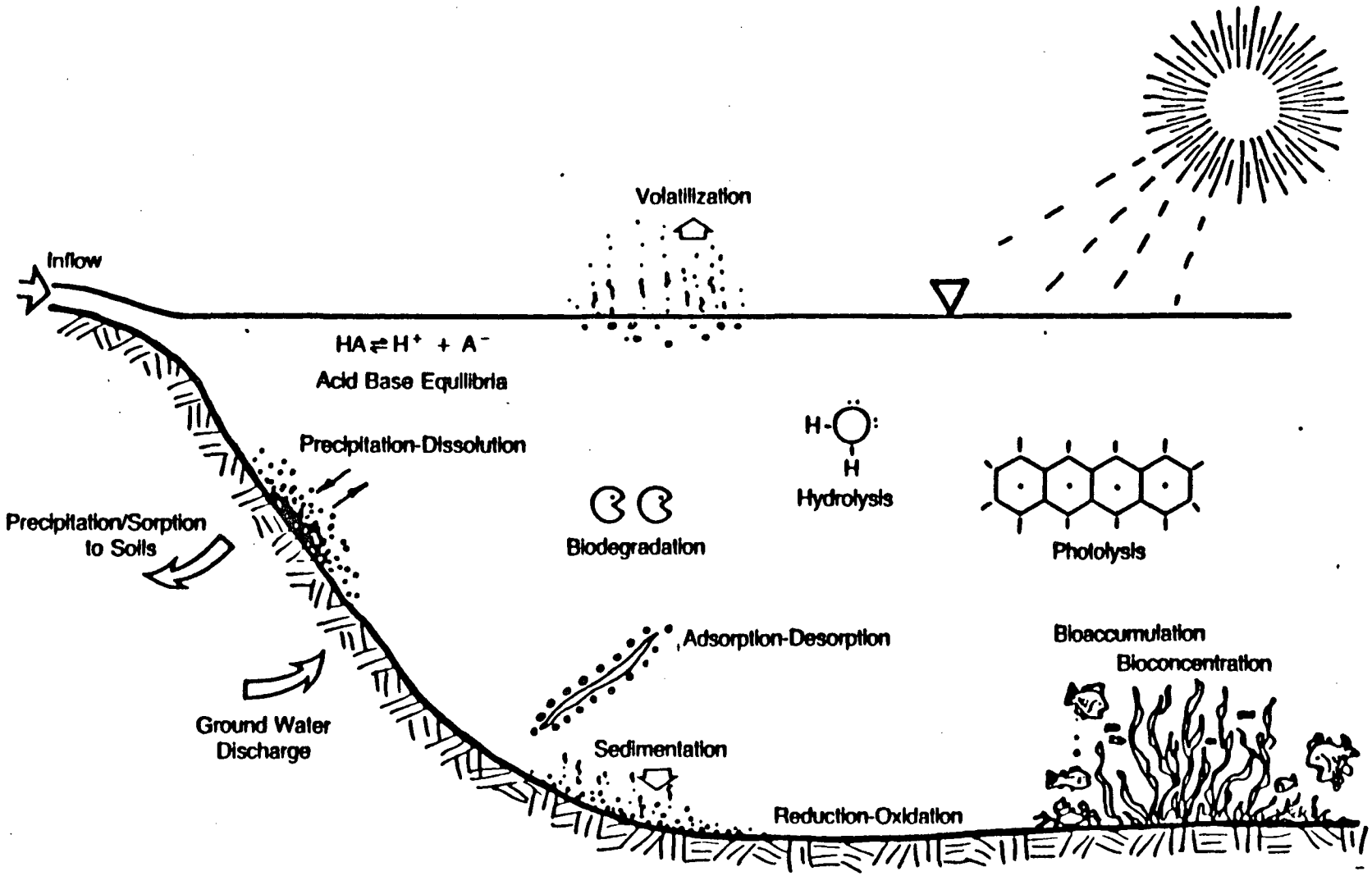
- Evaluate fate and transport processes for the indicators;
- Define potentially exposed populations;
- Establish exposure scenarios for each medium;
- Estimate exposure point concentrations;

Figure 2-1
Fate and Transport Processes of Chemicals in the Terrestrial and Atmospheric Environment



Source: ERM 1986

Figure 2-2
Fate and Transport Processes of Chemicals in the Aquatic Environment



Source: ERM 1986

or dermal contact, is identified as part of the exposure scenarios. Exposure scenarios are determined by integrating information from the RI with knowledge about potentially exposed populations and their likely behavior.

2.3.3 Determine Exposures to Potentially Affected Populations

Once exposure scenarios are established, the next step is the quantitative determination of the exposure concentrations at the potential points of contact by human populations.

If the transporting environmental medium is assumed to be in a steady-state condition, then monitoring data may be used to quantify exposure concentrations. If site-specific data are not available or if transient conditions are suspected, models may be used to predict exposure concentrations.

For this assessment:

- Ground water is considered a transport medium; therefore, existing ground water monitoring data were used to represent exposure concentrations.

- Air is considered as a transport medium due to volatilization of organic compounds present in ground water. Since no air monitoring data were available, the Industrial Source Complex (ISC) model in a screening mode was performed to predict exposure concentrations. The specifics of this screening study are presented in Appendix E.

2.3.4 Calculate Resultant Intakes by Potentially Exposed Populations

Once exposure concentrations in all media have been determined, the

resultant intakes to potentially exposed populations are calculated. "Exposure" is defined as the amount of compound contacting body boundaries (e.g., skin, lungs, or gastrointestinal tract), and "intake" is defined as the amount of chemical absorbed by the body. To calculate an intake, several factors must be considered:

- The amount of contaminated medium that contacts an internal or external body surface during each exposure event;

- The amount of contaminant absorbed during each exposure event; and

- The frequency of each exposure event.

First, the exposure coefficients, which combine information on the frequency and magnitude of contact with contaminants, are identified and used to yield a quantitative value of the amount of contaminated medium contacted per day. Exposure coefficients are developed for each exposure route and are used as input in calculating the intake incurred. An example of an exposure coefficient would be the average daily intake of drinking water or pounds of fish consumed in a week, etc.

In calculating the intake incurred, an exposure coefficient is multiplied by the compound-specific environmental concentrations from site-specific monitoring data. This calculation provides a route-specific estimate of the total amount of each contaminant to which the population is exposed on a daily basis. Summing the exposures for each exposure route yields a total daily exposure level for each contaminant.

This exposure value may be adjusted to account for the extent to which each chemical is transferred across the membranes of the exposed organism (i.e., the extent of absorption). This adjustment

is accomplished by multiplying the route-specific daily exposure values by an absorption factor. Absorption factors may be available in the compound-specific toxicity profiles prepared by EPA or Agency for Toxic Substances and Disease Registry (ATSDR). When empirically derived absorption factors are not available, a conservative extimate of the absorption factor is applied, thereby generating a conservative, worst-case estimate of the intake incurred. Finally, this whole-body intake estimate, in milligrams per day (mg/day), is converted to terms of mg of contaminant/kilogram (kg) of body mass/day by dividing it by the body mass representative of the receptor population. Ranges of standard factors (i.e., body mass, surface area, etc.) for use in performing exposure assessments are available in the literature. Use of these standard factors promotes consistency among all exposure assessment activities.

The risk characterization portion of this risk assessment utilized average daily intake and maximum daily intake estimates. Estimates of average daily intake were calculated by multiplying the exposure coefficients derived during the exposed populations analysis by the average environmental concentrations. Estimates of maximum daily intake were calculated by multiplying the exposure coefficients by the maximum environmental concentrations.

Subchronic (short-term) exposure is based on the number of exposure events that occur during the short-term time frame using maximum contaminant concentrations in the media to define dosage. Subchronic exposure values are intended to represent the 10- to 90-day exposures. Chronic (long-term) exposures are based on the number of events that occur within an assumed 70-year lifetime using average contaminant concentrations in the media to define dosage.

The resultant subchronic and chronic intakes are then used in the risk characterization process. For carcinogens, the chronic

intakes (CIs) are used to asses carcinogenic risk. For noncarcinogens, both subchronic intakes (SIs) and CIs are used to evaluate acute and chronic effects.

Inhalation Exposure

Potential inhalation intakes are estimated based on the number of hours in each event, the inhalation rate of the exposed individual during the event, the concentration of contaminant in the air breathed, and the amount retained in the lungs. The equation for calculating event-based intakes is:

$$IEX = D \times I \times C \times RF \times 1/BW,$$

where:

IEX = estimated inhalation intake (mass of contaminant per event);

D = duration of an exposure (hours per day);

I = alveolar air rates of exposed persons without exertion (m^3/hr);

C = contaminant concentration in exposure medium (mg/m^3);

RF = inhaled compound in alveolar air spaces, that is, the fraction of the inhaled concentration that is absorbed into the bloodstream (assumed to be 100%); and

BW = body weight of exposed person (kg).

Inhalation While Bathing

A potential inhalation exposure may occur when compounds dissolved in water are volatilized during bathing. The inhalation intake for

this event is calculated as follows:

$$IEX = [(AW \times C \times D_1 \times I)/(2 \times SV)] + [(AW \times C \times D_2 \times I)/BV) \times ABS_a \times 1/BW$$

where:

IEX = estimated inhalation intake (mg/kg/day)

AW = amount of water used during shower (L)

C = contaminant concentration in water (mg/L)

D1 = duration of exposure in shower (hr)

D2 = duration of additional exposure in enclosed bathroom (hr)

I = alveolar air rates of exposed persons without exertion (m^3/hr)

SV = shower volume (m^3)

BV = bathroom volume (m^3)

ABS_a = absorption into alveolar space (100%)

BW = body weight of exposed person (kg)

Subchronic (short-term) exposure resulting from inhalation is calculated using the maximum contaminant air concentration. Chronic (long-term) exposure is based on the average air concentration.

Dermal Exposure

Dermal intake is determined by the concentration of compounds in

a contaminated medium that is contacted, the body surface area contacted, the duration of the contact, the flux, and the absorbed fraction. For exposure to contaminated water, dermal intake per event is calculated as follows:

$$DEX = D \times SA \times C \times Flux \times ABS \times 1/BW$$

where:

DEX = estimated dermal intake per event (mg/kg/day);

D = duration of an exposure (hours);

SA = skin surface area available for contact (cm^2);

C = contaminant concentration in water (mg/L);

ABS = the fraction of a compound absorbed through the skin;

Flux = flux rate of water across skin ($mg/cm^2/hr$); and

BW = body weight of exposed person (kg).

Possible subchronic intake resulting from each dermal exposure event is calculated using the maximum (short-term) contaminant concentrations. Chronic intake is based on average (long-term) contaminant concentrations.

Ingestion Exposure

Potential intake resulting from ingestion of water-borne contaminants is determined by multiplying the concentration of the contaminant in the water ingested per day and the degree of absorption (assumed to be one hundred percent) and is calculated as follows:

$$IngEx = C \times 1/BW \times Amt \times ABS_w$$

where:

IngEx = estimated intake ingested per event (mg/kg/day)

C = contaminant concentration in water (mg/L)

BW = body weight of exposed person (kg)

Amt = amount ingested (liters of water per day)

ABS_w = percent of contaminant absorbed into the blood stream

2.4 Toxicity Evaluation

The selected indicators are subjected to a toxicity evaluation in order to develop a data base to which exposure point intakes can be compared during the risk characterization evaluation. This evaluation includes the consideration of experimental studies using mammals and aquatic nonmammalian species (where available), as well as relevant standards for humans. This evaluation presents summaries of health effects data, toxicokinetics, toxicodynamics, and ecotoxicology available for the indicators. All relevant indices of toxicity for this risk assessment were obtained from USEPA databases.

In judging the qualitative evidence of carcinogenicity, EPA and the International Agency for Research on Cancer (IARC) have adopted a "weight-of-evidence" classification considering the quality and adequacy of all relevant data on responses induced by a possible carcinogen (Federal Register 1986). There are three major steps in determining the weight-of-evidence for

carcinogenicity:

1. Characterization of the evidence from human studies and from animal studies individually,

2. Combination of the two types of studies into a final indication of overall weight-of-evidence for human carcinogenicity, and

3. Evaluation of all supportive information to determine if the overall weight-of-evidence should be modified.

2.5 Risk Characterization

The risks to the potentially exposed population from exposure and subsequent intakes of the indicators are characterized in the following three tasks:

1. Comparison with Applicable or Relevant and Appropriate Requirements (ARARs),

2. Calculation of Noncarcinogenic Hazard Index, and

3. Calculation of Carcinogenic Risk.

2.5.1 Comparison with Applicable or Relevant and Appropriate Requirements

The exposure point concentrations of all contaminants are compared to ARARs or standards as defined by the National Contingency Plan (NCP). At present, EPA considers drinking water maximum contaminant levels (MCLs), national ambient air quality standards (NAAQS), and federally approved state water quality standards developed under the Clean Water Act to be applicable or relevant and appropriate requirements. The NCP (under mandate from the

Superfund Amendments and Reauthorization Act, or SARA) also requires that the Federal Water Quality Criteria and Maximum Contaminant Level Goals (MCLG) be considered relevant and appropriate, even though these criteria have not been promulgated. Other criteria are deemed "to-be-considered" (TBCs) and are evaluated as potential standards if promulgated standards do not exist.

2.5.2 Calculation of Noncarcinogenic Hazard Index

The Hazard Index method is used for assessing the overall potential for adverse noncarcinogenic health effects related to exposure to the indicator compounds. This approach assumes that multiple subthreshold exposures could result in an adverse effect and that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to acceptable exposures. This relationship can be expressed as:

$$\text{Hazard Index} = E_1/AI_1 + E_2/AI_2 + \ldots + E_i/AI_i$$

where:

E_i = Exposure intake for the i^{th} contaminant; and

AI_i = Acceptable intake (or reference intake) for the i^{th} contaminant.

For a single contaminant, there may be a potential adverse health effect when the hazard index exceeds one. For multiple chemical exposures, the hazard indices, if summed, may result in an overall hazard index that exceeds one even if no single chemical exceeds its acceptable level. However, the assumption of additivity should be made only for compounds that produce the same toxic effect by the same mechanisms of action. If the total hazard index exceeds unity, the compounds are segregated by critical effect (or target

organ effect) and separate hazard indices for each compound are derived.

EPA has developed information regarding acceptable intakes for chronic and subchronic exposures known as Reference Doses (RfDs) and Acceptable Subchronic Intakes (AISs), respectively. RfDs and AISs are available for a number of compounds through EPA's Integrated Risk Information System (IRIS), the primary qualitative and quantitative risk information data base.

2.5.3 Carcinogenic Risk

For potential carcinogens, risks are estimated as probabilities. The carcinogenic potency factor, which is the upper 95% confidence limit of the probability of a carcinogenic response per unit intake over a lifetime of exposure, converts estimated CIs directly to incremental risk values. CPFs are available for many compounds through IRIS, the quantitative risk information data base. For Superfund evaluations, it is also assumed that cancer risk for chemical I is:

$$\text{Risk (I)} = [\text{CI (inh)} \times \text{CPF (inh)}] + [\text{CI (oral)} \times \text{CPF (oral)}] + [\text{CI (dermal)} \times \text{CPF (dermal)}]$$

where:

CI = chronic intake (mg/kg/day);

inh = inhalation exposure route;

CPF = carcinogenic potency factor for specific exposure route [$(\text{mg/kg/day})^{-1}$];

oral = oral exposure route;

dermal = dermal exposure route; and

CPF (dermal) = CPF for oral exposure route since dermal factors have not been derived.

The low-dose carcinogenic risk equation is:

Total Risk from all indicator compounds =
Σ [CI x Carcinogenic potency factor (CPF)]

The carcinogenic risks posed by each carcinogen are summed for each receptor population (i.e., children ages 2-6, children ages 6-12, and adults). The carcinogenic risk for each receptor population is then weighted and finally, the weighted results are added to yield a lifetime-weighted carcinogenic risk.

2.6 Uncertainty

Uncertainties exist at many levels in the process, including fate and transport of indicators, definitive measurements of actual or potential human exposures and in the carcinogenic potency factors for carcinogens or reference doses for noncarcinogens. The magnitude of uncertainty varies with the quality of data used in the risk assessment process and tends to be both site-specific and substance-specific. EPA's risk assessment process is highly conservative in its determination of actual human health risks. At each step, conservative assumptions are made to ensure that the final health risk projections will not underestimate the magnitude of risk to potentially exposed populations at a site.

SECTION 3
INDICATORS

3.1 Selection of Contaminants of Concern

This section discusses the results of the indicator selection process. The numerous contaminants identified in the Remedial Investigation are composed of a diverse group of compounds with varying toxicological properties. The extent of contamination differs widely in concentration and occurrence throughout the site. Selective identification of compounds of concern is undertaken in order to focus effort on a limited set of compounds that represent the majority of risks or hazards associated with the CLTL site. Selection of indicators for this risk assessment (RA) was performed in accordance with procedures described in detail in the Superfund Public Health Evaluation Manual (US EPA 1986a).

3.2 Indicator Selection

The first task in the indicator selection process is the development of a preliminary list based on chemical toxicity information and site concentration data. A chemical's indicator score (IS) is calculated by totaling several medium-specific values, which are the products (CT) of concentrations (C) and medium-specific toxicity constants (T) (US EPA 1986a). The compounds can then be ranked by their carcinogenic and noncarcinogenic indicator scores. By considering additional factors such as mobility, frequency of detection, extent of contamination, similarity to other related compounds, bioconcentration potential, persistence, etc., a final group of representative compounds is then selected.

The following points pertain to the review of analytical data for chemicals detected at the CLTL site:

(1) The data used in this risk assessment are presented in Appendix A.

(2) The selection process has been limited to Priority Pollutant inorganic constituents and organic compounds. Compounds that are tentatively identified are not included in the process. Both identification and quantitation of tentatively identified compounds (TICs) are limited by analytical procedures. It should be noted, in regard to all compounds identified in the TIC analyses, that TICs are non-Priority Pollutant compounds identified by finding the "best" match between the mass spectra derived from the unknown peak in the sample and a computer library search of mass spectra. The concentrations reported for the TICs are estimated values calculated by assuming a 1:1 response factor to that of the closest eluting internal standard of known concentration. Therefore, the TIC is not quantitated to a reference standard of the identified compound. These factors cause a gross approximation of the TIC concentration and qualitative identification.

(3) The concentrations of Priority Pollutant inorganic constituents in soil samples were compared to background levels provided by NJDEP, which are specific to this site, and to the site-specific background soil samples collected by ERM. Only those inorganics found at levels above background or NJDEP soil concentrations were considered in the selection process. (The background levels used in the CLTL RA are also presented in Appendix A).

(4) Only ground water, surface soils, and subsurface soils were addressed in the indicator selection process for the CLTL Risk Assessment.

(5) Organic compounds removed from consideration were those

detected infrequently at trace levels, or near the laboratory reporting limit or both.

(6) Compounds for which no medium-specific toxicity constants were available in the Superfund Public Health Evaluation Manual (US EPA, 1986a, Appendices A-3 and A-5) could not be ranked in the indicator selection process. These compounds were qualitatively evaluated for potential toxicity during the indicator selection process.

(7) Modified arithmetic means were used as representative concentrations in the indicator selection process and subsequent sections of the report. The mean is modified to use one-half the laboratory reporting limit for compounds occurring at levels below the analytical detection limit.

The indicator worksheets for the CLTL site are presented in Appendix B. The short-listed indicator compounds/constituents (generally the top third in ranking) and the assumptions used to select the final indicators are given in Table 3-1.

3.3 Discussion of Classification of Compounds

A general discussion of the chemical classes and several representative compounds detected during the RI is presented here to emphasize the need to select indicators from various classes. The volatile organics are composed, in general, of halogenated aliphatic and selected aromatic compounds. These compounds are generally soluble in water and have relatively high volatility rates. They are not readily adsorbed to soils/sediments or suspended particles and are therefore available for transport to ground water through leaching processes, to surface water through run-off, and to the atmosphere through volatilization from soils or surface water or both. Toluene, trichloroethene, benzene, ethylbenzene, and vinyl chloride were among the volatile organic

Table 3-1

JUSTIFICATION FOR SELECTION OF INDICATORS

COMPOUND	JUSTIFICATION	RANK NC	RANK PC	SELECTED
Arsenic	o Exceeded MCL in intermediate/shallow ground water o Exceeded background soil levels o Detected in all media sampled	1	1	Yes
1,2-Dichloroethane	o Highest scored volatile organic compound o Exceeded MCL in intermediate/shallow ground water	17	2	Yes
Trichloroethene	o Exceeded MCL in intermediate/shallow ground water o Frequently detected in intermediate/shallow ground water and subsurface soils o Highest concentration of any VOC detected in subsurface soils	2	3	Yes
Vinyl Chloride	o Class A carcinogen o Exceeded MCL in intermediate/shallow ground water	10	4	Yes
1,1-Dichloroethene	o Class C carcinogen; not evaluated as a carcinogen per guideline o Exceeded MCL in intermediate/shallow ground water o Low noncarcinogen ranking o Detected in 3/70 samplings in intermediate/shallow ground water	20	-	No
Benzene	o Class A carcinogen o Exceeded MCL in intermediate/shallow ground water o Detected in subsurface soils (<1 ppm)	14	7	Yes
Zinc	o Highly ranked noncarcinogen o Detected frequently in all media sampled o Exceeded soil background levels	3	-	Yes
trans-1,2-Dichloroethene	o Highly ranked noncarcinogen o Detected frequently in all media sampled o Exceeded MCLG in intermediate/shallow ground water o Detected in subsurface soils at maximum of 10 ppm o Degradation product of trichloroethene	4	-	Yes
Lead	o Highly ranked noncarcinogen o Detected frequently in all media sampled o Exceeded newly proposed MCL (0.005 mg/L-11/88) in deep and intermediate/shallow ground water o Maximum concentrations detected in surface and subsurface soils exceeded soil background levels	7	-	Yes

Table 3-1
(continued)

JUSTIFICATION FOR SELECTION OF INDICATORS

COMPOUND	JUSTIFICATION	RANK NC	RANK PC	SELECTED
1,2-Dichlorobenzene	o Exceeded MCL in intermediate/shallow ground water o Infrequently detected in subsurface soils (3/66) but at concentrations >200 ppm o EPA severity of effect ratings (RVes): 4-oral, 5-inhalation	12	-	Yes
Chlorobenzene	o Exceeded MCL in intermediate/shallow ground water o Infrequently detected in subsurface soils (5/66) but at maximum of 53 ppm o EPA severity of effect ratings (RVes): 4-oral, 1-inhalation	13	-	No
Phenol	o Maximum concentration detected in intermediate/ shallow ground water exceeded drinking water level (1,000 ppb in June 1986; 80 ppb in September 1986 - maximum concentration not confirmed) o Detected infrequently in subsurface soils (3/66) o Detected infrequently in intermediate/shallow ground water (5/70)	15	-	No

MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal (proposed)

compounds detected at the site.

The semi-volatile organics contain two classes: the base-neutrals and the acid extractables. Base-neutrals are those compounds which require basic or neutral pH conditions for extraction from environmental matrices. In general, these compounds are quite strongly adsorbed to available organic matter, such as soils, sediments, or suspended particles. Therefore, the movement of base-neutrals through soils and ground water systems is likely to be substantially retarded. However, they may be readily transported to surface waters as run-off during high rainfall events, to the atmosphere as fugitive dust, and possibly by volatilization from soils and surface waters to the atmosphere. Various base-neutrals were detected during the RI, including phthalate esters, 1,2-dichlorobenzene, and polynuclear aromatic hydrocarbons (PNAs).

The acid extractables are phenolic compounds (in some cases listed as cresols) and require acidic pH conditions for their extraction from environmental matrices. Phenolics have moderate to high water solubilities, but extremely low volatilization rates. As a class, the degree of adsorption onto soils/sediments and suspended particles is mixed. Phenolic compounds do not readily volatilize, but are susceptible to oxidation, photolysis, and biodegradation. Phenol, 2,4-dichlorophenol, and 4-nitrophenol are representative of the acid extractables detected during the RI.

The inorganic class contains the trace elements and the metals. Fate and transport processes are dependent upon the chemical speciation of the inorganic constituent. However, these constituents may adsorb to soils or sediments, or suspended particles, thus limiting their transport to the ground water, surface water, and atmosphere. Arsenic, lead, zinc, and cadmium were among the inorganic constituents detected during the RI.

Water solubility of the inorganics varies widely, depending on environmental conditions and concentrations of complexing species present. Inorganics generally do not volatilize.

3.3.1 Summary of the Indicators

The indicators were selected for the aforementioned media using EPA's procedures and methods as detailed in the SPHEM (US EPA 1986a). The worksheets from this selection process are given in Appendix B. Primary consideration in the final selection of indicator compounds was based upon toxicity and the concentrations and frequency with which a compound was detected in all media. The resulting indicators selected for the Bridgeport CLTL Active Terminal Risk Assessment are: arsenic; 1,2-dichloroethane; trichloroethene; vinyl chloride; benzene; zinc; trans-1,2-dichloroethene; lead; and 1,2-dichlorobenzene.

SECTION 4
EXPOSURE EVALUATION: NO-ACTION ALTERNATIVE

4.1 Exposure Evaluation

The purpose of an exposure evaluation is to determine the potential intake of each indicator by an exposed or potentially exposed population in the absence of any remedial action. This exposure evaluation is performed according to the methods presented in the SPHEM (USEPA 1986a) and the Superfund Exposure Assessment Manual (USEPA 1988).

Exposure evaluation involves the following steps:

- Identification of exposure pathways
  - -- Determination of possible chemical release sources and release media
  - -- Prediction of environmental fate and transport of indicators released from contamination source areas
  - -- Identification and characterization of possible human exposure points
  - -- Identification of human exposure routes at possible exposure points
- Estimation of exposure point concentrations
- Estimate chemical intakes

The steps in exposure evaluation are presented in the subsections below.

4.2 Source(s) of Contamination

The primary sources of contamination at the site appear to be the subsurface soils and ground water in the areas of the former settling lagoons and aeration lagoons (Figure 1-2). The highest concentrations of compounds/constituents in the soils are in the area of these former lagoons. Other potential sources of contamination at the site include the overflow area, described in Section 1.3, and the parking lot, where poor housekeeping practices may contribute to the observed contamination. The RI also identified the rinse water holding tank, where two leaks had been discovered (and repaired), as an additional potential source of contamination.

4.3 Fate and Transport Processes

The purpose of this qualitative evaluation is to identify any significant intermedia transport routes that may need to be considered in detail later through fate and transport modeling.

The indicators chosen for this RA behave differently in the environmental media being considered: air (vapors) and ground water. In general, the volatile organic compounds (VOCs) tend to be more mobile in the environment than arsenic, zinc or lead. Complete fate and transport profiles for these indicators are given in Appendix C. Table 4-1 presents the relative importance of aquatic processes influencing the fate and transport for the indicators. Table 4-2 details the physical-chemical properties of the indicators that determine their environmental fate and transport.

In general, volatilization and oxidation are important fate processes for the volatile organics. These compounds adsorb to soil particles or bioaccumulate in tissues to a lesser extent than inorganic constituents, base-neutrals such as phthalate esters or

Table 4-1

RELATIVE IMPORTANCE OF PROCESSES INFLUENCING FATE OF INDICATORS
AT CLTL BRIDGEPORT SITE

	Sorption	Volatilization	Biodegradation	Photolysis-Direct	Hydrolysis	Bioaccumulation
Trichloroethene	?	+	+	-	-	-
trans-1,2-Dichloroethene	-	+	+	-	-	-
Vinyl Chloride	-	+	-	-	-	-
Benzene	+	+	?	-	-	-
1,2-Dichlorobenzene	+	+	?	?	-	+
1,2-Dichloroethane	?	+	?	-	-	-
Arsenic	+	-	-	-	-	+
Lead	+	-	-	-	-	+
Zinc	+	-	-	-	-	+

Key to Symbols:
+ Could be an important fate process
- Not likely to be an important process
? Importance of process uncertain or not known

SOURCES: Mills, et al., 1982
Callahan, et al., 1979
Clement Associates, Inc., 1985

TABLE 4-2

PHYSICAL AND CHEMICAL PROPERTIES
OF THE INDICATORS

Lead	Tri-chloroethene	trans-1,2-Dichloroethene	Vinyl chloride	Benzene	1,2-Dichloro-benzene	1,2-Di-chloroethane	Arsenic	Lead	Zinc
Molecular weight, g	131.39	96.94	62.5	78.12	147.01	98.98	74.92	207.19	65
Melting point, °C	-73	-50	-153.8	5.5	-17	-35.36	817	1740	419
Boiling Point, °C	87	47.5	-13.37	80.1	180.5	83.47	613	327	907
Density, g/m	1.464	1.256	0.91	0.879	1.3 (20°C)	1.253 (20°C)	5.727	11.35	7.14
Partition Coefficients									
Water solubility, ppm (25°C)	1.10E+03 (20°C)	6.00E+02 (20°C)	2.70E+03	1.75E+03	1.00E+02 (20°C)	8.69E+03	Insoluble	Insol-uble	Insoluble
Octanol-Water, Kow	2.63E+02	1.23E+02	1.70E+01	1.35E+02	3.60E+03	3.00E+01	NA	NA	NA
Sediment-Water, Koc	1.26E-02	5.90E+01	8.20E+00	8.30E+01	1.70E+03	1.40E+01	NA	NA	NA
Microorganism-Water, Kb [(ug/g)/(mg/L)]	9.70E+01	4.80E+01	5.70E+00	3.70E+01	7.30E+02	9.00E+00	NA	NA	NA
Volatilization Coefficients									
Henry's Law Constants (atm m3/mole)	9.10E-03	6.70E-02	8.14E-02	5.50E-03	1.93E-03	9.14E-04	NA	NA	NA
Vapor Pressure, mm Hg	5.79E+01 (20°C)	3.26E+02 (20°C)	2.66E+03	9.52E+01	1.00E+00 (20°C)	6.10E+01 (20°C)	0.00E+00	0.00E+00	0.00E+00
Reaeration Rate Ratio, (KvC/KvO)	5.48E-01	6.01E-01	6.75E-01	5.74E-01	4.95E-01	NAV	NA	NA	NA

NA - Not applicable
NAV - Not available

SOURCES: Verschueren, 1983
Weast, 1974
Mills, et al., 1982
Lyman, et al., 1982
Clements Associates, Inc., 1985
US EPA, 1986a (Appendix A-1)

polynuclear aromatic hydrocarbons, or pesticides. For the inorganic constituents, adsorption onto soil particles and subsequent erosion of surficial soils could result in the transport of contaminated dust particles.

4.4 Exposure Scenario for Each Medium

Exposure scenarios are determined by integrating information about the nature and extent of contamination as defined in the RI with knowledge about potentially exposed populations and their likely behavior.

4.4.1 No-Action Conditions at the Active Terminal

The present conditions at the CLTL site are as follows:

Site Conditions

- The facility functions as an operational truck terminal;
- The CLTL terminal is bounded to the south and east by Moss Branch and Cedar Swamp, to the north by a residential area, and to the west by open land and a few residences (Figure 1-2); an orchard and the BROS site lie to the east of the terminal beyond Cedar Swamp; Cooper Lake lies north of the residential area discussed above;
- The area south and east of the site is a swamp to which access is restricted because of the marshy conditions and profuse vegetation;
- The areas of the former settling lagoons and former aeration lagoons are vegetated to various extents;
- A truck parking lot/driveway area covers approximately

two-thirds of the terminal; a non-hazardous dust suppressant (confirmed by EP toxicity analysis) is used over much of the parking lot/driveway area;

- The site is fenced along Cedar Swamp Road and Oak Grove Road.

Extent of Contamination

- The former settling lagoons and the former aeration lagoons are the primary sources of Priority Pollutant contaminants occurring in ground water beneath the CLTL site.

- The extent of contamination in shallow and intermediate subzone ground water is adequately defined to begin remedial action.

- The primary areas with soil contamination in the active terminal area of the CLTL site include the former settling lagoons, the former aeration lagoons, the former overflow area, and the truck parking lot/driveway area. Additional sampling is necessary to fully characterize the extent of contamination in the truck parking lot/driveway area.

- Localized contamination of shallow soil in the truck parking lot/driveway area may be attributed to poor housekeeping practices in this area. Historical overflow of the former final settling lagoon is a source of Priority Pollutant inorganic and organic contaminants present in shallow soil east of the former final settling lagoon.

TABLE 4-3

POTENTIAL EXPOSURE PATHWAYS FOR AFFECTED MEDIUM

TRANSPORT MEDIA	SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTE	SELECTED FOR ANALYSIS
Ground water	Contaminated Soils	Infiltration and Transport	Shallow/ Intermediate Subzones	Dermal contact	Yes
				Inhalation	Yes
				Ingestion	Yes
			Deep subzone	Dermal Contact	Yes
				Inhalation	Yes
				Ingestion	Yes
			Trailer Rinsing Operation CLTL Production Well	Dermal contact	Yes-workers only
Air	CLTL Production Well	Volatilization	Off-Site Residences	Inhalation	Yes-residential area
		Volatilization	Trailer Rinsing Operation	Inhalation	Yes-workers

4.4.2 Exposure Scenarios for the Environmental Media

Potentially Affected Populations

- Approximately 20 potentially affected residences are found within a 2,000 foot radius of the site (Figure 4-1);

- Workers at the CLTL terminal represent a second population for whom an exposure scenario must be considered. There are 3 shifts 5 days/week at the CLTL terminal; there is 1 shift on Saturdays.

Further details on the site background, operations, and conditions may be found in Section 1 of this report and also in the Remedial Investigation Report for the site (EPA 1989).

The primary exposure pathways for the indicators are influenced by the geology and hydrology of the site as well as the chemical properties of the indicators. These factors interact to define the various routes by which the compounds originating at the site could affect potentially exposed populations. These routes are presented in detail in Table 4-3 and are summarized below:

Medium	Release Pathway	Exposure Route
Ground Water	Residential Use of Ground Water	Ingestion Inhalation Dermal Contact
	Industrial Use of Ground Water (CLTL Production Well)	Dermal Contact
Air	Volatilization from Contaminated Ground Water (CLTL Production Well)	Inhalation

TABLE 4-4

GROUND WATER SAMPLE RESULTS FROM CLTL PRODUCTION WELL
(concentration in ppb)

PARAMETER	SEP. 86	LIMIT OF DETECTION
ORGANICS		
Methylene Chloride	50	5
trans-1,2-Dichloroethene	2900	5
Trichloroethene	1900	5
Benzene	40	5
Vinyl Chloride	20	10
1,2-Dichloroethane	30	5
Tetrachloroethene	10	5
Chlorobenzene	10	5
INORGANICS		
Copper	50	20
Zinc	80	20
Phenols	36	4
TOC	4700	100
TOX	2500	5
TDS	172000	10000

Source: ERM, 1989

Ground Water

Ground water is considered a transport medium because the shallow/intermediate and deep subzone ground water potentially could be used as a potable water supply.

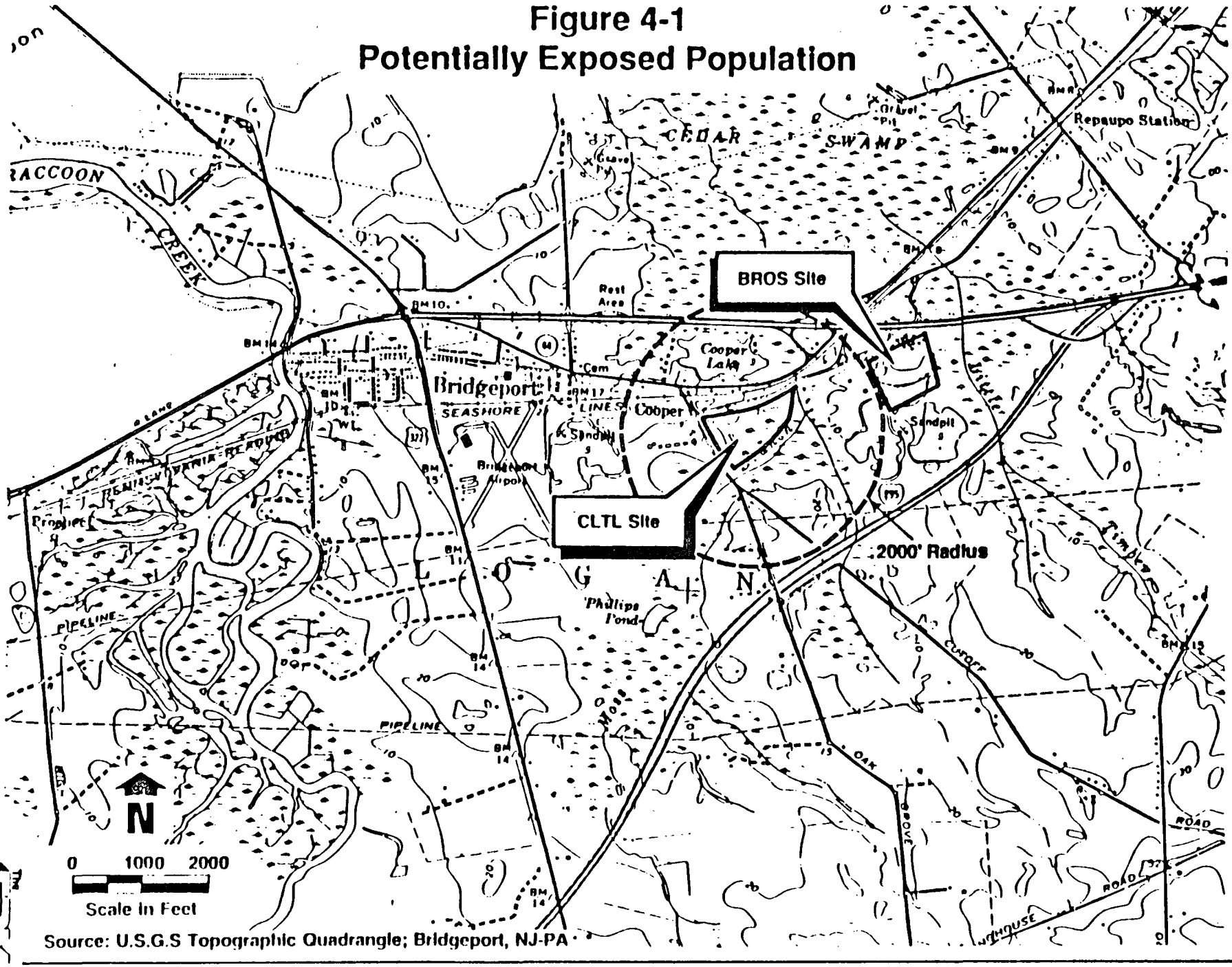
Ground water from the CLTL production well is used at a rate of 15,000 gallons per day for the trailer rinsing operations. The concentrations reported in the CLTL production well are presented in Table 4-4. These concentrations will be used to assess the risk to workers and to residents in the area from the trailer rinsing operations.

Air

As described above, contaminated ground water from the CLTL Production Well is used in the trailer rinsing operation at the terminal. Volatilization of organic compounds from this water may present a potential risk to workers at this facility and residents living near the CLTL active terminal who may inhale the contaminants. For this reason, air is considered as a transport medium.

Inhalation of fugitive dust particles from the CLTL parking lot is considered an exposure pathway. Conditions were selected to represent the worst case for fugitive dust emissions. This exposure pathway is based on the limited soil sampling performed in the CLTL truck parking lot. Additional sampling will be necessary to fully characterize the health risks related to soil contamination at the site. Preliminary determination of the intakes and resultant risks associated with this scenario are presented in Appendix D.

Figure 4-1
Potentially Exposed Population



Source: U.S.G.S Topographic Quadrangle; Bridgeport, NJ-PA

Table 4-5

ROUTES OF EXPOSURE USED IN CALCULATION OF INTAKES

POPULATION	ROUTES OF DERMAL EXPOSURE	ROUTES OF INHALATION INTAKE	ROUTES OF INGESTION EXPOSURE
Adult	o Dermal contact with ground water while bathing	o Volatilization of compounds into the air from ground water while bathing o Volatilization of compounds into air from CLTL production well during trailer rinsing operation	o Ingestion of ground water as potable water supply
Children Age 2-6	o Dermal contact with ground water while bathing	o Volatilization of compounds into the air from ground water while bathing o Volatilization of compounds into air from CLTL production well during trailer rinsing operation	o Ingestion of ground water as potable water supply
Children Age 6-12	o Dermal contact with ground water while bathing	o Volatilization of compounds into the air from ground water while bathing o Volatilization of compounds into air from CLTL production well during trailer rinsing operation	o Ingestion of ground water as potable water supply
Adult (Workers)	o Dermal contact with CLTL production well water while rinsing trailers	o Volatilization of compounds into air from CLTL production well during trailer rinsing operation	Not Applicable

Table 4-6

STANDARD PARAMETERS USED FOR CALCULATION OF INTAKES

Parameter		Standard Value Adult	Child Age 6-12	Child Age 2-6
Physical Characteristics				
Average Body Weight (kg)		70 (a)	29 (b)	16 (b)
Surface Area Available for Dermal Exposure (sq cm)	a	18150	10470	6980
Activity Characteristics				
Amount of Water Ingested Daily (liters)	a	2	2	1
Percentage of Surface Area Immersed While Bathing (%)	a	100	100	100
Length of Exposure While Bathing (minutes)	c	20	20	20
Amount of Air Breathed While Bathing (cubic meters)	c	0.42	0.42	0.42
Length of Additional Exposure After Bathing (minutes)	c	10	10	10
Volume of Showerstall (cubic meters)	c	3	3	3
Volume of Bathroom (cubic meters)	c	10	10	10
Volume of Water Used While Showering (liters)	c	200	200	200
Absorption via Ingestion (%)	a	100	100	100
Bathing Frequency	a	1/day	1/day	1/day
Alveolar Air Rates - Resident (cubic meters/hr)	a	0.83	0.46 (no exertion)	0.25
Absorption in Alveolar Spaces (%)	a	100	100	100
Alveolar Air Rates - Worker (cubic meters/hr)	a	2.8 (moderate exertion)	NA	NA
Exposure Duration - Worker	d	8 hrs/day 250 days/yr		
Exposure Duration - Residents	d	24 hrs/day 312 days/yr*	24 hrs/day 312 days/yr	24 hrs/day 312 days/yr
Percentage Surface Area Exposed - Workers (%)		20	NA	NA
Water Usage	e	75	75	100
Material Characteristics				
Mass Flux Rate (water-based) (mg/sq cm/hr)	a	0.5	0.5	0.5

a) Superfund Exposure Assessment Manual (US EPA, 1988)
b) Anderson, et al., 1985
c) K.G. Symms, "An Approximation of the Inhalation Exposure to Volatile Synthetic Organic Compounds from Showering with Contaminated Household Water, paper presented at the Symposium of American College of Toxicologists, 15 November 1985.
d) ERM Staff Professional Judgment
e) Versar, Inc., 1987

NA - Not applicable
* 312 day residential exposure to vapors from trailer rinsing operation based on 6 days/week for 52 weeks

4.5 Exposures to Potentially Affected Populations

The next step in a RA is the quantitative determination of the potential exposure concentrations at the points of contact to human populations.

4.5.1 Potentially Affected Populations

The sources of contamination and applicable transport mechanisms have been evaluated to define the average and worst-case exposure scenarios for the CLTL site. Approximately 20 residences are located within 2,000 feet of the CLTL active terminal (Figure 4-1).

The analytical results of ground water samples from residential wells in the vicinity of the CLTL site collected by USEPA are presented in Appendix A. The most recent sampling was conducted in March 1989. The contamination detected in this round of sampling of the residential wells along Oak Grove Road included TCE (12 ppb), copper (33 to 260 ppb), and zinc (80 to 220 ppb).

For this RA, the potentially affected population consists of adults and children living in the vicinity of the CLTL site and individuals working on-site. Routes of exposure concerning contaminant intakes and dosage are analyzed for each of the three populations: adult (and worker), children ages 2-6, and children ages 6-12. The routes of exposure for the different populations are outlined in Table 4-5.

4.6 Calculation of Resultant Intakes

Conservative assumptions consistent with EPA Guidelines (USEPA 1986a, 1988) were used for this RA. The assumptions concerning duration and frequency of contact with the exposure medium along with other standard parameters for calculation of intakes are given in Table 4-6.

TABLE 4-7

SUBCHRONIC/CHRONIC EXPOSURE CHARACTERISTICS

ROUTE OF EXPOSURE	MEDIA	ACTIVITY	POPULATION	SUBCHRONIC EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
Dermal	Ground water (shallow/ intermediate and deep sub-zones)	Casual Contact During Bathing	Child Age 2-6	Twenty minutes of exposure (100% of body) at maximum concentration	Twenty minutes of exposure (100% of body) 365 days per year at average concentration
			Child Age 6-12	Twenty minutes of exposure (100% of body) at maximum concentration	Twenty minutes of exposure (100% of body) 365 days per year at average concentration
			Adults	Twenty minutes of exposure (100% of body) at maximum concentration	Twenty minutes of exposure (100% of body) 365 days per year at average concentration
	Ground water (CLTL Production well)	Casual Contact During Work	Worker		Eight hours of exposure (20% of body) at sampled concentration
Inhalation	Air (vapors from truck rinsing operation-CLTL Production well)	Inhalation	Child Age 2-6		Twenty-four hours of exposure 312 days per year at sampled concentration
			Child Age 6-12		Twenty-four hours of exposure, 312 days per year at sampled concentration
			Adults		Twenty-four hours of exposure, 312 days per year at sampled concentration
	Ground Water (shallow/ intermediate and deep sub-zones)	Volatilization During Bathing	Child Age 2-6	Twenty minutes of exposure to maximum concentration	Twenty minutes of exposure, 365 days per year at average concentration
			Child Age 6-12	Twenty minutes of exposure to maximum concentration	Twenty minutes of exposure, 365 days per year at average concentration
			Adults	Twenty minutes of exposure to maximum concentration	Twenty minutes of exposure, 365 days per year at average concentration

TABLE 4-7
(continued)

SUBCHRONIC/CHRONIC EXPOSURE CHARACTERISTICS

ROUTE OF EXPOSURE	MEDIA	ACTIVITY	POPULATION	SUBCHRONIC EXPOSURE CHARACTERISTICS	CHRONIC EXPOSURE CHARACTERISTICS
	Air (volatilized compounds from CLTL Production well)	Inhalation	Worker		Eight hours of exposure to sampled concentration in production well
Ingestion	Ground Water shallow/intermediate and deep subzones	Possible Drinking	Child Age 2-6	Ingestion of 1L of contaminated water at maximum concentration	Ingestion of 1L of contaminated water at average concentration
			Child Age 6-12	Ingestion of 2L of contaminated water at maximum concentration	Ingestion of 2L of contaminated water at average concentration
			Adults	Ingestion of 2L of contamined water at maximum concentration	Ingestion of 2L of contaminated water at average concentration

Table 4-8

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE @ (mg/kg/day)
GROUND WATER (shallow/intermediate subzones)	INHALATION (bathing) (1)	Adults	Trichloroethene	4.80E+00	8.21E-01	4.30E-01	6.27E-02
			trans-1,2-Dichloroethene	6.90E+01	1.18E+01	3.97E+00	5.79E-01
			Vinyl chloride	8.90E+00	1.52E+00	3.88E-01	5.66E-02
			Benzene	3.00E-01	5.13E-02	3.05E-02	4.45E-03
			1,2-Dichlorobenzene	1.80E+00	3.08E-01	1.16E-01	1.69E-02
			Arsenic	1.23E+00	Not volatile	5.64E-02	Not volatile
			Lead	3.50E+00	Not volatile	1.14E-01	Not volatile
			Zinc	6.85E+01	Not volatile	2.41E+00	Not volatile
			1,2-Dichloroethane	1.40E+00	2.39E-01	7.67E-02	1.12E-02
		Child 6-12	Trichloroethene	4.80E+00	1.09E+00	4.30E-01	8.65E-03
			trans-1,2-Dichloroethene	6.90E+01	1.57E+01	3.97E+00	7.99E-02
			Vinyl chloride	8.90E+00	2.03E+00	3.88E-01	7.81E-03
			Benzene	3.00E-01	6.84E-02	3.05E-02	6.14E-04
			1,2-Dichlorobenzene	1.80E+00	4.10E-01	1.16E-01	2.33E-03
			Arsenic	1.23E+00	Not volatile	5.64E-02	Not volatile
			Lead	3.50E+00	Not volatile	1.14E-01	Not volatile
			Zinc	6.85E+01	Not volatile	2.41E+00	Not volatile
			1,2-Dichloroethane	1.40E+00	3.19E-01	7.67E-02	1.54E-03
		Child 2-6	Trichloroethene	4.80E+00	1.08E+00	4.30E-01	5.69E-03
			trans-1,2-Dichloroethene	6.90E+01	1.55E+01	3.97E+00	5.25E-02
			Vinyl chloride	8.90E+00	2.00E+00	3.88E-01	5.14E-03
			Benzene	3.00E-01	6.75E-02	3.05E-02	4.04E-04
			1,2-Dichlorobenzene	1.80E+00	4.05E-01	1.16E-01	1.54E-03
			Arsenic	1.23E+00	Not volatile	5.64E-02	Not volatile
			Lead	3.50E+00	Not volatile	1.14E-01	Not volatile
			Zinc	6.85E+01	Not volatile	2.41E+00	Not volatile
			1,2-Dichloroethane	1.40E+00	3.15E-01	7.67E-02	1.02E-03
	DERMAL CONTACT bathing (2)	Adults	Trichloroethene	4.80E+00	2.05E-04	4.30E-01	1.57E-05
			trans-1,2-Dichloroethene	6.90E+01	2.95E-03	3.97E+00	1.45E-04
			Vinyl chloride	8.90E+00	3.81E-04	3.88E-01	1.42E-05
			Benzene	3.00E-01	1.28E-05	3.05E-02	1.11E-06
			1,2-Dichlorobenzene	1.80E+00	7.70E-05	1.16E-01	4.23E-06
			Arsenic	1.23E+00	5.26E-05	5.64E-02	2.06E-06
			Lead	3.50E+00	1.50E-04	1.14E-01	4.16E-06
			Zinc	6.85E+01	2.93E-03	2.41E+00	8.79E-05
			1,2-Dichloroethane	1.40E+00	5.99E-05	7.67E-02	2.80E-06

Table 4-8
(continued)

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE @ (mg/kg/day)
		Child 6-12	Trichloroethene	4.80E+00	2.86E-04	4.30E-01	2.26E-06
			trans-1,2-Dichloroethene	6.90E+01	4.11E-03	3.97E+00	2.09E-05
			Vinyl chloride	8.90E+00	5.30E-04	3.88E-01	2.04E-06
			Benzene	3.00E-01	1.79E-05	3.05E-02	1.60E-07
			1,2-Dichlorobenzene	1.80E+00	1.07E-04	1.16E-01	6.10E-07
			Arsenic	1.23E+00	7.33E-05	5.64E-02	2.97E-07
			Lead	3.50E+00	2.09E-04	1.14E-01	6.00E-07
			Zinc	6.85E+01	4.08E-03	2.41E+00	1.27E-05
			1,2-Dichloroethane	1.40E+00	8.34E-05	7.67E-02	4.03E-07
		Child 2-6	Trichloroethene	4.80E+00	3.46E-04	4.30E-01	1.82E-06
			trans-1,2-Dichloroethene	6.90E+01	4.97E-03	3.97E+00	1.68E-05
			Vinyl chloride	8.90E+00	6.41E-04	3.88E-01	1.64E-06
			Benzene	3.00E-01	2.16E-05	3.05E-02	1.29E-07
			1,2-Dichlorobenzene	1.80E+00	1.30E-04	1.16E-01	4.91E-07
			Arsenic	1.23E+00	8.86E-05	5.64E-02	2.39E-07
			Lead	3.50E+00	2.52E-04	1.14E-01	4.83E-07
			Zinc	6.85E+01	4.93E-03	2.41E+00	1.02E-05
			1,2-Dichloroethane	1.40E+00	1.01E-04	7.67E-02	3.25E-07
	INGESTION (drinking) (2)	Adults	Trichloroethene	4.80E+00	1.03E-01	4.30E-01	7.85E-03
			trans-1,2-Dichloroethene	6.90E+01	1.48E+00	3.97E+00	7.25E-02
			Vinyl chloride	8.90E+00	1.90E-01	3.88E-01	7.08E-03
			Benzene	3.00E-01	6.42E-03	3.05E-02	5.57E-04
			1,2-Dichlorobenzene	1.80E+00	3.85E-02	1.16E-01	2.12E-03
			Arsenic	1.23E+00	2.63E-02	5.64E-02	1.03E-03
			Lead	3.50E+00	7.49E-02	1.14E-01	2.08E-03
			Zinc	6.85E+01	1.46E+00	2.41E+00	4.40E-02
			1,2-Dichloroethane	1.40E+00	3.00E-02	7.67E-02	1.40E-03
		Child 6-12	Trichloroethene	4.80E+00	2.48E-01	4.30E-01	1.96E-03
			trans-1,2-Dichloroethene	6.90E+01	3.56E+00	3.97E+00	1.81E-02
			Vinyl chloride	8.90E+00	4.59E-01	3.88E-01	1.77E-03
			Benzene	3.00E-01	1.55E-02	3.05E-02	1.39E-04
			1,2-Dichlorobenzene	1.80E+00	9.29E-02	1.16E-01	5.29E-04
			Arsenic	1.23E+00	6.35E-02	5.64E-02	2.57E-04
			Lead	3.50E+00	1.81E-01	1.14E-01	5.20E-04
			Zinc	6.85E+01	3.54E+00	2.41E+00	1.10E-02
			1,2-Dichloroethane	1.40E+00	7.22E-02	7.67E-02	3.50E-04

Table 4-8
(continued)

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE @ (mg/kg/day)
		Child 2-6	Trichloroethene	4.80E+00	2.25E-01	4.30E-01	1.19E-03
			trans-1,2-Dichloroethene	6.90E+01	3.24E+00	3.97E+00	1.10E-02
			Vinyl chloride	8.90E+00	4.17E-01	3.88E-01	1.07E-03
			Benzene	3.00E-01	1.41E-02	3.05E-02	8.41E-05
			1,2-Dichlorobenzene	1.80E+00	8.44E-02	1.16E-01	3.20E-04
			Arsenic	1.23E+00	5.77E-02	5.64E-02	1.56E-04
			Lead	3.50E+00	1.64E-01	1.14E-01	3.15E-04
			Zinc	6.85E+01	3.21E+00	2.41E+00	6.67E-03
			1,2-Dichloroethane	1.40E+00	6.57E-02	7.67E-02	2.12E-04
GROUND WATER (Deep subzone)	INHALATION (bathing) (1)	Adults	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	3.42E-03	3.96E-03	5.78E-04
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+000
			Arsenic	9.00E-03	Not volatile	5.33E-03	Not volatile
			Lead	1.10E-02	Not volatile	3.21E-03	Not volatile
			Zinc	1.7E+00	Not volatile	2.77E-01	Not volatile
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Child 6-12	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	4.56E-03	3.96E-03	7.97E-05
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	Not volatile	5.33E-03	Not volatile
			Lead	1.10E-02	Not volatile	3.21E-03	Not volatile
			Zinc	1.7E+00	Not volatile	2.77E-01	Not volatile
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Ild 2-6	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	4.50E-03	3.96E-03	5.24E-05
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	Not volatile	5.33E-03	Not volatile
			Lead	1.10E-02	Not volatile	3.21E-03	Not volatile
			Zinc	1.7E+00	Not volatile	2.77E-01	Not volatile
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-8
(continued)

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE @ (mg/kg/day)
	DERMAL bathing (2)	Adults	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	8.56E-07	3.96E-03	1.45E-07
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	3.85E-07	5.33E-03	1.95E-07
			Lead	1.10E-02	4.71E-07	3.21E-03	1.17E-07
			Zinc	1.7E+00	7.27E-05	2.77E-01	1.01E-05
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Child 6-12	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	1.19E-06	3.96E-03	2.08E-08
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	5.36E-07	5.33E-03	2.80E-08
			Lead	1.10E-02	6.56E-07	3.21E-03	1.69E-08
			Zinc	1.7E+00	1.01E-04	2.77E-01	1.40E-06
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Child 2-6	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	1.44E-06	3.96E-03	1.68E-08
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	6.48E-07	5.33E-03	2.26E-08
			Lead	1.10E-02	7.92E-07	3.21E-03	1.36E-08
			Zinc	1.7E+00	1.22E-04	2.77E-01	1.17E-06
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	INGESTION (2)	Adults	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	4.28E-04	3.96E-03	7.23E-05
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	1.93E-04	5.33E-03	9.73E-05
			Lead	1.10E-02	2.35E-04	3.21E-03	5.86E-05
			Zinc	1.7E+00	3.65E-02	2.77E-01	5.06E-03
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-8
(continued)

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE @ (mg/kg/day)
		Child 6-12	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	1.03E-03	3.96E-03	1.81E-05
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	4.64E-04	5.33E-03	2.43E-05
			Lead	1.10E-02	5.68E-04	3.21E-03	1.46E-05
			Zinc	1.7E+00	8.76E-02	2.77E-01	1.26E-03
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Child 2-6	Trichloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			trans-1,2-Dichloroethene	2.00E-02	9.38E-04	3.96E-03	1.09E-05
			Vinyl chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			1,2-Dichlorobenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Arsenic	9.00E-03	4.22E-04	5.33E-03	1.47E-05
			Lead	1.10E-02	5.16E-04	3.21E-03	8.86E-06
			Zinc	1.7E+00	7.97E-02	2.77E-01	7.64E-04
			1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND WATER CLTL Production well	INHALATION (vapors)	Worker (3)	Trichloroethene			4.05E-02	7.56E-03
			trans-1,2-Dichloroethene			6.18E-02	1.15E-02
			Vinyl chloride			4.26E-04	7.95E-05
			Benzene			8.52E-04	1.59E-04
			1,2-Dichlorobenzene			0.00E+00	0.00E+00
			Arsenic			Not volatile	0.00E+00
			Lead			Not volatile	0.00E+00
			Zinc			Not volatile	0.00E+00
			1,2-Dichloroethane			6.39E-04	1.19E-04
		Adults (4)	Trichloroethene			1.06E-04	2.19E-05
			trans-1,2-Dichloroethene			1.36E-04	2.81E-05
			Vinyl chloride			3.86E-06	7.97E-07
			Benzene			1.83E-06	3.78E-07
			1,2-Dichlorobenzene			0.00E+00	0.00E+00
			Arsenic			Not volatile	0.00E+00
			Lead			Not volatile	0.00E+00
			Zinc			Not volatile	0.00E+00
			1,2-Dichloroethane			5.64E-07	1.16E-07

Table 4-8
(continued)

Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE # (mg/kg/day)
		Child 6-12 (4)	Trichloroethene			1.06E-04	2.98E-06
			trans-1,2-Dichloroethene			1.36E-04	3.83E-06
			Vinyl chloride			3.86E-06	1.09E-07
			Benzene			1.83E-06	5.15E-08
			1,2-Dichlorobenzene			0.00E+00	0.00E+00
			Arsenic			Not volatile	0.00E+00
			Lead			Not volatile	0.00E+00
			Zinc			Not volatile	0.00E+00
			1,2-Dichloroethane			5.64E-07	1.59E-08
		Child 2-6 (4)	Trichloroethene			1.06E-04	2.03E-06
			trans-1,2-Dichloroethene			1.36E-04	2.60E-06
			Vinyl chloride			3.86E-06	7.39E-08
			Benzene			1.83E-06	3.50E-08
			1,2-Dichlorobenzene			0.00E+00	0.00E+00
			Arsenic			Not volatile	0.00E+00
			Lead			Not volatile	0.00E+00
			Zinc			Not volatile	0.00E+00
			1,2-Dichloroethane			5.64E-07	1.08E-08
	DERMAL	Worker (3)	Trichloroethene			1.90E+00	2.31E-04
			trans-1,2-Dichloroethene			2.90E+00	3.53E-04
			Vinyl chloride			2.00E-02	2.43E-06
			Benzene			4.00E-02	4.87E-06
			1,2-Dichlorobenzene			0.00E+00	0.00E+00
			Arsenic			0.00E+00	0.00E+00
			Lead			0.00E+00	0.00E+00
			Zinc			8.00E-02	9.73E-06
			1,2-Dichloroethane			3.00E-02	3.65E-06

\# Chronic intake (X years/68 years) = Lifetime weighted intakes for adults X=58; child 6-12, X=6; child 2-6, X=4.
(1) Ground water concentration (mg/L)
(2) Concentration is in mg/L
(3) Inhalation of volatilized compounds from CLTL production well (Appendix D), mg/cubic meter
(4) Concentration from ISC screening model detailed in Appendix E.

Sample calculations are provided in Appendix F.

Table 4-7 presents the exposure characteristics (i.e., duration, frequency, etc.) for each exposure route. Monitoring data were used in this RA to determine the exposure point concentrations for ground water use.

The concentration of volatilized compounds from the trailer rinsing operation at the nearest residential area was calculated in the following manner:

- Calculation of emission rates for indicators detected in ground water from the CLTL production well (Table 4-4); and

- Calculation of exposure point concentrations using the Industrial Source Complex (ISC) Model in a screening mode. Details of this screening study are presented in Appendix E. The exposure point concentrations are given in Table 4-8.

- For worker exposure, the monitoring data from ground water samples from the CLTL production well were used as exposure point concentrations.

The calculation of intakes of contaminants from the above exposure routes was performed according to EPA guidance (USEPA 1986a, 1988). The resulting intakes for chronic and subchronic exposure levels are presented in Table 4-8. Sample calculations using the medium concentration, parameters of exposure, and calculations of intakes are presented in Appendix F.

SECTION 5
TOXICITY EVALUATION

5.1 Introduction

The toxicity evaluation is conducted as part of the risk assessment to quantitatively and qualitatively assess the potential for adverse human health effects from exposure to the indicators at the CLTL site. The quantitative portion of the evaluation entails identifying the relevant indices of toxicity against which exposure point intakes can be compared in the risk characterization of the site. These toxicity indices are presented in Table 5-1. The qualitative aspect of the evaluation includes a summary of the pertinent toxicology data for each compound as well as the EPA (Federal Register 1986) and International Agency for Research on Cancer (IARC) (IARC 1987) weight-of-evidence classifications which describe each compound's potential for human carcinogenicity. The background and methodology for the toxicity evaluation is presented in the SPHEM (USEPA 1986a).

The weight-of-evidence carcinogenicity classification followed by a brief summary of the adverse health effects associated with each indicator are presented below. A detailed toxicology profile for each indicator is included in Appendix G.

5.2 Weight-of-Evidence Carcinogenicity Classification

Arsenic (inorganic), benzene, and vinyl chloride have all been classified by both EPA and IARC as known human carcinogens on the basis of human epidemiological studies; this rating corresponds to Class A and Group 1, respectively.

1,2-Dichloroethane has been classified by EPA as a probable human carcinogen (Class B2) and by IARC as a possible human carcinogen (Group 2B) on the basis of experimental evidence of carcinogenicity in several species of laboratory animals.

TABLE 5-1

RELEVANT QUANTITATIVE INDICES OF
TOXICOLOGY FOR INDICATOR COMPOUNDS

COMPOUND	CLASS	ORAL AIS mg/kg/day	ORAL RfD mg/kg/day	INHALATION AIS mg/kg/day	INHALATION RfD mg/kg/day	ORAL CPF 1/(mg/kg/day)	INHALATION CPF 1/(mg/kg/day)	SOURCE
Arsenic	PC	N/A	N/A	N/A	N/A	1.8	50	IRIS
Benzene	PC	N/A	N/A	N/A	N/A	0.029	0.029	IRIS
1,2-Dichlorobenzene	NC	0.9	0.09	0.4	0.04	N/A	N/A	PHRED
1,2-Dichloroethane	PC	N/A	N/A	N/A	N/A	0.091	0.091	IRIS
Lead	NC	ND	0.0014	ND	0.00043	ND	ND	SPHEM
trans-1,2-Dichloroethene	NC	0.2	0.02	-	-	N/A	N/A	IRIS
Trichloroethene	PC	N/A	N/A	N/A	N/A	0.011	0.013	IRIS
Vinyl Chloride	PC	N/A	N/A	N/A	N/A	2.3	0.295	ATSDR
Zinc	NC	0.2	0.2	ND	ND	N/A	N/A	ECAO

N/A - Not applicable
ND - Not determined
ATSDR - Agency for Toxic Substances and Disease Registry
IRIS - EPA Integrated Risk Information System; IRIS accessed on-line 1/20/89
PHRED - Public Health Risk Evaluation Database; updated 9/88
SPHEM - Superfund Public Health Evaluation Manual
ECAO - USEPA Environmental Criteria and Assessment Office - Health Effects Assessment Summary Tables Second Quarter FY 1989
AIS - Acceptable subchronic intake
RfD - Reference dose (long term or chronic conditions)
CPF - Carcinogenic potency factor
PC - Potential carcinogen
NC - Noncarcinogen

Trichloroethene has been classified by EPA as a probable human carcinogen (Class B2) and by IARC as a compound for which carcinogenicity to humans is not classifiable (Group 3) due to limited or inadequate data.

Lead has not yet been classified by EPA and is classified by IARC as a possible human carcinogen (Group 2B).

Trans-1,2-Dichloroethene, 1,2-dichlorobenzene, and zinc are classified as non-carcinogens (Group D) by EPA. IARC has not classified trans-1,2-dichloroethene as a carcinogen and has classified 1,2-dichlorobenzene as a compound for which carcinogenicity to humans is not classifiable due to limited or inadequate data (Group 3).

5.3 Summaries of Adverse Health Effects

Arsenic

Large doses of inorganic arsenic taken orally can cause death. Lower doses may cause a variety of systemic effects such as irritation of the digestive tract, liver, and kidney injury, decreased production of white and red blood cells, and impaired nerve function causing a "pins and needles" sensation in the feet and hands. Oral exposure to inorganic arsenic causes characteristic skin abnormalities including hyperpigmentation and small "corns" (hyperkeratoses) which may ultimate progress to skin cancer. Arsenic ingestion has also been reported to increase the risk of liver, bladder, kidney and lung cancer. Inhaled arsenic has the ability to increase the risk of lung cancer. This has been observed in smelter workers exposed to high levels of airborne arsenic.

Benzene

Benzene has a low acute toxicity in mammals. Benzene exerts mainly a narcotic action at high concentration levels. Chronic intoxication in man may give rise to severe bone marrow toxicity, eventually resulting in leukemia.

1,2-Dichlorobenzene

1,2-Dichlorobenzene is used as an herbicide, insecticide, and as an industrial solvent. This compound is irritating to the skin and eyes but is not considered highly toxic to humans. The principal toxicology study for 1,2-dichlorobenzene is a National Toxicology Program (NTP) 1985 study. In this chronic study the rats and mice were exposed orally to 1,2-dichlorobenzene and exhibited liver and kidney damage.

1,2-Dichloroethane

1,2-Dichloroethane is moderately toxic upon acute exposure by the oral or inhalation routes, and has a depressing action on the central nervous system. Higher concentrations may also elicit toxic responses in other organs including liver, kidney, lungs, and the heart. Upon repeated exposures, the liver is the main target organ. 1,2-Dichloroethane has been shown to be carcinogenic in laboratory animals, producing tumors in rats and mice at multiple sites, and has also given a positive response in several short-term tests. The substance does not seem to adversely affect reproduction except at doses toxic to the mother.

trans-1,2-Dichloroethene

There have not been many studies on the toxic effects of trans-1,2-dichloroethene. It is believed to enter the body through the lungs, gastrointestinal tract, and the skin. Exposure to high concentrations of trans-1,2-dichloroethene in the air causes nausea, vomiting, weakness, tremors, cramps, and central nervous system depression in humans. Long-term exposure to low concentrations of trans-1,2-dichloroethene to animals did not produce any significant effects. The carcinogenic and reproductive effects of trans-1,2-dichloroethene are currently under study by the National Toxicity Program (NTP).

Lead

Lead is absorbed through the lungs, gastrointestinal tract, and, to a lesser extent, the skin. It is absorbed more readily in children than adults and can cross the placenta to damage the fetus. Lead may decrease the growth and intelligence quotient (IQ) of the fetus and young children. Lead intoxication can cause brain and kidney damage in children and adults. Lead has caused cancer at injection sites in lab animals, an unlikely route of human exposure, and there is insufficient evidence of lead causing cancer in humans.

Trichloroethene

Trichloroethene can be absorbed via inhalation, ingestion, or skin contact. Acute exposure may cause anesthesia and an irregular heartbeat. Long-term exposure can produce damage to the nervous system, leading to incoordination, sleep disturbances, and psychotic episodes. The EPA has classified trichloroethene as a probable human carcinogen. Trichloroethene has caused toxic effects to the fetus, but there is no evidence that it causes developmental effects.

Vinyl Chloride

Vinyl chloride can enter the body through the lungs, gastrointestinal tract, and the skin. Chronic effects include liver and kidney damage, thickening of the skin, and changes in the circulation and bone structure of the fingers. One half of all angiosarcomas of the liver have occurred in vinyl chloride workers. The EPA has classified vinyl chloride as a known human carcinogen (Class A). Vinyl chloride has been shown to cause toxic effects to the fetus and may also cause development defects.

Zinc

Zinc is an essential trace element in human and animal nutrition. In the body it is found in high concentrations in male reproductive organs, pancreatic islets, muscle, kidney, liver and bone. It is essential for the activity of

some enzymes. The human recommended daily allowance of zinc for adults is 15 mg. Zinc appears to be toxic only at levels at least an order of magnitude greater than the RDA; toxicity appears to result from an overload of the homeostatic mechanism for absorption and excretion of zinc.

SECTION 6

RISK CHARACTERIZATION

6.1 Introduction

This section assesses the potential risks to human health associated with exposure to the various indicators under the No-Action Alternative (i.e., no remedial activity) at the CLTL-Bridgeport, New Jersey active terminal site. Both present and future risks are evaluated for identified receptors. The potential risks of exposure to carcinogens and noncarcinogens are assessed separately by the following:

- Comparison of current exposure point concentrations with potentially applicable or relevant and appropriate requirements (ARARs),
- Comparison of estimated intakes of noncarcinogens with acceptable intakes, and
- Conservative estimation of the carcinogenic risks related to exposure to carcinogenic or potentially carcinogenic indicator compounds at the CLTL site.

A discussion of uncertainties encountered in the risk assessment process is included in this section to provide some perspective in interpreting the results of the assessment.

6.2 Applicable or Relevant and Appropriate Requirements (ARARs) and Criteria To Be Considered (TBCs)

Section 121 of CERCLA requires that remedial actions achieve a level of cleanup of hazardous substances that: 1) protects human health and the environment, and 2) meets "legally applicable" standards promulgated by EPA or a state for any hazardous substances or pollutants remaining on the site. In addition, the remedial action must meet cleanup criteria and requirements that are "relevant and appropriate under the circumstances of the release of such a hazardous substance or pollutant or contaminant." The legally applicable standards at a CERCLA site are referred to as ARARs.

Identification of possible requirements, criteria, standards, etc. depends upon the recognized uses and designations of the resources of concern. For those contaminants without ARARs at the CLTL site, a request was made to New Jersey Department of Environmental Protection (NJDEP) for site-specific, medium-specific requirements. These criteria are deemed "to be considered" under the circumstances of the release. The ARARs and TBCs applicable for this site are presented in Table 6-1.

6.2.1 Legally Applicable Standards - ARARs

Maximum Contaminant Levels (MCLs) are promulgated by US EPA under the Safe Drinking Water Act (40 CFR Section 141.1-141.62). MCLs are legally applicable to public water supplies serving 25 or more persons. MCLs have been established for TCE and related organics (40 CFR Section 141.61(a)).

Although there is currently no public water supply in the vicinity of the CLTL active terminal site that has been affected by the releases, MCLs will be considered as legally applicable for this site. The MCLs are relevant and appropriate for Class II aquifers even when no public water supply is affected. Additionally, MCLs will be considered for the residential wells, although these private wells do not serve 25 or more people.

Additional legally applicable standards are: 1) New Jersey Safe Drinking Water Act (NJSDWA) MCLs promulgated under A-280 amendments to the Act (Organics Adopted 5 December 1988 in NJAC 7:10-16); 2) US EPA MCLGs (goals; and 3) New Jersey ground water standards promulgated in NJAC 7:9-6.

EPA does not have legally applicable standards for soils (excluding dioxin and PCBs, which were not detected at the site). New Jersey does not presently have legally applicable soil standards.

6.2.2 "To Be Considered" (TBCs)

In addition to legally binding laws and regulations, many federal and state

Table 6-1

Applicable or Relevant and Appropriate
Requirements (ARARs) and To Be Considered (TBCs)

MEDIUM	ARARs LEGALLY APPLICABLE	TO BE CONSIDERED (TBC)
Ground Water	o US EPA Maximum Contaminant Levels (MCLs) o US EPA MCLGs (Goals) o NJAC 7:9-6 Ground Water Standards o New Jersey Safe Drinking Water Act MCLs	o Proposed MCLs o Health advisories o Drinking water equivalent levels o Risk-specific doses o New Jersey health advisories
Soils	o None applicable	o New Jersey Cleanup Objectives
Air	o OSHA guidelines for worker exposure at active facilities	

ARARs and TBCs provided by New Jersey Department of Environmental Protection (and agreed to by US EPA Region II).

environmental and public health programs also develop criteria, advisories, guidance, and proposed standards that are not legally binding, but that may provide useful information or recommended procedures. These criteria are not ARARs, but are evaluated along with ARARs, to develop protective cleanup level targets. Chemical-specific TBCs such as health advisories and reference doses will be used in the absence of ARARs or where ARARs are not sufficiently protective to develop cleanup goals. In addition, other TBCs such as guidance or policy documents developed to implement regulations may be considered and used as appropriate. After the risk assessment has been conducted, if no ARARs address a particular situation, or if existing ARARs do not ensure protectiveness, to-be-considered advisories, criteria, or guidelines can be useful in setting cleanup targets (US EPA 1988, p. 1-76).

For ground water, the TBCs include proposed MCLs, health advisories, drinking water equivalent levels, or risk specific doses, and state health advisories (US EPA 1988, p. 5-4)

The TBCs for soil at the CLTL site are limited to the NJDEP soil cleanup objectives.

6.3 Comparison of Actual Concentrations with ARARs and TBCs

The actual concentrations of the compounds detected in the shallow/intermediate ground water subzones, the deep ground water subzone, and the surface and subsurface soils are compared with their respective ARARs and TBCs in Table 6-2.

The results of the comparison with ARARS and TBCs for ground water in the shallow/intermediate subzones are summarized below:

- Concentrations of arsenic, chromium, lead, nickel, silver, and zinc (maximum only) exceeded their respective ARARs;
- Concentrations of methylene chloride, trans-1,2-dichloroethene, trichloroethene, benzene, vinyl chloride, 1,2-dichloroethane, tetrachloroethene, chlorobenzene, 1,1-dichloroethene, 1,2-dichloropropane, 1,2-dichlorobenzene (maximum only) and 1,4-dichlorobenzene (maximum only) exceeded their respective ARARs; and

Table 6-2

ENVIRONMENTAL STANDARDS

Concentrations in ppb for ground water and ppm for soils

INDICATOR COMPOUNDS/ CONSTITUENTS	GROUND WATER SHALLOW/INTERMED MAX	SHALLOW/INTERMED AVE	DEEP MAX	DEEP AVE	ARARs EPA MCL (MCLG)	ARARs NJSDWA MCL*	ARARs NJAC 7:9-6 GROUND WATER STANDARDS**	SURF SOILS MAX	SURF SOILS AVE	SUBSURF SOILS MAX	SUBSURF SOILS AVE	TRC CLEANUP OBJECTIVES**
Antimony	9	24.8										
Arsenic	1230	56.4	9	5.33	50	50	50	94.9	11.1	453	11.1	20
Beryllium	7	2.66						0.72	0.297	0.79	0.241	
Cadmium					5		10	8.3	0.675	36.3	1.28	3
Chromium VI	690	53.4	60	27.9	120	50	50	101	18.9	76	12.6	100
Copper	290	43.1	40	14.2	1300		1000	92.9	9.71	39.6	5.34	170
Lead	3500	114	11	3.21	5		50	374	48.2	838	25.8	250-1000
Mercury, inorganic	1	0.499	0.2	0.475	3		2	0.99	0.0824			1
Nickel	160	31.7						31.6	4.93	15.7	3.8	100
Selenium					45	50	10					4
Silver and compounds	20	5.21				50	50			0.9	0.506	5
Thallium								2	9.72	2	9.73	
Zinc	68500	2410	1700	27.7			5000	348	36.8	1320	39.6	350
Methylene chloride	100	7.14				2 +		0.014	0.0035	3.1	0.06	[4]
trans-1,2-Dichloroethene	69000	3970	20	3.96	70	10 +		0.42	0.0169	10	0.179	[4]
Chloroform	30	3.14			100							[4]
Trichloroethene	4800	430			5	1 +				290	7.81	[4]
Benzene	300	30.5			5	1 +				1.16	0.0206	[4]
Toluene	310	13.6	40	5.63	2000			0.53	0.0207	8.57	0.231	[4]
Vinyl chloride	8900	388			2	2 +						[4]
1,2-Dichloroethane	1400	76.7			5	2 +						[4]
Tetrachloroethene	830	24.3			(0)	1 +		1.8	0.0645	16	0.279	[4]
Chlorobenzene	600	30.5			60	4 +				53	0.896	[4]
Ethylbenzene	340	9.82			680			0.74	0.0279	17.4	0.389	[4]
1,1-Dichloroethene	20	3.25			7	2 +						[4]
1,2-Dichloropropane	670	12.4			6							[4]
Trichloromonofluoromethane	50	3.71										[4]
1,1,2-Trichloroethane	70	3.46										[4]
1,1,1-Trichloroethane					200	26 +				0.43	0.00918	[4]
1,2-Dichlorobenzene	1000	116			620	600 +				220	3.81	[4]
1,3-Dichlorobenzene	10	5.22				600 +						[4]
1,4-Dichlorobenzene	40	5.88			600	75				0.96	0.179	[4]
Dibutyl Phthalate	30	5.44								77	1.95	[4]
Diethyl phthalate	50	7										[4]
N-Nitroso-diphenylamine	1050	44.5						2.91	0.308	88	4.38	[4]
1,2,4-Trichlorobenzene	110	6.54						0.73	0.186	4.74	0.245	[4]
Butyl benzyl phthalate	700	23.5						0.98	0.195	639	21.3	[4]
Bis(2-ethylhexyl)phthalate	820	17						22.7	1.33	1020	40.5	[4]
Isophorone	10	5.07										[4]
Nitrobenzene	70	5.96						6.3	0.378			[4]
Phenol	1000	28.6					3.5			12.1	0.434	[4]
2,4-Dichlorphenol	70	6.94								4.4	0.237	[4]

Table 6-2
(continued)

ENVIRONMENTAL STANDARDS

Concentrations in ppb for ground water and ppm for soils

INDICATOR COMPOUNDS/ CONSTITUTENTS	GROUND WATER SHALLOW/INTERMED MAX	GROUND WATER SHALLOW/INTERMED AVE	GROUND WATER DEEP MAX	GROUND WATER DEEP AVE	ARARs EPA MCL (MCLG)	ARARs NJSDWA MCL*	ARARs NJAC 7:9-6 GROUND WATER STANDARDS**	SURF SOILS MAX	SURF SOILS AVE	SUBSURF SOILS MAX	SUBSURF SOILS AVE	TBC CLEANUP OBJECTIVES**
4-Nitrophenol	70	13.6								3.3	0.462	[4]
Dioctyl phthalate								0.58	0.181	3.64	0.233	[4]
Anthracene										2.57	0.204	[4]
Fluoranthene								2.61	0.289	5.8	0.349	[4]
Phenanthrene								7.4	0.504	22	0.619	[4]
Pyrene								2.92	0.296	2.68	0.235	[4]
Benz(a)anthracene								2.71	0.271	0.6	0.173	[4]
Chyrsene								2.82	0.258			[4]
Benzo(k)fluoranthene								3.97	0.328	0.71	0.183	[4]
Benzo(b)fluoranthene								1.02	0.196			[4]
Fluorene										11.6	0.423	[4]
Benzo(a)pyrene								2.61	0.293	0.7	0.175	[4]
Indeno(1,2,3-cd)pyrene								1.25	0.233			[4]
Benzo(ghi)perylene								3.44	0.314			[4]
Acenaphthene										11.6	0.415	[4]
Pentachlorophenol										6.6	0.52	[4]
Ni-Nitroso-dipropylamine								0.48	0.177			[4]
Heptachlor	0.06	0.0255			0.4					0.01	0.00508	[4]
alpha-Hexachlorocyclohexane	0.05	0.0254	0.11	0.0321								[4]
delta-HCCH	0.06	0.0255			0.004	0.0002						[4]
DDT	0.3	0.0342	0.1	0.0313			0.001	0.048	0.0103	0.034	0.00556	[4]
Endosulfan	0.25	0.032										[4]
DDE	1.1	0.0418					0.001	0.99	0.0687	2.49	0.0949	[4]
DDD							0.001	0.4	0.0302	0.383	0.0196	[4]
Cyanide							200	ND	0.025	3.5	0.0895	[4]
Chloroethane	10	5.07										[4]
Naphthalene	2500	97						6.3	0.4	301	6.93	[4]
2-Chloronaphthalene	20	5.22										[4]
Dimethyl phthalate	20	5.29										[4]
2,4-Dimethyl phenol	100	9.91								6.6	0.328	[4]
n-Nitrophenol	40	5.51										[4]
Endosulfan sulfate	0.4	0.104										[4]

* New Jersey State Drinking Water Authority Maximum Contaminant Levels Provided by Roman Luzecky (NJ DEP) Memos Dated 5/5/88 and 5/23/88.
** Provided by Roman Luzecky (NJ DEP) Memo Dated 5/5/88
*** Inorganic Values in Surface Soils in New Jerey Provided by Harry Motto at Cooks College Dated 5/23/88
[4] Soil Cleanup Levels Provided by NJ DEP are 1 ppm for Total Volatile Organics and 10 ppm for Total Base Neutrals Adopted 12/5/88 in NJAC 7:10-16

- Concentrations of DDT and DDE exceeded their respective ARARS.

The comparison for the deep ground water subzone indicated that chromium, trans-1,2-dichloroethene, lead, and DDT exceeded their respective ARARs.

For the surface soils, additional sampling is necessary to fully characterize the extent of contamination in the truck parking lot/driveway area. The comparison results using the current sampling data are as follows:

- Maximum concentrations only of arsenic, cadmium, and chromium exceeded their respective TBCs;
- Maximum concentration of total VOCs exceeded the 1 ppm New Jersey soil cleanup objective; and
- Concentration of total base neutrals exceeded the 10 ppm New Jersey soil cleanup objective.

The comparison of the subsurface soils with TBCs indicated the following:

- Maximum concentrations of arsenic, cadmium, and zinc exceeded their respective TBCs;
- Concentration of total VOCs exceeded 1 ppm (the respective TBC); and
- Concentration of total base-neutrals exceeded the TBC of 10 ppm.

6.4 Calculation of Noncarcinogenic Hazard

As described in the Superfund Public Health Evaluation Manual (USEPA 1986a), noncarcinogenic hazard is evaluated by calculating a hazard index. This index is the ratio of the calculated chronic or subchronic intakes to the acceptable exposure levels. A value of less than one indicates that a reference level has not been exceeded, and is generally not considered to present a significant health risk. Table 6-3 summarizes the assessment of noncarcinogenic hazard under conditions of no remedial action for the site.

Three hazard indices were calculated for the CLTL site. The following populations and scenarios were evaluated:

Table 6-3

Noncarcinogenic Hazard Index

ROUTE OF EXPOSURE	EXPOSURE MEDIA		CHEMICAL	SI (mg/kg/day)	AIS (mg/kg/day)	SI/AIS	CI (mg/kg/day)	RfD (mg/kg/day)	Weighted Hazard Index
INHALATION	GROUND WATER intermediate/ shallow subzone (bathing)	Adults	trans-1,2-Dichloroethene	1.18E+01	2.00E-01	5.90E+01	5.79E-01	2.00E-02	2.90E+01
			1,2-Dichlorobenzene	3.08E-01	4.00E-01	7.70E-01	1.69E-02	4.00E-02	4.23E-01
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 6-12	trans-1,2-Dichloroethene	1.57E+01	2.00E-01	7.87E+01	7.99E-02	2.00E-02	3.99E+00
			1,2-Dichlorobenzene	4.10E-01	4.00E-01	1.03E+00	2.33E-03	4.00E-02	5.83E-02
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 2-6	trans-1,2-Dichloroethene	1.55E+01	2.00E-01	7.76E+01	5.25E-02	2.00E-02	2.63E+00
			1,2-Dichlorobenzene	4.05E-01	4.00E-01	1.01E+00	1.54E-03	4.00E-02	3.84E-02
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
	GROUND WATER deep subzone (bathing)	Adults	trans-1,2-Dichloroethene	3.42E-03	2.00E-01	1.71E-02	5.78E-04	2.00E-02	2.89E-02
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 6-12	trans-1,2-Dichloroethene	4.56E-03	2.00E-01	2.28E-02	7.97E-05	2.00E-02	3.98E-03
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 2-6	trans-1,2-Dichloroethene	4.50E-03	2.00E-01	2.25E-02	5.24E-05	2.00E-02	2.62E-03
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
	GROUND WATER CLTL Production well (vapors from truck rinsing)	Workers	trans-1,2-Dichloroethene	1.90E-02	2.00E-01	9.89E-02	5.79E-03	2.00E-02	2.90E-01
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile		0.00E+00	Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00

Table
(continued)

Noncarcinogenic Hazard Index

ROUTE OF EXPOSURE	EXPOSURE MEDIA		CHEMICAL	SI (mg/kg/day)	AIS (mg/kg/day)	SI/AIS	CI (mg/kg/day)	RfD (mg/kg/day)	Weighted Hazard Index
		Adult	trans-1,2-Dichloroethene	3.88E-05	2.00E-01	1.10E-06	1.41E-05	2.00E-02	7.06E-04
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile			Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 6-12	trans-1,2-Dichloroethene	5.19E-05	2.00E-01	1.47E-06	1.92E-06	2.00E-02	9.61E-05
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile			Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
		Child 2-6	trans-1,2-Dichloroethene	5.09E-05	2.00E-01	1.45E-06	1.30E-06	2.00E-02	6.51E-05
			1,2-Dichlorobenzene	0.00E+00	4.00E-01	0.00E+00	0.00E+00	4.00E-02	0.00E+00
			Lead[a]	Not volatile			Not volatile		0.00E+00
			Zinc	Not volatile		0.00E+00	Not volatile		0.00E+00
DERMAL CONTACT	GROUND WATER intermediate/ shallow subzone	Adults	trans-1,2-Dichloroethene	2.95E-03	2.00E-01	1.48E-02	1.45E-04	2.00E-02	7.25E-03
			1,2-Dichlorobenzene	7.70E-05	9.00E-01	8.56E-05	4.23E-06	9.00E-02	4.71E-05
			Lead[a]	1.50E-04			4.16E-06		
			Zinc	2.93E-03	2.00E-01	1.47E-02	8.79E-05	2.00E-01	4.40E-04
		Child 6-12	trans-1,2-Dichloroethene	4.11E-03	2.00E-01	2.06E-02	2.09E-05	2.00E-02	1.04E-03
			1,2-Dichlorobenzene	1.07E-04	9.00E-01	1.19E-04	6.10E-07	9.00E-02	6.78E-06
			Lead[a]	2.09E-04			6.00E-07		
			Zinc	4.08E-03	2.00E-01	2.04E-02	1.27E-05	2.00E-01	6.35E-05
		Child 2-6	trans-1,2-Dichloroethene	4.97E-03	2.00E-01	2.48E-02	1.68E-05	2.00E-02	8.41E-04
			1,2-Dichlorobenzene	1.30E-04	9.00E-01	1.44E-04	4.91E-07	9.00E-02	5.46E-06
			Lead[a]	2.52E-04			4.83E-07		
			Zinc	4.93E-03	2.00E-01	2.47E-02	1.02E-05	2.00E-01	5.10E-05
	GROUND WATER deep subzone (bathing)	Adults	trans-1,2-Dichloroethene	8.56E-07	2.00E-01	4.28E-06	1.45E-07	2.00E-02	7.23E-06
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	4.71E-07			1.17E-07		
			Zinc	7.27E-05	2.00E-01	3.64E-04	1.01E-05	2.00E-01	5.05E-05
		Child 6-12	trans-1,2-Dichloroethene	1.19E-06	2.00E-01	5.96E-06	2.08E-08	2.00E-02	1.04E-06
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	6.56E-07			1.69E-08		
			Zinc	1.01E-04	2.00E-01	5.05E-04	1.46E-06	2.00E-01	7.30E-06
		Child 2-6	trans-1,2-Dichloroethene	1.44E-06	2.00E-01	7.20E-06	1.68E-08	2.00E-02	8.39E-07
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	7.92E-07			1.36E-08		
			Zinc	1.22E-04	2.00E-01	6.10E-04	1.17E-06	2.00E-01	5.85E-06

Table 6-3
(continued)

Noncarcinogenic Hazard Index

ROUTE OF EXPOSURE	EXPOSURE MEDIA		CHEMICAL	SI (mg/kg/day)	AIS (mg/kg/day)	SI/AIS	CI (mg/kg/day)	RfD (mg/kg/day)	CI/RfD
DERMAL CONTACT	CLTL Production well (spray)	Workers	trans-1,2-Dichloroethene	5.40E-04	2.00E-01	2.70E-03	1.30E-06	2.00E-02	6.51E-05
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	0.00E+00		0.00E+00	0.00E+00		0.00E+00
			Zinc	NA	2.00E-01	NA	9.73E-06	2.00E-01	4.87E-05
INGESTION	GROUND WATER intermediate/ shallow subzone	Adults	trans-1,2-Dichloroethene	1.48E+00	2.00E-01	7.38E+00	7.25E-02	2.00E-02	3.62E+00
			1,2-Dichlorobenzene	3.85E-02	9.00E-01	4.28E-02	2.12E-03	9.00E-02	2.35E-02
			Lead[a]	7.49E-02		5.35E+01	2.00E-03		
			Zinc	1.46E+00	2.00E-01	7.30E+00	4.40E-02	2.00E-01	2.20E-01
		Child 6-12	trans-1,2-Dichloroethene	3.56E+00	2.00E-01	1.78E+01	1.81E-02	2.00E-02	9.06E-01
			1,2-Dichlorobenzene	9.29E-02	9.00E-01	1.03E-01	5.29E-04	9.00E-02	5.88E-03
			Lead[a]	1.81E-01		1.29E+02	5.20E-04		
			Zinc	3.54E+00	2.00E-01	1.77E+01	1.10E-02	2.00E-01	5.50E-02
		Child 2-6	trans-1,2-Dichloroethene	3.24E+00	2.00E-01	1.62E+01	1.10E-02	2.00E-02	5.48E-01
			1,2-Dichlorobenzene	8.44E-02	9.00E-01	9.38E-02	3.20E-04	9.00E-02	3.56E-03
			Lead[a]	1.64E-01		1.17E+02	3.15E-04		
			Zinc	3.21E+00	2.00E-01	1.61E+01	6.67E-03	2.00E-01	3.34E-02
	GROUND WATER deep subzone	Adults	trans-1,2-Dichloroethene	4.20E-04	2.00E-01	2.14E-03	7.23E-05	2.00E-02	3.61E-03
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	2.35E-04		1.68E-01	5.86E-05		
			Zinc	3.65E-02	2.00E-01	1.83E-01	5.06E-03	2.00E-01	2.53E-02
		Child 6-12	trans-1,2-Dichloroethene	1.03E-03	2.00E-01	5.16E-03	1.81E-05	2.00E-02	9.03E-04
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	5.68E-04			1.46E-05		
			Zinc	8.76E-02	2.00E-01	4.38E-01	1.26E-03	2.00E-01	6.30E-03
		Child 2-6	trans-1,2-Dichloroethene	9.38E-04	2.00E-01	4.69E-03	1.09E-05	2.00E-02	5.46E-04
			1,2-Dichlorobenzene	0.00E+00	9.00E-01	0.00E+00	0.00E+00	9.00E-02	0.00E+00
			Lead[a]	5.16E-04			8.86E-06		
			Zinc	7.97E-02	2.00E-01	3.99E-01	7.64E-04	2.00E-01	3.82E-03

Table 6-3
(continued)

Noncarcinogenic Hazard Index

		SUBCHRONIC[a] EXPOSURE	CHRONIC EXPOSURE
residents all exposures except deep ground water	trans-1,2-Dichloroethene =	9.65E+01	4.07E+01
	1,2-Dichlorobenzene =	1.13E+00	5.53E-01
	Lead[d] =	[d]	
	Zinc =	1.17E+01	3.09E-01
	Total =	1.15E+02	4.16E+01
residents exposure to deep ground water	trans-1,2-Dichloroethene =	2.80E-02	4.06E-02
	1,2-Dichlorobenzene =	0.00E+00	0.00E+00
	Lead[d] =	[d]	
	Zinc =	4.39E-01	3.55E-02
	Total =	4.67E-01	7.61E-02
worker exposure	trans-1,2-Dichloroethene =	NA	2.90E-01
	1,2-Dichlorobenzene =	NA	0.00E+00
	Lead[d] =	NA	
	Zinc =	NA	4.87E-05
	Total =		2.90E-01

[a] Since the sum of noncarcinogenic risk exceeds one, the compounds will be summed according to target organs.

NA Not applicable.

[d] The RFD and AIS for lead have been withdrawn by EPA's RfD work group. The HI for lead could not be evaluated. This does not imply an absence of health risk due to lead exposure at the CLTL site.

[e] HI summary data presented for exposures for a child aged 6-12. These exposures resulted in the highest subchronic noncarcinogenic risk levels.

- Residents living near the site who use ground water from the shallow/intermediate subzones as a potable water supply and who may be exposed to compounds volatilizing from the CLTL production well during the truck rinsing operations at the CLTL site;

- Residents who may use ground water from the deep subzone as a potable water supply in the future and who may be exposed to compounds volatilizing from the CLTL production well during the truck rinsing operations at the CLTL site; and

- Workers involved in the truck rinsing operation at the CLTL site.

Additional surface soils sampling is necessary prior to complete determination of the health risks associated with contaminated soils at the CLTL site. A preliminary assessment of the health risks due to inhalation of fugitive dusts from the truck parking lot/driveway area is presented in Appendix D.

The RFD for lead is currently under reconsideration by EPA's RFD workgroup. The HI for lead could not be determined for these exposures.

Case 1

For the first case, subchronic and chronic exposures were calculated for residents living near the CLTL terminal who use ground water from the shallow/intermediate subzones as their sole residential water supply. Three age groups were considered: adults, children ages 2-6 and children ages 6-12. This case evaluated the following routes of exposure:

- Dermal contact with the ground water during bathing;

- Inhalation of volatile organic compounds released (from the ground water) during bathing;

- Ingestion of the ground water; and

- Inhalation of volatilized compounds released during the truck rinsing operation at the CLTL active terminal.

The subchronic and lifetime-weighted hazard indices calculated for the scenario are greater than one, which exceeds EPA's recommended guideline.

When the hazard index exceeds one, it is evaluated on the basis of the toxic endpoints of the indicators. This recalculation considers compounds that produce the same target organ effect. In this case, the hazard index was calculated by indicator.

The chronic hazard indices for exposure to 1,2-dichlorobenzene and zinc are less than one, while the index for trans-1,2- dichloroethene exceedes one. All hazard indices were weighted to account for a lifetime of exposure. The pathway resulting in exceedance of the chronic hazard index for trans-1,2-dichloroethene is ingestion of ground water from the shallow/intermediate subzones by adults, children ages 2-6, and children ages 6-12.

The subchronic hazard indices for all of the indicator compounds exceed one. The HI for 1,2-dichloroethene exceeds one in all age groupsfor inhalation of the compound from groundwater while bathing and ingestion of groundwater by all age groups.

Case 2

For the second case, chronic and subchronic exposures were again calculated for adults, children ages 2-6, and children ages 6-12. The routes of exposure included ingestion and dermal contact with ground water from the deep subzone, and inhalation of volatile organic compounds (detected in this ground water) while bathing. The chronic lifetime-weighted hazard index for all indicators by these exposure routes is less than one. The subchronic hazard indices for these exposure pathways do not exceed one for any age group.

Case 3

Chronic exposures to the workers are dermal contact with compounds contained in and inhalation of compounds volatilized from the CLTL production well ground water during trailer rinsing operations. The hazard index for worker exposure is less than one and has been weighted to account for a lifetime of exposure.

6.5 Calculation of Carcinogenic Risk

Table 6-4
CALCULATION OF TOTAL SITE RISK FROM POTENTIAL CARCINOGENS

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	CI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/(mg/kg/day)	ROUTE/CHEMICAL WEIGHTED RISK
INHALATION	GROUND WATER intermediate/ shallow subzone (bathing)	Adults	Trichloroethene	6.27E-02	1.30E-02	8 E-04
			Vinyl Chloride	5.66E-02	2.95E-01	2 E-02
			Benzene	4.45E-03	2.90E-02	1 E-04
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.12E-02	9.10E-02	1 E-03
		Child 6-12	Trichloroethene	8.65E-03	1.30E-02	1 E-04
			Vinyl chloride	7.81E-03	2.95E-01	2 E-03
			Benzene	6.14E-04	2.90E-02	2 E-05
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.54E-03	9.10E-02	1 E-04
		Child 2-6	Trichloroethene	5.69E-03	1.30E-02	7 E-05
			Vinyl chloride	5.14E-03	2.95E-01	2 E-03
			Benzene	4.04E-04	2.90E-02	1 E-05
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.02E-03	9.10E-02	9 E-05
	GROUND WATER deep subzone (bathing)	Adults	Trichloroethene	0.00E+00	1.30E-02	0 E+00
			Vinyl chloride	0.00E+00	2.95E-01	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 6-12	Trichloroethene	0.00E+00	1.30E-02	0 E+00
			Vinyl chloride	0.00E+00	2.95E-01	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 2-6	Trichloroethene	0.00E+00	1.30E-02	0 E+00
			Vinyl chloride	0.00E+00	2.95E-01	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
	GROUND WATER CLTL production well (vapors)	Workers	Trichloroethene	7.56E-03	1.30E-02	1 E-04
			Vinyl chloride	7.95E-05	2.95E-01	2 E-05
			Benzene	1.59E-04	2.90E-02	5 E-06
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.19E-04	9.10E-02	1 E-05
		Adults	Trichloroethene	2.19E-05	1.30E-02	3 E-07
			Vinyl chloride	7.97E-07	2.95E-01	2 E-07
			Benzene	3.78E-07	2.90E-02	1 E-08
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.16E-07	9.10E-02	1 E-08
		Child 6-12	Trichloroethene	2.98E-06	1.30E-02	4 E-08
			Vinyl chloride	1.09E-07	2.95E-01	3 E-08
			Benzene	5.15E-08	2.90E-02	1 E-09
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.59E-08	9.10E-02	1 E-09
		Child 2-6	Trichloroethene	2.03E-06	1.30E-02	3 E-08
			Vinyl chloride	7.39E-08	2.95E-01	2 E-08
			Benzene	3.50E-08	2.90E-02	1 E-09
			Arsenic	Not volatile	5.00E+01	0 E+00
			1,2-Dichloroethane	1.08E-08	9.10E-02	1 E-09

Table 6-4
(continued)
CALCULATION OF TOTAL SITE RISK FROM POTENTIAL CARCINOGENS

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	CI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/(mg/kg/day)	ROUTE/CHEMICAL WEIGHTED RISK
DERMAL CONTACT	GROUND WATER intermediate/ shallow subzone (bathing)	Adults	Trichloroethene	1.57E-05	1.10E-02	2 E-07
			Vinyl chloride	1.42E-05	2.30E+00	3 E-05
			Benzene	1.11E-06	2.90E-02	3 E-08
			Arsenic	2.06E-06	1.80E+00	4 E-06
			1,2-Dichloroethane	2.8E-06	9.10E-02	3 E-07
		Child 6-12	Trichloroethene	2.26E-06	1.10E-02	2 E-08
			Vinyl chloride	2.04E-06	2.30E+00	5 E-06
			Benzene	1.60E-07	2.90E-02	5 E-09
			Arsenic	2.97E-07	1.80E+00	5 E-07
			1,2-Dichloroethane	4.03E-07	9.10E-02	4 E-08
		Child 2-6	Trichloroethene	1.82E-06	1.10E-02	2 E-08
			Vinyl chloride	1.64E-06	2.30E+00	4 E-06
			Benzene	1.29E-07	2.90E-02	4 E-09
			Arsenic	2.39E-07	1.80E+00	4 E-07
			1,2-Dichloroethane	3.25E-07	9.10E-02	3 E-08
DERMAL CONTACT	GROUND WATER deep subzone (bathing)	Adults	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	1.95E-07	1.80E+00	4 E-07
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 6-12	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	2.80E-08	1.80E+00	5 E-08
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 2-6	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	2.26E-08	1.80E+00	4 E-08
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
	CLTL Production well (spray)	Workers	Trichloroethene	2.31E-04	1.10E-02	3 E-06
			Vinyl chloride	2.43E-06	2.30E+00	6 E-06
			Benzene	4.87E-06	2.90E-02	1 E-07
			Arsenic	0.00E+00	1.80E+00	0 E+00
			1,2-Dichloroethane	3.65E-06	9.10E-02	3 E-07
INGESTION	GROUND WATER intermediate/ shallow subzone	Adults	Trichloroethene	7.85E-03	1.10E-02	9 E-05
			Vinyl chloride	7.08E-03	2.30E+00	2 E-02
			Benzene	5.57E-04	2.90E-02	2 E-05
			Arsenic	1.03E-03	1.80E+00	2 E-03
			1,2-Dichloroethane	1.40E-03	9.10E-02	1 E-04
		Child 6-12	Trichloroethene	1.96E-03	1.10E-02	2 E-05
			Vinyl chloride	1.77E-03	2.30E+00	4 E-03
			Benzene	1.39E-04	2.90E-02	4 E-06
			Arsenic	2.57E-04	1.80E+00	5 E-04
			1,2-Dichloroethane	3.50E-04	9.10E-02	3 E-05
		Child 2-6	Trichloroethene	1.19E-03	1.10E-02	1 E-05
			Vinyl chloride	1.07E-03	2.30E+00	2 E-03
			Benzene	8.41E-05	2.90E-02	2 E-06
			Arsenic	1.56E-04	1.80E+00	3 E-04
			1,2-Dichloroethane	2.12E-04	9.10E-02	2 E-05

Table 6-4
(continued)
CALCULATION OF TOTAL SITE RISK FROM POTENTIAL CARCINOGENS

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	CI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/(mg/kg/day)	ROUTE/CHEMICAL WEIGHTED RISK
	GROUND WATER deep subzone	Adults	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	9.73E-05	1.80E+00	2 E-04
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 6-12	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	2.43E-05	1.80E+00	4 E-05
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00
		Child 2-6	Trichloroethene	0.00E+00	1.10E-02	0 E+00
			Vinyl chloride	0.00E+00	2.30E+00	0 E+00
			Benzene	0.00E+00	2.90E-02	0 E+00
			Arsenic	1.47E-05	1.80E+00	3 E-05
			1,2-Dichloroethane	0.00E+00	9.10E-02	0 E+00

Lifetime weighted risk for residents all pathways except deep ground water = 6 E-02
deep ground water only = 3 E-04
Lifetime weighted risk for workers = 1 E-04

An assessment of potential carcinogenic risks for the No-Action Alternative conditions at the CLTL site is presented in Table 6-4. The first scenario evaluates chronic residential exposure to ground water in the shallow/intermediate subzones (including dermal contact, ingestion, and inhalation of volatile organic compounds during bathing). This scenario includes inhalation of compounds volatilized during trailer rinsing operations at the CLTL active terminal.

The lifetime-weighted risk for this scenario is 6×10^{-2}. EPA's guidelines for acceptable carcinogenic risk at hazardous waste sites is 1×10^{-4} to 1×10^{-7}, with a lifetime risk of 1×10^{-6} commonly used as a benchmark. The risk from compounds detected at the CLTL site for case 1 is greater than the range considered acceptable by EPA. The exposure pathways that result in the exceedance of risk guidelines are ingestion of vinyl chloride and arsenic in the shallow/intermediate ground water subzones by all age groups, inhalation of vinyl chloride, 1,2 dichloroethene and trichloroethene by adults while bathing, and inhalation of vinyl chloride by both age groups of children while bathing.

Chronic exposures for residential exposure to the deep ground water subzone are evaluated in a second scenario. Exposure routes include dermal contact with deep subzone ground water, inhalation of compounds volatilized during bathing, and ingestion of constituents. The lifetime-weighted risk for exposures to the deep ground water subzone is 3×10^{-4}, which is also greater than EPA's acceptable risk range.

Chronic exposures for workers involve dermal contact with and inhalation of volatilized compounds detected in ground water from the CLTL production well during trailer rinsing activities. The lifetime-weighted risk to workers is 8×10^{-5}, which is within EPA's range of acceptable risk at Superfund sites.

6.6 Site-Specific Uncertainties

The risk assessment process is imprecise in its determination of actual human health risks. Uncertainties exist at many levels in the process, including fate

and transport of indicators, definitive measurements of actual or potential human exposures, carcinogenic potency factors for carcinogens, and reference doses for noncarcinogens. The magnitude of uncertainty varies with the quality of data used in the risk assessment process and tends to be both site-specific and substance-specific. In general, regardless of the magnitude of uncertainty, the risk assessment process at every step makes conservative assumptions to protect human health concerns. The EPA risk assessment process is much more likely to over-estimate than under-estimate actual risks to potentially exposed populations.

Uncertainties that are site-specific for the CLTL-Bridgeport, NJ risk assessment include:

- the health risks related to surface soil contamination at the CLTL site have not been fully evaluated. A preliminary assessment of the health risks related to inhalation of fugitive dusts from the CLTL truck parking lot area is presented in Appendix D. Additional surface soil sampling is necessary prior to complete determination of the health risks related to contaminated soils at the CLTL site. These risk levels will be in addition to those determined for groundwater use at CLTL.

- the size of future populations which may be exposed to airborne, waterborne, or soil contaminants; and

- the precise nature of future exposure routes, including the fate and transport modeling of presently detected compounds at the site.

In addition, given the complex nature of contaminants at this site, and the nearby BROS landfill, a potential for contaminant interactions exists for populations which may be exposed to emissions from both facilities.

Further uncertainties exist concerning future pathways of ground water contamination at various depths, confounded by the complex hydrogeologic setting of the site. In addition, air modeling is dependent upon present site uses and conditions on site, such as a large parking area for trucks. Potential future changes in use or configuration of the several acre parking area will affect the nature of airborne emissions from the site and, thus, provide an additional uncertainty in prospective risk assessment. Finally, this assessment is site-specific and has not considered the toxicity of or potential interactions with off-site contaminants. Hence, an additional uncertainty exists in the event

that nearby populations are affected by potentially interacting toxins generated on and off site (e.g., initiating carcinogens on site, such as vinyl chloride, and promoting carcinogens from the BROS landfill, such as polycyclic aromatic hydrocarbons).

SECTION 7
CONCLUSIONS

7.1 Background

The baseline risk assessment (RA) is a process which evaluates the collective demographic, geographic, physical, chemical, and biological factors at a site in order to determine the magnitude of the public health impact if no remediation were to take place at the site. This report has been prepared in order to evaluate the potential level of risk at the Chemical Leaman Tank Lines (CLTL), Bridgeport, New Jersey terminal under conditions of a No-Action Alternative.

7.2 Exposure Scenarios

The two potentially exposed populations identified for the site are residents living in the vicinity of the site and individuals working in the CLTL trailer rinsing operation at the active terminal. The media examined in this RA were the shallow/intermediate ground water subzones, the deep ground water subzone, and air (vapors). The exposure pathways for the residents, which include adults, children ages 2-6, and children ages 6-12, are as follows:

- Inhalation of volatilized compounds from ground water (i.e., the CLTL production well) during trailer rinsing operations at the active terminal;
- Inhalation of and dermal contact with compounds detected in the shallow/intermediate ground water subzones during bathing;
- Ingestion of compounds detected in shallow/intermediate ground water subzones;
- Inhalation of and dermal contact with compounds detected in the deep ground water subzone during bathing; and

- Ingestion of compounds detected in the deep ground water subzone.

The exposure pathways for the worker are inhalation of and dermal contact with compounds detected in the ground water from the CLTL production well during trailer rinsing operations. Additional surface soil sampling is necessary to fully determine the extent of contamination in the truck parking lot/driveway area. A preliminary assessment of the health risk due to inhalation of fugitive dusts from the truck parking lot/driveway area is presented in Appendix D.

7.3 Evaluation of ARARs and TBCs

Section 121 of CERCLA requires that remedial actions achieve a level of cleanup of hazardous substances that: 1) protects human health and the environment, and 2) meets "legally applicable" standards promulgated by EPA or a state for any hazardous substances or pollutants remaining on the site. In addition, the remedial action must meet cleanup criteria and requirements that are "relevant and appropriate under the circumstances of the release of such a hazardous substance or pollutant or contaminant." The legally applicable standards at a CERCLA site are referred to as "ARARs."

Identification of possible requirements, criteria, standards, etc. depends upon the recognized uses and designations of the resources of concern. If ARARs did not exist for a compound detected at the CLTL site, a request was made to New Jersey Department of Environmental Protection (NJDEP) for site-specific, medium-specific requirements. These criteria are deemed "to be considered" under the circumstances of the release. The ARARs and TBCs applicable for this site are presented in Table 7-1.

Actual concentrations of Priority Pollutant contaminants detected

Table 7-1

Applicable or Relevant and Appropriate
Requirements (ARARs) and To Be Considered (TBCs)

MEDIUM	ARARs LEGALLY APPLICABLE	TO BE CONSIDERED (TBC)
Ground Water	o US EPA Maximum Contaminant Levels (MCLs) o US EPA MCLGs (Goals) o NJAC 7:9-6 Ground Water Standards o New Jersey Safe Drinking Water Act MCLs	o Proposed MCLs o Health advisories o Drinking water equivalent levels o Risk-specific doses o New Jersey health advisories
Soils	o None applicable	o New Jersey Cleanup Objectives
Air	o OSHA guidelines for worker exposure at active facilities	

ARARs and TBCs provided by New Jersey Department of Environmental Protection (and agreed to by US EPA Region II).

in various media at the CLTL active terminal site were compared to ARARs and TBCs. Both average concentrations and maximum concentrations (for a given constituent in a particular medium) were evaluated. The conclusions of this comparison are presented in the following subsections.

Ground Water

Concentrations of various inorganic constituents and organic compounds detected in the shallow, intermediate and deep subzones exceeded their respective ARARs. The five exceedances for the inorganics are the maximum and average concentrations of arsenic, chromium, lead, nickel, and silver. In addition, the maximum concentration of zinc detected in this subzone exceeded the ARAR, although the average concentration of zinc was less than the ARAR.

Maximum and average concentrations of ten organic compounds (detected in the shallow/intermediate ground water subzones) exceeded their respective ARARs. These include methylene chloride, trans-1,2-dichloroethene, trichloroethene, benzene, vinyl chloride, 1,2-dichloroethane, tetrachloroethene, chlorobenzene, 1,1-dichloroethene, and 1,2-dichloropropane. Maximum but not average concentrations of 1,2-dichlorobenzene and 1,4-dichlorobenzene exceeded their respective ARARs, as well.

DDT and DDE were detected (in the shallow/intermediate ground water subzones) in maximum and average concentrations which exceeded their respective ARARs.

Four compounds were detected in excess of ARARs in the deep subzone: chromium, lead, trans-1,2-dichloroethene, and DDT. Each exceedance occurred one time, although most of the monitoring wells for the deep ground water subzone have undergone more than one round of sampling.

TABLE 7-2

SUMMARY OF THE RISKS ASSOCIATED WITH
THE CLTL BRIDGEPORT, NJ TERMINAL

CONDITIONS	DESCRIPTION	LIFETIME WEIGHTED CARCINOGENIC RISK *
Resident	Ambient air from the ground water from the CLTL production well used for trailer rinsing.	6E-07
	Groundwater from the shallow/ intermediate subzones used for bathing and drinking purposes	**6E-02**
	Groundwater from the deep subzone used for bathing and drinking purposes	**3E-04**
Worker	Ambient air from the groundwater from the CLTL production well used for trailer rinsing (inhalation and dermal contact)	1E-04

		LIFETIME WEIGHTED NONCARCINOGENIC HAZARD INDEX**	SUBCHRONIC NONCARCINOGENIC HAZARD INDEX**
Resident	EXPOSURES EXCLUDING DEEP GROUNDWATER SUBZONE	**Total 4.16E+01**	**1.15E+02**
	trans-1,2-dichloroethene	**4.07E+01**	**9.65E+01**
	1,2-dichlorobenzene	5.53E-01	**1.13E+00**
	zinc	3.09E-01	**1.17E+01**
	lead	***	***
	EXPOSURES TO DEEP GROUNDWATER SUBZONE	Total 9.93E-02	4.67E-01
	trans-1,2-dichloroethene	4.06E-02	2.80E-02
	1,2-dichlorobenzene	0	0
	zinc	3.55E-02	4.39E-01
	lead	***	***
Worker	trans-1,2-dichloroethene	2.90E-01	NA
	1,2-dichlorobenzene	0	NA
	zinc	4.87E-05	NA
	lead	***	NA

Bold values indicate that the calculated risk is greater than EPA's acceptable ranges.
Carcinogenic recommended guidelines - 1.00E-04 to 1.00E-07 (EPA)
Hazard Index - less than one (EPA)

* Indicators evaluated: trichloroethene, vinyl chloride, arsenic, benzene and 1,2-dichlorobenzene
** Indicators evaluated: trans-1,2-dichloroethene, 1,2-dichlorobenzene, zinc and lead
*** EPA has withdrawn the reference dose for lead for reconsideration. The hazard index for lead could not be evaluated. This does not imply an absence of health risk due to lead exposure at the CLTL site.
NA = Not Applicable

Soils

For surface soils, the comparison of actual concentrations with TBCs (i.e., NJDEP soil cleanup objectives) resulted in the identification of several constituents which exceeded TBCs. Maximum concentrations of arsenic, cadmium, and chromium exceeded their respective TBCs. In addition, the maximum concentration of total VOCs exceeded the NJDEP soil cleanup objective of 1 ppm. Finally, several surface soil samples had concentrations of total base neutrals greater than the TBC of 10 ppm.

The comparison of actual concentrations of compounds detected in subsurface soils also identified samples where TBCs were exceeded. Maximum concentrations of arsenic, cadmium, and zinc exceeded the TBCs. The maximum and average concentrations of total VOCs exceeded the TBC of 1 ppm. The concentration of total base neutrals also exceeded the TBC in several samples.

7.4 Results of Risk and Hazard Index Calculations

Carcinogenic Risk

The conclusions drawn from the analyses performed in this assessment are presented in Table 7-2. The lifetime-weighted carcinogenic risk to the residents (excluding exposures to the deep ground water subzone) is 6×10^{-2}, which is over two orders of magnitude greater than the highest end of EPA's acceptable range (1×10^{-4} to 1×10^{-7}). The risk is mostly attributable to ingestion and inhalation of vinyl chloride and ingestion of arsenic in the shallow/intermediate ground water subzones.

The risk to residents who might use the deep ground water subzone as a potable water supply is 3×10^{-4}, which is higher than EPA's acceptable range. This risk is associated with the arsenic concentrations detected in the deep ground water subzone.

However, if the aquifer were to be used for drinking water, the MCL for arsenic (50 ppb) would be the primary ARAR. The deep ground water subzone has a maximum arsenic concentration of 9 ppb, which is below the MCL for arsenic.

The lifetime-weighted risk to workers in the trailer rinsing operation is 1×10^{-4}, which is within the acceptable range.

Noncarcinogenic Hazard

The hazard index evaluates exposure to noncarcinogens. The subchronic and chronic hazard indices were calculated for each noncarcinogen evaluated and then totaled. For residents exposed to ground water in the shallow/intermediate subzones (but excluding exposure to the deep subzone), the total subchronic and chronic hazard indices were greater than one, which exceeds EPA's recommended guideline.

The hazard indices were subsequently evaluated separately for each indicator. The chronic hazard indices for exposure to 1,2 dichlorobenzene and zinc are less than one, while the index for trans-1,2-dichloroethene exceeds one. The pathway resulting in exceedance of the chronic hazard index for trans-1,2-dichloroethene is ingestion of groundwater from the shallow/intermediate subzones by adults, children ages 2-6 and children ages 6-12.

The subchronic hazard indices for all of the indicator compounds exceed one. The HI for 1,2 dichlorobenzene exceeds one in all age groups for inhalation of the compound in groundwater. The HI for 1,2 diclorobenzene exceeds one due to childhood exposure to the compound through inhalation while bathing. The HI for zinc exceeds one for ingestion of groundwater by all age groups.

The lifetime-weighted total hazard index for potential deep ground

water subzone use was less than one when all of the indices were summed. Also, the total hazard index for worker exposure was less than one when all the indices were summed.

7.5 Perspective

The calculated risk and hazard values should be evaluated in the following context:

- Until 1987, most of the residents in the vicinity of the site maintained individual water supply wells. However, several of these wells have not been used for drinking water since levels of solvents and other chemicals were detected above drinking water standards in the ground water in the late 1970s. During 1987, the homes north of the site along Rt. 44 were connected to an extension of the Bridgeport Municipal Water System (Gloucester County Health Department, personal communication). In the interim, between the late 1970s and the date of completion of the Bridgeport municipal water line, CLTL provided, upon request, potable water from Pureland Water Company at no cost to homes in the area. Several homes, which were not connected to the municipal water line, are still supplied bottled water by CLTL.

- Approximately 20 homes are located within 2000 feet of the CLTL site boundary. Several of these homes are currently using groundwater from private wells for household uses. The most recent residential well sampling (March 29, 1989) detected TCE at levels above the Federal MCL in one private well. There is potential for current and future exposure to CLTL-related groundwater contaminants in the vicinity of the CLTL facility.

- A preliminary assessment of the health risks related to inhalation of fugitive dusts from the CLTL truck parking lot area is presented in Appendix D. Additional surface soil sampling is necessary prior to complete determination of the health risks related to contaminated soils at the CLTL site. These risk levels will be in addition to those determined for groundwater use at CLTL.

APPENDIX A

Appendix A contains the analytical data from the Remedial Investigation (ERM 1989). The following tables and figures are included:

Figure

1-10	Locations of Residential Wells in the Vicinity of the CLTL Site included in the Monthly EPA Monitoring

Table

1-7	Range in Concentration of Priority Pollutant Volatile Organic Compounds in Ground Water Samples Collected by EPA from Residential Wells in the Vicinity of the Chemical Leaman Site
4-7	Priority Pollutant Organic Compounds in Ground Water Collected From Deep Subzone Wells in the Remedial Investigation at the CLTL Site
4-8	Priority Pollutant Organic Compounds in Ground Water Collected From Intermediate Subzone Wells in the Remedial Investigation at the CLTL Site
4-9	Priority Pollutant Organic Compounds in Ground Water Collected from Shallow Subzone Wells in the Remedial Investigation at the CLTL Site
4-12	Priority Pollutant Inorganic Constituents, Classical Parameters, and Water Quality Parameters in Ground Water Collected from Deep Subzone Wells in the Remedial Investigation at the CLTL Site

Table (Continued)

Table (Continued)

Figure 1-10
Locations of Residential Wells in the Vicinity of the CLTL Site Included in the Monthly EPA Monitoring

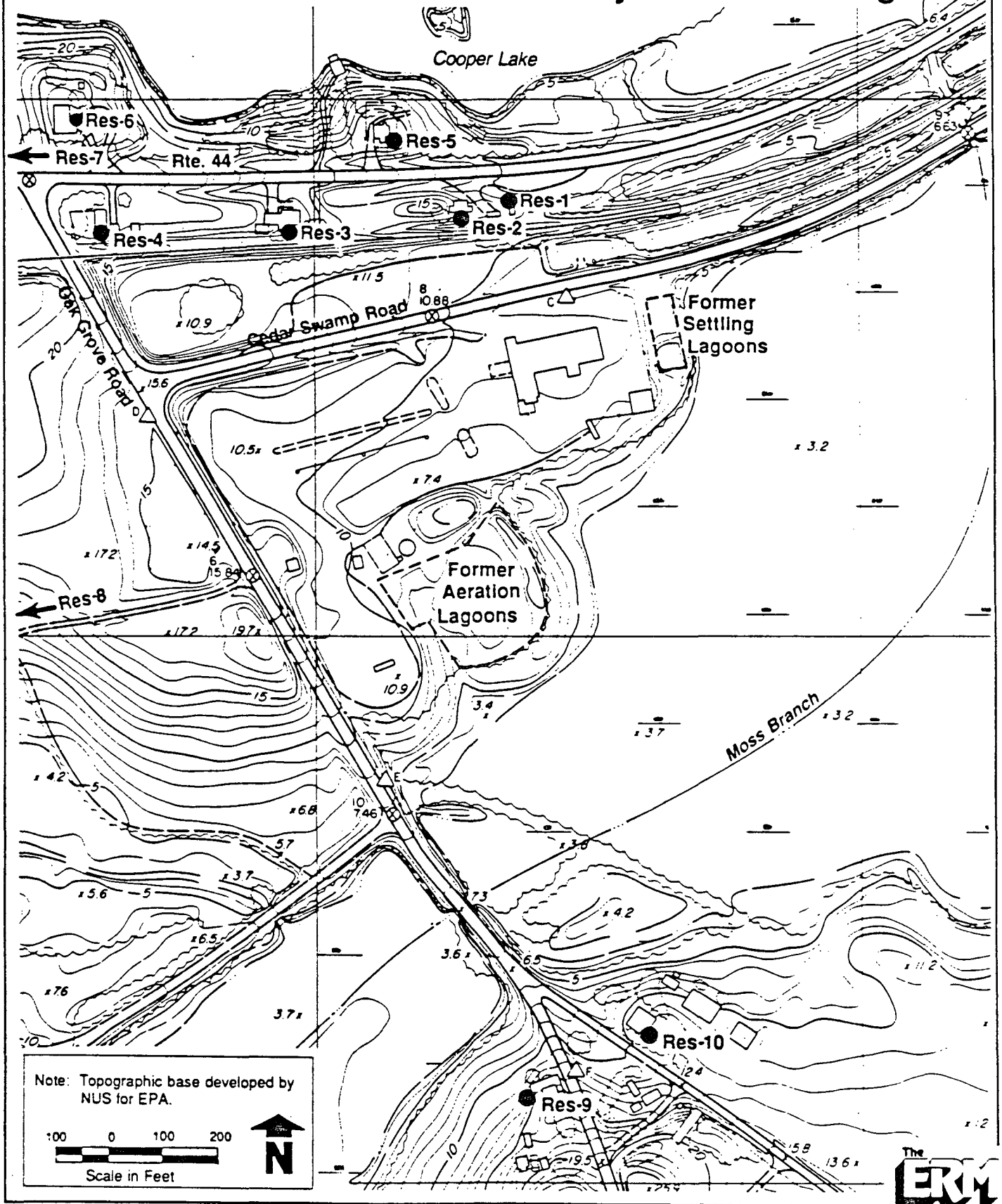


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Table 1-7

Range in Concentration of Priority Pollutant Volatile Organic Compounds in Ground Water Samples Collected by EPA from Residential Wells in the Vicinity of the Chemical Leaman Site

PARAMETER:	Location				
	Res-1	Res-2	Res-3	Res-4	Res-5
Times Sampled	15	29	28	12	16
Benzene	*	ND-37 *25X*	*	*	*
Chlorobenzene	*	ND-13 *21X*	*	*	*
1,2-dichloroethane	ND-2J *1X*	ND-93 *26X*	*	*	*
Chloroform	ND-2K *1X*	ND-2.4 *5X*	*	ND-2K *1X*	ND-2K *1X*
1,1-dichloroethylene	*	ND-2K *1X*	*	*	*
1,2-trans dichloroethylene	ND-1J,2K *2X*	21-1000 *29X*	6.3-40 *28X*	*	ND-2K *1X*
1,2-dichloropropane	*	ND-2K *4X*	*	*	*
Methylene chloride	*	ND-2K *4X*	ND-2K *2X*	ND-2.2 *1X*	*
Tetrachloroethylene	*	18-770 *29X*	ND-2K *7X*	*	ND-11 *8X*
Toluene	*	ND-6.8 *1X*	*	*	*
Trichloroethylene	3.3-45 *15X*	1.4K-40 *29X*	75-260 *28X*	*	ND-2K *3X*
Vinyl chloride	*	ND-1800 *27X*	*	*	*
2-butanone	*	*	*	*	ND-4 *1X*

EPA Qualifiers:
All concentrations in ug/l.
ND=Not Detetced.
K=Detected but not quantified. Actual value known to be less than value given.
J=Estimated value.

ERM Qualifiers:
X=Number of times detected.
*=Not Detected or Not Analyzed at specific sampling events.
Verified screened intervals of these wells are not available; wells reportedly screened in intermediate subzone.

Table 1-7 , (cont.)

PARAMETER:	Location				
	Res-6	Res-7	Res-8	Res-9	Res-10
Times Sampled	12	7	12	8	11
Benzene	*	*	*	*	*
Chlorobenzene	*	*	*	*	*
1,2-dichloroethane	*	*	*	*	*
Chloroform	*	ND-2K *1X*	*	ND-2K *1X*	*
1,1-dichloroethylene	*	*	*	*	*
1,2-trans dichloroethylene	*	*	*	*	*
1,2-dichloropropane	*	*	*	*	*
Methylene chloride	*	*	*	*	*
Tetrachloroethylene	*	*	*	*	*
Toluene	*	*	*	*	*
Trichloroethylene	*	*	*	*	*
Vinyl chloride	*	*	*	*	*
2-butanone	*	*	*	*	*

EPA Qualifiers:
All concentrations in ug/l.
ND=Not detected.
K=Detected but not quantified. Actual values known to be less than value given.
J=Estimated value.

ERM Qualifiers:
X=Number of times detected.
*=Not Detected or Not Analyzed at specific sampling events.
Verified screened intervals of these wells are not available; wells reportedly screened in intermediate subzone.

Table 4-7

Priority Pollutant Organic Compounds in Ground Water Collected from Deep Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	ARAR, IF KNOWN*	DEEP SUBZONE WELLS											
		1 C		4 D			9 A		10 D	USGS-C		USGS-D ●	
		Jun-88	Sep-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Jun-88	Sep-88
VOLATILES													
METHYLENE CHLORIDE	2										NS		NS
TRANS-1,2-DICHLOROETHENE	10			20									
CHLOROFORM													
TRICHLOROETHENE	1												
BENZENE	1												
TOLUENE									40				
VINYL CHLORIDE	2												
1,2-DICHLOROETHANE	2												
TETRACHLOROETHENE	1												
CHLOROBENZENE	4												
ETHYLBENZENE													
1,1-DICHLOROETHENE	2												
1,2-DICHLOROPROPANE													
FLUOROTRICHLOROMETHANE													
1,1,2-TRICHLOROETHANE													
CHLOROETHANE													
SEMIVOLATILES													
1,2-DICHLOROBENZENE													
1,3-DICHLOROBENZENE													
1,4-DICHLOROBENZENE													
NAPHTHALENE													
DI-N-BUTYL PHTHALATE													
DIETHYL PHTHALATE													
N-NITROSODIPHENYLAMINE													
1,2,4-TRICHLOROBENZENE													
2-CHLORONAPHTHALENE													
BUTYL BENZYL PHTHALATE													
BIS(2-ETHYLHEXYL)PHTHALATE													
ISOPHORONE													
DIMETHYL PHTHALATE													
NITROBENZENE													
PHENOL													
2,4-DIMETHYLPHENOL													
2,4-DICHLOROPHENOL													
4-NITROPHENOL													
2-NITROPHENOL													
PESTICIDES													
HEPTACHLOR													
ALPHA BHC			0.11										
DELTA BHC													
ODT			0.10										
ENDOSULFAN 1													
ENDOSULFAN SULFATE													
DDE													

● COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCNETRATION ENTERED FOR COMPOUNDS NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(e) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 5/88

Table 4-8

Priority Pollutant Organic Compounds in Ground Water Collected from Intermediate Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS															
		1 B		2 B		2C			2 D		3 B		4 C		5 A		
		Jun-86	Sep-86	Jun-86	Sep-86 **	Jun-86	Sep-86	May-88	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Sep-86		Sep-86
VOLATILES																	
METHYLENE CHLORIDE	2					10							10				
TRANS-1,2-DICHLOROETHENE	10			990	500	1400	820	1100			710	310	20000	11000			
CHLOROFORM																	
TRICHLOROETHENE	1			4100	1500	4800	1200	470			220		1500	40			
BENZENE	1			10		60	20				70	40	160	90			
TOLUENE				20													
VINYL CHLORIDE	2					60	30				210	70	610				
1,2-DICHLOROETHANE	2			40	20	90	50				20		20	20			
TETRACHLOROETHENE	1					100	30										
CHLOROBENZENE	4					40	10				10		30	10			
ETHYLBENZENE						30							20				
1,1-DICHLOROETHENE	2												20				
1,2-DICHLOROPROPANE																	
FLUOROTRICHLOROMETHANE				50		40											
1,1,2-TRICHLOROETHANE																	
CHLOROETHANE																	
SEMIVOLATILES																	
1,2-DICHLOROBENZENE				1400	610	1600	1400	1100 J			30	20					
1,3-DICHLOROBENZENE								10 J									
1,4-DICHLOROBENZENE						10											
NAPHTHALENE				60	50	80	70	68						20			
DI-N-BUTYL PHTHALATE																	
DIETHYL PHTHALATE																	
N-NITROSODIPHENYLAMINE								12									
1,2,4-TRICHLOROBENZENE																	
2-CHLORONAPHTHALENE																	
BUTYL BENZYL PHTHALATE																	
BIS(2-ETHYLHEXYL)PHTHALATE																	
ISOPHORONE																	
DIMETHYL PHTHALATE																	
NITROBENZENE																	
PHENOL					30												
2,4-DIMETHYLPHENOL																	
2,4-DICHLOROPHENOL																	
4-NITROPHENOL																	
2-NITROPHENOL																	
PESTICIDES																	
HEPTACHLOR																	
ALPHA BHC																	
DELTA BHC																	
DDT							0 3										
ENDOSULFAN 1							0.09										
ENDOSULFAN SULFATE																	
DDE																	

@ COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(a) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 6/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-8 , (cont.)

COMPOUND	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS (CONT)																	
		8 B		7 B		9C	10C	CL - 3		CL - 6		DW-1			USG S-A		USG S-B		
		Jun-86	Sep-86	Jun-86	Sep-86	Mar-86	Mar-86	Jun-86	Sep-86 **	Jun-86	Sep-86 **	Jun-86***	Sep-86 **	Mar-86	Jun-86	Sep-86	Jun-86	Sep-86	
VOLATILES																			
METHYLENE CHLORIDE	2							80	100							NS		NS	
TRANS-1,2-DICHLOROETHENE	10		30		70	620	8	14000	14000	43000	6600	38000	69000	25000					
CHLOROFORM								20											
TRICHLOROETHENE	1	40	170	100	100	1500		2000	3800	900	80	2200	200	200					
BENZENE	1						9	150	190				300	140					
TOLUENE								50	80				200	110					
VINYL CHLORIDE	2							570	700	800		2400	5200	1300					
1,2-DICHLOROETHANE	2								390	1200	170		400	290					
TETRACHLOROETHENE	1					9.5		30											
CHLOROBENZENE	4						8	60	60		180		200	140					
ETHYLBENZENE								20					100						
1,1-DICHLOROETHENE	2							20											
1,2-DICHLOROPROPANE								30											
FLUOROTRICHLOROMETHANE																			
1,1,2-TRICHLOROETHANE																			
CHLOROETHANE																			
SEMIVOLATILES																			
1,2-DICHLOROBENZENE								30		60	20			16					
1,3-DICHLOROBENZENE																			
1,4-DICHLOROBENZENE																			
NAPHTHALENE								120	30	520	100	130	180	120					
DI-N-BUTYL PHTHALATE																			
DIETHYL PHTHALATE								50	20	30	30	10		21					
N-NITROSODIPHENYLAMINE								150	30	460	300	60	110	87					
1,2,4-TRICHLOROBENZENE																			
2-CHLORONAPHTHALENE																			
BUTYL BENZYL PHTHALATE																			
BIS(2-ETHYLHEXYL)PHTHALATE																			
ISOPHORONE												10							
DIMETHYL PHTHALATE								20	10										
NITROBENZENE									70										
PHENOL									470	1000	80								
2,4-DIMETHYLPHENOL								80		60		30		89					
2,4-DICHLOROPHENOL										70		10		87					
4-NITROPHENOL								20	70										
2-NITROPHENOL									40										
PESTICIDES																			
HEPTACHLOR																			
ALPHA BHC												0.05							
DELTA BHC										0.06									
DDT		0.1																	
ENDOSULFAN 1		0.25																	
ENDOSULFAN SULFATE																			
DDE									0.07		0.05								

@ COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(#) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 6/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-8 , (cont.)

COMPOUND	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS (CONT)						PRODUCTION WELL	
		Res-2		Res-1		Res-3			
		Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
VOLATILES									
METHYLENE CHLORIDE	2		NS		NS		NS	NS	50
TRANS-1,2-DICHLOROETHENE	10	100							2900
CHLOROFORM									
TRICHLOROETHENE	1			50		80			1900
BENZENE	1								40
TOLUENE									
VINYL CHLORIDE	2	30							20
1,2-DICHLOROETHANE	2								30
TETRACHLOROETHENE	1	160							10
CHLOROBENZENE	4								10
ETHYLBENZENE									
1,1-DICHLOROETHENE	2								
1,2-DICHLOROPROPANE									
FLUOROTRICHLOROMETHANE									
1,1,2-TRICHLOROETHANE									
CHLOROETHANE									
SEMIVOLATILES									
1,2-DICHLOROBENZENE									
1,3-DICHLOROBENZENE									
1,4-DICHLOROBENZENE									
NAPHTHALENE									
DI-N-BUTYL PHTHALATE									
DIETHYL PHTHALATE									
N-NITROSODIPHENYLAMINE									
1,2,4-TRICHLOROBENZENE									
2-CHLORONAPHTHALENE									
BUTYL BENZYL PHTHALATE									
BIS(2-ETHYLHEXYL)PHTHALATE									
ISOPHORONE									
DIMETHYL PHTHALATE									
NITROBENZENE									
PHENOL									
2,4-DIMETHYLPHENOL									
2,4-DICHLOROPHENOL									
4-NITROPHENOL									
2-NITROPHENOL									
PESTICIDES									
HEPTACHLOR									
ALPHA BHC									
DELTA BHC									
ODT									
ENDOSULFAN I									
ENDOSULFAN SULFATE									
DDE									

@ COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(@) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 6/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-9

Priority Pollutant Organic Compounds in Ground Water Collected from Shallow Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	ARAR, IF KNOWN*	SHALLOW SUBZONE WELLS															
		1 A		2 A		3 A		4 A		7 A		8 A		CL-1	
		Jun-88	Sep-88	Jun-88	Sep-88	Jun-88	Sep-88 **	Jun-88	Sep-88 **	Jun-88	Sep-88	Jun-88	Sep-88 **	Jun-88	Sep-88
VOLATILES															
METHYLENE CHLORIDE	2			20											
TRANS-1,2-DICHLOROETHENE	10					80	10					15000	5900		
CHLOROFORM													30		
TRICHLOROETHENE	1					40							50		
BENZENE	1					80	50						290		
TOLUENE								30					310		
VINYL CHLORIDE	2					30						5900	8900		
1,2-DICHLOROETHANE	2											900	1400		
TETRACHLOROETHENE	1												70		
CHLOROBENZENE	4					20	10					600	600		
ETHYLBENZENE						10							340		
1,1-DICHLOROETHENE	2												20		
1,2-DICHLOROPROPANE													670		
FLUOROTRICHLOROMETHANE															
1,1,2-TRICHLOROETHANE													70		
CHLOROETHANE						10									
SEMIVOLATILES															
1,2-DICHLOROBENZENE				20	20	40	20					350	410		
1,3-DICHLOROBENZENE												10			
1,4-DICHLOROBENZENE												40			
NAPHTHALENE												2500	2240		
DI-N-BUTYL PHTHALATE										10		30			
DIETHYL PHTHALATE												10			
N-NITROSODIPHENYLAMINE												480	1050		
1,2,4-TRICHLOROBENZENE												110			
2-CHLORONAPHTHALENE												20			
BUTYL BENZYL PHTHALATE												780	490		
BIS(2-ETHYLHEXYL)PHTHALATE												820			
ISOPHORONE															
DIMETHYL PHTHALATE															
NITROBENZENE															
PHENOL												50			
2,4-DIMETHYLPHENOL												100			
2,4-DICHLOROPHENOL															
4-NITROPHENOL															
2-NITROPHENOL															
PESTICIDES															
HEPTACHLOR															
ALPHA BHC															
DELTA BHC															
DDT										0.3					
ENDOSULFAN 1		0.1		0.05						0.11					
ENDOSULFAN SULFATE				0.4											
DDE													1.1		

(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCNETRATIONS ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(#) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 6/88

Table 4-9,(cont.)

COMPOUND	ARAR, IF KNOWN*	SHALLOW SUBZONE WELLS (CONT)															
		CL-2		CL-4		TP-1		TP-12		TP-13		TP-16		TP-19		TP-22	
		Jun-88	Sep-88	Jun-88	Sep-88	Jun-88	Sep-88 **	Jun-88	Sep-88 #	Jun-88	Sep-88	Jun-88	Sep-88##	Jun-88	Sep-88	Jun-88	Sep-88
VOLATILES																	
METHYLENE CHLORIDE	2			20	10			NA		NA	NA			NA	NA	NA	NA
TRANS-1,2-DICHLOROETHENE	10	270	1500	1900	1800	20	60		1100								
CHLOROFORM																	
TRICHLOROETHENE	1	130	60	930	1100		30		500								
BENZENE	1	10		150	150												
TOLUENE				10	10												
VINYL CHLORIDE	2	80	30	80	70				30								
1,2-DICHLOROETHANE	2	20	10	80	90												
TETRACHLOROETHENE	1	830	310														
CHLOROBENZENE	4			10	10												
ETHYLBENZENE				10													
1,1-DICHLOROETHENE	2																
1,2-DICHLOROPROPANE																	
FLUOROTRICHLOROMETHANE																	
1,1,2-TRICHLOROETHANE																	
CHLOROETHANE																	
SEMIVOLATILES																	
1,2-DICHLOROBENZENE				150	150												
1,3-DICHLOROBENZENE		10															
1,4-DICHLOROBENZENE		20	10														
NAPHTHALENE				30	20												
DI-N-BUTYL PHTHALATE																	
DIETHYL PHTHALATE																	
N-NITROSODIPHENYLAMINE																	
1,2,4-TRICHLOROBENZENE																	
2-CHLORONAPHTHALENE																	
BUTYL BENZYL PHTHALATE																	
BIS(2-ETHYLHEXYL)PHTHALATE																	
ISOPHORONE																	
DIMETHYL PHTHALATE																	
NITROBENZENE																	
PHENOL																	
2,4-DIMETHYLPHENOL																	
2,4-DICHLOROPHENOL																	
4-NITROPHENOL																	
2-NITROPHENOL																	
PESTICIDES																	
HEPTACHLOR				0.06													
ALPHA BHC																	
DELTA BHC																	
ODT																	
ENDOSULFAN 1																	
ENDOSULFAN SULFATE																	
DDE																	

(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCNETRATIONS ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT
CONCENTRATIONS REPORTED IN ug/L (PPB)
(#) ANALYZED FOR VOLATILES ONLY
(**) VOLATILE HOLDING TIME EXCEEDED
(***) EXTRACTION HOLDING TIME EXCEEDED ON ACID EXTRACTABLES AND BASE NEUTRALS; CONCENTRATIONS SUSPECT

*GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJ DRINKING WATER QUALITY INSTITUTE
OBTAINED FROM NJDEP 6/88

Table 4-12

Priority Pollutant Inorganic Constituents, Classical Parameters, and Water Quality Parameters in Ground Water Collected from Deep Subzone Wells in the Remedial Investigation at the CLTL Site

PARAMETER	ARAR, IF KNOWN*	DEEP SUBZONE WELLS									
		1C		4D			9A		10D	USGS-C		USGS-D @	
		Jun-88	Sep-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Jun-88	Sep-88
ARSENIC	50						9				NS		NS
ANTIMONY													
BERYLLIUM													
CADMIUM	10												
CHROMIUM	50								60				
COPPER	1000					30			40				
LEAD	50								11				
MERCURY	2								0.2				
NICKEL						60 J							
SELENIUM	10												
SILVER	50												
THALLIUM													
ZINC	5000	220	1700	40	80	510 J	250	70	340 J	70			
PHENOLS			4										
CYANIDE **	200												
TOC		1000	2400	2600	1400	1500 B	1300	1000	8700 J	2800			
TOX				24				9	28 B				
COD **			93000				23000		19000				
TDS **		132000	83000	458000	76000	120000	143000	92000	430000	83000			

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1988 AND SEPTEMBER 1988 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1988. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(#) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.6 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

Table 4-13

Priority Pollutant Inorganic Constituents, Classical Parameters, and Water Quality Parameters in Ground Water Collected from Intermediate Subzone Wells in the Remedial Investigation at the CLTL Site

PARAMETER	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS															
		1 B		2 B		2C			2 D		3 B		4 C		6 A		
		Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	
ARSENIC	50				20							4		6			
ANTIMONY																	
BERYLLIUM																	
CADMIUM	10																
CHROMIUM	50				100												
COPPER	1000			60	290		70	180				50		110		80	
LEAD	50																
MERCURY	2							0.2									
NICKEL					120			70									
SELENIUM	10																
SILVER	50																
THALLIUM																	
ZINC	5000	50	400	200	3360	260	1660	2410 J		500	390	760	90	210	60	120	
PHENOLS				19	34	38	29	29			32	26	39	19		8	
CYANIDE **	200																
TOC		2200	1100	14000	12000	14000	14000	11000 J	1500	1500	29000	36000	29000	25000	4600	4600	
TOX		22		8200	1500	4600	1900	2600	7	66	700	370	13000	59	47000	17	
COD **		13000	46000	40000	124000	48000	58000	121000			126000	136000	100000	86000	47000	27000	
TDS **		147000	158000	427000	264000	473000	374000	340000	151000	138000	460000	406000	488000	465000	290000	174000	

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATIONS ENTERED FOR PARAMTERS NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1986 AND SEPTEMBER 1986 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1986. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(#) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.6 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-13, (cont.)

PARAMETER	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS (CONT)															
		6 B		7 B		8C	10C	CL - 3		CL - 6		DW-1			USG B-A		
		Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	
ARSENIC	50					10		165	90	1230	580	21		20		NS	
ANTIMONY								9									
BERYLLIUM								7	6								
CADMIUM	10																
CHROMIUM	50			60													
COPPER	1000					80	50	180	70	70							
LEAD	50						5 B	3500	380					6 B			
MERCURY	2						0.2										
NICKEL								120	160								
SELENIUM	10																
SILVER	50											20					
THALLIUM																	
ZINC	5000	50	80		300	200 J	900 J	840	320	5840	2050				7020		
PHENOLS		4				0	0	2900	610	1400	184	50	147	310 J			
CYANIDE **	200																
TOC		1000	5800	1800	4100	1700 J	45000 J	20000	15000	36000	18000	40000	49000	800 J	3000		
TOX		37	150	60	120	1800	140	11000	6000		2600	23000	23000	12000	13		
COD **						14000	107000	110000	70000	477000	70000	176000	201000	311000			
TDS **		123000	80000	240000	295000	180000	580000	480000	449000	156000 *	319000	596000 *	541000	400000	237000		

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATIONS ENTERED FOR PARAMTERS NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1986 AND SEPTEMBER 1986 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1986. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(a) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) *REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION*

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.6 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-13, (cont.)

PARAMETER	ARAR, IF KNOWN*	INTERMEDIATE SUBZONE WELLS (CONT)									
		USG 9-B		Res-2		Res-1		Res-3		PRODUCTION WELL	
		Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
ARSENIC	50	27	NS		NS		NS		NS	NS	
ANTIMONY											
BERYLLIUM											
CADMIUM	10										
CHROMIUM	50										
COPPER	1000			100				160			50
LEAD	50	2380									
MERCURY	2										
NICKEL											
SELENIUM	10										
SILVER	50										
THALLIUM											
ZINC	5000	100				130					80
PHENOLS											30
CYANIDE **	200										
TOC		1300		3400		700		1200			4700
TOX				200		40		65			2500
COD **				14000							
TDS **		63000		234000		63000		198000			172000

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATIONS ENTERED FOR PARAMTERS NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1986 AND SEPTEMBER 1986 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1986. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(B) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.8 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-14

Priority Pollutant Inorganic Constituents, Classical Parameters, and Water Quality Parameters in Ground Water Collected from Shallow Subzone Wells in the Remedial Investigation at the CLTL Site

PARAMETER	ARAR, IF KNOWN*	SHALLOW SUBZONE WELLS															
		1 A		2 A		3 A		4 A		7 A		8 A		CL - 1		CL - 2	
		Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
ARSENIC	50		20				50			190	50	160	100			14	
ANTIMONY																	
BERYLLIUM										@							
CADMIUM	10																
CHROMIUM	50	300				280	120	70		690		310	60	200		50	
COPPER	1000	220		50		120	80	30		270		110	30	40	40		
LEAD	50	200								200		650					
MERCURY	2												1				
NICKEL		100		70		80	80			160							
SELENIUM	10																
SILVER	50																
THALLIUM																	
ZINC	5000	190		590	1300	2640	1160	60	80	1710	2100	1110	690	230	90	50	200
PHENOLS				6	5	66	20	66	46			310	360				7
CYANIDE **	200																
TOC		4600	1600	12000	13000	59000	64000	120000	38000	3400	2200	57000	44000	2400	2700	5900	8800
TOX				88	450	360	210	28	32		13	13000	6000	6	14	690	1100
COD **		44000	31000	57000	38000	271000 *	233000	228000	185000	42000	46000	742000	309000		16000	38000	31000
TDS **		186000	149000	306000	295000	732000	840000	532000	977000	62000	89000	620000 *	429000	236000	211000	373000	333000

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATIONS ENTERED FOR PARAMTERS NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1986 AND SEPTEMBER 1986 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1986. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(#) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.6 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

Table 4-14, (cont.)

PARAMETER	ARAR, IF KNOWN*	SHALLOW SUBZONE WELLS (CONT)													
		CL - 4		TP - 1		TP-12		TP-13		TP-16		TP-19		TP-22	
		Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86 #	Jun-86	Sep-86	Jun-86	Sep-86
ARSENIC	50	12	20	5	9	NA	NA	NA	NA	160		NA	NA	NA	NA
ANTIMONY															
BERYLLIUM															
CADMIUM	10														
CHROMIUM	50									50					
COPPER	1000		30							30					
LEAD	50				480										
MERCURY	2														
NICKEL		50	50												
SELENIUM	10														
SILVER	50														
THALLIUM															
ZINC	5000	50	80	58100	68500					140					
PHENOLS		65	41	8						6					
CYANIDE **	200														
TOC		19000	21000	9900	13000					30000					
TOX		2100	1800	45	110					24					
COD **		47000	70000	47000	54000					113000					
TDS **		522000 *	576000	228000	289000					282000 *					

@ COMPLETED BELOW DEEP SUBZONE
ALL RESULTS REPORTED IN ug/l (PPB)
NO CONCENTRATIONS ENTERED FOR PARAMTERS NOT DETECTED ABOVE QUANTITATION LIMIT
(*) ANALYSIS HOLDING TIME EXCEEDED; CONCENTRATIONS SUSPECT
(**) ALL CYANIDE ANALYSIS HOLDING TIMES WERE EXCEEDED FOR JUNE 1986 AND SEPTEMBER 1986 AND ALL COD AND TDS ANALYSIS HOLDING TIMES WERE EXCEEDED FOR SEPTEMBER 1986. CONCENTRATIONS ARE ESTIMATED FOR THESE PARAMETERS ON THESE DATES.
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
(#) ANALYZED FOR VOLATILES ONLY
(J) REPORTED RESULT IS A QUANTITATIVE ESTIMATE
(B) REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION

* NJ GROUND WATER STANDARDS/OBJECTIVES (ug/l) - NJAC 7:9-6.6 GROUND WATER QUALITY CRITERIA OBTAINED FROM NJDEP 5/88

Table 4-15

Tentatively Identified Organic Compounds in Ground Water Collected from Deep Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	DEEP SUBZONE WELLS											
	1C		4D			6A		10D	USGS-C		USGS-D	
	Jun-88	Sep-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Jun-88	Sep-88
METHYL ESTER OF 9-OCTADECANOIC ACID												
AMINO METHYL PENTANONE												
DIMETHYL BENZENE												
CYCLOHEXANONE												
METHYLETHYOXYPROPANE												
TRIMETHYLCYCLOHEXANONE												
BENZENE METHANOL												
DIMETHYL BENZENE METHANOL												
BUTOXYBUTENE												
2-DICHLOROETHENYL BENZENE ISOMER												
NITROCRESOL												
ETHYL CRESOL ISOMER												
1,2-BIS(2-CHLOROETHOXY)ETHANE												
1,2-BIS(CHLOROETHOXY)ETHANE												
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER												
2 ETHYLHEXANOL												
N-PHENYLBENZENAMINE												
CHLOROETHANOL PHOSPHATE												
TOLUENE								7				
STYRENE												
BENZENAMINE												
CHLOROETHENYL BENZENE												
2-ETHOXYLHEXANOIC ACID												
ETHYL PHENOL ISOMER												
DIMETHYL PHENOL ISOMER												
CHLOROPHENOL ISOMER												
UNKNOWN PHTHALATE ESTER												
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE			11						24		10	
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID									27			
CHLORINATED HYDROCARBON												
2-METHYLBENZENAMINE												
METHYL PHENOL ISOMER												
(1-METHYLETHYL)BENZENE												
1-HEXANE												
2-HEXANE												
HEXADECANOIC ACID												
3,3,5-TRIMETHYL-CYCLOHEXANONE												
3,3,6-TRIMETHYL-CYCLOHEXANE												
2,2-DIMETHYL-1-PROPANOL												
3-(1-METHYLETHYL)-PHENOL												
(1)BENZOTHIENO(4,6 - B)(1)BENZOTHIOPHENE												
4-METHYLPHENOL												
1,7-DIHYDRO-6H-PURIN-6-ONE												
ALPHA-HYDROXY-BENZENEACETIC ACID												
TERT-BUTOXYISOPROPOXY METHANE												
1,2-BENZENEDICARBOXYLIC ACID ESTER												
3,3-DIMETHYL-2(3H)-BENZOFURANONE												
N,N-DIMETHYL ACETAMIDE												
4-HYDROXY-3-METHYL-2-BUTANONE												
1-METHOXY-2-PROPANONE												
ETHYL ESTER PHOSPHORIC ACID												
BIS(2-METHOXYETHYL)PHTHALATE												
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL												
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL												
DIMETHYL PHENOL												
(2-METHOXYETHOXY)ETHENE												
2,2'-OXYBIS-BUTANE												
1-METHOXY-2-BUTANOL												
1,1'-OXYBIS-2-PROPANOL												
MONOPROPANOATE PROPANOL												
ESTER 1,2-BENZENEDICARBOXYLIC ACID												
HEXAHYDRO 2H-AZEPIN-2-ONE			32				30					
9,12-OCTADECADIEN-1-OL			12									
BUTYL MYRISTATE(BUTYL TETRADECYLATE)			18									

Table 4-15, (cont.)

COMPOUND	DEEP SUBZONE WELLS										
	1C		4D			8A		10D	USGS-C		USGS-D	
	Jun-88	Sep-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Mar-88	Jun-88	Sep-88	Jun-88	Sep-88
UNKNOWN HYDROCARBON						73			14	NS	10	NS
2-(2-METHOXYETHOXY)ETHANOL												
SATURATED ALIPHATIC HYDROCARBON												
ALIPHATIC HYDROCARBON	129			21		11						
ETHYLESTER CARBAMIC ACID	23											
HYDROXY METHYL PENTANONE	41											
METHOXY ETHOXY ETHANOL	12											
BUTYL BENZENE SULFONAMIDE	27											
HEXANOIC ACID												
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL												
HEPTADECENE-8-CARBONIC ACID												
XYLENE												
BENZOFURAN												
1-PROPYNYL BENZENE												
2-CHLORO-6-METHYL PYRIDINE												
1-METHYLNAPHTHALENE												
4,4'-(1-METHYLETHYLDIENE)BISPHENOL												
1,1'-OXYBISETHANE												
N,N-DIMETHYLFORAMIDE												
METHYLBENZENAMINE												
CHLOROBENZENAMINE												
BENZO(B)THIOPHENE												
OCTYL PHENOL ISOMER												
2-CHLORO-PHOSPHATE ETHANOL												
HEXANE												
2-BUTOXY ETHANOL												
2-METHYLPENTENE												
1,1-TETRAHYDROTHIOPHENE DIOXIDE												
BENZOTHIOZOLE												
4-(1,1-DIMETHYLETHYL)PHENOL												
UNKNOWN								18				
PROPANOL												
METHYL DIMETHYLMETHOXYPROPANE												
HYDROXYPROPOXYPROPANOL												
UNKNOWN PYRIDINE												
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)												
TETRAMETHYL BUTYL PHENOL												
FATTY ACID												
METHOXYMETHYL AZIRIDINE												
HYDROXYMETHYL BENZENE ACETIC ACID												
AZULENE												
DIMETHYL PROPANOL												
METHYL FORMAMIDE												
ACETONE												
BIS(1-METHYL-2-HYDROXYETHYL)ETHER												
METHYL NAPHTHALENE												
UNKNOWN PHTHALATE ESTER			11									
CRESOL												
BENZOIC ACID												
BENZENEACETIC ACID												
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL												
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD												
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL												
PHENOXY ETHANOL												
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID												
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE												

Table 4-15, (cont.)

COMPOUND	DEEP SUBZONE WELLS											
	1 C		4 D			6 A		10 D	USGS-C		USGS-D @	
	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
FATTY ACID ESTER ALPHA-TERPINEOL 3-METHYL-2-CYCLOHEXEN-1-ONE 1,1,3-TRIMETHYL-CYCLOPENTANE				12								
HEXADECANE TRICHLOROETHENE DICHLOROIDOMETHANE 3-METHOXY-2-METHYLPHENOL												
2-CHLORO,PHOSPHATE (3:1) ETHANOL DIMETHYL BENZENE ISOMER MOL. SULFUR METHYL NAPTHALENE ISOMER												
XYLENE ISOMER 1,2,4-TRIMETHYLBENZENE 3-METHYL-BENZENAMINE UNDECANE												
CHLORO BENZENAMINE ISOMER TETRADECANE 2,6,10,16-TETRAMETHYL-HEPTADECANE PENTADECANE												
PHOSPHORIC ACID ESTER 2-METHYL-2,4-PENTANDIOL METHYL-BENZENAMINE ISOMER DIETHYL ESTER 2-BUTENEDIOIC ACID												
4-METHYL-2-NITROPHENOL 2-(2-HYDROXYPROPOXY)-1-PROPANOL 4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID 3-CHLORO BENZENAMINE												
TRIETHYL ESTER PHOSPHORIC ACID METHYL PIRODINE ISOMER 2, METHYL PHENOL 1,4 DICHLORO 2 ETHENYL BENZENE BICYCLO(4,2,0)OCTA 1,3,6 TRIENE												
ETHANOL, 2-PHENOXY UNKNOWN ALKENE UNKNOWN ALIPHATIC HYDROCARBON ISOMER OF CHLOROAMILINE 7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL		13						19				
UNKNOWN THIOPHENE UNKNOWN PHENOL ETHANOL, 2-CHORO-, PHOSPHATE BENZENE, 1-PROPYNYL- BENZENAMINE, 3-METHYL-												
UNKNOWN PHOSPHORIC ACID ESTER UNKNOWN AROMATIC HYDROCARBON PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)- 1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-												
BENZENE, METHYL- BENZENE, CHLORO- PYRIDINE, 4-METHYL- PHENOL, 2-ETHYL- PHENOL, 2,3-DIMETHYL- PHENOL,TERT-BUTYL ISOMER UNKNOWN AROMATIC												

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED
ALL RESULTS ARE QUANTITATIVE ESTIMATES

Table 4-16

Tentatively Identified Organic Compounds in Ground Water Collected from Intermediate Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	INTERMEDIATE SUBZONE WELLS										
	1B		2B		2C			2D		3B	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON			88		188			12		882	
2-(2-METHOXYETHOXY)ETHANOL	52										
SATURATED ALIPHATIC HYDROCARBON	10										
ALIPHATIC HYDROCARBON										351	726
ETHYLESTER CARBAMIC ACID											
HYDROXY METHYL PENTANONE											
METHOXY ETHOXY ETHANOL											
BUTYL BENZENE SULFONAMIDE										93	
HEXANOIC ACID											
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL			20	20							
HEPTADECENE-8-CARBONIC ACID											
XYLENE			22								
BENZOFURAN			12		12	39					
1-PROPYNYL BENZENE			75		103						
2-CHLORO-6-METHYL PYRIDINE			11								
1-METHYLNAPHTHALENE			12			17					
4,4'-(1-METHYLETHYLDIENE)BISPHENOL			21								
1,1'-OXYBISETHANE					10					27	
N,N-DIMETHYLFORAMIDE					32	56					94
METHYLBENZENAMINE					13						
CHLOROBENZENAMINE					50						
BENZO(B)THIOPHENE					23	20					
OCTYL PHENOL ISOMER					10	24					23
2-CHLORO-PHOSPHATE ETHANOL					30	25					100
HEXANE								10			
2-BUTOXY ETHANOL											
2-METHYLPENTENE											
1,1-TETRAHYDROTHIOPHENE DIOXIDE											
BENZOTHIOZOLE											
4-(1,1-DIMETHYLETHYL)PHENOL											
UNKNOWN				310		5741	1480		137	1151	
PROPANOL										48	
METHYL DIMETHYLMETHOXYPROPANE										215	
HYDROXYPROPOXYPROPANOL										863	
UNKNOWN PYRIDINE										65	
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)										258	
TETRAMETHYL BUTYL PHENOL										51	
FATTY ACID				28						768	
METHOXYMETHYL AZIRIDINE										83	
HYDROXYMETHYL BENZENE ACETIC ACID										57	
AZULENE										214	
DIMETHYL PROPANOL										134	
METHYL FORMAMIDE										107	
ACETONE											
BIS(1-METHYL-2-HYDROXYETHYL)ETHER											37
METHYL NAPHTHALENE											
UNKNOWN PHTHALATE ESTER											
CRESOL											
BENZOIC ACID											
BENZENEACETIC ACID											
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL											
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD											
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL											
PHENOXY ETHANOL											
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID											
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE											

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	1 B		2 B		2C			2 D		3 B
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID											
AMINO METHYL PENTANONE											
DIMETHYL BENZENE											
CYCLOHEXANONE											
METHYLETHOXYPROPANE											
TRIMETHYLCYCLOHEXANONE											
BENZENE METHANOL											
DIMETHYL BENZENE METHANOL											
BUTOXYBUTENE											
2-DICHLOROETHENYL BENZENE ISOMER											
NITROCRESOL											
ETHYL CRESOL ISOMER											
1,2-BIS(2-CHLOROETHOXY)ETHANE						100					
1,2-BIS(CHLOROETHOXY)ETHANE											
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER											
2-ETHYLHEXANOL											
N-PHENYLBENZENAMINE											
CHLOROETHANOL PHOSPHATE											
TOLUENE											
STYRENE											
BENZENAMINE											
CHLOROETHENYL BENZENE											
2-ETHOXYLHEXANOIC ACID.											
ETHYL PHENOL ISOMER											
DIMETHYL PHENOL ISOMER											
CHLOROPHENOL ISOMER											
UNKNOWN PHTHALATE ESTER											
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE											
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID											
CHLORINATED HYDROCARBON			73								
2-METHYLBENZENAMINE						12					
METHYL PHENOL ISOMER						14					
(1-METHYLETHYL)BENZENE											
1-HEXANE											
2-HEXANE											
HEXADECANOIC ACID			21								
3,3,6-TRIMETHYL-CYCLOHEXANONE											
3,3,6-TRIMETHYL-CYCLOHEXANE											
2,2-DIMETHYL-1-PROPANOL											
3-(1-METHYLETHYL)-PHENOL			13								
(1)BENZOTHIENO(4,6 - B)(1)BENZOTHIOPHENE		61									
4-METHYLPHENOL			12								
1,7-DIHYDRO-8H-PURIN-8-ONE			69								
ALPHA-HYDROXY-BENZENEACETIC ACID						17					
TERT-BUTOXYISOPROPOXY METHANE						20					
1,2-BENZENEDICARBOXYLIC ACID ESTER						17					
3,3-DIMETHYL-2(3H)-BENZOFURANONE											
N,N-DIMETHYL ACETAMIDE											54
4-HYDROXY-3-METHYL-2-BUTANONE											300
1-METHOZY-2-PROPANONE											47
ETHYL ESTER PHOSPHORIC ACID											120
BIS(2-METHOXYETHYL)PHTHALATE											27
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL											
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL											
DIMETHYL PHENOL											
(2-METHOXYETHOXY)ETHENE											
2,2'-OXYBIS-BUTANE											
1-METHOXY-2-BUTANOL											
1,1'-OXYBIS-2-PROPANOL											
MONOPROPANOATE PROPANOL											
ESTER 1,2-BENZENEDICARBOXYLIC ACID											
HEXAHYDRO 2H-AZEPIN-2-ONE											
9,12-OCTADECADIEN-1-OL											
BUTYL MYRISTATE(BUTYL TETRADECYLATE)											

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	1 B		2 B		2C			2 D		3 B	
	Jun-96	Sep-96	Jun-96	Sep-96	Jun-96	Sep-96	Mar-96	Jun-96	Sep-96	Jun-96	Sep-96
FATTY ACID ESTER ALPHA-TERPINEOL 3-METHYL-2-CYCLOHEXEN-1-ONE 1,1,3-TRIMETHYL-CYCLOPENTANE											
HEXADECANE TRICHLOROETHENE DICHLOROIDOMETHANE 3-METHOXY-2-METHYLPHENOL											
2-CHLORO,PHOSPHATE (3:1) ETHANOL DIMETHYL BENZENE ISOMER MOL, SULFUR METHYL NAPTHALENE ISOMER											
XYLENE ISOMER 1,2,4-TRIMETHYLBENZENE 3-METHYL-BENZENAMINE UNDECANE											
CHLORO BENZENAMINE ISOMER TETRADECANE 2,6,10,16-TETRAMETHYL-HEPTADECANE PENTADECANE											
PHOSPHORIC ACID ESTER 2-METHYL-2,4-PENTANDIOL METHYL-BENZENAMINE ISOMER DIETHYL ESTER 2-BUTENEDIOIC ACID											
4-METHYL-2-NITROPHENOL 2-(2-HYDROXYPROPOXY)-1-PROPANOL 4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID 3-CHLORO BENZENAMINE											
TRIETHYL ESTER PHOSPHORIC ACID METHYL PIRODINE ISOMER 2, METHYL PHENOL 1,4 DICHLORO 2 ETHENYL BENZENE BICYCLO(4,2,0)OCTA 1,3,6 TRIENE											
ETHANOL, 2-PHENOXY *UNKNOWN ALKENE* UNKNOWN ALIPHATIC HYDROCARBON ISOMER OF CHLOROAMILINE 7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL							18 20				
UNKNOWN THIOPHENE UNKNOWN PHENOL ETHANOL, 2-CHORO-, PHOSPHATE BENZENE, 1-PROPYNYL- BENZENAMINE, 3-METHYL-							31 12 16				
UNKNOWN PHOSPHORIC ACID ESTER UNKNOWN AROMATIC HYDROCARBON *PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-* 1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-							16 10 39 10				
BENZENE, METHYL- BENZENE, CHLORO- PYRIDINE, 4-METHYL- PHENOL, 2-ETHYL- PHENOL, 2,3-DIMETHYL- PHENOL,TERT-BUTYL ISOMER UNKNOWN AROMATIC											

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	4C		6A		6B		7B		9C	10C
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Mar-88
UNKNOWN HYDROCARBON	813				21					67J
2-(2-METHOXYETHOXY)ETHANOL		1272			26					
SATURATED ALIPHATIC HYDROCARBON										
ALIPHATIC HYDROCARBON			115							
ETHYLESTER CARBAMIC ACID			17							
HYDROXY METHYL PENTANONE			27							
METHOXY ETHOXY ETHANOL			20							
BUTYL BENZENE SULFONAMIDE			22							
HEXANOIC ACID										
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL										
HEPTADECENE-8-CARBONIC ACID										
XYLENE										
BENZOFURAN										
1-PROPYNYL BENZENE										
2-CHLORO-6-METHYL PYRIDINE										
1-METHYLNAPHTHALENE										
4,4'-(1-METHYLETHYLDIENE)BISPHENOL										
1,1'-OXYBISETHANE										
N,N-DIMETHYLFORAMIDE	180	140								
METHYLBENZENAMINE										
CHLOROBENZENAMINE	50									
BENZO(B)THIOPHENE										
OCTYL PHENOL ISOMER	23	16								
2-CHLORO-PHOSPHATE ETHANOL		30		11						
HEXANE										
2-BUTOXY ETHANOL		23	10							
2-METHYLPENTENE										
1,1-TETRAHYDROTHIOPHENE DIOXIDE										
BENZOTHIOZOLE										
4-(1,1-DIMETHYLETHYL)PHENOL										
UNKNOWN				47		480		120		570
PROPANOL										
METHYL DIMETHYLMETHOXYPROPANE										
HYDROXYPROPOXYPROPANOL										
UNKNOWN PYRIDINE										
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)										
TETRAMETHYL BUTYL PHENOL										
FATTY ACID										
METHOXYMETHYL AZIRIDINE										
HYDROXYMETHYL BENZENE ACETIC ACID										
AZULENE										
DIMETHYL PROPANOL										
METHYL FORMAMIDE										
ACETONE										
BIS(1-METHYL-2-HYDROXYETHYL)ETHER	26									
METHYL NAPHTHALENE	38									
UNKNOWN PHTHALATE ESTER										
CRESOL										
BENZOIC ACID										
BENZENEACETIC ACID										
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL										
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD	12									
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	105									49
PHENOXY ETHANOL			40							
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID					10					
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE										

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	4C		8A		8B		7B		8C	10C
	Jun-88	Sep-88	Jun-88	Sep-88	Jun-88	Sep-88	Jun-88	Sep-88	Mar-88	Mar-88
METHYL ESTER OF 9-OCTADECANOIC ACID										
AMINO METHYL PENTANONE										
DIMETHYL BENZENE										
CYCLOHEXANONE										
METHYLETHYOXYPROPANE										
TRIMETHYLCYCLOHEXANONE										
BENZENE METHANOL										
DIMETHYL BENZENE METHANOL										
BUTOXYBUTENE										
2-DICHLOROETHENYL BENZENE ISOMER										
NITROCRESOL										
ETHYL CRESOL ISOMER										
1,2-BIS(2-CHLOROETHOXY)ETHANE										
1,2-BIS(CHLOROETHOXY)ETHANE										
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER										
2-ETHYLHEXANOL										
N-PHENYLBENZENAMINE										
CHLOROETHANOL PHOSPHATE										
TOLUENE										
STYRENE										
BENZENAMINE										
CHLOROETHENYL BENZENE										
2-ETHOXYLHEXANOIC ACID										
ETHYL PHENOL ISOMER										
DIMETHYL PHENOL ISOMER										
CHLOROPHENOL ISOMER										
UNKNOWN PHTHALATE ESTER										
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE										
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID										
CHLORINATED HYDROCARBON										
2-METHYLBENZENAMINE										
METHYL PHENOL ISOMER										
(1-METHYLETHYL)BENZENE										
1-HEXANE										
2-HEXANE										
HEXADECANOIC ACID	36		14							
3,3,6-TRIMETHYL-CYCLOHEXANONE										
3,3,6-TRIMETHYL-CYCLOHEXANE										
2,2-DIMETHYL-1-PROPANOL										
3-(1-METHYLETHYL)-PHENOL										
(1)BENZOTHIENO(4,5 - B)(1)BENZOTHIOPHENE										
4-METHYLPHENOL										
1,7-DIHYDRO-8H-PURIN-8-ONE										
ALPHA-HYDROXY-BENZENEACETIC ACID										
TERT-BUTOXYISOPROPOXY METHANE										
1,2-BENZENEDICARBOXYLIC ACID ESTER										
3,3-DIMETHYL-2(3H)-BENZOFURANONE										
N,N-DIMETHYL ACETAMIDE										
4-HYDROXY-3-METHYL-2-BUTANONE										
1-METHOXY-2-PROPANONE										
ETHYL ESTER PHOSPHORIC ACID										
BIS(2-METHOXYETHYL)PHTHALATE										
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL										
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL										
DIMETHYL PHENOL	18									
(2-METHOXYETHOXY)ETHENE	83									
2,2'-OXYBIS-BUTANE	180									
1-METHOXY-2-BUTANOL	28									
1,1'-OXYBIS-2-PROPANOL	500									
MONOPROPANOATE PROPANOL	15									
ESTER 1,2-BENZENEDICARBOXYLIC ACID	15									
HEXAHYDRO 2H-AZEPIN-2-ONE			40		340		13			
9,12-OCTADECADIEN-1-OL										
BUTYL MYRISTATE(BUTYL TETRADECYLATE)										

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	4 C		6 A		6 B		7 B		9C	10C
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Mar-88
FATTY ACID ESTER										
ALPHA-TERPINEOL				11						
3-METHYL-2-CYCLOHEXEN-1-ONE				14						
1,1,3-TRIMETHYL-CYCLOPENTANE				31						
HEXADECANE				18						
TRICHLOROETHENE						20				
DICHLOROIDOMETHANE										
3-METHOXY-2-METHYLPHENOL										
2-CHLORO,PHOSPHATE (3:1) ETHANOL										
DIMETHYL BENZENE ISOMER										
MOL, SULFUR										
METHYL NAPTHALENE ISOMER										
XYLENE ISOMER										
1,2,4-TRIMETHYLBENZENE										
3-METHYL-BENZENAMINE										
UNDECANE										
CHLORO BENZENAMINE ISOMER		.40								
TETRADECANE										
2,6,10,18-TETRAMETHYL-HEPTADECANE										
PENTADECANE										
PHOSPHORIC ACID ESTER										
2-METHYL-2,4-PENTANDIOL										
METHYL-BENZENAMINE ISOMER										
DIETHYL ESTER 2-BUTENEDIOIC ACID										
4-METHYL-2-NITROPHENOL										
2-(2-HYDROXYPROPOXY)-1-PROPANOL										
4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE										
BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID										
3-CHLORO BENZENAMINE										
TRIETHYL ESTER PHOSPHORIC ACID										
METHYL PIRODINE ISOMER										
2, METHYL PHENOL										
1,4 DICHLORO 2 ETHENYL BENZENE										
BICYCLO(4,2,0)OCTA 1,3,6 TRIENE										
ETHANOL, 2-PHENOXY										
UNKNOWN ALKENE										13
UNKNOWN ALIPHATIC HYDROCARBON										13
ISOMER OF CHLOROAMILINE										36
7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL										190
UNKNOWN THIOPHENE										
UNKNOWN PHENOL										21
ETHANOL, 2-CHORO-, PHOSPHATE										19
BENZENE, 1-PROPYNYL-										
BENZENAMINE, 3-METHYL-										
UNKNOWN PHOSPHORIC ACID ESTER										
UNKNOWN AROMATIC HYDROCARBON										
PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-										
1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-										
BENZENE, METHYL-										
BENZENE, CHLORO-										
PYRIDINE, 4-METHYL-										
PHENOL, 2-ETHYL-										
PHENOL, 2,3-DIMETHYL-										
PHENOL,TERT-BUTYL ISOMER										40
UNKNOWN AROMATIC										

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)										
	CL - 3		CL - 6		DW-1			USQ 9-A		USQ 9-B	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON							48J	25	NS	53	NS
2-(2-METHOXYETHOXY)ETHANOL											
SATURATED ALIPHATIC HYDROCARBON											
ALIPHATIC HYDROCARBON				38							
ETHYLESTER CARBAMIC ACID											
HYDROXY METHYL PENTANONE											
METHOXY ETHOXY ETHANOL											
BUTYL BENZENE SULFONAMIDE											
HEXANOIC ACID											
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL						100					
HEPTADECENE-8-CARBONIC ACID											
XYLENE											
BENZOFURAN											
1-PROPYNYL BENZENE											
2-CHLORO-6-METHYL PYRIDINE											
1-METHYLNAPHTHALENE											
4,4'-(1-METHYLETHYLDIENE)BISPHENOL				23		100					
1,1'-OXYBISETHANE											
N,N-DIMETHYLFORAMIDE						350					
METHYLBENZENAMINE	2084										
CHLOROBENZENAMINE	4042										
BENZO(B)THIOPHENE											
OCTYL PHENOL ISOMER						120					
2-CHLORO-PHOSPHATE ETHANOL											
HEXANE											
2-BUTOXY ETHANOL											
2-METHYLPENTENE											
1,1-TETRAHYDROTHIOPHENE DIOXIDE											
BENZOTHIOZOLE											
4-(1,1-DIMETHYLETHYL)PHENOL											
UNKNOWN		320		178		600	572				
PROPANOL											
METHYL DIMETHYLMETHOXYPROPANE											
HYDROXYPROPOXYPROPANOL											
UNKNOWN PYRIDINE											
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)											
TETRAMETHYL BUTYL PHENOL											
FATTY ACID											
METHOXYMETHYL AZIRIDINE											
HYDROXYMETHYL BENZENE ACETIC ACID											
AZULENE											
DIMETHYL PROPANOL											
METHYL FORMAMIDE											
ACETONE											
BIS(1-METHYL-2-HYDROXYETHYL)ETHER		13									
METHYL NAPHTHALENE											
UNKNOWN PHTHALATE ESTER								13			
CRESOL											
BENZOIC ACID											
BENZENEACETIC ACID											
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL											
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD											
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL						100					
PHENOXY ETHANOL											
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID											
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE											

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)										
	CL - 3		CL - 6		DW - 1			USG 9 - A		USG 9 - B	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID											
AMINO METHYL PENTANONE											
DIMETHYL BENZENE											
CYCLOHEXANONE											
METHYLETHYOXYPROPANE											
TRIMETHYLCYCLOHEXANONE											
BENZENE METHANOL											
DIMETHYL BENZENE METHANOL											
BUTOXYBUTENE											
2-DICHLOROETHENYL BENZENE ISOMER	692										
NITROCRESOL	130										
ETHYL CRESOL ISOMER	219										
1,2-BIS(2-CHLOROETHOXY)ETHANE		99									
1,2-BIS(CHLOROETHOXY)ETHANE	250										
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER	85										
2-ETHYLHEXANOL	57										
N-PHENYLBENZENAMINE	50										
CHLOROETHANOL PHOSPHATE	56										
TOLUENE	235										
STYRENE	73										
BENZENAMINE	1340										
CHLOROETHENYL BENZENE	270										
2-ETHOXYLHEXANOIC ACID	91										
ETHYL PHENOL ISOMER	6523			12		110					
DIMETHYL PHENOL ISOMER	696										
CHLOROPHENOL ISOMER	602										
UNKNOWN PHTHALATE ESTER											
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE											
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID											
CHLORINATED HYDROCARBON											
2-METHYLBENZENAMINE											
METHYL PHENOL ISOMER		32					73				
(1-METHYLETHYL)BENZENE											
1-HEXANE											
2-HEXANE											
HEXADECANOIC ACID		11									
3,3,5-TRIMETHYL-CYCLOHEXANONE						160					
3,3,5-TRIMETHYL-CYCLOHEXANE											
2,2-DIMETHYL-1-PROPANOL											
3-(1-METHYLETHYL)-PHENOL											
(1)BENZOTHIENO(4,5 - B)(1)BENZOTHIOPHENE											
4-METHYLPHENOL											
1,7-DIHYDRO-6H-PURIN-6-ONE											
ALPHA-HYDROXY-BENZENEACETIC ACID											
TERT-BUTOXYISOPROPOXY METHANE											
1,2-BENZENEDICARBOXYLIC ACID ESTER											
3,3-DIMETHYL-2(3H)-BENZOFURANONE											
N,N-DIMETHYL ACETAMIDE											
4-HYDROXY-3-METHYL-2-BUTANONE											
1-METHOZY-2-PROPANONE											
ETHYL ESTER PHOSPHORIC ACID											
BIS(2-METHOXYETHYL)PHTHALATE											
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL		120				420					
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL											
DIMETHYL PHENOL											
(2-METHOXYETHOXY)ETHENE											
2,2'-OXYBIS-BUTANE											
1-METHOXY-2-BUTANOL											
1,1'-OXYBIS-2-PROPANOL											
MONOPROPANOATE PROPANOL											
ESTER 1,2-BENZENEDICARBOXYLIC ACID											
HEXAHYDRO 2H-AZEPIN-2-ONE											
9,12-OCTADECADIEN-1-OL											
BUTYL MYRISTATE(BUTYL TETRADECYLATE)											

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)									
	CL - 3		CL - 6		DW-1			USG 8-A		USG 8-B
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Mar-88	Jun-86	Sep-86	Jun-86	Sep-86
FATTY ACID ESTER											
ALPHA-TERPINEOL											
3-METHYL-2-CYCLOHEXEN-1-ONE											
1,1,3-TRIMETHYL-CYCLOPENTANE											
HEXADECANE											
TRICHLOROETHENE											
DICHLOROIDOMETHANE											
3-METHOXY-2-METHYLPHENOL											
2-CHLORO,PHOSPHATE (3:1) ETHANOL		24		26							
DIMETHYL BENZENE ISOMER				54		170					
MOL, SULFUR		25				310					
METHYL NAPTHALENE ISOMER				38							
XYLENE ISOMER											
1,2,4-TRIMETHYLBENZENE											
3-METHYL-BENZENAMINE											
UNDECANE											
CHLORO BENZENAMINE ISOMER		270				220					
TETRADECANE											
2,6,10,16-TETRAMETHYL-HEPTADECANE											
PENTADECANE											
PHOSPHORIC ACID ESTER											
2-METHYL-2,4-PENTANDIOL		39									
METHYL-BENZENAMINE ISOMER		78		140		730					
DIETHYL ESTER 2-BUTENEDIOIC ACID		620									
4-METHYL-2-NITROPHENOL		20									
2-(2-HYDROXYPROPOXY)-1-PROPANOL		20									
4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE		43									
BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID				31							
3-CHLORO BENZENAMINE				29		720					
TRIETHYL ESTER PHOSPHORIC ACID											
METHYL PIRODINE ISOMER						3700					
2, METHYL PHENOL				13		100					
1,4 DICHLORO 2 ETHENYL BENZENE				16							
BICYCLO(4,2,0)OCTA 1,3,6 TRIENE				31							
ETHANOL, 2-PHENOXY											
UNKNOWN ALKENE							49				
UNKNOWN ALIPHATIC HYDROCARBON											
ISOMER OF CHLOROAMILINE							106				
7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL							57				
UNKNOWN THIOPHENE											
UNKNOWN PHENOL											
ETHANOL, 2-CHORO-, PHOSPHATE											
BENZENE, 1-PROPYNYL-											
BENZENAMINE, 3-METHYL-											
UNKNOWN PHOSPHORIC ACID ESTER											
UNKNOWN AROMATIC HYDROCARBON							32				
PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-											
1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-											
BENZENE, METHYL-							32				
BENZENE, CHLORO-							50				
PYRIDINE, 4-METHYL-							150				
PHENOL, 2-ETHYL-							29				
PHENOL, 2,3-DIMETHYL-							23				
PHENOL,TERT-BUTYL ISOMER											
UNKNOWN AROMATIC							23				

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)						PRODUCTION WELL	
	Res-2		Res-1		Res-3			
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON	227	NS	57	NS	88	NS	NS	
2-(2-METHOXYETHOXY)ETHANOL								
SATURATED ALIPHATIC HYDROCARBON								
ALIPHATIC HYDROCARBON								
ETHYLESTER CARBAMIC ACID								
HYDROXY METHYL PENTANONE								
METHOXY ETHOXY ETHANOL								
BUTYL BENZENE SULFONAMIDE								
HEXANOIC ACID								
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL								
HEPTADECENE-8-CARBONIC ACID								
XYLENE								
BENZOFURAN								
1-PROPYNYL BENZENE								
2-CHLORO-5-METHYL PYRIDINE								
1-METHYLNAPHTHALENE								
4,4'-(1-METHYLETHYLDIENE)BISPHENOL								
1,1'-OXYBISETHANE								
N,N-DIMETHYLFORAMIDE								47
METHYLBENZENAMINE								
CHLOROBENZENAMINE								
BENZO(B)THIOPHENE								
OCTYL PHENOL ISOMER								
2-CHLORO-PHOSPHATE ETHANOL								
HEXANE								
2-BUTOXY ETHANOL								
2-METHYLPENTENE								
1,1-TETRAHYDROTHIOPHENE DIOXIDE								
BENZOTHIOZOLE								
4-(1,1-DIMETHYLETHYL)PHENOL								
UNKNOWN								310
PROPANOL								
METHYL DIMETHYLMETHOXYPROPANE								
HYDROXYPROPOXYPROPANOL								
UNKNOWN PYRIDINE								
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)								
TETRAMETHYL BUTYL PHENOL								
FATTY ACID								
METHOXYMETHYL AZIRIDINE								
HYDROXYMETHYL BENZENE ACETIC ACID								
AZULENE								
DIMETHYL PROPANOL								
METHYL FORMAMIDE								
ACETONE								
BIS(1-METHYL-2-HYDROXYETHYL)ETHER								
METHYL NAPHTHALENE								
UNKNOWN PHTHALATE ESTER	20							
CRESOL								
BENZOIC ACID								
BENZENEACETIC ACID								
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL								
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD								
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL								
PHENOXY ETHANOL								
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID								
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE								

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)						PRODUCTION WELL	
	Res-2		Res-1		Res-3			
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID								
AMINO METHYL PENTANONE								
DIMETHYL BENZENE								
CYCLOHEXANONE								
METHYLETHYOXYPROPANE								
TRIMETHYLCYCLOHEXANONE								
BENZENE METHANOL								
DIMETHYL BENZENE METHANOL								
BUTOXYBUTENE								
2-DICHLOROETHENYL BENZENE ISOMER								
NITROCRESOL								
ETHYL CRESOL ISOMER								
1,2-BIS(2-CHLOROETHOXY)ETHANE								
1,2-BIS(CHLOROETHOXY)ETHANE								
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER								
2-ETHYLHEXANOL								
N-PHENYLBENZENAMINE								
CHLOROETHANOL PHOSPHATE								
TOLUENE								
STYRENE								
BENZENAMINE								
CHLOROETHENYL BENZENE								
2-ETHOXYLHEXANOIC ACID								
ETHYL PHENOL ISOMER								
DIMETHYL PHENOL ISOMER								
CHLOROPHENOL ISOMER								
UNKNOWN PHTHALATE ESTER								
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE								
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID								
CHLORINATED HYDROCARBON								
2-METHYLBENZENAMINE								
METHYL PHENOL ISOMER								14
(1-METHYLETHYL)BENZENE								
1-HEXANE								
2-HEXANE								
HEXADECANOIC ACID								
3,3,5-TRIMETHYL-CYCLOHEXANONE								
3,3,5-TRIMETHYL-CYCLOHEXANE								
2,2-DIMETHYL-1-PROPANOL								
3-(1-METHYLETHYL)-PHENOL								
(1)BENZOTHIENO(4,5 - B)(1)BENZOTHIOPHENE								
4-METHYLPHENOL								
1,7-DIHYDRO-6H-PURIN-6-ONE								
ALPHA-HYDROXY-BENZENEACETIC ACID								
TERT-BUTOXYISOPROPOXY METHANE								
1,2-BENZENEDICARBOXYLIC ACID ESTER								
3,3-DIMETHYL-2(3H)-BENZOFURANONE								
N,N-DIMETHYL ACETAMIDE								
4-HYDROXY-3-METHYL-2-BUTANONE								
1-METHOXY-2-PROPANONE								
ETHYL ESTER PHOSPHORIC ACID								
BIS(2-METHOXYETHYL)PHTHALATE								
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL								51
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL								
DIMETHYL PHENOL								
(2-METHOXYETHOXY)ETHENE								
2,2'-OXYBIS-BUTANE								
1-METHOXY-2-BUTANOL								
1,1'-OXYBIS-2-PROPANOL								
MONOPROPANOATE PROPANOL								
ESTER 1,2-BENZENEDICARBOXYLIC ACID								
HEXAHYDRO 2H-AZEPIN-2-ONE								
9,12-OCTADECADIEN-1-OL								
BUTYL MYRISTATE(BUTYL TETRADECYLATE)								

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-16, (cont.)

COMPOUND	INTERMEDIATE SUBZONE WELLS (CONT)						PRODUCTION WELL	
	Roo-2		Roo-1		Roo-3			
	Jun-06	Sep-06	Jun-06	Sep-06	Jun-06	Sep-06	Jun-06	Sep-06
FATTY ACID ESTER ALPHA-TERPINEOL 3-METHYL-2-CYCLOHEXEN-1-ONE 1,1,3-TRIMETHYL-CYCLOPENTANE								
HEXADECANE TRICHLOROETHENE DICHLOROIDOMETHANE 3-METHOXY-2-METHYLPHENOL								
2-CHLORO,PHOSPHATE (3:1) ETHANOL DIMETHYL BENZENE ISOMER MOL, SULFUR METHYL NAPTHALENE ISOMER								10
XYLENE ISOMER 1,2,4-TRIMETHYLBENZENE 3-METHYL-BENZENAMINE UNDECANE								
CHLORO BENZENAMINE ISOMER TETRADECANE 2,6,10,10-TETRAMETHYL-HEPTADECANE PENTADECANE								
PHOSPHORIC ACID ESTER 2-METHYL-2,4-PENTANDIOL METHYL-BENZENAMINE ISOMER DIETHYL ESTER 2-BUTENEDIOIC ACID								
4-METHYL-2-NITROPHENOL 2-(2-HYDROXYPROPOXY)-1-PROPANOL 4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID 3-CHLORO BENZENAMINE								21 27
TRIETHYL ESTER PHOSPHORIC ACID METHYL PIRODINE ISOMER 2, METHYL PHENOL 1,4 DICHLORO 2 ETHENYL BENZENE BICYCLO(4,2,0)OCTA 1,3,9 TRIENE								19
ETHANOL, 2-PHENOXY UNKNOWN ALKENE UNKNOWN ALIPHATIC HYDROCARBON ISOMER OF CHLOROANILINE 7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL								
UNKNOWN THIOPHENE UNKNOWN PHENOL ETHANOL, 2-CHORO-, PHOSPHATE BENZENE, 1-PROPYNYL- BENZENAMINE, 3-METHYL-								
UNKNOWN PHOSPHORIC ACID ESTER UNKNOWN AROMATIC HYDROCARBON PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)- 1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-								
BENZENE, METHYL- BENZENE, CHLORO- PYRIDINE, 4-METHYL- PHENOL, 2-ETHYL- PHENOL, 2,3-DIMETHYL- PHENOL,TERT-BUTYL ISOMER UNKNOWN AROMATIC								

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

"Monitoring Wells 2D, 4C, 6B, DW-1, and CLTL Production Well are screened in the Lower Intermediate Zone"

Table 4-17

Tentatively Identified Organic Compounds in Ground Water Collected from Shallow Subzone Wells in the Remedial Investigation at the CLTL Site

COMPOUND	SHALLOW SUBZONE WELLS									
	1 A		2 A		3 A		4 A		7 A	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON	20		97	100	1299		1372		146	
2-(2-METHOXYETHOXY)ETHANOL	20		13						34	
SATURATED ALIPHATIC HYDROCARBON										
ALIPHATIC HYDROCARBON				12		487				790
ETHYLESTER CARBAMIC ACID										
HYDROXY METHYL PENTANONE										
METHOXY ETHOXY ETHANOL										
BUTYL BENZENE SULFONAMIDE										
HEXANOIC ACID			15							
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL			38		66	120				
HEPTADECENE-8-CARBONIC ACID			16							
XYLENE										
BENZOFURAN										
1-PROPYNYL BENZENE										
2-CHLORO-6-METHYL PYRIDINE										
1-METHYLNAPHTHALENE										
4,4'-(1-METHYLETHYLDIENE)BISPHENOL					43					
1,1'-OXYBISETHANE					10					
N,N-DIMETHYLFORAMIDE					51	40				
METHYLBENZENAMINE										
CHLOROBENZENAMINE										
BENZO(B)THIOPHENE										
OCTYL PHENOL ISOMER					21					
2-CHLORO-PHOSPHATE ETHANOL										
HEXANE										
2-BUTOXY ETHANOL					13					
2-METHYLPENTENE					16					
1,1-TETRAHYDROTHIOPHENE DIOXIDE					13					
BENZOTHIOZOLE					15					
4-(1,1-DIMETHYLETHYL)PHENOL					67	41				
UNKNOWN				531	10	804		180		100
PROPANOL										
METHYL DIMETHYLMETHOXYPROPANE										
HYDROXYPROPOXYPROPANOL										
UNKNOWN PYRIDINE										
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)										
TETRAMETHYL BUTYL PHENOL										
FATTY ACID				10			870			
METHOXYMETHYL AZIRIDINE										
HYDROXYMETHYL BENZENE ACETIC ACID										
AZULENE										
DIMETHYL PROPANOL										
METHYL FORMAMIDE										
ACETONE							30			
BIS(1-METHYL-2-HYDROXYETHYL)ETHER										
METHYL NAPHTHALENE										
UNKNOWN PHTHALATE ESTER										
CRESOL							180			
BENZOIC ACID							198			
BENZENEACETIC ACID							105			
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL							936			
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD										
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL										
PHENOXY ETHANOL										
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID										
0,0-DIETHYL-S-ETHYL PHOSPHOROTHIOATE										

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	1 A		2 A		3 A		4 A		7 A	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID										
AMINO METHYL PENTANONE										
DIMETHYL BENZENE										
CYCLOHEXANONE										
METHYLETHYOXYPROPANE										
TRIMETHYLCYCLOHEXANONE										
BENZENE METHANOL										
DIMETHYL BENZENE METHANOL										
BUTOXYBUTENE										
2-DICHLOROETHENYL BENZENE ISOMER										
NITROCRESOL										
ETHYL CRESOL ISOMER										
1,2-BIS(2-CHLOROETHOXY)ETHANE										
1,2-BIS(CHLOROETHOXY)ETHANE										
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER										
2-ETHYLHEXANOL										
N-PHENYLBENZENAMINE										
CHLOROETHANOL PHOSPHATE										
TOLUENE										
STYRENE										
BENZENAMINE										
CHLOROETHENYL BENZENE										
2-ETHOXYLHEXANOIC ACID										
ETHYL PHENOL ISOMER										
DIMETHYL PHENOL ISOMER										
CHLOROPHENOL ISOMER										
UNKNOWN PHTHALATE ESTER										
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE						120				
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID										
CHLORINATED HYDROCARBON										
2-METHYLBENZENAMINE										
METHYL PHENOL ISOMER										
(1-METHYLETHYL)BENZENE						13				
1-HEXANE						14				
2-HEXANE						28				
HEXADECANOIC ACID										
3,3,6-TRIMETHYL-CYCLOHEXANONE										
3,3,6-TRIMETHYL-CYCLOHEXANE						220				
2,2-DIMETHYL-1-PROPANOL						100				
3-(1-METHYLETHYL)-PHENOL										
(1)BENZOTHIENO(4,8 - B)(1)BENZOTHIOPHENE										
4-METHYLPHENOL										
1,7-DIHYDRO-6H-PURIN-6-ONE										
ALPHA-HYDROXY-BENZENEACETIC ACID										
TERT-BUTOXYISOPROPOXY METHANE										
1,2-BENZENEDICARBOXYLIC ACID ESTER										
3,3-DIMETHYL-2(3H)-BENZOFURANONE						15				
N,N-DIMETHYL ACETAMIDE										
4-HYDROXY-3-METHYL-2-BUTANONE										
1-METHOZY-2-PROPANONE										
ETHYL ESTER PHOSPHORIC ACID										
BIS(2-METHOXYETHYL)PHTHALATE										
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL								290		
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL								150		
DIMETHYL PHENOL										
(2-METHOXYETHOXY)ETHENE										
2,2'-OXYBIS-BUTANE										
1-METHOXY-2-BUTANOL										
1,1'-OXYBIS-2-PROPANOL										
MONOPROPANOATE PROPANOL										
ESTER 1,2-BENZENEDICARBOXYLIC ACID										
HEXAHYDRO 2H-AZEPIN-2-ONE										
9,12-OCTADECADIEN-1-OL										
BUTYL MYRISTATE(BUTYL TETRADECYLATE)										

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	1 A		2 A		3 A		4 A		7 A	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
FATTY ACID ESTER ALPHA-TERPINEOL 3-METHYL-2-CYCLOHEXEN-1-ONE 1,1,3-TRIMETHYL-CYCLOPENTANE										
HEXADECANE TRICHLOROETHENE DICHLOROIDOMETHANE 3-METHOXY-2-METHYLPHENOL										
2-CHLORO,PHOSPHATE (3:1) ETHANOL DIMETHYL BENZENE ISOMER MOL. SULFUR METHYL NAPTHALENE ISOMER										
XYLENE ISOMER 1,2,4-TRIMETHYLBENZENE 3-METHYL-BENZENAMINE UNDECANE										
CHLORO BENZENAMINE ISOMER TETRADECANE 2,6,10,16-TETRAMETHYL-HEPTADECANE PENTADECANE										
PHOSPHORIC ACID ESTER 2-METHYL-2,4-PENTANDIOL METHYL-BENZENAMINE ISOMER DIETHYL ESTER 2-BUTENEDIOIC ACID										
4-METHYL-2-NITROPHENOL 2-(2-HYDROXYPROPOXY)-1-PROPANOL 4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID 3-CHLORO BENZENAMINE										
TRIETHYL ESTER PHOSPHORIC ACID METHYL PIRODINE ISOMER 2, METHYL PHENOL 1,4 DICHLORO 2 ETHENYL BENZENE BICYCLO(4,2,0)OCTA 1,3,5 TRIENE										
ETHANOL, 2-PHENOXY UNKNOWN ALKENE UNKNOWN ALIPHATIC HYDROCARBON ISOMER OF CHLOROAMILINE *7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL*										
UNKNOWN THIOPHENE UNKNOWN PHENOL ETHANOL, 2-CHORO-, PHOSPHATE BENZENE, 1-PROPYNYL- BENZENAMINE, 3-METHYL-										
UNKNOWN PHOSPHORIC ACID ESTER UNKNOWN AROMATIC HYDROCARBON PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)- 1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-										
BENZENE, METHYL- BENZENE, CHLORO- PYRIDINE, 4-METHYL- PHENOL, 2-ETHYL- PHENOL, 2,3-DIMETHYL- PHENOL,TERT-BUTYL ISOMER UNKNOWN AROMATIC										

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATION ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	8 A		CL - 1		CL - 3		CL - 4		TP - 1	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON			27		104		254			
2-(2-METHOXYETHOXY)ETHANOL					13					
SATURATED ALIPHATIC HYDROCARBON										
ALIPHATIC HYDROCARBON	1310					21	190		176	154
ETHYLESTER CARBAMIC ACID										
HYDROXY METHYL PENTANONE							23			
METHOXY ETHOXY ETHANOL										
BUTYL BENZENE SULFONAMIDE										
HEXANOIC ACID										
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL										
HEPTADECENE-8-CARBONIC ACID										
XYLENE										
BENZOFURAN										
1-PROPYNYL BENZENE										
2-CHLORO-6-METHYL PYRIDINE										
1-METHYLNAPHTHALENE										
4,4'-(1-METHYLETHYLDIENE)BISPHENOL	150									
1,1'-OXYBISETHANE							40			
N,N-DIMETHYLFORAMIDE							909	280		
METHYLBENZENAMINE										
CHLOROBENZENAMINE							74			
BENZO(B)THIOPHENE										
OCTYL PHENOL ISOMER										
2-CHLORO-PHOSPHATE ETHANOL	380									
HEXANE										
2-BUTOXY ETHANOL										
2-METHYLPENTENE										
1,1-TETRAHYDROTHIOPHENE DIOXIDE										
BENZOTHIOZOLE										
4-(1,1-DIMETHYLETHYL)PHENOL	510									
UNKNOWN	130		84		359		106	724		42
PROPANOL										
METHYL DIMETHYLMETHOXYPROPANE										
HYDROXYPROPOXYPROPANOL							27			
UNKNOWN PYRIDINE										
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)										
TETRAMETHYL BUTYL PHENOL							87			
FATTY ACID							117			
METHOXYMETHYL AZIRIDINE										
HYDROXYMETHYL BENZENE ACETIC ACID										
AZULENE										
DIMETHYL PROPANOL										
METHYL FORMAMIDE										
ACETONE										
BIS(1-METHYL-2-HYDROXYETHYL)ETHER										
METHYL NAPHTHALENE										
UNKNOWN PHTHALATE ESTER										
CRESOL										
BENZOIC ACID										
BENZENEACETIC ACID										
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL										
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD										
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL										
PHENOXY ETHANOL										
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID										
0,0-DIETHYL-0-ETHYL PHOSPHOROTHIOATE					14					

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	8 A		CL - 1		CL - 2		CL - 4		TP - 1	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID					32		24			
AMINO METHYL PENTANONE							240			
DIMETHYL BENZENE							48			
CYCLOHEXANONE							43	87		
METHYLETHYOXYPROPANE							371			
TRIMETHYLCYCLOHEXANONE							72			
BENZENE METHANOL							51			
DIMETHYL BENZENE METHANOL							18			
BUTOXYBUTENE							142			
2-DICHLOROETHENYL BENZENE ISOMER										
NITROCRESOL										
ETHYL CRESOL ISOMER										
1,2-BIS(2-CHLOROETHOXY)ETHANE								250		
1,2-BIS(CHLOROETHOXY)ETHANE										
BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER										
2-ETHYLHEXANOL										
N-PHENYLBENZENAMINE										
CHLOROETHANOL PHOSPHATE										
TOLUENE										
STYRENE										
BENZENAMINE		2500								
CHLOROETHENYL BENZENE										
2-ETHOXYLHEXANOIC ACID										
ETHYL PHENOL ISOMER										
DIMETHYL PHENOL ISOMER								51		
CHLOROPHENOL ISOMER										
UNKNOWN PHTHALATE ESTER										
N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE										
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID										
CHLORINATED HYDROCARBON										
2-METHYLBENZENAMINE								18		
METHYL PHENOL ISOMER		140								
(1-METHYLETHYL)BENZENE										
1-HEXANE										
2-HEXANE										
HEXADECANOIC ACID								15		
3,3,6-TRIMETHYL-CYCLOHEXANONE		200								
3,3,6-TRIMETHYL-CYCLOHEXANE										
2,2-DIMETHYL-1-PROPANOL										
3-(1-METHYLETHYL)-PHENOL										
(1)BENZOTHIENO(4,5 - B)(1)BENZOTHIOPHENE										
4-METHYLPHENOL										
1,7-DIHYDRO-8H-PURIN-8-ONE										
ALPHA-HYDROXY-BENZENEACETIC ACID										
TERT-BUTOXYISOPROPOXY METHANE										
1,2-BENZENEDICARBOXYLIC ACID ESTER		370						83		
3,3-DIMETHYL-2(3H)-BENZOFURANONE										
N,N-DIMETHYL ACETAMIDE										
4-HYDROXY-3-METHYL-2-BUTANONE										
1-METHOXY-2-PROPANONE										
ETHYL ESTER PHOSPHORIC ACID										
BIS(2-METHOXYETHYL)PHTHALATE										
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL					20					
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL										
DIMETHYL PHENOL										
(2-METHOXYETHOXY)ETHENE										
2,2'-OXYBIS-BUTANE										
1-METHOXY-2-BUTANOL										
1,1'-OXYBIS-2-PROPANOL										
MONOPROPANOATE PROPANOL										
ESTER 1,2-BENZENEDICARBOXYLIC ACID										
HEXAHYDRO 2H-AZEPIN-2-ONE			140						75	
9,12-OCTADECADIEN-1-OL										
BUTYL MYHISTATE(BUTYL TETRADECYLATE)										

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	@ A		CL - 1		CL - 2		CL - 4		TP - 1	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86
FATTY ACID ESTER										
ALPHA-TERPINEOL										
3-METHYL-2-CYCLOHEXEN-1-ONE										
1,1,3-TRIMETHYL-CYCLOPENTANE										
HEXADECANE		160								
TRICHLOROETHENE										
DICHLOROIDOMETHANE								27		
3-METHOXY-2-METHYLPHENOL								17		
2-CHLORO,PHOSPHATE (3:1) ETHANOL								110		
DIMETHYL BENZENE ISOMER										
MOL. SULFUR										
METHYL NAPTHALENE ISOMER		430								
XYLENE ISOMER		480								
1,2,4-TRIMETHYLBENZENE		150								
3-METHYL-BENZENAMINE		710								
UNDECANE		210								
CHLORO BENZENAMINE ISOMER		1970								
TETRADECANE		750								
2,6,10,15-TETRAMETHYL-HEPTADECANE		110								
PENTADECANE		750								
PHOSPHORIC ACID ESTER		300								
2-METHYL-2,4-PENTANDIOL										
METHYL-BENZENAMINE ISOMER										
DIETHYL ESTER 2-BUTENEDIOIC ACID										
4-METHYL-2-NITROPHENOL										
2-(2-HYDROXYPROPOXY)-1-PROPANOL										
4A,9B-DIHYDRO-6,8B-DIMETHYL-3(4H)DIBENZOFURANONE										
BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID										
3-CHLORO BENZENAMINE										
TRIETHYL ESTER PHOSPHORIC ACID										
METHYL PIRODINE ISOMER										
2, METHYL PHENOL										
1,4 DICHLORO 2 ETHENYL BENZENE										
BICYCLO(4,2,0)OCTA 1,3,6 TRIENE										
ETHANOL, 2-PHENOXY										
UNKNOWN ALKENE										
UNKNOWN ALIPHATIC HYDROCARBON										
ISOMER OF CHLOROAMILINE										
7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL										
UNKNOWN THIOPHENE										
UNKNOWN PHENOL										
ETHANOL, 2-CHORO-, PHOSPHATE										
BENZENE, 1-PROPYNYL-										
BENZENAMINE, 3-METHYL-										
UNKNOWN PHOSPHORIC ACID ESTER										
UNKNOWN AROMATIC HYDROCARBON										
PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)-										
1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-										
BENZENE, METHYL-										
BENZENE, CHLORO-										
PYRIDINE, 4-METHYL-										
PHENOL, 2-ETHYL-										
PHENOL, 2,3-DIMETHYL-										
PHENOL,TERT-BUTYL ISOMER										
UNKNOWN AROMATIC										

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATIONS ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	TP-12		TP-13		TP-16		TP-19		TP-22	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86 #	Jun-86	Sep-86	Jun-86	Sep-86
UNKNOWN HYDROCARBON	NA		NA	NA			NA	NA	NA	NA
2-(2-METHOXYETHOXY)ETHANOL										
SATURATED ALIPHATIC HYDROCARBON										
ALIPHATIC HYDROCARBON					111					
ETHYLESTER CARBAMIC ACID					16					
HYDROXY METHYL PENTANONE										
METHOXY ETHOXY ETHANOL										
BUTYL BENZENE SULFONAMIDE										
HEXANOIC ACID										
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANOL										
HEPTADECENE-8-CARBONIC ACID										
XYLENE										
BENZOFURAN										
1-PROPYNYL BENZENE										
2-CHLORO-6-METHYL PYRIDINE										
1-METHYLNAPHTHALENE										
4,4'-(1-METHYLETHYLDIENE)BISPHENOL										
1,1'-OXYBISETHANE										
N,N-DIMETHYLFORAMIDE					10					
METHYLBENZENAMINE										
CHLOROBENZENAMINE										
BENZO(B)THIOPHENE										
OCTYL PHENOL ISOMER										
2-CHLORO-PHOSPHATE ETHANOL										
HEXANE										
2-BUTOXY ETHANOL										
2-METHYLPENTENE										
1,1-TETRAHYDROTHIOPHENE DIOXIDE										
BENZOTHIOZOLE										
4-(1,1-DIMETHYLETHYL)PHENOL										
UNKNOWN					11					
PROPANOL										
METHYL DIMETHYLMETHOXYPROPANE										
HYDROXYPROPOXYPROPANOL										
UNKNOWN PYRIDINE										
DIETHYL ESTER (BENZENE CARBOXYLIC ACID)										
TETRAMETHYL BUTYL PHENOL										
FATTY ACID					11					
METHOXYMETHYL AZIRIDINE										
HYDROXYMETHYL BENZENE ACETIC ACID										
AZULENE										
DIMETHYL PROPANOL										
METHYL FORMAMIDE										
ACETONE										
BIS(1-METHYL-2-HYDROXYETHYL)ETHER										
METHYL NAPHTHALENE										
UNKNOWN PHTHALATE ESTER										
CRESOL										
BENZOIC ACID										
BENZENEACETIC ACID										
1,1'[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BISPROPANOL										
4,4'-(1-METHYLETHYLIDENE)BIS PHENOL MIX WITH UNK HYD										
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL										
PHENOXY ETHANOL										
2-METHYL-3-HYDROXY-2,4,4-TRIMETHYLPENTYLESTER OF PROP ACID										
0,0-DIETHYL-0-ETHYL PHOSPHOROTHIOATE										

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	TP-12		TP-13		TP-18		TP-19		TP-22	
	Jun-86	Sep-86	Jun-86	Sep-86	Jun-86	Sep-86 #	Jun-86	Sep-86	Jun-86	Sep-86
METHYL ESTER OF 9-OCTADECANOIC ACID AMINO METHYL PENTANONE DIMETHYL BENZENE CYCLOHEXANONE					18					
METHYLETHYOXYPROPANE TRIMETHYLCYCLOHEXANONE BENZENE METHANOL DIMETHYL BENZENE METHANOL										
BUTOXYBUTENE 2-DICHLOROETHENYL BENZENE ISOMER NITROCRESOL ETHYL CRESOL ISOMER										
1,2-BIS(2-CHLOROETHOXY)ETHANE 1,2-BIS(CHLOROETHOXY)ETHANE BIS-(2-METHOXYETHYL)BENZENE DICARBOXYLIC ACID ESTER 2-ETHYLHEXANOL										
N-PHENYLBENZENAMINE CHLOROETHANOL PHOSPHATE TOLUENE STYRENE										
BENZENAMINE CHLOROETHENYL BENZENE 2-ETHOXYLHEXANOIC ACID ETHYL PHENOL ISOMER										
DIMETHYL PHENOL ISOMER CHLOROPHENOL ISOMER UNKNOWN PHTHALATE ESTER N-(1,1-DIMETHYLETHYL)-3-METHYLBENZAMIDE										
3-NITRO-1,2-BENZENEDICARBOXYLIC ACID CHLORINATED HYDROCARBON 2-METHYLBENZENAMINE METHYL PHENOL ISOMER										
(1-METHYLETHYL)BENZENE 1-HEXANE 2-HEXANE HEXADECANOIC ACID										
2,3,6-TRIMETHYL-CYCLOHEXANONE 3,3,5-TRIMETHYL-CYCLOHEXANE 2,2-DIMETHYL-1-PROPANOL 3-(1-METHYLETHYL)-PHENOL										
(1)BENZOTHIENO(4,5 - B)(1)BENZOTHIOPHENE 4-METHYLPHENOL 1,7-DIHYDRO-6H-PURIN-6-ONE ALPHA-HYDROXY-BENZENEACETIC ACID										
TERT-BUTOXYISOPROPOXY METHANE 1,2-BENZENEDICARBOXYLIC ACID ESTER 3,3-DIMETHYL-2(3H)-BENZOFURANONE N,N-DIMETHYL ACETAMIDE										
4-HYDROXY-3-METHYL-2-BUTANONE 1-METHOXY-2-PROPANONE ETHYL ESTER PHOSPHORIC ACID BIS(2-METHOXYETHYL)PHTHALATE										
1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIS(OXY)]BIS-2-PROPANOL 1,1'-[(1-METHYL-1,2-ETHANEDIYL)BIX(OXY)]BIS-2-PROPANOL DIMETHYL PHENOL (2-METHOXYETHOXY)ETHENE										
2,2'-OXYBIS-BUTANE 1-METHOXY-2-BUTANOL 1,1'-OXYBIS-2-PROPANOL MONOPROPANOATE PROPANOL										
ESTER 1,2-BENZENEDICARBOXYLIC ACID HEXAHYDRO 2H-AZEPIN-2-ONE 9,12-OCTADECADIEN-1-OL BUTYL MYRISTATE(BUTYL TETRADECYLATE)										

Table 4-17, (cont.)

COMPOUND	SHALLOW SUBZONE WELLS (CONT)									
	TP-12		TP-13		TP-16		TP-19		TP-22	
	Jun-96	Sep-96	Jun-96	Sep-96	Jun-96	Sep-96 @	Jun-96	Sep-96	Jun-96	Sep-96
FATTY ACID ESTER ALPHA-TERPINEOL 3-METHYL-2-CYCLOHEXEN-1-ONE 1,1,3-TRIMETHYL-CYCLOPENTANE										
HEXADECANE TRICHLOROETHENE DICHLOROIDOMETHANE 3-METHOXY-2-METHYLPHENOL										
2-CHLORO,PHOSPHATE (3:1) ETHANOL DIMETHYL BENZENE ISOMER MOL. SULFUR METHYL NAPTHALENE ISOMER										
XYLENE ISOMER 1,2,4-TRIMETHYLBENZENE 3-METHYL-BENZENAMINE UNDECANE										
CHLORO BENZENAMINE ISOMER TETRADECANE 2,6,10,16-TETRAMETHYL-HEPTADECANE PENTADECANE										
PHOSPHORIC ACID ESTER 2-METHYL-2,4-PENTANDIOL METHYL-BENZENAMINE ISOMER DIETHYL ESTER 2-BUTENEDIOIC ACID										
4-METHYL-2-NITROPHENOL 2-(2-HYDROXYPROPOXY)-1-PROPANOL 4A,9B-DIHYDRO-6,9B-DIMETHYL-3(4H)DIBENZOFURANONE BIS(2-METHOXYETHYL)ESTER 1,2-BENZENEDICARBOXYLIC ACID 3-CHLORO BENZENAMINE										
TRIETHYL ESTER PHOSPHORIC ACID METHYL PIRODINE ISOMER 2, METHYL PHENOL 1,4 DICHLORO 2 ETHENYL BENZENE BICYCLO(4,2,0)OCTA 1,3,5 TRIENE										
ETHANOL, 2-PHENOXY UNKNOWN ALKENE UNKNOWN ALIPHATIC HYDROCARBON ISOMER OF CHLOROAMILINE 7-BENZOFURANOL, 2,3,-DIHYDRO-2,2-DIMETHYL										
UNKNOWN THIOPHENE UNKNOWN PHENOL ETHANOL, 2-CHORO-, PHOSPHATE BENZENE, 1-PROPYNYL- BENZENAMINE, 3-METHYL-										
UNKNOWN PHOSPHORIC ACID ESTER UNKNOWN AROMATIC HYDROCARBON PHENOL, 4-(1,1,3,3-TETRAMETHYLBUTYL)- 1,2-BENZENEDICARBOXYLIC ACID, 3-NITRO-										
BENZENE, METHYL- BENZENE, CHLORO- PYRIDINE, 4-METHYL- PHENOL, 2-ETHYL- PHENOL, 2,3-DIMETHYL- PHENOL,TERT-BUTYL ISOMER UNKNOWN AROMATIC										

(@) COMPLETED BELOW DEEP SUBZONE
(NA) INSUFFICIENT WATER FOR SAMPLE
(NS) WELL NOT SAMPLED
NO CONCENTRATIONS ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT
ALL RESULTS ARE QUANTITATIVE ESTIMATES

Table 4-20

Priority Pollutant Organic Compounds in Subsurface Soil Boring Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	B1 *			B2 *			B3 *	B4 *	B5 *		B6		B7 *	B8 *	B9 *	
	0-1	2-3	4-5	0-1	2-3	4-5	9.5-10	5-6	1-2	11-12	7-8	16-17	11-12	11-12	9-10	13-14
VOLATILES																
METHYLENE CHLORIDE																
TRANS-1,2-DICHLOROETHYLENE							1.0					10				
TRICHLOROETHENE												290				
BENZENE												1.10				
TOLUENE							0.8					8.57				
TETRACHLOROETHENE							0.6					16				
CHLOROBENZENE							2.8				0.47	53				
ETHYLBENZENE							3.8				0.24	17.4				
1,1,1-TRICHLOROETHANE																
SEMIVOLATILES																
1,2-DICHLOROBENZENE											2.37	11.6				
1,4-DICHLOROBENZENE																
NAPHTHALENE							3.7				5.69	301				
DI-N-BUTYL PHTHALATE							1.4				0.71	15.1				
DI-N-OCTYL PHTHALATE									0.58		0.93	5				
N-NITROSODIPHENYLAMINE							12.7	1.22	2.91		1.66	19.7				
1,2,4-TRICHLOROBENZENE							0.6				4.74					
BUTYL BENZYL PHTHALATE							23.1				2.73	350				
BIS(2-ETHYLHEXYL)PHTHALATE							44.3	3.66	22.7		20.5	371				
PHENOL											0.71					
2,4-DIMETHYLPHENOL																
2,4-DICHLOROPHENOL																
4-NITROPHENOL																
ANTHRACENE																
FLUORANTHRENE							0.8		0.58		1.66	5.8				
PHENANTHRENE							0.6				1.9	22				
PYRENE							0.8				1.42					
BENZO (A) ANTHRACENE							0.6									
BENZO (K) FLUORANTHRENE							0.7				0.71					
FLUORENE											0.83	11.6				
BENZO (A) PYRENE							0.7									
ACENAPHTHENE												11.6				
PENTACHLOROPHENOL																
PESTICIDES																
HEPTACHLOR		0.01														
DDT	0.02															
DDE							0.09		0.558		2.48	0.174				
DDD																

CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
* - PESTICIDES/PCB EXTRACTION HOLDING TIME EXCEEDED; CONCENTRATIONS ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 8/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-20, (cont.)

PARAMETER	B10 *			B11		B12 *		B13 *					B14		
	5-6	6-7	9-10	7-8 **	9-10	3-4	7-8	3-4	7-8	9-10	11-12	13-14	3-4	7-8	8-10
VOLATILES															
METHYLENE CHLORIDE															
TRANS-1,2-DICHLOROETHYLENE															
TRICHLOROETHENE				210											
BENZENE															
TOLUENE				4 93											
TETRACHLOROETHENE				1.1											
CHLOROBENZENE				0.43											
ETHYLBENZENE				3											
1,1,1-TRICHLOROETHANE				0 43											
SEMIVOLATILES															
1,2-DICHLOROBENZENE				220											
1,4-DICHLOROBENZENE				0 96											
NAPHTHALENE				46 1											
DI-N-BUTYL PHTHALATE				11 8											
DI-N-OCTYL PHTHALATE				3 64											
N-NITROSODIPHENYLAMINE		59	1.25	69.7											
1,2,4-TRICHLOROBENZENE															
BUTYL BENZYL PHTHALATE				257	1.3										
BIS(2-ETHYLHEXYL)PHTHALATE		256	0 81	800	1 54	1.05							1.68		
PHENOL															
2,4-DIMETHYLPHENOL															
2,4-DICHLOROPHENOL															
4-NITROPHENOL															
ANTHRACENE				2 57											
FLUORANTHRENE				4 07											
PHENANTHRENE				4.61											
PYRENE				2.68											
BENZO (A) ANTHRACENE															
BENZO (K) FLUORANTHRENE															
FLUORENE				4.5											
BENZO (A) PYRENE															
ACENAPHTHENE				4.61											
PENTACHLOROPHENOL															
PESTICIDES															
HEPTACHLOR															
DDT															
DDE		0.79											0.327		
DDD													0.383		

CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
* - PESTICIDES/PCB EXTRACTION HOLDING TIME EXCEEDED; CONCENTRATIONS ESTIMATED
** - VOLATILE HOLDING TIME EXCEEDED; CONCENTRATIONS ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 6/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-20, (cont.)

PARAMETER	B16		B16			B17		B18 *			B19 *			B20		B21		
	3-4	7-8	3-4	7-8	9-10	7-8	11-12	2-3	3-4	7-8	0-1	7-8	9-10	1-2	7-8	3-4	5-6	7-8
VOLATILES																		
METHYLENE CHLORIDE	0.58						3.1											
TRANS-1,2-DICHLOROETHYLENE									0.33									
TRICHLOROETHENE																		
BENZENE																		
TOLUENE									0.33									
TETRACHLOROETHENE																		
CHLOROBENZENE									0.45									
ETHYLBENZENE									0.33									
1,1,1-TRICHLOROETHANE																		
SEMIVOLATILES																		
1,2-DICHLOROBENZENE																		
1,4-DICHLOROBENZENE																		
NAPHTHALENE	1.13	0.58	66						10									
DI-N-BUTYL PHTHALATE	1.24		77						7.8									
DI-N-OCTYL PHTHALATE																		
N-NITROSODIPHENYLAMINE	2.03	0.7	88						12.2			3.7						
1,2,4-TRICHLOROBENZENE																		
BUTYL BENZYL PHTHALATE	7.78	1.39	630	2.13					63.5									
BIS(2-ETHYLHEXYL)PHTHALATE	26.8	3.71	1020	0.71	1.03			10.6	212			9.1		2.25			1.07	
PHENOL			12.1						4.70									
2,4-DIMETHYLPHENOL			8.6						1.56			2.7						
2,4-DICHLOROPHENOL			4.4						0.45									
4-NITROPHENOL			3.3															
ANTHRACENE																		
FLUORANTHRENE																		
PHENANTHRENE	0.68																	
PYRENE																		
BENZO (A) ANTHRACENE																		
BENZO (K) FLUORANTHRENE																		
FLUORENE																		
BENZO (A) PYRENE																		
ACENAPHTHENE																		
PENTACHLOROPHENOL			8.6															
PESTICIDES																		
HEPTACHLOR																		
DDT						0.034												
DDE		0.104	1.54			0.023		0.067			0.99	0.2						
DDD		0.104	0.22			0.08		0.038			0.4	0.12						

CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
* - PESTICIDES/PCB EXTRACTION HOLDING TIME EXCEEDED; CONCENTRATIONS ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 8/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-20, (cont.)

PARAMETER	B22				B23				B24			B25			B26 *		
	3-4	5-6	7-8	9-10	1-2	3-4	5-6	7-8	3-4	5-6	7-8	3-4	5-6	7-8	3-4	5-6	7-8
VOLATILES																	
METHYLENE CHLORIDE																	
TRANS-1,2-DICHLOROETHYLENE																	
TRICHLOROETHENE																	
BENZENE																	
TOLUENE																	
TETRACHLOROETHENE																	
CHLOROBENZENE																	
ETHYLBENZENE																	
1,1,1-TRICHLOROETHANE																	
SEMIVOLATILES																	
1,2-DICHLOROBENZENE																	
1,4-DICHLOROBENZENE																	
NAPHTHALENE																	
DI-N-BUTYL PHTHALATE																	
DI-N-OCTYL PHTHALATE																	
N-NITROSODIPHENYLAMINE																	
1,2,4-TRICHLOROBENZENE																	
BUTYL BENZYL PHTHALATE																	
BIS(2-ETHYLHEXYL)PHTHALATE					1.26												
PHENOL																	
2,4-DIMETHYLPHENOL																	
2,4-DICHLOROPHENOL																	
4-NITROPHENOL																	
ANTHRACENE																	
FLUORANTHRENE																	
PHENANTHRENE																	
PYRENE																	
BENZO (A) ANTHRACENE																	
BENZO (K) FLUORANTHRENE																	
FLUORENE																	
BENZO (A) PYRENE																	
ACENAPHTHENE																	
PENTACHLOROPHENOL																	
PESTICIDES																	
HEPTACHLOR																	
DDT																	
DDE					0.09												
DDD					0.09												

CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
* - PESTICIDES/PCB EXTRACTION HOLDING TIME EXCEEDED; CONCENTRATIONS ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 8/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-21

Priority Pollutant Organic Compounds in Bucket Auger Soil Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	AG - 1		AG - 2		AG - 3		AG - 4	
	0.5-1.0'	3.0-3.5'	0.5-1.0'	2.2-2.8'	0.5-1.0'	2.5-3.0'	0.5-1.0'	2.0-2.5'
VOLATILES								
METHYLENE CHLORIDE		0.010 B	0.014 B			0.019 B	0.011 B	
TRANS-1,2-DICHLOROETHYLENE								
TRICHLOROETHENE								
BENZENE								
TOLUENE							0.006 B	
TETRACHLOROETHENE								
CHLOROBENZENE								
ETHYLBENZENE								
1,1,1-TRICHLOROETHANE								
SEMIVOLATILES								
1,2-DICHLOROBENZENE								
1,4-DICHLOROBENZENE								
NAPHTHALENE								
N-NITROSODI-N-PROPYLAMINE			0.46					
NITROBENZENE								
DI-N-BUTYL PHTHALATE								
DI-N-OCTYL PHTHALATE								
N-NITROSODIPHENYLAMINE								
1,2,4-TRICHLOROBENZENE								
BUTYL BENZYL PHTHALATE								
BIS(2-ETHYLHEXYL)PHTHALATE	1.64 B							0.4 B
PHENOL								
2,4-DIMETHYLPHENOL								
2,4-DICHLOROPHENOL								
4-NITROPHENOL								
ANTHRACENE								
FLUORANTHRENE								
PHENANTHRENE								
PYRENE								
BENZO (A) ANTHRACENE								
CHRYSENE								
BENZO (K) FLUORANTHRENE								
BENZO (B)FLOURANTHRENE								
FLUORENE								
BENZO (A) PYRENE								
INDENO(1,2,3-CD)PYRENE								
BENZO(GHI)PERYLENE								
ACENAPHTHENE								
PENTACHLOROPHENOL								
PESTICIDES								
HEPTACHLOR								
DDT			0.048	0.012				
DDE			0.024					
DDD	0.022		0.203					

J - REPORTED RESULT IS A QUANTITATIVE ESTIMATE
B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 5/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-22

Priority Pollutant Organic Compounds Detected in Shallow Soil Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	S1	S2	S3	S4	S5	S6	S7	S8	S9
VOLATILES									
METHYLENE CHLORIDE									
TRANS-1,2-DICHLOROETHYLENE	0.42								
TRICHLOROETHENE									
BENZENE									
TOLUENE	0.53								
TETRACHLOROETHENE	1.8								
CHLOROBENZENE									
ETHYLBENZENE	0.74								
1,1,1-TRICHLOROETHANE									
SEMIVOLATILES									
1,2-DICHLOROBENZENE									
1,4-DICHLOROBENZENE									
NAPHTHALENE	6.3								
NITROBENZENE	6.3								
DI-N-BUTYL PHTHALATE									
DI-N-OCTYL PHTHALATE									
N-NITROSODIPHENYLAMINE									
1,2,4-TRICHLOROBENZENE									
BUTYL BENZYL PHTHALATE									
BIS(2-ETHYLHEXYL)PHTHALATE						1.97			
PHENOL									
2,4-DIMETHYLPHENOL									
2,4-DICHLOROPHENOL									
4-NITROPHENOL									
ANTHRACENE									
FLUORANTHRENE			2.61						
PHENANTHRENE	7.4		2.09						
PYRENE			2.92						
BENZO(A)ANTHRACENE			2.71						
CHRYSENE			2.82						
BENZO(K)FLUORANTHRENE			3.97						
BENZO(B)FLUORANTHRENE									
FLUORENE									
BENZO(A)PYRENE			2.61						
INDENO(1,2,3-CD)PYRENE			1.25						
BENZO(GHI)PERYLENE			3.44						
ACENAPHTHENE									
PENTACHLOROPHENOL									
PESTICIDES/PCBs *									
HEPTACHLOR									
DDT				0.033			0.033		0.044
DDE				0.022		0.073	0.011		0.033
DDD				0.022			0.011		0.011

B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
CONCENTRATION REPORTED IN mg/Kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
S1-S9 COLLECTED FEBRUARY 1986
S10-S15 COLLECTED APRIL 1986
S16-S19 COLLECTED MARCH 1988
ALL SAMPLES COLLECTED 0.5-1.5 FEET BELOW SURFACE
* - PESTICIDE/PCB EXTRACTION HOLDING TIME EXCEEDED FOR S1 THROUGH S15; CONCENTRATION ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 5/86.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

Table 4-22, (cont.)

PARAMETER	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
VOLATILES										
METHYLENE CHLORIDE										0.01 B
TRANS-1,2-DICHLOROETHYLENE										
TRICHLOROETHENE										
BENZENE										
TOLUENE										
TETRACHLOROETHENE										
CHLOROBENZENE										
ETHYLBENZENE										
1,1,1-TRICHLOROETHANE										
SEMIVOLATILES										
1,2-DICHLOROBENZENE										
1,4-DICHLOROBENZENE										
NAPHTHALENE										0.6
NITROBENZENE										
DI-N-BUTYL PHTHALATE										
DI-N-OCTYL PHTHALATE										
N-NITROSODIPHENYLAMINE										1.53
1,2,4-TRICHLOROBENZENE										0.73
BUTYL BENZYL PHTHALATE										0.98
BIS(2-ETHYLHEXYL)PHTHALATE							0.97 B	1.35 B		2.8
PHENOL										
2,4-DIMETHYLPHENOL										
2,4-DICHLOROPHENOL										
4-NITROPHENOL										
ANTHRACENE										
FLUORANTHRENE										0.87
PHENANTHRENE										0.6
PYRENE										1.16
BENZO(A)ANTHRACENE										0.65
CHRYSENE										
BENZO(K)FLUORANTHRENE										1.05
BENZO(B)FLUORANTHRENE										1.02
FLUORENE										
BENZO(A)PYRENE										1.38
INDENO(1,2,3-CD)PYRENE										1.02
BENZO(GHI)PERYLENE										1.16
ACENAPHTHENE										
PENTACHLOROPHENOL										
PESTICIDES/PCBs *										
HEPTACHLOR										
ODT										
DDE	0.011	0.043							0.048	
DDD								0.012		

B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
CONCENTRATION REPORTED IN mg/Kg (ppm) dry weight
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
S1-S9 COLLECTED FEBRUARY 1988
S10-S15 COLLECTED APRIL 1988
S16-S19 COLLECTED MARCH 1988
ALL SAMPLES COLLECTED 0.5-1.5 FEET BELOW SURFACE
* - PESTICIDE/PCB EXTRACTION HOLDING TIME EXCEEDED FOR S1 THROUGH S15; CONCENTRATION ESTIMATED

NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 5/88.
-SOIL CLEANUP OBJECTIVES ARE 1 PPM FOR TOTAL VOLATILE ORGANICS AND 10 PPM FOR TOTAL BASE NEUTRALS.

TABLE 4-23

BACKGROUND LEVELS AND CLEAN-UP OBJECTIVES FOR
SELECTED PRIORITY POLLUTANT INORGANIC CONSTITUENTS
AND INDICATOR PARAMETERS DETECTED IN SOIL AT THE CLTL SITE

CONSTITUENT/ PARAMETER	SITE-SPECIFIC BACKGROUND LEVEL[a] (mg/kg)	BACKGROUND LEVEL FOR NEW JERSEY SOIL[b] (mg/kg)	NJDEP CLEAN-UP OBJECTIVE[c] (mg/kg)
Arsenic	8.6	NA	20
Beryllium	0.2	NA	1
Cadmium	0.2*	1.0-1.4	3
Chromium	15	5-48	100
Copper	6	0.5-53.6	170
Lead	7	1-180	250-1,000
Mercury	0.2*	NA	1
Nickel	5	11.1-86.5	100
Silver	0.9	NA	5
Thallium	2	NA	NA
Zinc	23.2	4.5-168	350
TOC	1,400	NA	NA
COD	10,600	NA	NA

a - Highest concentration in samples from background soil borings in Area 4, CLTL site.

b - 1987 Draft New Jersey Risk Assessment Guidelines.

c - Soil cleanup objectives provided by NJDEP.

NA - Level not established.

* - Not detected above laboratory reporting limit in Area 4. Value represents laboratory reporting limit.

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Table 4-24

Priority Pollutant Inorganic Constituents, Classical Parameters, and Indicator Parameters In Subsurface Soil Boring Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	REFERENCE LEVEL*	B1			B2			B3	B4	B5		B6		B7	B8	B9	
		0-1	2-3	4-5	0-1	2-3	4-5	9.5-10	5-6	1-2	11-12	7-8	16-17	11-12	11-12	9-10	13-14
ANTIMONY																	
ARSENIC	20	8.8	4.8	7.3	6.5	7.4	2.1	4.4	17.3	8.8	2.99	4.74	3.13	8.56	1.95	3.37	4.22
BERYLLIUM	1	0.2	0.1														
CADMIUM	3							2.8	2.03	1.05		1.78					
CHROMIUM	100	15	10	12	11	10	3	9	32.5	10.5	8	29.6	11.6	8.9	8.9	5.8	7.8
COPPER	170	4	3	8	8	4	2	5	26.4	9.3	1.1	10.7	3.5	2.3	1.1	1.2	1.1
LEAD	250-1000	8		7	4			106	50.8	53.5		838	105			1.2	
MERCURY	1																
NICKEL	100	5		3	3	1		3	8.1	3.5	1.1	3.8	2.3	1.2	2.3	2.3	1.1
SELENIUM	1																
SILVER				0.9													
THALLIUM		2	2	1													
ZINC	350	23.2	8.9	21	13.3	12.5	4	16.8	118	34	4.71	87.3	11	4.72	3.89	5.46	5
PHENOLS								0.5	0.41	0.21			3.5	0.35			
CYANIDE																	
TOC		1400	640	370	1300	310	260	370	3000	6700	250	640	3900	160	190	170	130
TOX																120	
COD **		10600	1200	3800	3900	<600	500	11100	36600*	19700*	<300*	10600*	23500*	<300*	500*	300*	<300*

NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT
* REPORTED ON WET WEIGHT BASIS
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED, CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 5/88.

Table 4-24, (cont.)

PARAMETER	REFERENCE LEVEL*	B10			B11		B12		B13					B14			B15	
		5 - 6	6 - 7	9 - 10	7 - 8	9 - 10	3 - 4	7 - 8	3 - 4	7 - 8	9 - 10	11 - 12	13 - 14	3 - 4	7 - 8	8 - 10	3 - 4	7 - 8
ANTIMONY																		
ARSENIC	20	2.2	453	3.18	3		3.48	2.38	4.23	0.71	2.32	1.91	0.82	12.5	8.73	2.85	8.12	9.27
BERYLLIUM	1		0.79				0.23							0.23	0.12		0.23	0.12
CADMIUM	3		8.86											0.9			1.24	4.4
CHROMIUM	100	9.3	35.4	9.1	3.2	1.2	9.3	7.8	3.3		3.5	4.5	3.5	19.1	20.3	6.8	23.7	22.00
COPPER	170	3.5	39.4	1.1	1.1		4.7	2.3			8.1		2.4	12.4	8.00	1.1	7.8	12.7
LEAD	250-1000	4.8	70.9				4.7	1.1	1.1		2.3			33.8	8.4	2.3	20.3	37.1
MERCURY	1																	
NICKEL	100	4.8	15.7	1.1			7	2.3						7.9	4.8	2.3	6.8	7.00
SELENIUM	1																	
SILVER																		
THALLIUM																		
ZINC	350	10.4	1320	6.93	3.11	2.13	16.5	7.35	4.02	1.42	1.04	4.84	3.65	54.8	22.2	6.13	39.5	88.7
PHENOLS			15.7		5.4						0.25							0.58
CYANIDE		3.5		0.68														
TOC		1200	67000	570	1400	190	170	110	210	120	190	170	160	1100	1400	90	2100	2000
TOX					540								120					
COD **		5000*	223400*	2300*	38800*	<600*	600*	<400*	600*	<300*	<700*	400*	700*	29100*	3100*	500*	25600*	22100*

NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT
* REPORTED ON WET WEIGHT BASIS
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED, CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 9/88.

Table 4-24, (cont.)

PARAMETER	REFERENCE LEVEL*	B16			B17		B18			B19			B20	
		3 - 4	7 - 8	9 - 10	7 - 8	11 - 12	2 - 3	3 - 4	7 - 8	0 - 1	7 - 8	9 - 10	1 - 2	7 - 8
ANTIMONY														
ARSENIC	20	12.7	3.07	1.03	20.4	4.59	8.14	8.57	5.2	94.9	17	4.04	1.69	1.51
BERYLLIUM	1	0.22						0.22	0.11			0.23	0.11	
CADMIUM	3	36.3	2.01				1.11	0.45		8.3	1.23		0.22	
CHROMIUM	100	76.00	8.3	9.1	16.00	13.3	13.4	17.8	15.8	101	24.8	17.3	9	10.5
COPPER	170	39.6	2.4	1.1	10.3	4.8	8.9	7.8	4.5	92.9	14.8	4.6	2.2	
LEAD	250-1000	130	2.4	1.1	29.7	6.00	21.2	22.3	5.7	374	34.5	3.5	3.4	
MERCURY	1									0.99				
NICKEL	100	12.1	3.5	2.3	6.9	4.8	5.6	6.7	4.5	31.6	9.9		4.5	
SELENIUM	1													
SILVER														
THALLIUM														
ZINC	350	110	30.2	9.13	39	19.6	26.9	41.5	15.6	348	57.9	8.66	16.5	3.26
PHENOLS		17.6					0.28	10		4.55	11.8	0.23		
CYANIDE														
TOC		1100	140	140	3000	1400	5000	2700	540	16000	12000	540	870	130
TOX														
COD **		54700*	900*	1800*	21100*	15700*	18700*	32800*	1500*	233900*	86500*	800*	4400*	<300*

NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT
* REPORTED ON WET WEIGHT BASIS
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED, CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 5/88.

Table 4-24, (cont.)

PARAMETER	REFERENCE LEVEL*	B21 3 - 4	B21 5 - 6	B21 7 - 8	B22 3 - 4	B22 5 - 6	B22 7 - 8	B22 9 - 10	B23 1 - 2	B23 3 - 4	B23 5 - 6	B23 7 - 8	B24 3 - 4	B24 5 - 6	B24 7 - 8
ANTIMONY															
ARSENIC	20	2.64	1.43	1.12	0.88	1.13	2.8	2.36	18.8	3.98	1.09	3.00	5.98	2.04	1.6
BERYLLIUM	1								0.36	0.12			0.12		
CADMIUM	3							0.22	1.26				0.36		
CHROMIUM	100	10.3	8.3	8.0	10.1	6.8	6.8	6.7	32.5	19.3	9.7	5.8	14.4	9.1	8.00
COPPER	170	2.3	1.2		2.3	1.1			23.5	4.8	2.4		12	2.3	1.1
LEAD	250-1000	2.3			2.3				68.8	3.6	2.4		6.00		
MERCURY	1														
NICKEL	100	2.3	1.2		2.3	1.1			10.8	6.00	3.6		7.2	11.3	2.3
SELENIUM	1														
SILVER															
THALLIUM															
ZINC	350	8.28	5.96	3.35	8.68	4.88	4.19	3.15	49.8	23.5	10.9	3.46	20.1	44.7	5.94
PHENOLS						0.23			3.77						
CYANIDE															
TOC		180	190	59	620	150	120	89	10000	340	310	97	620	150	30
TOX															
COD **		1800*	900*	500*	2100*	1300*	500*	<300*	121500*	2800*	3900*	400*	3400*	1800*	500*

NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT
* REPORTED ON WET WEIGHT BASIS
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED, CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 5/88.

Table 4-24, (cont.)

PARAMETER	REFERENCE LEVEL*	B28 3 - 4	B28 5 - 6	B28 7 - 8	B26 3 - 4	B26 5 - 6	B26 7 - 8
ANTIMONY							
ARSENIC	20	6.52	2.38	2.00	6.12	1.87	1.39
BERYLLIUM	1				0.24		0.12
CADMIUM	3				5.65	0.82	
CHROMIUM	100	20.1	7.2	9.4	17.8	7.00	7.00
COPPER	170	5.9	2.4	1.2	5.9	1.2	
LEAD	250-1000	3.6	1.2		3.5		
MERCURY	1						
NICKEL	100	4.7	2.4	1.2	4.7	1.2	
SELENIUM	1						
SILVER							
THALLIUM							
ZINC	350	20.7	7.39	5.17	25.8	5.96	2.44
PHENOLS					0.22		
CYANIDE							
TOC		960	98	52	2000	150	50
TOX							
COD **		2200*	1500*	<300*	5100*	1300*	400*

NO CONCENTRATION ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT
* REPORTED ON WET WEIGHT BASIS
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED, CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 5/88.

Table 4-25

Priority Pollutant Inorganic Constituents, Classical Parameters, and Indicator Parameters in Bucket Auger Soil Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	REFERENCE LEVEL*	AG - 1		AG - 2		AG - 3		AG - 4	
		0.5-1.0'	3.0-3.5'	0.5-1.0'	2.2-2.8'	0.5-1.0'	2.5-3.0'	0.5-1.0'	2.0-2.5'
ANTIMONY									
ARSENIC	20	13.5 J	5.0 J	26.3 J	7.1 J	6.8 J	3.8 J	4.5 J	5.8 J
BERYLLIUM	1	0.67		0.72					
CADMIUM	3								
CHROMIUM	100	14.6	13.8	15.6	15.3	19.2	6.3	12.4	16.1
COPPER	170	10.1	5.0	14.4	5.9	6.8	3.0	4.5	4.6
LEAD	250-1000	20.2		38.3	8.2	6.8		6.8	
MERCURY	1								
NICKEL	100	6.7	5.0	8.4	5.9	5.6		5.6	
SELENIUM	1								
SILVER									
THALLIUM									
ZINC	350	36.0 J	25.0 J	55.0 J	24.7 J	27.1 J	11.3 J	24.8 J	20.7 J
PHENOLS									
CYANIDE									
TOC		3000	3900	6500	1500	3200	350	1900	930
TOX					470 B	110 B		230 B	
COD		11900	11100	29100	6350	5080	1500	12400	4490

J - REPORTED RESULT IS A QUANTITATIVE ESTIMATE
B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
NO CONCENTRATION ENTERED FOR PARAMETERS NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) DRY WEIGHT

*-NJDEP SOIL CLEANUP OBJECTIVES (PPM) PROVIDED BY NJDEP 5/88.

Table 4-26

Priority Pollutant Inorganic Constituents, Classical Parameters, and Indicator Parameters in Shallow Soil Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	REFERENCE LEVEL*	S1	S2	S3	S4	S5	S6	S7	S8	S9
ANTIMONY										
ARSENIC	20	11.40	3.01	8.87	14.00	3.73	8.22	4.20	3.71	12.10
BERYLLIUM	1	0.42	0.22		0.55	0.32		0.22	0.21	0.33
CADMIUM	3						0.41			0.22
CHROMIUM	100	10.60	7.50	21.90	15.50	20.20	9.30	8.80	13.80	13.30
COPPER	170	4.20	3.20	3.10	7.80	2.13	5.20	5.50	5.30	6.70
LEAD	250-1000	75.00	2.20	4.20	15.50	5.30	254.00	18.80	6.40	23.40
MERCURY	1									
NICKEL	100	4.20	3.20		5.50	2.10	2.10	3.30	3.20	3.30
SELENIUM	1									
SILVER										
THALLIUM										
ZINC	350	18.80	11.60	12.30	31.60	12.60	50.20	35.10	15.60	25.80
PHENOLS		1.10					0.31			
CYANIDE										
TOC		8700	100	980	4200	910	17000	4300	800	860
TOX										
COD **		63400	800	4700	12900	3200	26900	11000	3000	11000

B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
NO CONCENTRATIONS ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
S1-S9 COLLECTED FEBRUARY 1988
S10-S15 COLLECTED APRIL 1988
S16-S19 COLLECTED MARCH 1988
ALL SAMPLES COLLECTED 0.5-1.5 FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED FOR S1 THROUGH S15; CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 6/88.

Table 4-26, (cont.)

PARAMETER	REFERENCE LEVEL*	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
ANTIMONY											
ARSENIC	20	14.10	6.47	6.10	5.05	4.93	3.30	4.80 J	3.50 J	8.30 J	7.70 J
BERYLLIUM	1		0.32	0.21	0.43	0.21	0.10				
CADMIUM	3										2.62
CHROMIUM	100	40.00	22.70	17.80	22.80	35.80	8.20	10.70	8.80	13.10	16.40
COPPER	170	8.90	9.70	5.20	6.40	4.20	2.10	3.80		4.80	13.10
LEAD	250-1000	7.80	9.70	4.20	5.40	5.20	1.00			9.50	384.00
MERCURY	1										
NICKEL	100	4.40	3.20	2.10	4.30	3.10					4.40
SELENIUM	1										
SILVER											
THALLIUM											
ZINC	350	28.30	23.70	14.50	17.10	14.20	5.57	20.2 J	15.00 J	18.70 J	71.00 J
PHENOLS			0.14		0.086						0.98
CYANIDE											
TOC		490	1000	1900	1400	940	300	3900	3200	5700	7800
TOX											220 B
COD **		2000	3700	3100	2500	1800	900	11200	9010	13900	24600

B - REPORTED RESULT IS QUALITATIVELY INVALID SINCE THIS COMPOUND WAS DETECTED IN A BLANK AT A SIMILAR CONCENTRATION
J - REPORTED RESULT IS A QUANTITATIVE ESTIMATE
NO CONCENTRATIONS ENTERED FOR PARAMETER NOT DETECTED ABOVE QUANTITATION LIMIT
CONCENTRATION REPORTED IN mg/kg (ppm) dry weight
S1-S9 COLLECTED FEBRUARY 1988
S10-S19 COLLECTED APRIL 1988
S16-S19 COLLECTED MARCH 1988
ALL SAMPLES COLLECTED 0.5-1.5 FEET BELOW SURFACE
** - COD ANALYSIS HOLDING TIME EXCEEDED FOR S1 THROUGH S15; CONCENTRATION ESTIMATED

*-NJDEP SOIL CLEANUP OBJECTIVES PROVIDED BY NJDEP 5/88.

Table 4-27

Tentatively Identified Organic Compounds Detected in Subsurface Soil Boring Samples Collected in the Remedial Investigation at the CLTL Site

PARAMETER	B1			B2			B3	B4	B5		B6		B7	B8	B9	
	0-1	2-3	4-5	0-1	2-3	4-5	9.5-10	5-6	1-2	11-12	7-8	16-17	11-12	11-12	9-10	13-14
ALIPHATIC HYDROCARBON	10						74	15.0	342		60.2	384.2				
UNKNOWN HYDROCARBON	23.6						32	4.5								
1-ETHYL-2-METHYLCYCLOPENTANE		0.9														
2,2,4-TRIMETHYL-1-PENTENE							0.24									
1-METHYLETHYLBENZENE							8.8									
UNKNOWN							0.18	10.80			0.800					
XYLENE							2.8									
SUBSTITUTED NAPHTHALENE							2									
ISOMERIC DODECYLBENZENE							1									
2-ETHYLHEXYL DIPHENYL ESTER PHOSPHORIC ACID							3									
ACETONE								0.520			0.280					
3,7,7-TRIMETHYLBICYCLO[4.1.0]HEPT-3-ENE								0.200								
FATTY ACID								1.0				88				
SULFUR								1.5	5							
D-FRIEDOOLEAN-14-EN-3-ONE								3.5								
METHYL ESTER ACETIC ACID											0.360					
METHYLCYCLOHEXANE												1.2				
CUMENE												13.2				
STYRENE												14.4				
1,1,3-TRIMETHYLCYCLOHEXANE												1.2				
2-METHYLNAPHTHALENE												18				
DIMETHYLNAPHTHALENES											2.2	12				
TETRAMETHYLBUTYLPHENOLS																
TRIMETHYLNAPHTHALENE																
NONYLPHENOL																
UNKNOWN SILOXANES																
ETHYL NAPHTHALENE																
1,2,4,5-TETRACHLOROBENZENE																
1,4-PENTAMETHYLENE-DEWAR-BENZENE																
OCTYL PHENOL ISOMER																
MIX OF NONYL PHENOL ISOMER AND 1-BUTOXYMETHYLETHYLBENZENE																
SUBSTITUTED CYCLOHEXANE ISOMER																
HEXADECANOIC ACID																
UNKNOWN PHTHALATES																
3,6-DIMETHYLPHENOL																
1,3,3-TRIMETHYL-2-OXABICYCLO[2.2.2]OCTANE																
STIGMAST-3,6-DIENE-7-ONE																

CONCENTRATION REPORTED IN mg/kg (ppm)
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
ALL CONCENTRATIONS ARE ESTIMATED

Table 4-27, (cont.)

PARAMETER	B10			B11		B12		B13					B14		
	5-6	6-7	9-10	7-8	9-10	3-4	7-8	3-4	7-8	9-10	11-12	13-14	3-4	7-8	8-10
ALIPHATIC HYDROCARBON		94	1.6	378.2	0.520										
UNKNOWN HYDROCARBON		8		47									4.6		
1-ETHYL-2-METHYLCYCLOPENTANE															
2,2,4-TRIMETHYL-1-PENTENE															
1-METHYLETHYLBENZENE															
UNKNOWN			2	34											
XYLENE															
SUBSTITUTED NAPHTHALENE															
ISOMERIC DODECYLBENZENE															
2-ETHYLHEXYL DIPHENYL ESTER PHOSPHORIC ACID															
ACETONE		0.500													
3,7,7-TRIMETHYLBICYCLO[4.1.0]HEPT-3-ENE															
FATTY ACID				38											
SULFUR		26							0.8		0.7	1.0			
D-FRIEDOOLEAN-14-EN-3-ONE		8													
METHYL ESTER ACETIC ACID															
METHYLCYCLOHEXANE															
CUMENE															
STYRENE															
1,1,3-TRIMETHYLCYCLOHEXANE															
2-METHYLNAPHTHALENE		29	0.8	21											
DIMETHYLNAPHTHALENES		89		18											
TETRAMETHYLBUTYLPHENOLS		40													
TRIMETHYLNAPHTHALENE		6													
NONYLPHENOL		13													
UNKNOWN SILOXANES				76											
ETHYL NAPHTHALENE				15											
1,2,4,5-TETRACHLOROBENZENE				17											
1,4-PENTAMETHYLENE-DEWAR-BENZENE													0.8		
OCTYL PHENOL ISOMER													2.7	0.5	
MIX OF NONYL PHENOL ISOMER AND 1-BUTOXYMETHYLETHYLBENZENE													0.6		
SUBSTITUTED CYCLOHEXANE ISOMER															
HEXADECANOIC ACID															
UNKNOWN PHTHALATES															
3,6-DIMETHYLPHENOL															
1,3,3-TRIMETHYL-2-OXABICYCLO[2.2.2]OCTANE															
STIGMAST-3,6-DIENE-7-ONE															

CONCENTRATION REPORTED IN mg/kg (ppm)
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
ALL CONCENTRATIONS ARE ESTIMATED

Table 4-27, (cont.)

PARAMETER	B15		B16			B17		B18			B19			B20		B21		
	3-4	7-8	3-4	7-8	9-10	7-8	11-12	2-3	3-4	7-8	0-1	7-8	9-10	1-2	7-8	3-4	5-6	7-8
ALIPHATIC HYDROCARBON	48	250	6540	04	08		03	245	318			31		0.3	32.7			
UNKNOWN HYDROCARBON								83				18		0.9				
1-ETHYL-2-METHYLCYCLOPENTANE																		
2,2,4-TRIMETHYL-1-PENTENE																		
1-METHYLETHYLBENZENE																		
UNKNOWN								84							0.4			
XYLENE																		
SUBSTITUTED NAPHTHALENE																		
ISOMERIC DODECYLBENZENE																		
2-ETHYLHEXYL DIPHENYL ESTER PHOSPHORIC ACID														0.4				
ACETONE																		
3,7,7-TRIMETHYLBICYCLO[4.1.0]HEPT-3-ENE																		
FATTY ACID								13		0.5								
SULFUR								2.0								0.8	0.9	1.4
D-FRIEDOOLEAN-14-EN-3-ONE												0.8						
METHYL ESTER ACETIC ACID																		
METHYLCYCLOHEXANE																		
CUMENE																		
STYRENE																		
1,1,3-TRIMETHYLCYCLOHEXANE																		
2-METHYLNAPHTHALENE		0.7							1	2								
DIMETHYLNAPHTHALENES	1		380						1									
TETRAMETHYLBUTYLPHENOLS								2.2	0.8			3		0.8				
TRIMETHYLNAPHTHALENE																		
NONYLPHENOL																		
UNKNOWN SILOXANES																		
ETHYL NAPHTHALENE									0.7									
1,2,4,5-TETRACHLOROBENZENE																		
1,4-PENTAMETHYLENE-DEWAR-BENZENE																		
OCTYL PHENOL ISOMER	4	2		0.6														
MIX OF NONYL PHENOL ISOMER AND 1-BUTOXYMETHYLETHYLBENZENE																		
SUBSTITUTED CYCLOHEXANE ISOMER			99															
HEXADECANOIC ACID						0.6												
UNKNOWN PHTHALATES								2.4	1									
3,5-DIMETHYLPHENOL																		
1,3,3-TRIMETHYL-2-OXABICYCLO[2.2.2]OCTANE																		
STIGMAST-3,5-DIENE-7-ONE																		

CONCENTRATION REPORTED IN mg/kg (ppm)
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
ALL CONCENTRATIONS ARE ESTIMATED

Table 4-27, (cont.)

PARAMETER	B22				B23				B24			B28			B26		
	3-4	5-6	7-8	9-10	1-2	3-4	5-6	7-8	3-4	5-6	7-8	3-4	5-6	7-8	3-4	5-6	7-8
ALIPHATIC HYDROCARBON					13 3										3.5		
UNKNOWN HYDROCARBON					6.2												
1-ETHYL-2-METHYLCYCLOPENTANE																	
2,2,4-TRIMETHYL-1-PENTENE																	
1-METHYLETHYLBENZENE																	
UNKNOWN					1.8										7.1		
XYLENE																	
SUBSTITUTED NAPHTHALENE																	
ISOMERIC DODECYLBENZENE																	
2-ETHYLHEXYL DIPHENYL ESTER PHOSPHORIC ACID																	
ACETONE																	
3,7,7-TRIMETHYLBICYCLO[4,1,0]HEPT-3-ENE																	
FATTY ACID																	
SULFUR	0.8	0.8	0.9	0.7	0.8												
D-FRIEDOOLEAN-14-EN-3-ONE					2.3										1.9		
METHYL ESTER ACETIC ACID																	
METHYLCYCLOHEXANE																	
CUMENE																	
STYRENE																	
1,1,3-TRIMETHYLCYCLOHEXANE																	
2-METHYLNAPHTHALENE																	
DIMETHYLNAPHTHALENES																	
TETRAMETHYLBUTYLPHENOLS																	
TRIMETHYLNAPHTHALENE																	
NONYLPHENOL																	
UNKNOWN SILOXANES																	
ETHYL NAPHTHALENE																	
1,2,4,5-TETRACHLOROBENZENE																	
1,4-PENTAMETHYLENE-DEWAR-BENZENE																	
OCTYL PHENOL ISOMER																	
MIX OF NONYL PHENOL ISOMER AND 1-BUTOXYMETHYLETHYLBENZENE																	
SUBSTITUTED CYCLOHEXANE ISOMER																	
HEXADECANOIC ACID																	
UNKNOWN PHTHALATES																	
3,5-DIMETHYLPHENOL																	
1,3,3-TRIMETHYL-2-OXABICYCLO[2.2.2]OCTANE					0.160												
STIGMAST-3,5-DIENE-7-ONE					1.1												

CONCENTRATION REPORTED IN mg/kg (ppm)
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT
SAMPLE DEPTHS GIVEN IN FEET BELOW SURFACE
ALL CONCENTRATIONS ARE ESTIMATED

Table 4-29

Tentatively Identified Organic Compounds Detected in Shallow Soil Samples Collected in the Remedial Investigation at the CLTL Site

COMPOUNDS	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12	S-13	S-14	S-15	S-16	S-17	S-18	S-19
ALIPHATIC HYDROCARBON	1302 000		6 300			281.300				1.200	3 500	60.800	20 000	1.300					
UNKNOWN	88.380		10 800														9.425	0.321	1 892
UNKNOWN HYDROCARBON										0 300	0 600		2.100	10 400					7.902
UNKNOWN POLYAROMATIC HYDROCARBON			11 600																
METHYL CYCLOHEXANE	0 760																		
DIMETHYLCYCLOHEXANE	0 760																		
1-ETHYL-4-METHYL CYCLOHEXANE	0 320																		
1,1,3-TRIMETHYLCYCLOHEXANE	0 600																		
ETHYLCYCLOHEXANE	0.840																		
8-(1-METHYLETHYLIDENE)-BICYCLO [5.1.0]OCTANE	0 480																		
DIMETHYLNAPHTHALENE	43 000																		
NITROBENZENAMINE	33 000																		
DIMETHYLPHENANTHRENE			8.500																
METHYL PHENANTHRENE			3 600																
TRIMETHYLPHENANTHRENE			7 900																
METHYL PYRENE			8 700																
METHYL BENZO(A)ANTHRACENE			2.900																
PERYLENE			3 100																
DIMETHYL BENZO(C)PHENANTHRENE			2 500																
SULFUR										0.100									
ACETIC ACID, PENTYL ESTER														0.700					
PHENOL, 2-FLUORO-																	4.138		
1-PROPENE,3-ISOTHIOCYANATO-																	4 388		
1,1-BIPHENYL, FLUORO-																	2.528		
1H-BENZOTRIAZOLE																			1.087
BENZENE, 2,4-DICHLORO-1-(TRIFLUOROMETHYL)																			2.391
CHLOROAMLINE																			0.685
1H-INDENE, 1-ETHYLIDENE-																			0.728
NAPHTHALENE, METHYL																			9 424
BENZENAMINE, DICHLORO																			2.619
HEPTADECANE, 2,6,10,15-TETRAMETHYL																			1.739
HEXADECANE, 8-OCTYL																			1.739
HEXADECANE																			1.413
HEPTADECANE																			1.186
PHENOL, 2,4-DITERTBUTYL																			2.410
BENZENE,1-CHLORO-4-TRIFLUOROMETHYL																			0.009

ALL REPORTED RESULTS ARE QUANTITATIVE ESTIMATES.
CONCENTRATIONS ARE REPORTED IN mg/kg (ppm)
S1-S9 COLLECTED FEBRUARY 1986
S10-S15 COLLECTED APRIL 1986
S16-S19 COLLECTED MARCH 1988
ALL SAMPLES COLLECTED 0.5-1.5 FEET BELOW SURFACE
NO CONCENTRATIONS ENTERED FOR COMPOUNDS NOT DETECTED ABOVE THE QUANTITATION LIMIT

Table 4-28

Tentatively Identified Organic Compounds in Bucket Auger Soil Samples Collected in the Remedial Investigation at the CLTL Site

COMPOUND	AG - 1		AG - 2		AG - 3		AG - 4	
	0.5-1.0'	3.0-3.5'	0.5-1.0'	2.2-2.8'	0.5-1.0'	2.5-3.0'	0.5-1.0'	2.0-2.5'
UNKNOWN	2.483	2.213	1.607	0.506	3.026	0.300	0.393	0.471
UNKNOWN HYDROCARBON					0.506			
PHENOL, 2-FLUORO-	6.404	6.375			5.888			
7H-PYRAZOLO[4,3-DIPYRMIDIN-	0.449				0.506		0.506	
1,1'-BIPHENYL, FLUORO-	0.483	0.662			0.393		0.483	
HEXANEDIOIC ACID, SUBSTITUTED	4.607	0.475						
ACETIC ACID		0.250			0.685			
2-PROPANONE, 1-HYDROXY-		0.212						
METHANAMINE, N,N-DIMETHYL-		2.000						
1H-IMIDAZOLE, 4-METHYL-		1.188					0.236	
2H-1-BENZOPYRAN-2-ONE, 4,5,7		0.400						
HEXANEDIOIC ACID, DIOCTYL ESTER			0.262				0.258	
ETHANONE, 2-(FORMYLOXY)-1PH				0.176				
BENZAMIDE, N-PROPYL-				0.165				
OCTANE, 3-METHYL-					0.607		0.258	
ISOTHIAZOLE, METHYL-, ISOMER					0.427		0.292	
1H-PYRAZOLE, 1-METHYL-					0.842			

ALL RESULTS ARE ESTIMATED CONCENTRATIONS
CONCENTRATIONS REPORTED IN mg/kg (ppm) DRY WEIGHT
NO CONCENTRATION ENTERED FOR COMPOUND NOT DETECTED ABOVE QUANTITATION LIMIT

APPENDIX B

WORKSHEETS USED IN THE SELECTION OF INDICATORS AT CLTL-BRIDGEPORT, NJ TERMINAL

WORKSHEET 1.
SCORING FOR INDICATOR CHEMICAL SELECTION:
CONCENTRATIONS IN VARIOUS ENVIRONMENTAL MEDIA.

NAME OF SITE: Bridgeport,NJ
DATE PREPARED: 1/23/89
ANALYST: TAS

CHEMICAL	DEEP GROUND WATER (mg/L)		INT/SHAL/RES GW (mg/L)		SURFACE SOIL (mg/kg)		SUBSURFACE SOIL (mg/kg)	
	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE
Antimony			9.00E-03	2.48E-02				
Arsenic	9.00E-03	5.33E-03	1.23E+00	5.64E-02	9.49E+01	1.11E+01	4.53E+02	1.17E+01
Beryllium			7.00E-03	2.66E-03	7.20E-01	2.97E-01	7.90E-01	2.41E-01
Cadmium					8.30E+00	6.75E-01	3.63E+01	1.28E+00
Chromium VI	6.00E-02	2.79E-02	6.90E-01	5.34E-02	1.01E+02	1.89E+01	7.60E+01	1.26E+01
Copper	4.00E-02	1.42E-02	2.90E-01	4.31E-02	9.29E+01	9.71E+00	3.96E+01	5.34E+00
Lead	1.10E-02	3.21E-03	3.50E+00	1.14E-01	3.74E+02	4.82E+01	8.38E+02	2.58E+01
Mercury, inorganic	2.00E-04	4.75E-04	1.00E-03	4.99E-04	9.90E-01	8.24E-02		
Nickel			1.60E-01	3.17E-02	3.16E+01	4.93E+00	1.57E+01	3.80E+00
Selenium								
Silver and compounds			2.00E-02	5.21E-03			9.00E-01	5.06E-01
Thallium					2.00E+00	9.72E+00	2.00E+00	9.73E+00
Zinc	1.70E+00	2.77E-01	6.85E+01	2.41E+00	3.48E+02	3.68E+01	1.32E+03	3.96E+01
Methylene chloride			1.00E-01	7.14E-03	1.40E-02	3.45E-03	3.10E+00	6.00E-02
trans-1,2-Dichloroethene	2.00E-02	3.96E-03	6.90E+01	3.97E+00	4.20E-01	1.69E-02	1.00E+01	1.79E-01
Chloroform			3.00E-02	3.14E-03				
Trichloroethene			4.80E+00	4.30E-01			2.90E+02	7.81E+00
Benzene			3.00E-01	3.05E-02			1.16E+00	2.06E-02
Toluene	4.00E-02	5.63E-03	3.10E-01	1.36E-02	5.30E-01	2.07E-02	8.57E+00	2.31E-01
Vinyl chloride			8.90E+00	3.88E-01				
1,2-Dichloroethane			1.40E+00	7.67E-02				
Tetrachloroethene			8.30E-01	2.43E-02	1.80E+00	6.45E-02	1.60E+01	2.79E-01
Chlorobenzene			6.00E-01	3.05E-02			5.30E+01	8.95E-01
Ethylbenzene			3.40E-01	9.82E-03	7.40E-01	2.79E-02	1.74E+01	3.89E-01
1,1-Dichloroethene			2.00E-02	3.25E-03				
1,2-Dichloropropane			6.70E-01	1.24E-02				
Trichloromonofluoromethane			5.00E-02	3.71E-03				
1,1,2-Trichloroethane			7.00E-02	3.46E-03				
1,1,1-Trichloroethane							4.30E-01	9.18E-03
1,2-Dichlorobenzene			1.80E+00	1.16E-01			2.20E+02	3.81E+00
1,3-Dichlorobenzene			1.00E-02	5.22E-03				
1,[illegible]-Dichlorobenzene			4.00E-02	5.88E-03			9.60E-01	1.79E-01

WORKSHEET 1 continued.

CHEMICAL	DEEP GROUND WATER (mg/L)		INT/SHAL/RES GW (mg/L)		SURFACE SOIL (mg/kg)		SUBSURFACE SOIL (mg/kg)	
	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE
Dibutyl phthalate			3.00E-02	5.44E-03			7.70E+01	1.95E+00
Diethyl phthalate			5.00E-02	7.00E-03				
N-Nitroso-diphenylamine			1.05E+00	4.45E-02	2.91E+00	3.08E-01	8.80E+01	4.38E+00
1,2,4-Trichlorobenzene			1.10E-01	6.54E-03	7.30E-01	1.86E-01	4.74E+00	2.45E-01
Butyl benzyl phthalate			7.80E-01	2.35E-02	9.80E-01	1.95E-01	6.39E+02	2.13E+01
Bis(2-ethylhexyl)phthalate			8.20E-01	1.70E-02	2.27E+01	1.33E+00	1.02E+03	4.05E+01
Isophorone			1.00E-02	5.07E-03				
Nitrobenzene			7.00E-02	5.96E-03	6.30E+00	3.78E-01		
Phenol			1.00E+00	2.86E-02			1.21E+01	4.34E-01
2,4-Dichlorophenol			7.00E-02	6.94E-03			4.40E+00	2.37E-01
4-Nitrophenol			7.00E-02	1.36E-02			3.30E+00	4.62E-01
Dioctyl phthalate					5.80E-01	1.81E-01	3.64E+00	2.33E-01
Anthracene							2.57E+00	2.04E-01
Fluoranthene					2.61E+00	2.89E-01	5.80E+00	3.49E-01
Phenanthrene					7.40E+00	5.04E-01	2.20E+01	6.19E-01
Pyrene					2.92E+00	2.96E-01	2.68E+00	2.35E-01
Benz(a)anthracene					2.71E+00	2.71E-01	6.00E-01	1.73E-01
Chrysene					2.82E+00	2.58E-01		
Benzo(k)fluoranthene					3.97E+00	3.28E-01	7.10E-01	1.83E-01
Benzo(b)fluoranthene					1.02E+00	1.96E-01		
Fluorene							1.16E+01	4.23E-01
Benzo(a)pyrene					2.61E+00	2.93E-01	7.00E-01	1.75E-01
Indeno(1,2,3-cd)pyrene					1.25E+00	2.33E-01		
Benzo(ghi)perylene					3.44E+00	3.14E-01		
Acenaphthene							1.16E+01	4.15E-01
Pentachlorophenol							6.60E+00	5.20E-01
N-Nitroso-dipropylamine					4.80E-01	1.77E-01		
Heptachlor			6.00E-05	2.55E-05			1.00E-02	5.08E-03
alpha-Hexachlorocyclohexane	1.10E-04	3.21E-05	5.00E-05	2.54E-05				
delta-HCCH			6.00E-05	2.55E-05				
DDT	1.00E-04	3.13E-05	3.00E-04	3.42E-05	4.80E-02	1.03E-02	3.40E-02	5.56E-03
Endosulfan			2.50E-04	3.20E-05				
DDE			1.10E-03	4.18E-05	9.90E-01	6.87E-02	2.49E+00	9.49E-02
DDD					4.00E-01	3.02E-02	3.83E-01	1.96E-02
Cyanide					ND	2.50E-02	3.50E+00	8.95E-02

WORKSHEET 2.
SCORING FOR INDICATOR CHEMICAL SELECTION:
TOXICITY INFORMATION.

NAME OF SITE: Bridgeport NJ
DATE PREPARED: 1/23/89
ANALYST: TAS

CHEMICAL	TOXICOLOGIC CLASS	EPA RATING VALUE ORAL	EPA RATING VALUE INHALATION	WATER T.C.	SOIL T.C.	AIR T.C.
Antimony	NC	10	0	4.35E+00	2.17E-04	2.29E+02
Arsenic	PC	A	A	4.07E+00	2.03E-04	4.07E+01
Arsenic	NC	9	9	1.80E+01	9.00E-04	1.80E+02
Beryllium	PC	B1	B1			2.28E+01
Beryllium	NC	-	0			1.45E+04
Cadmium	PC	-	B1			1.65E+01
Cadmium	NC	10	0	4.45E+00	2.23E-04	3.59E+02
Chromium VI	PC		A			1.11E+02
Chromium VI	NC	-	0			2.50E+01
Copper	NC	5	5	7.14E-01	3.57E-05	7.14E+00
Lead	NC	10	10	0.93E-01	4.46E-05	0.93E+00
Mercury, inorganic	NC	7	0	1.84E+01	9.21E-04	1.86E+02
Nickel	PC	A	A			2.85E+00
Nickel	NC	10	10	4.26E+00	2.13E-04	1.57E+02
Selenium	NC	10	10	1.05E+02	5.26E-03	1.05E+02
Silver and compounds	NC	1	1	2.00E+01	1.00E-03	1.05E+03
Thallium	NC					
Zinc	NC	0	0	1.07E-01	5.33E-06	9.20E-03
Methylene chloride	PC	B2	B2			
Methylene chloride	NC	10	10	9.20E-04	4.60E-08	6.20E-03
trans-1,2-Dichloroethene	NC	5	5	5.29E-02	2.65E-06	5.29E-01
Chloroform	PC	B2	B2	5.63E-02	2.81E-06	5.63E-01
Trichloroethene	PC	B2	B2	4.29E-03	2.14E-07	4.29E-02
Trichloroethene	NC	5	4	1.05E+00	5.26E-05	2.96E+01
Benzene	PC	A	A	7.71E-03	3.86E-07	7.71E-02
Benzene	NC	5	10	1.17E-01	5.85E-06	1.18E+02
Toluene	NC	7	7	5.20E-03	2.60E-07	5.20E-02
Vinyl chloride	PC	A	A	4.29E-03	2.14E-07	4.29E-02
Vinyl chloride	NC	10	10	8.77E-02	4.39E-06	8.77E-01
1,2-Dichloroethane	PC	B2	B2	5.86E-02	2.93E-06	5.86E-01
1,2-Dichloroethane	NC	10	8	1.76E-02	8.80E-07	1.10E+00
Tetrachloroethene	PC	B2	B2	8.86E-03	4.43E-07	8.86E-02
Tetrachloroethene	NC	7	10	9.62E-03	4.18E-07	2.75E-02
Chlorobenzene	NC	4	1	1.43E-01	7.14E-06	2.79E-01
Ethylbenzene	NC	4	4	1.10E-02	5.52E-07	1.10E-01
1,1-Dichloroethene	PC	C	C	1.23E-01	6.14E-06	1.23E+00
1,1-Dichloroethene	NC	7	5	3.71E-01	1.86E-05	5.65E+00
1,2-Dichloropropane	NC	10	10	1.00E-01	5.00E-06	1.00E+00
Trichloromonofluoromethane	NC					
1,1,2-Trichloroethane	PC	C	C	1.03E-02	5.14E-07	1.03E-01

WORKSHEET 2 continued.

CHEMICAL	TOXICOLOGIC CLASS	EPA RATING VALUE ORAL	EPA RATING VALUE INHALATION	WATER T.C.	SOIL T.C.	AIR T.C.
1,1,1-Trichloroethane	NC	2	2	7.33E-04	3.67E-08	7.33E-03
1,2-Dichlorobenzene	NC	4	5	5.19E-02	2.60E-06	3.61E-01
1,3-Dichlorobenzene	NC	4	5	5.19E-02	2.60E-06	3.61E-01
1,4-Dichlorobenzene	NC	4	5	5.19E-02	2.60E-06	3.61E-01
Dibutyl phthalate	NC	8	8	3.81E-02	1.90E-06	3.81E-01
Diethyl phthalate	NC	4	4	2.67E-04	1.34E-08	2.67E-03
N-Nitroso-diphenylamine	PC			3.54E-03	1.77E-07	3.54E-02
1,2,4-Trichlorobenzene	NC	4	1	2.14E-01	1.07E-05	1.52E+00
Butyl benzyl phthalate	NC	10		5.45E-02	2.72E-06	
Bis(2-ethylhexyl)phthalate	PC	B2	B2	5.71E-04	2.86E-08	5.71E-03
Isophorone	NC					
Nitrobenzene	NC		8			4.66E+00
Phenol	NC	3	10	1.00E-01	5.02E-06	2.49E+00
2,4-Dichlorophenol	NC	5	5	8.26E-02	4.13E-06	8.26E-01
4-Nitrophenol	NC					
Dioctyl phthalate	NC	6		5.70E-03	2.86E-07	
Anthracene	PC					
Fluoranthene	PC					
Phenanthrene	PC	D	D			
Pyrene	PC					
Benz(a)anthracene	PC	B2	B2	5.81E-01	2.91E-05	5.81E+00
Chrysene	PC	B2	B2			
Benzo(k)fluoranthene	PC	D	D	1.43E+01	7.00E-04	1.43E+02
Benzo(b)fluoranthene	PC	B2	B2	1.43E+01	7.00E-04	1.43E+02
Fluorene	PC					
Benzo(a)pyrene	PC	B2	B2	4.55E+00	2.28E-04	4.55E+01
Benzo(a)pyrene	NC	8	6	2.67E+01	1.33E-03	1.91E+01
Indeno(1,2,3-cd)pyrene	PC	C	C	1.42E+01	7.00E-04	1.43E+02
Benzo(ghi)perylene	PC					
Acenaphthene	NC					
Acenaphthene	PC					
Pentachlorophenol	PC	D	D			
Pentachlorophenol	NC	8		2.70E-01	1.34E-05	
N-Nitroso-dipropylamine	PC			2.01E+00	1.00E-04	2.01E+01
Heptachlor	PC	B2	B2	3.20E+00	1.60E-04	3.20E+01
alpha-Hexachlorocyclohexane	PC	B2	B2	1.56E+00	7.79E-05	1.56E+01
delta-HCCH	PC	D	D	6.03E+00	3.01E-04	6.03E+01
DDT	PC	B2	B2	1.59E-01	7.97E-06	1.59E+00
Endosulfan	NC					
DDE	PC	B2	B2	1.13E-01	5.64E-06	1.13E+00
DDD	PC	B2	B2	3.71E-02	1.86E-06	3.71E-01
Cyanide	NC					

WORKSHEET 3.
SCORING FOR INDICATOR CHEMICAL SELECTION:
CALCULATION OF CT AND IS VALUES FOR CARCINOGENIC EFFECTS.

NAME OF SITE: Bridgeport NJ
DATE PREPARED: 1/23/89
ANALYST: TAS

	DEEP GROUND WATER CT		INT/SHAL/RES GW CT		SURFACE SOIL CT		SUBSURFACE SOIL CT		IS VALUE		TENATIVE RANK	
CHEMICAL	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE
Arsenic	3.66E-02	2.17E-02	5.01E+00	2.30E-01	1.93E-02	2.25E-03	9.20E-02	2.37E-03	5.15E+00	2.56E-01	1	1
1,2-Dichloroethane			8.20E-02	4.49E-03					8.20E-02	4.49E-03	2	2
Trichloroethene			2.06E-02	1.84E-03			6.21E-05	1.67E-06	2.07E-02	1.85E-03	4	3
Vinyl chloride			3.82E-02	1.66E-03					3.82E-02	1.66E-03	3	4
Benzene			2.31E-03	2.35E-04			4.48E-07	7.95E-09	2.31E-03	2.35E-04	9	5
Tetrachloroethene			7.35E-03	2.15E-04	7.97E-07	2.86E-08	7.09E-06	1.24E-07	7.36E-03	2.16E-04	5	6
Chloroform			1.69E-03	1.77E-04					1.69E-03	1.77E-04	10	7
N-Nitroso-diphenylamine			3.72E-03	1.58E-04	5.15E-07	5.45E-08	1.56E-05	7.76E-07	3.73E-03	1.59E-04	6	8
Benzo(a)pyrene					5.95E-04	6.67E-05	1.60E-04	3.99E-05	7.55E-04	1.07E-04	12	9
alpha-Hexachlorocyclohexane	1.72E-04	5.01E-05	7.80E-05	3.96E-05					2.50E-04	8.96E-05	17	10
Heptachlor			1.92E-04	8.16E-05			1.60E-06	8.13E-07	1.94E-04	8.25E-05	18	11
N-Nitroso-dipropylamine					4.80E-05	1.77E-05			4.80E-05	1.77E-05	22	12
Benz(a)anthracene					7.89E-05	7.88E-06	1.75E-05	5.04E-06	9.63E-05	1.29E-05	20	13
Bis(2-ethylhexyl)phthalate			4.68E-04	9.70E-06	6.49E-07	3.79E-08	2.92E-05	1.16E-06	4.98E-04	1.09E-05	15	14
DDT	1.59E-05	4.98E-06	4.77E-05	5.44E-06	3.83E-07	8.19E-08	2.71E-07	4.43E-08	6.43E-05	1.05E-05	21	15
DDE			1.24E-04	4.73E-06	5.58E-06	3.88E-07	1.40E-05	5.35E-07	1.44E-04	5.65E-06	19	16
DDD					7.44E-07	5.62E-08	7.12E-07	3.64E-08	1.46E-06	9.26E-08	23	17
Beryllium											-	-
Cadmium											-	-
Chromium VI											-	-
Nickel											-	-
Methylene chloride											-	-
Anthracene											-	-
Fluoranthene											-	-
Pyrene											-	-
Chrysene											-	-
Fluorene											-	-
Benzo(ghi)perylene											-	-
Acenaphthene											-	-

WORKSHEET 4.
SCORING FOR INDICATOR CHEMICAL SELECTION:
CALCULATION OF CT AND IS VALUES FOR NONCARCINOGENIC EFFECTS.

NAME OF SITE: Bridgeport, NJ
DATE PREPARED: 1/23/89
ANALYST: TAS

	DEEP GROUND WATER CT		INT/SHAL/RES GW CT		SURFACE SOIL CT		SUBSURFACE SOIL CT		IS VALUE		TENATIVE RANK	
CHEMICAL	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE	MAX	AVE
Arsenic	1.62E-01	9.60E-02	2.21E+01	1.02E+00	8.54E-02	9.99E-03	4.08E-01	1.05E-02	2.28E+01	1.13E+00	2	1
Trichloroethene			5.04E+00	4.51E-01			1.53E-02	4.11E-04	5.06E+00	4.52E-01	4	2
Zinc	1.82E-01	2.96E-02	7.33E+00	2.57E-01	1.85E-03	1.96E-04	7.04E-03	2.11E-04	7.52E+00	2.87E-01	3	3
trans-1,2-Dichloroethene	1.06E-03	2.09E-04	3.65E+00	2.10E-01	1.11E-06	4.48E-08	2.65E-05	4.75E-07	3.65E+00	2.10E-01	5	4
Nickel			6.82E-01	1.35E-01	6.73E-03	1.05E-03	3.34E-03	8.09E-04	6.92E-01	1.37E-01	8	5
Antimony			3.92E-02	1.08E-01					3.92E-02	1.08E-01	16	6
Lead	9.82E-03	2.87E-03	3.13E+00	1.01E-01	1.67E-02	2.15E-03	3.74E-02	1.15E-03	3.19E+00	1.08E-01	6	7
Silver and compounds			4.00E-01	1.04E-01			9.00E-04	5.06E-04	4.01E-01	1.05E-01	9	8
Copper	2.86E-02	1.01E-02	2.07E-01	3.08E-02	3.32E-03	3.47E-04	1.41E-03	1.90E-04	2.40E-01	4.15E-02	10	9
Vinyl chloride			7.81E-01	3.40E-02					7.81E-01	3.40E-02	7	10
Mercury, inorganic	3.68E-03	8.74E-03	1.84E-02	9.17E-03	9.12E-04	7.59E-05			2.30E-02	1.80E-02	20	11
1,2-Dichlorobenzene			9.34E-02	6.02E-03			5.72E-04	9.92E-06	9.40E-02	6.02E-03	12	12
Chlorobenzene			8.58E-02	4.37E-03			3.78E-04	6.39E-06	8.62E-02	4.37E-03	13	13
Benzene			3.51E-02	3.57E-03			6.79E-06	1.20E-07	3.51E-02	3.57E-03	17	14
Phenol			1.00E-01	2.86E-03			6.07E-05	2.18E-06	1.00E-01	2.86E-03	11	15
1,2,4-Trichlorobenzene			2.35E-02	1.40E-03	7.81E-06	1.99E-06	5.07E-05	2.62E-06	2.36E-02	1.41E-03	19	16
1,2-Dichloroethane			2.46E-02	1.35E-03					2.46E-02	1.35E-03	18	17
Butyl benzyl phthalate			4.25E-02	1.28E-03	2.67E-06	5.29E-07	1.74E-03	5.81E-05	4.43E-02	1.34E-03	15	18
1,2-Dichloropropane			6.70E-02	1.24E-03					6.70E-02	1.24E-03	14	19
1,1-Dichloroethene			7.42E-03	1.21E-03					7.42E-03	1.21E-03	23	20
Benzo(a)pyrene					3.47E-03	3.89E-04	9.31E-04	2.33E-04	4.40E-03	6.22E-04	25	21
2,4-Dichlorophenol			5.78E-03	5.73E-04			1.82E-05	9.79E-07	5.80E-03	5.74E-04	24	22
Cadmium					1.85E-03	1.51E-04	8.09E-03	2.86E-04	9.95E-03	4.36E-04	21	23
1,4-Dichlorobenzene			2.08E-03	3.05E-04			2.50E-06	4.65E-07	2.08E-03	3.06E-04	27	24
1,3-Dichlorobenzene			5.19E-04	2.71E-04					5.19E-04	2.71E-04	30	25
Tetrachloroethene			7.98E-03	2.34E-04	7.52E-07	2.70E-08	6.69E-06	1.17E-07	7.99E-03	2.34E-04	22	26
Dibutyl phthalate			1.14E-03	2.07E-04			1.46E-04	3.70E-06	1.29E-03	2.11E-04	29	27
Ethylbenzene			3.74E-03	1.08E-04	4.08E-07	1.54E-08	9.60E-06	2.15E-07	3.75E-03	1.08E-04	26	28
Toluene	2.08E-04	2.93E-05	1.61E-03	7.08E-05	1.38E-07	5.38E-09	2.23E-06	6.00E-08	1.82E-03	1.00E-04	28	29
Pentachlorophenol							8.84E-05	6.96E-06	8.84E-05	6.96E-06	32	30
Methylene chloride			9.20E-05	6.57E-06	6.44E-10	1.59E-10	1.43E-07	2.76E-09	9.21E-05	6.57E-06	31	31
Diethyl phthalate			1.34E-05	1.87E-06					1.34E-05	1.87E-06	33	32
Dioctyl phthalate					1.66E-07	5.17E-08	1.04E-06	6.66E-08	1.21E-06	1.18E-07	34	33
1,1,1-Trichloroethane							1.58E-08	3.37E-10	1.58E-08	3.37E-10	35	34
Cyanide											-	-
Beryllium											-	-
Chromium VI											-	-
Thallium											-	-
Trichloromonofluoromethane											-	-
Isophorone											-	-
Nitrobenzene											-	-
4-Nitrophenol											-	-
Acenaphthene											-	-
Endosulfan											-	-
Selenium											-	-

WORKSHEET 5.
SCORING FOR INDICATOR CHEMICAL SELECTION:
EVALUATION OF EXPOSURE FACTORS AND FINAL CHEMICAL SELECTION.

NAME OF SITE: Bridgeport, NJ
DATE PREPARED: 1/23/89
ANALYST: TAS

CHEMICAL	IS VALUE AVE PC	IS VALUE AVE NC	PC	NC	WATER SOLUBILITY (mg/L)	VAPOR PRESSURE (mm HG)	HENRY'S LAW CONSTANT (atm-m3/mole)	Koc	HALF-LIFE (DAYS) SOIL	AIR	SW	GW	IC
Antimony		1.08E-01		6		1.00E+00	NA		4.8	-	PERS	-	
Arsenic	2.56E-01	1.13E+00	1	1		0.00E+00	NA		5.0	-	PERS	-	YES
Beryllium	-	-	-	-		0.00E+00	NA						
Cadmium	-	4.36E-04	-	23		0.00E+00	NA		4.8	-	PERS	-	
Chromium VI	-	-	-	-		0.00E+00	NA		4.8	-	3.00	-	
Copper		4.15E-02		9		0.00E+00	NA						
Lead		1.08E-01		7		0.00E+00	NA		4.8	-	PERS	-	YES
Mercury, inorganic		1.80E-02		11									
Nickel	-	1.37E-01	-	5		0.00E+00	NA						
Selenium		-		-		0.00E+00	NA						
Silver and compounds		1.05E-01		8		0.00E+00	NA						
Thallium		-		-		0.00E+00							
Zinc		2.87E-01		3		0.00E+00	NA		4.8	20.0	PERS	-	
Methylene chloride	-	6.57E-06	-	31	2.00E+04	3.62E+02	2.03E-03	8.8	53.2	-	1.20	5.80	
trans-1,2-Dichloroethene		2.10E-01		4	6.30E+03	3.24E+02	6.56E-03	59	2.1	-	1.00	6.00	YES
Chloroform	1.77E-04		7		8.20E+03	1.51E+02	2.87E-03	31	80.0	-	0.30	30.00	
Trichloroethene	1.85E-03	4.52E-01	3	2	1.10E+03	5.79E+01	9.10E-03	126	3.7	-	1.00	90.00	YES
Benzene	2.35E-04	3.57E-03	5	14	1.75E+03	9.52E+01	5.59E-03	83	6.0	-	1.00	6.00	YES
Toluene		1.00E-04		29	5.35E+02	2.81E+01	6.37E-03	300	1.3	-	0.17	-	
Vinyl chloride	1.66E-03	3.40E-02	4	10	2.67E+03	2.66E+03	8.19E-02	57	1.2	-	1.00	5.00	YES
1,2-Dichloroethane	4.49E-03	1.35E-03	2	17	8.52E+03	6.40E+01	9.78E-04	14	36.0	127.0	0.17	-	YES
Tetrachloroethene	2.16E-04	2.34E-04	6	26	1.50E+02	1.78E+01	2.59E-02	364	47.0	-	1.00	30.00	
Chlorobenzene		4.37E-03		13	4.66E+02	1.17E+01	3.72E-03	330	3.5	-	0.30	-	
Ethylbenzene		1.08E-04		28	1.52E+02	7.00E+00	6.43E-03	1100	1.5	-	1.50	7.50	
1,1-Dichloroethene	4.00E-04	1.21E-03		20	2.25E+03	6.00E+02	3.40E-02	65	2.0	-	1.00	6.00	
1,2-Dichloropropane		1.24E-03		19	2.70E+03	4.20E+01	2.31E-03	51	80.0	-	1.40	7.70	
Trichloromonofluoromethane		-		-	1.10E+03	6.67E+02		159					
1,1,2-Trichloroethane	3.57E-05		17		4.50E+03	3.00E+01	1.17E-03	56	24.0	-	1.90	-	
1,1,1-Trichloroethane		3.37E-10		34	1.50E+03	1.23E+02	1.44E-02	152	803.0	1752.0	0.14	7.00	
1,2-Dichlorobenzene		6.02E-03		12	1.00E+02	1.00E+00	1.93E-03	1700	26.0	-	1.50	8.50	YES
1,3-Dichlorobenzene		2.71E-04		25	1.23E+02	2.28E+00	3.59E-03	1700					
1,4-Dichlorobenzene		3.06E-04		24	7.90E+01	1.18E+00	2.89E-03	1700	23.0	-	1.50	8.50	
Dibutyl phthalate		2.11E-04		27	1.30E+01	1.00E-05	2.82E-07	170000					
Diethyl phthalate		1.87E-06		32	8.96E+02	3.50E-03	1.14E-06	142					
N-Nitroso-diphenylamine	1.59E-04		8										
1,2,4-Trichlorobenzene		1.41E-03		16	3.00E+01	2.90E-01	2.31E-03	9200			1.20	-	
Butyl benzyl phthalate		1.34E-03		18									
Bis(2-ethylhexyl)phthalate	1.09E-05		14										

WORKSHEET 5 continued.

	IS VALUE				WATER	VAPOR	HENRY'S LAW		HALF-LIFE (DAYS)						
	AVE	AVE			SOLUBILITY	PRESSURE	CONSTANT								
CHEMICAL	PC	NC	PC	NC	(mg/L)	(mm HG)	(atm-m3/mole)	Koc	SOIL		AIR		SW		GW	IC
Isophorone		-		-												
Nitrobenzene		-		-	1.90E+03	1.50E-01		36					12.50	-		
Phenol		2.86E-03		15	9.30E+04	3.41E-01	4.54E-07	14.2			0.6	9.0	0.62	9.00		
2,4-Dichlorophenol		5.74E-04		22	4.60E+03	5.90E-02	2.75E-06	380			2.3	-	6.00	-		
4-Nitrophenol		-		-												
Dioctyl phthalate		1.18E-07		33												
Anthracene	-		-		4.50E-02	1.95E-04	1.02E-03	14000								
Fluoranthene	-		-		2.06E-01	5.00E-06	6.46E-06	38000			5.5	-	1.00	2.00		
Phenanthrene	-		-		1.00E+00	6.80E-04	1.59E-04	14000					0.38	2.00		
Pyrene	-		-		1.32E-01	2.50E-06	5.04E-06	38000			0.1	2.0				
Benz(a)anthracene	1.29E-05		13		5.70E-03	2.20E-08	1.16E-06	1E+06			5.5	-	1.00	5.00		
Chrysene	-		-		1.80E-03	6.30E-09	1.05E-06	200000			5.5	-	0.20	-		
Benzo(k)fluoranthene					4.30E-03	5.10E-07	3.94E-05	550000								
Benzo(b)fluoranthene					1.40E-02	5.00E-07	1.19E-05	550000			5.5	-	1.00	2.00		
Fluorene	-		-		1.69E+00	7.10E-04	6.42E-05	7300								
Benzo(a)pyrene	1.07E-04	6.22E-04	9	21	1.20E-03	5.60E-09	1.55E-06	6E+06	420	480	1.0	6.0	0.40	-		
Indeno(1,2,3-cd)pyrene					5.30E-04	1.00E-10	6.86E-08	2E+06			5.5	-	0.0208	2.08		
Benzo(ghi)perylene	-		-		7.00E-04	1.03E-10	5.34E-08	2E+06								
Acenaphthene	-	-	-	-	3.42E+00	1.55E-03	9.20E-05	4600								
Pentachlorophenol		6.96E-06		30	1.40E+01	1.10E-04	2.75E-06	53000			21.0	-	5.00	-		
N-Nitroso-dipropylamine	1.77E-05		12													
Heptachlor	8.25E-05		11		1.80E-01	3.00E-04	8.19E-04	12000			40.0	-	0.96	-		
alpha-Hexachlorocyclohexane	8.96E-05		10		1.63E+00	2.50E-05	5.87E-06	3800								
delta-HCCH					3.14E+01	1.70E-05	2.07E-07	6600								
DDT	1.05E-05		15		5.00E-03	5.50E-06	5.13E-04	243000	1000	5500			56.00	110.00		
Endosulfan		-		-												
DDE	5.65E-06		16		4.00E-02	6.50E-06	6.80E-05	4E+06								
DDD	9.26E-08		17		1.00E-01	1.89E-06	7.96E-06	770000								
Cyanide		-		-			NA				73000.0	-	0.33	0.80		

APPENDIX C

FATE AND TRANSPORT PROFILES
FOR INDICATORS
AT CLTL-BRIDGEPORT, NJ TERMINAL

Arsenic

Benzene

1,2-Dichlorobenzene

1,2-Dichloroethane

Lead

trans-1,2-Dichloroethene

Trichloroethene

Vinyl Chloride

Zinc

ARSENIC

General:

Arsenic is a rare but ubiquitous element in the earth's crust with an average abundance of 5 ppm. Being the third member of Group VB of the periodic table, arsenic at times behaves much like phosphorus and antimony. In the natural environment, arsenic has four oxidation states of which the most common are +3 and +5. Because of the multiple oxidation states and arsenic's tendency to form soluble complexes, the geochemistry of arsenic is intricate and not well characterized, but the toxicology of many forms have been documented. Arsenic is generally encountered in copper smelting plants and is added to agricultural soils low in trace metals.

Fate and Transport:

The major environmental fate processes of arsenic are sorption, bioaccumulation, and biodegradation/biotransformation. The cycling of arsenic through the environment is dominated by its adsorption onto and desorption from soils and sediments. The half-life of arsenic in soils is given as persistent and is governed by the soil type, soil pH, phosphate levels, and levels of iron or aluminum. Some arsenic compounds tend to bioaccumulate in lower levels of the food chain and, to a certain extent, in fish. Arsenic accumulates more readily in fat rather than muscle tissue of fish, with a half-life for arsenic in the gut and liver of green sunfish reported to be seven days. Arsenic is readily biotransformed in aquatic environments to methylated forms. In these forms, arsenic becomes more mobile, enters the water, and subsequently, the food chain. This mobility could bring increasing concentrations of arsenic to the aquatic environment from contaminated sediments. Based upon the limited qualitative data available for arsenic, photolysis, oxidation, volatilization, and hydrolysis are considered to be environmentally insignificant fate processes.

Summary:

The environmental transport pathway for arsenic is adsorption onto soils, sediments, and/or suspended particles.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. US EPA, Washington, DC. Vol. I, EPA-440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. US EPA, Washington, DC. EPA 440/4-81-014.

Sittig, M. 1981. Handbook of Toxic and Hazardous Chemicals. Noyes Publications, Park Ridge, NJ.

US EPA. 1984. U.S. Environmental Protection Agency. National Primary Drinking Water Regulations for Volatile Synthetic Organic Chemicals: Proposed Rulemaking. Fed. Reg. 49: 24330-24355.

US EPA. 1985. U.S. Environmental Protection Agency. Office of Drinking Water. Health Advisories for 52 Chemicals which have been detected in Drinking Water. PB 86-118338. September 1985.

BENZENE

General:

Benzene occurs naturally in the environment, but man-made inputs/releases have greatly increased its concentrations in various media. Predominantly used as a starting material in the synthesis of organic chemicals, benzene is also used as a commercial solvent and as a carier for pesticides. A moderately volatile organic chemical with a high water solubility, benzene has a low chemical reactivity based upon the stability of the aromatic ring. From its density and water solubility, any benzene in excess of its water solubility would rise to the top of a water column.

Fate and Transport:

The major environmental fate process is volatilization of benzene from both soil and water to the atmosphere. The volatilization half-life of benzene in water at 25°C has been calculated at 4.8 hours. The overall half-life of benzene in water is estimated at 1-6 days. Once volatilized, benzene is available for oxidation by hydroxyl radicals, yielding phenol and ozone. The atmospheric half-life of benzene in rural and urban settings is calculated to be 458 and 46 hours, respectively, with an overall atmospheric half-life greater than 1 day. Sorption onto soils, sediments, and suspended particles occurs on a limited basis; thus, sorption is a less important fate process. Benzene can be considered moderately mobile in soils. Studies show that microorganisms in soil and water are capable of degrading benzene. However, this process is slow compared to the rate of volatilization. Benzene is resistant to hydrolysis and photolysis. Little is known about the bioaccumulation of benzene, but based upon its octanol/water partition coefficient, it is anticipated to be very low.

Summary:

The major environmental transport processes for benzene is volatilization from soil and water to the atmosphere and leaching from contaminated soils to ground water.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Gilbert, D., et al. 1981 (revised January 1982). An Exposure and Risk Assessment for Benzene. U.S. EPA, Washington, DC. EPA 440/4-85-015.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. U.S. EPA, Washington, DC. EPA 440/4-81-014.

Mills, W.B., et al. 1982. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants. U.S. EPA. Athens, GA. Vol. I, EPA 600/6-82-004a; Vol. II, EPA 600/6-82-004b.

Prasad, S.S., et al. 1985. Partitioning Analysis of Chemical Substances as a Tool for Managing Hazardous Waste Studies. In Proceedings of the International Conference on New Frontiers for Hazardous Waste Management. EPA 600/9-85/025, pp. 377-385.

US EPA. 1985. U.S. Environmental Protection Agency. Office of Solid Waste. Support Document Health Based Numbers, Solubilities and Half Lives of Constituents of Concern; Half-lives of Constituents of Concern in four Environmental Media. Washington, DC.

1,2-DICHLOROBENZENE

General:

1,2-Dichlorobenzene (1,2-DCB) is a colorless liquid with a pleasant odor. It is used as a starting material in the manufacture of other organic chemicals, herbicides, and dyes; as a solvent; and as a degreaser. It reacts violently with aluminum. 1,2-DCB has a moderate-to-low water solubility, and is miscible with other organic solvents. Based upon its density, if its water solubility is exceeded, 1,2-DCB will sink to the bottom of a water column.

Fate and Transport:

Volatilization, sorption, and bioaccumulation are competing fate processes in the environment for 1,2-dichlorobenzene. The major fate process depends upon the type of aquatic and soil environments present at a site. The laboratory volatilization half-life from surface water is 0.5-9 days while the overall atmospheric and surface water half-lives are 26 days and 1.5-8.5 days, respectively. Based upon its K_{oc} and K_{ow} values and limited studies, 1,2-DCB does sorb to soil, but is moderately mobile in soils. 1,2-DCB is a lipophilic compound which bioaccumulates in animal and human tissue from air, water, and food. Limited information exists concerning the importance of hydrolysis, photolysis, and biodegradation as fate processes for 1,2-DCB.

Summary:

Volatilization, sorption, and bioaccumulation compete as environmental transport processes of 1,2-DCB. Any one of these three processes could dominate depending upon the environmental conditions. 1,2-Dichlorobenzene can be leached from contaminated soils by infiltration water and transported to ground water.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Clement Associates, Inc. 1985. U.S. Environmental Protection Agency. Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites, Final. Clement Associates, Inc. September 1985.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. U.S. EPA, Washington, DC. EPA 440/4-81-014.

Mills, W.B., et al. 1982. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants. U.S. EPA. Athens, GA. Vol. I, EPA 600/6-82-004a; Vol. II. EPA 600/6-82-004b.

Prasad, S.S., et al. 1985. Partitioning Analysis of Chemical Substances as a Tool for Managing Hazardous Waste Studies. In Proceedings of the International Conference on New Frontiers for Hazardous Waste Management. EPA 600/9-85/025, pp. 377-385.

U.S. EPA. 1985. U.S. Environmental Protection Agency. Office of Health and Environmental Assessment. Health Assessment Document for Chlorinated Benzenes. January 1985. EPA 600/8-84/015F.

1,2-DICHLOROETHANE

General:

1,2-Dichloroethane (EDC) is a highly volatile saturated aliphatic hydrocarbon with a sweet, chloroform-like odor. It is used in the manufacture of vinyl chloride, in paints and varnish removers, in cosmetics, and food additives through the extraction of spices. EDC has a relatively high water solubility and a density greater than water, thus excess EDC would sink in water.

Fate and Transport:

Volatilization of EDC in the environmental is the most important fate processes. EDC has a laboratory half-life of 29 minutes. In the troposphere, EDC reacts rapidly with hydroxyl radicals to allow little intact EDC to reach the stratosphere. The initial photodissociation product is probably cloroacetyl chloride. The overall half-life of EDC in the atmosphere is 36-127 days. Hydrolysis is not considered an environmentally significant fate process due to EDC's resistance to hydrolysis ($t_{1/2}$ = 6 months to 50,000 years). Limited information suggests that selected fish and oysters may biodegrade EDC, but not enough data exists to determine the environmental significance of biodegradation. Oxidation, sorption, and bioaccumulation are not considered significant fate processes for EDC in the environment based upon available information.

Summary:

The major environmental transport process for EDC is through volatilization from soils and water to the atmosphere. EDC is redeposited in the hydrosphere through precipitation, dry transfer, and dry fallout of particles from adsorbed EDC. This compound may also be transported from contaminated soils to ground water via leaching (or infiltration).

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Clement Associates, Inc. 1985. U.S. Environmental Protection Agency. Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites, Final. Clement Associates. September 1985.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. U.S. EPA, Washington, DC. EPA 440/4-81-014.

Mills, W.B., et al. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants. U.S. EPA, Athens, GA. Vol. I, EPA 600/6-82-004a; Vol. II, EPA 600/6-82-004b.

U.S. EPA. 1984. U.S. Environmental Protection Agency. Office of Drinking Water. Washington, DC. Techniques for the Assessment of the Carcinogenic Risk to the U.S. Population Due to Exposure from Selected Volatile Organic Compounds from Drinking Water. PB84-213941.

LEAD

General:

Lead, a relatively rare metal which occurs in the earth's crust at an average concentration of 15 ppm, is ubiquitous in the environment and occurs at low levels in most ground and surface waters. In the natural environment, lead has three oxidation states: 0, +2, and +4. Lead is a major constituent of more than 200 identified minerals which include galena (PbS), angelesite ($PbSO_4$), and cerrusite ($PbCO_3$). Some industrially produced lead compounds are readily soluble in water; however, metallic lead and the common lead minerals are insoluble in water.

Fate and Transport:

The major environmental fate processes of lead are adsorption, bioaccumulation, and biodegradation/biotransformation. The movement of lead through the environment is dominated by adsorption onto and desorption from soils and sediments. The transport of lead in the aquatic environment is influenced by the speciation of the ion. Although lead exists mainly as the divalent cation in most pristine waters and becomes adsorbed onto particulate phases, organic material in contaminated waters will have a great effect on the chemical form in which lead will be present. The half-life of lead in soils is given as persistent and is governed by different sorption mechanisms such as geological setting, pH, Eh, availability of ligands, and dissolved particulate iron concentration. The available information indicates that fish bioaccumulate very little lead in edible tissues; however, oysters and mussels are capable of accumulating lead at high levels. The principle form of lead accumulated by aquatic animals is divalent lead, which increases in availability as pH decreases. Lead can be methylated by microorganisms present in lake sediments. Based upon the limited quantitative data available for lead, photolysis, oxidation, volatilization, and hydrolysis are considered to be environmentally insignificant fate processes.

Summary:

The environmental transport pathway for lead is adsorption onto soils, sediments, and/or suspended particles. The transport of lead through the aquatic environment is greater when lead is methylated to tetramethyl lead.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

U.S. EPA. 1985. U.S. Environmental Protection Agency. Office of Drinking Water. Health Advisories for 52 Chemicals which have been detected in Drinking Water. PB 86-118338. September 1985.

Clement Associates, Inc. 1985. U.S. Environmental Protection Agency. Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites, Final. Clement Associates. September 1985.

trans-1,2-DICHLOROETHENE

General:

trans-1,2-Dichloroethene is a colorless liquid with an ether-like odor. It has many uses as a solvent, in rubber manufacturing, as a refrigerant, and as an additive to dye and lacquer solutions. It is also used as a constituent of perfumes and thermoplastics. trans-1,2-Dichloroethene is only slightly soluble in water. When its water solubility is exceeded, this chemical will sink in a column of water.

Fate and Transport:

Volatilization appears to be the major transport process for trans-1,2-dichloroethene in surface water and soils. The volatilization half-life in surface water is reported to be 22 minutes. Once in the troposphere, the chemical is attacked at the double bond by hydroxyl radicals to yield formic acid, hydrochloric acid, and carbon monoxide. The tropospheric half-life of trans-1,2-dichloroethene, based on its rate of reaction with hydroxyl radicals, is probably less than one day. Based on its oxidation rate in the troposphere, little or no trans-1,2-dichloroethene would be expected to migrate into the stratosphere; thus, photolysis is probably a minor fate process in the atmosphere. Photolysis of trans-1,2-dichloroethene also does not appear to be an important fate process in the terrestrial or aquatic environments. Oxidation and hydrolysis in the aquatic environmental do not appear to be significant. Based on its K_{oc}, trans-1,2-dichloroethene probably does not adsorb to soils and sediments to any extent. Based on its octanol/water partition coefficient (K_{ow}), this compound probably does not bioaccumulate. trans-1,2-Dichloroethene does biodegrade in the environment, especially under anaerobic conditions, but the degradation rates are probably slow. Therefore, biodegradation is probably not an important fate process.

Summary:

The major environmental fate and transport process for trans-1,2-dichloroethene is volatilization from surface water and soils to the troposphere, with subsequent attack by hydroxyl radicals. Leaching of trans-1,2-dichloroethene from contaminated soils to ground water is another transport process.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Verschueren, K. 1983. Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold Co. New York.

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TRICHLOROETHENE

General:

Trichloroethene (TCE) is ubiquitous in the environment, although it is not naturally occurring. Still widely used as a solvent in industrial degreasing of metals, TCE had minor uses in fumigant mixtures, inhalation anesthesia, and decaffeination of coffee, but most of these applications have been discontinued. TCE is a highly volatile, unsaturated, aliphatic hydrocarbon with a relatively high water solubility. From its density, any TCE in excess of its water solubility would sink to the bottom of a water column.

Fate and Transport:

Volatilization of TCE in the environment is its most important fate process. Its laboratory half-life is reported to be 21 minutes. Once the compound enters the troposphere, high temperatures and UV radiation promote rapid degradation ($t_{1/2}$ = 4 days) to hydrochloric acid (HCl), dichloroacetyl chloride, phosgene, carbon monoxide, and hexachlorobutadiene. The overall half-life of TCE in surface water and air is 1-90 days and 4 days, respectively. Limited laboratory studies on the adsorption of TCE onto soils and sediments indicate that TCE does not adsorb onto pure clays to a great extent (<5 percent sorption). Thus, adsorption will not be considered as a major fate process. TCE does not significantly bioaccumulate in the environment as seen by bioconcentration factors of 10^{-17} for bluegills, with a half-life in tissue of less than 1 day. Higher mammals, including man, can degrade TCE to chlorinated acetic acids. Under anaerobic conditions, TCE can degrade to carbon dioxide in subsurface environments. However, biodegradation/biotransformation is considered of minor significance as an environmental fate process.

Summary:

The major environmental transport process for TCE is volatilization from water and soils to the atmosphere and leaching from soils to ground water.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Mills, W.B., et al. 1982. Water Quality Assessment: A Screening Procedure for toxic and Conventional Pollutants. U.S. EPA. Athens, GA. Vol. I, EPA 600/6-82-004a; Vol. II, EPA 600/6-82-004b.

Schuller, T.A. 1983. "Sorption and Analysis of Trichloroethylene (TCE) in Clays." Master of Science Thesis. West Chester University. Chemistry Department.

U.S. EPA. 1985. U.S. Environmental Protection Agency. Office of Health and Environmental Assessment. Proposed guidelines for the Health and Risk Assessment of Chemical Mixtures. Fed. Regist., Jan. 9, 1985, 50:1170-1176.

Wilson, J.T. and B.H. Wilson. 1985. "Biotransformation of Trichloretheylene in Soil." Appl. Environ. Micro. 49: 242-243.

VINYL CHLORIDE

General:

Vinyl chloride (chloroethene) is a starting material in the manufacture of PVC and other copolymers. It is moderately water soluble and is an extremely volatile unsaturated aliphatic hydrocarbon. Based upon its density, vinyl chloride would float if its water solubility were exceeded.

Fate and Transport:

Volatilization is the predominant fate process for vinyl chloride in the environment. The laboratory volatilization half-life of vinyl chloride from water is 26 minutes, while the overall half-lives in air and surface water are 1 day and 1-5 days, respectively. Once in the troposphere, vinyl chloride reacts rapidly ($t_{1/2}$ = few hours) to form hydrogen chloride (HCl) and formyl chloride (HCOCl) and, subsequently, carbon monoxide and hydrogen chloride ($t_{1/2}$ = 20 minutes). Studies indicate that volatilization proceeds so rapidly that the slower fate processes (photolysis, hydrolysis, and bioaccumulation) cannot occur. Sorption and biodegradation studies show minimal evidence that these processes occur for vinyl chloride.

Summary:

The predominant transport process for vinyl chloride from soils and water is volatilization to the atmosphere followed by oxidation in the troposphere. An additional transport process is the leaching of vinyl chloride from soils to ground water.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. U.S. EPA, Washington, DC. Vol. I, EPA 440/4-79-029a; Vol. II, EPA 440/4-79-029b.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. U.S. EPA, Washington, DC. EPA 440/4-81-014.

Mills, W.B., et al. 1982. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants. U.S. EPA. Athens, GA. Vol. I, EPA 600/6-82-004a; Vol. II, EPA 600/6-82-004b.

U.S. EPA. 1985. U.S. Environmental Protection Agency. Office of Health and Environmental Assessment. Proposed guidelines for the Health and Risk Assessment of Chemical Mixtures. Fed. Regist., Jan. 9, 1985, 50:1170-1176.

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Weast, R.C. (editor). 55th Ed., CRC Handbook of Chemistry and Physics. CRC Press. Boca Raton, Florida 1974-1975.

ZINC

General:

Zinc, a naturally occurring element found in the earth's crust, is associated with the minerals sphalerite (ZnS), smythsonite (ZnCO3), willemite (Zn2SiØ4), and zincite (ZnO). In aqueous solutions, zinc always has a valence of +2 and exhibits amphoteric properties such as dissolving in acids to form hydrated zinc (II) cations and in strong base to zincate anions. Zinc forms complexes with a variety of organic and inorganic ligands which are sufficiently soluble in water. Adsorption by clay minerals, hydrous oxides, and organic matter is a more probable limiting mechanism.

Fate and Transport:

The predominant environmental fate processes for zinc include sorption to soils, sediments and/or suspended particles, and metal oxides, clays, and organic matter, with adsorption increasing with pH. Bioaccumulation of zinc occurs in all organisms even in the absence of abnormally high zinc concentrations, because it is an essential nutrient. Bioconcentration factors ranging from 10^{1} to 10^{4} have been reported for zinc. No evidence of biodegradation of zinc in the environment is noted in the literature. Minor environmental significance is placed upon the role of volatilization, biodegradation, hydrolysis, photolysis and oxidation of zinc.

Summary:

The major environmental transport processes for zinc are sorption onto soils, sediments and/or suspended particles and bioaccumulation in organisms.

References:

Callahan, M.A., et al. 1979. Water-Related Environmental Fate of 129 Priority Pollutants. US EPA, Washington, DC. Vol.I, EPA 440/4-79-029a; Vol.II, EPA 440/4-79-029b.

Mabey, W.R., et al. 1982. Aquatic Fate Process Data for Organic Priority Pollutants. US EPA, Washington, DC. EPA 440/4-81-014.

Sittig, M. 1981. Handbook of Toxic and Hazardous Chemicals. Noyes Publications, Park Ridge, NJ.

US FPA. 1985. U.S. Environmental Protection Agency. Office of Drinking Water. Health advisories for 52 Chemicals which have been detected in Drinking Water. PB 86-118338. September 1985.

APPENDIX D

FUGITIVE DUST SCREENING

(Modification of ERM 1988 Work)

APPENDIX D
FUGITIVE DUST SCREENING

Wind Erosion Emissions

At present, the full extent of surface soils contamination is not known. This fugitive dust health screening is based on the preliminary surface soil sampling presented in the Remedial Investigation.

The wind erosion emissions from exposed soil areas can be estimated from methods presented by Cowherd et al. (U.S. EPA 1985). The mass fraction of the indicator substances found in the soil can be used to derive the emission rate of those components by a simple ratio of the total fugitive dust emissions. This common assumption is considered adequate for screening proposed. The method proposed by Cowherd is involved and will be only briefly described here. The reference should be consulted for further details.

The equation applying to soils with limited wind erosion potential was used for this site. The basic equation for estimating the total respirable particulate (10 micron aerodynamic diameter and below) emissions for surfaces with a limited erosion potential is as follows:

$$E_{10} = 0.83 \frac{f\ (Pu^{+})\ (1-V)}{(PE/50)^2} \qquad \text{Equation 1}$$

where:

E_{10} = respirable particulate emission rate per unit area of surface (mg)/(m^2-hr)

f = frequency of disturbance per month

u+ = observed or probable fastest mile of wind between disturbance (m/s)

$P(u^+)$ = erosion potential, i.e., quantity of erodible particles present on the surface prior to the onset of wind erosion (g/m^2)

V = fraction of contaminated surface covered by continuous vegetative cover

PE = Thornthwaites' Precipitation Evaporation Index used as an indication of soil moisture content

Several assumptions were made in order to determine subchronic and chronic exposure for fugitive dust. The frequency of disturbance per month (f) was assumed to be once per month on average. This is a considered to be a conservative estimate (US EPA 1985). The fastest mile of wind speed (u^+) reported at Philadelphia International Airport was 22.1 meters per second (m/s). This value for the fastest mile was extracted from Table 4-1 of the EPA Manual (US EPA 1985). Philadelphia is the closest representative meteorological station to the Bridgeport facility. For this exposure scenario, the assumption was made that no vegetative coverage would exist (i.e., V=0). The Thornthwaites'

Precipitation Evaporation Index (PE) for the site was determined to be approximately 120.

The variable $P(u^+)$ is computed according to the following relationship:

$P(u^+) = 6.7\ (u^+ - u_t)$, if u^+ is greater than or equal to u_t

$P(u^+) = 0$, if u^+ is less than u_t

The value of u_t is based on the friction velocity (u^*), which is a reference velocity defined by the square root of the Reynolds stress divided by the density of air. The friction velocity is dependent on the size distribution of the erodible particles and can be derived indirectly by determining the mode of the particle size distribution. Because a soil analysis of particle size distribution was not conducted at the site, a low value of 50 centimeters per second for u^* was assumed. The friction velocity in conjunction with an assumed roughness height of 8 centimeters, a height corresponding to low obstructions, was used to derive u_t by the following formula (US EPA 1985):

$$u_t = 2.5u^* (\ln(z/z_0)$$

where:

u_t = threshold value of wind speed at 7 meters (m/s)

u^* = friction velocity (cm/s)

z = 700 cm, assumed height above surface

z_0 = roughness height

This formula results in a value of 5.6 m/s for u_t, if u^* = 50 cm/s and z_0 = 8 cm. Since u^+ is greater than u_t, the value of $P(u^+)$ is 110.55 g/m2.

The basic wind erosion equation (equation 1) can be solved for this site as follows:

$$E_{10} = 0.83\frac{(1)\ (110.55)\ (1-0)}{(120/50)^2} = 15.92\ mg/(m^2\text{-}hr)$$

Multiplying by the site area (12,100 m^2) and converting to grams per second yield an average site total inhalable particulate emission rate of 0.054 g/s. This emission rate is appropriate for assessing the chronic health risk.

The subchronic health risk should be assessed on the basis of a worst case short-term emission factor which can be derived by assuming that the soil is disturbed immediately prior to the fastest mile wind speed event. This is accomplished by setting f = 30 in Equation 1 (US EPA 1985). Performing this calculation results in a maximum short term inhalable particulate emission rate 1.61 g/s.

The subchronic and chronic values are input to an air dispersion screening model to determine the impact at the nearest residence. The nearest resident is approximately 91 meters (300 feet) from the edge of the source.

Modeling Results

US EPA's Industrial Source Complex Dispersion Model (ISC) was used to perform the screening study (US EPA 1987). The short-term version of ISC was executed with a range of meteorological conditions consisting of 49 wind speed and stability combinations. For screening purposes, these hours are considered adequate to encompass the normal range of possible meteorological conditions. Furthermore, the meteorological conditions were identical with those incorporated in US EPA's Point Plume (PTPLU) screening model (US EPA 1986c). PTPLU and the urban version of this screening model, Point City (PTCITY), accept only traditional stack type sources. ISC accepts volume, point and area sources and has the ability to evaluate building downwash. Since wind erosion from an area is best modeled as an area source, ISC was selected. Furthermore, use of the ISC model in this manner is consistent with US EPA modeling guidance.

The model was executed in the rural mode and flat terrain was assumed. The site was modeled as an area source with dimensions of approximately 110 meters by 110 meters. The height of the source was assumed to be zero, since the source is at ground level. The chronic and subchronic emission rates of total inhalable particulates were input to the model. The predicted concentrations were then proportioned by a mass fraction of each chemical of concern determined from the soil analysis.

Subchronic Exposure Scenario

The wind erosion emission rate of inhalable particulates from the site for the subchronic exposure scenario was 1.61 grams per second (g/s). This resulted in a predicted maximum hourly ground

level concentration of 2840 ug/m^3 at 90 meters from the source, which is the point of the nearest residence. The meteorological conditions associated with the maximum concentration were a wind speed of 0.5 meters per second and neutral atmospheric stability. The maximum one hour concentration can be converted to a maximum 24-hour concentration by multiplying by 0.4. This assumes the conditions producing this concentration would persist for 40 percent of the day. This is generally accepted as a conservative method of converting a short-term hourly concentration to a 24-hour average as recommended by US EPA guidance (US EPA 1988a). The resulting worst case maximum 24-hour concentration would be 1136 mg/m^3.

Chronic Exposure Scenario

The wind erosion emission rate of inhalable particulates from the site for the chronic exposure scenario was 0.054 g/s. This yielded a maximum hourly ground level concentration of 95.9 ug/m^3 at the nearest residence. This occurred 90 meters from the source with a wind speed of 0.5 m/s and neutral stability. The maximum hourly concentration can be converted to an annual average by multiplying by 0.1. This factor is derived by using the 0.4 factor discussed above to convert to a 24-hour average and then assuming a 30 percent wind persistence in any one direction over the course of a year. This would result in an annual average of 9.6 ug/m^3.

Calculation of Concentrations at Residential Area

The total subchronic concentration at the residential area was calculated using:

$$C_{tot} = MCgl \times MF$$

where:

C_{tot} = total concentration at the receptor, (mg/m^3);
MCgl = maximum hourly ground level concentration, (mg/m^3); and
MF = mass fraction of inorganic constituent in surface soil.

Table D-1 presents the results of these calculations at the residential area.

The mass fraction of arsenic and lead were determined by summing the surficial soil concentrations and dividing the compound specific concentration by the total concentration. For example, the maximum concentration of arsenic is 94.9 gm/kg, the total maximum concentration of arsenic and lead is 468.9 mg/kg, and the mass fraction of arsenic is thus 94.9/468.9, or 20%.

The subchronic and chronic concentrations at the residential area were then multiplied by the mass fraction of arsenic and lead to determine the specific levels of these compounds. The total subchronic concentration is 1.136 mg/m^3 and the mass fraction of arsenic is 20. Therefore, the dust concentration of arsenic at the residential area is 1.136 (0.2) or 0.227 mg/m^3.

The compound specific dust concentrations are provided on Table D-1 and are used in Table D-2 to determine the subchronic and chronic intakes. The subchronic and chronic intakes for arsenic were calculated, for adults, using the following equations and the standard values from Table D-5:

Table D-1

CALCULATION OF POTENTIAL SUBCHRONIC AND CHRONIC CONCENTRATION OF ARSENIC AND LEAD AT THE RESIDENTIAL AREA

COMPOUND	MASS FRACTION IN SURFACE SOILS (%)	MAXIMUM HOURLY GROUND LEVEL CONCENTRATION MCgl (mg/m3)	C total CONCENTRATION (mg/m3)
SUBCHRONIC			
Arsenic	20	1.136	0.227
Lead	80	1.136	0.909
CHRONIC			
Arsenic	20	0.0096	0.002
Lead	80	0.0096	0.008

Concentration = [MCgl / 1000]*conversion* Mass Fraction
where
MCgl = maximum hourly ground level concentration (µg/ cubic meter)
Conversion = 24 hour for subchronic and annual for chronic exposures

TABLE D-2
Exposure Point Concentrations and Intakes

EXPOSURE MEDIA	ROUTE OF EXPOSURE	EXPOSED POPULATION	INDICATOR	SHORT TERM CONCENTRATION (PPM)	SUBCHRONIC INTAKE (mg/kg/day)	LONG TERM CONCENTRATION (PPM)	CHRONIC INTAKE # (mg/kg/day)
SURFACE SOILS	Inhalation	Adults [1]	Trichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			trans-1,2-Dichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Vinyl chloride	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Benzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Arsenic	2.27E-01	2.70E-03	1.92E-03	6.39E-07
			Lead	9.09E-01	1.08E-02	7.67E-03	2.55E-06
			1,2-Dichloroethane	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
		Child 6-12 [1]	Trichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			trans-1,2-Dichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Vinyl chloride	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Benzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Arsenic	2.27E-01	3.61E-03	1.92E-03	8.84E-08
			Lead	9.09E-01	1.45E-02	7.67E-03	3.53E-07
			1,2-Dichloroethane	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
		Child 2-6 [1]	Trichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			trans-1,2-Dichloroethene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Vinyl chloride	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Benzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00
			Arsenic	2.27E-01	3.54E-03	1.92E-03	5.81E-08
			Lead	9.09E-01	1.42E-02	7.67E-03	2.32E-07
			1,2-Dichloroethane	Not adsorbed	0.00E+00	Not adsorbed	0.00E+00

Chronic intakes * (Xyears/68 years) =Lifetime weighted intakes for adults X=58; child 6-12, X=6; child 2-6, X=4.
[1] Concentrations in mg/cubic meter are from wind erosion screening detailed in this Appendix.

TABLE D-3
Noncarcinogenic Hazard Index

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	SI (mg/kg/day)	AIS (mg/kg/day)	Subchronic Hazard	CI (mg/kg/day)	RfD (mg/kg/day)	Lifetime Chronic Hazard
INHALATION	SURFACE SOILS (dust emissions from gravel lot)	Adult	trans-1,2-Dichloroethene	Not adsorbed	2.00E-01	0.00E+00	Not adsorbed	2.00E-02	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	4.00E-01	0.00E+00	Not adsorbed	4.00E-02	0.00E+00
			Lead	1.08E-02			2.55E-06		
		Child 6-12	trans-1,2-Dichloroethene	Not adsorbed	2.00E-01	0.00E+00	Not adsorbed	2.00E-02	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	4.00E-01	0.00E+00	Not adsorbed	4.00E-02	0.00E+00
			Lead	1.45E-02			3.53E-07		
		Child 2-6	trans-1,2-Dichloroethene	Not adsorbed	2.00E-01	0.00E+00	Not adsorbed	2.00E-02	0.00E+00
			1,2-Dichlorobenzene	Not adsorbed	4.00E-01	0.00E+00	Not adsorbed	4.00E-02	0.00E+00
			Lead	1.42E-02			2.32E-07		

LIFETIME-WEIGHTED CHRONIC HAZARD:
LEAD: 7.29E-03

THE ACCEPTABLE INTAKE SUBCHRONIC (AIS) AND REFERENCE DOSE (RfD) FOR LEAD HAVE BEEN WITHDRAWN BY EPA'S REFERENCE DOSE WORK-GROUP FOR RECONSIDERATION. THIS DOES NOT IMPLY AN ABSENCE OF HEALTH RISK RELATED TO LEAD EXPOSURE UNDER THIS SCENARIO.

$$SI = [max, mg/m^3] \times AAR \times EXPR \times \%AA \times 1/BW$$

$$= 0.227\ mg/m^3 \times 0.83\ m^3/hr \times 1hr/day \times 1 \times 1/70\ kg$$

$$= 0.0027\ mg/kg/day$$

$$CI = [ave, mg/m^3] \times AAR \times EXPR \times \%AA \times 1/BW \times (X\ yrs/68\ yrs)$$

$$= 0.00192\ mg/m^3 \times 0.83\ m^3/m \times (1hr/d \times 12\ days/365\ days) \times 1 \times 1/70\ kg \times (58\ yrs/68\ yrs)$$

$$= 6.39 \times 10^{-7}$$

The hazard index and cancer risk calculations were performed according to the methods outlined in the Superfund Public Health Evaluation Manual (USEPA, 1986b). EPA's reference dose work group has withdrawn the RfD for lead for reconsideration, thus the hazard index could not be determined for this scenario. The lifetime-weighted carcinogenic risk posed by arsenic-contaminated dust particles at the residential area was shown on table D-4 to be 4×10^{-5}. This risk level was determined using the preliminary surface soil contamination levels reported in the Remedial Investigation. The health risks related to contaminated surface soils at the CLTL site will be re-evaluated when additional surface soil sampling is completed.

Table D-4
Calculation of Lifetime-weighted Risk From Potential Carcinogens

ROUTE OF EXPOSURE	EXPOSURE MEDIA	EXPOSED POPULATION	CHEMICAL	CI (mg/kg/day)	CARCINOGENIC POTENCY FACTOR 1/ (mg/kg/day)	LIFETIME-WEIGHTED RISK
INHALATION	SURFACE SOILS (dust emissions from gravel lot)	Adult	Trichloroethene	Not adsorbed	1.30E-02	0 E+00
			Vinyl chloride	Not adsorbed	2.95E-01	0 E+00
			Benzene	Not adsorbed	2.90E-02	0 E+00
			Arsenic	6.39E-07	5.00E+01	3 E-05
			1,2-Dichloroethane	Not adsorbed	9.10E-02	0 E+00
		Child 6-12	Trichloroethene	Not adsorbed	1.30E-02	0 E+00
			Vinyl chloride	Not adsorbed	2.95E-01	0 E+00
			Benzene	Not adsorbed	2.90E-02	0 E+00
			Arsenic	8.84E-08	5.00E+01	4 E-06
			1,2-Dichloroethane	Not adsorbed	9.10E-02	0 E+00
		Child 2-6	Trichloroethene	Not adsorbed	1.30E-02	0 E+00
			Vinyl chloride	Not adsorbed	2.95E-01	0 E+00
			Benzene	Not adsorbed	2.90E-02	0 E+00
			Arsenic	5.81E-08	5.00E+01	3 E-06
			1,2-Dichloroethane	Not adsorbed	9.10E-02	0 E+00

LIFETIME-WEIGHTED RISK: 4 E-05

Table D-5

STANDARD PARAMETERS USED FOR CALCULATION OF INTAKES

Fugitive Dust Exposure

PARAMETER	SYMBOL		Standard Value		
			Adult	Child age 6-12	Child age 2-6
Physical Characteristics					
Average Body Weight (kg)	BW		70 (a)	29 (b)	16 (b)
Activity Characteristics					
Aveolar Air Rates - Resident (cubic meters/hr)	AAR	a	0.83	0.46	0.25
Absorption in Aveolar Spaces (%)	%AA	a	100	100	100
Exposure Duration - Residents	EXPR	c	1 hr/day 12 days/yr	1 hr/day 12 days/yr	1 hr/day 12 days/yr

a) Superfund Exposure Assessment Manual (US EPA, 1988)
b) Anderson, et al., 1985
c) ERM Staff Professional Judgment

APPENDIX E

AIR DISPERSION SCREENING MODEL:

METHODOLOGY AND RESULTS

APPENDIX E

AIR DISPERSION SCREENING MODEL: Methodology and Results

Releases to Air

EPA's Industrial Source Complex (ISC) Model was used to perform the screening study (US EPA 1987). The short-term version of ISC was executed with a range of meteorological conditions consisting of 49 wind speeds and atmospheric stability combinations. For screening purposes, these 49 hours are considered adequate to encompass the normal range of possible meteorological conditions. Furthermore, the meteorological conditions were identical with those incorporated in US EPA's Point Plume (PTPLU) screening model (US EPA 1986c). PTPLU and the urban version of this screening model, Point City (PTCITY), accept only traditional stack type sources. ISC accepts volume, point and area sources and has the ability to evaluate building downwash. Since the ability to model volume sources was required, ISC was selected for this study. Use of the ISC model in this manner is consistent with US EPA modeling guidance.

There were two areas expected to produce toxic emissions at the Bridgeport facility. The two areas were the CLTL Production Well and the trailer rinsing bays. Both areas were modeled as volume sources. In the ISC model, the effect of a structure or building on the initial dispersion of pollutants is accounted for by use of volume source. It is recommended that vents and multiple release points on or near a structure be modeled as a volume

source (US EPA 1987). In addition, the facility was modeled in the rural mode and flat terrain was assumed.

The model was executed with a normalized 1 gram per second (g/s) emission rate. Since several substances were involved, this permitted the predicted concentration of the chemicals of concern to be directly calculated by simply multiplying by the appropriate emission factor. ERM obtained the dimensions for the structures from Chemical Leaman. The building dimensions were used to calculate the initial dispersion of the pollutants. It was assumed that 90% of the total volatile emissions were associated with the trailer rinsing area. The remaining 10% of the volatile emissions were assumed to be emitted from the CLTL Production Well.

Emission Rate Calculations

The emission rates of the indicators from ground water in the production well were calculated using the following equation (US EPA 1988):

$$E_i = [(D_i \times C_{gw} \times A)/[d^2 + (2Dt)]^{0.5}] \times Q,$$

where:

- E_i = emission rate of component i, (mg/sec);
- D_i = diffusion coefficient of component i in air, (cm^2/sec);
- C_{gw} = concentration of component i in ground water from production well, (mg/L);
- A = area of the room, (cm^2);
- d = depth to dry zone taken as zero since liquid sample, (cm);

t = time of sampling event = 1, (sec); and
Q = quantity of water used (L).

Two additional equations were required to estimate D_i in CM^2/sec. The first equation is:

$$D_i = D\ (P_a^{4/3})\ H_i^1,$$

where:

D_i = phase transfer coefficient, (cm^2/sec)
D = diffusion coefficient of component i in air, (cm^2/sec);
P_a = atmospheric porosity; and
H_i = Henry's Law Constant (dimensionless)

The second equation converts H in atm-m^2/mol to a dimensionless form as follows:

$$H_i = H_i/(RT),$$

where:

H_i = Henry's Law Constant for component i, (atm-m^3/mol);
R = gas constant - 8.2×10^{-5} atm-m^3/mol ^oK; and
T = absolute temperature, (^oK).

The values used in the calculation of E_i for the indicators for the pump room and trailer bay area are presented in Tables E-1 and E-2, respectively. For the pump room, C_w is the concentration of each compound detected in ground water from the production well (Table 4-4) times 10%, which is the fraction

Table E-1
Emission Rate Calculations for Indicators
Pump Room - 10 % of VOCs volatilized

Indicator	Hi atm-cub m/mol	R atm-cub m/mol °K	T °K	Hi'	Di sq cm/sec	Pa	D sq cm/sec
Arsenic	0.00E+00	8.20E-05	2.98E+02	0.00E+00	0.00E+00	1.00E+00	0.00E+00
Lead	0.00E+00	8.20E-05	2.98E+02	0.00E+00	0.00E+00	1.00E+00	0.00E+00
1,2-Dichloroethane	9.14E-04	8.20E-05	2.98E+02	3.74E-02	9.64E-02	1.00E+00	3.61E-03
Trichloroethene	9.10E-03	8.20E-05	2.98E+02	3.72E-01	8.61E-02	1.00E+00	3.20E-02
trans-1,2-Dichloroethene	6.56E-03	8.20E-05	2.98E+02	2.68E-01	8.39E-02	1.00E+00	2.25E-02
Benzene	5.59E-03	8.20E-05	2.98E+02	2.29E-01	9.23E-02	1.00E+00	2.11E-02
Vinyl chloride	8.19E-02	8.20E-05	2.98E+02	3.35E+00	1.14E-01	1.00E+00	3.81E-01
1,2-Dichlorobenzene	1.93E-03	8.20E-05	2.98E+02	7.90E-02	7.63E-02	1.00E+00	6.02E-03

Indicator	A sq cm	d cm	t sec	Cw mg/L	Q Liters	Ei mg/sec
Arsenic	5.57E+05	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00
Lead	5.57E+05	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00
1,2-Dichloroethane	5.57E+05	0.00E+00	1.00E+00	3.00E-03	5.68E+04	1.25E-03
Trichloroethene	5.57E+05	0.00E+00	1.00E+00	1.90E-01	5.68E+04	2.36E-01
trans-1,2-Dichloroethene	5.57E+05	0.00E+00	1.00E+00	2.90E-01	5.68E+04	3.02E-01
Benzene	5.57E+05	0.00E+00	1.00E+00	4.00E-03	5.68E+04	4.03E-03
Vinyl chloride	5.57E+05	0.00E+00	1.00E+00	2.00E-03	5.68E+04	8.57E-03
1,2-Dichlorobenzene	5.57E+05	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00

Ei =[D x Cgw x A] /[(d x d) +(2 x D x t)]^0.5 x Q

where

Ei = Emission rate of component i (mg/sec),
Di = Diffusion coefficient of component i in air (sq cm/sec),
Cgw = Concentration (10%) of component i in production well - average and maximum (mg/L),
A = Area of the truck rinsing bay (20ft x 30ft) (sq cm),
d = Depth to dry zone taken as zero since liquid sample (cm),
t = Time of sampling event (sec), and
Q = Quantity of water used (L).

where

D= Di x (Pa^4/3) x Hi'

and

Hi' = Hi / (RxT)

Table E-2
Emission Rate Calculations for Indicators
Trailer Rinsing Bays - ASSUMING REMAINING 90% VOLATILIZED

Indicator	Hi atm-cub m/mol	R atm-cub m/mol °K	T °K	Hi'	Di sq cm/sec	Pa	D sq cm/sec
Arsenic	0.00E+00	8.20E-05	2.98E+02	0.00E+00	0.00E+00	1.00E+00	0.00E+00
Lead	0.00E+00	8.20E-05	2.98E+02	0.00E+00	0.00E+00	1.00E+00	0.00E+00
1,2-Dichloroethane	9.14E-04	8.20E-05	2.98E+02	3.74E-02	9.64E-02	1.00E+00	3.61E-03
Trichloroethene	9.10E-03	8.20E-05	2.98E+02	3.72E-01	8.61E-02	1.00E+00	3.20E-02
trans-1,2-Dichloroethene	6.56E-03	8.20E-05	2.98E+02	2.68E-01	8.39E-02	1.00E+00	2.25E-02
Benzene	5.59E-03	8.20E-05	2.98E+02	2.29E-01	9.23E-02	1.00E+00	2.11E-02
Vinyl chloride	8.19E-02	8.20E-05	2.98E+02	3.35E+00	1.14E-01	1.00E+00	3.81E-01
1,2-Dichlorobenzene	1.93E-03	8.20E-05	2.98E+02	7.90E-02	7.63E-02	1.00E+00	6.02E-03

Indicator	A sq cm	d cm	t sec	Cw mg/L	Q Liters	Ei mg/sec
Arsenic	2.68E+06	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00
Lead	2.68E+06	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00
1,2-Dichloroethane	2.68E+06	0.00E+00	1.00E+00	2.70E-02	5.68E+04	5.41E-02
Trichloroethene	2.68E+06	0.00E+00	1.00E+00	1.71E+00	5.68E+04	1.02E+01
trans-1,2-Dichloroethene	2.68E+06	0.00E+00	1.00E+00	2.61E+00	5.68E+04	1.31E+01
Benzene	2.68E+06	0.00E+00	1.00E+00	3.60E-02	5.68E+04	1.75E-01
Vinyl chloride	2.68E+06	0.00E+00	1.00E+00	1.80E-02	5.68E+04	3.71E-01
1,2-Dichlorobenzene	2.68E+06	0.00E+00	1.00E+00	0.00E+00	5.68E+04	0.00E+00

$$Ei = [D \times Cgw \times A] / [(d \times d) + (2 \times D \times t)]^{0.5} \times Q$$

where

Ei = Emission rate of component i (mg/sec),
Di = Diffusion coefficient of component i in air (sq cm/sec),
Cgw = Concentration (90%) of component i in production well - average and maximum (mg/L),
A = Area of the truck rinsing bay (60ftx48ft) (sq cm),
d = Depth to dry zone taken as zero since liquid sample (cm),
t = Time of sampling event (sec), and
Q = Quantity of water used (L).

where

$$D = Di \times (Pa^{4/3}) \times Hi'$$

and

$$Hi' = Hi / (R \times T)$$

assumed volatilized in this area. The concentrations used in the trailer rinsing bays represents 90% of the concentration detected in the ground water.

The following assumptions were used in the calculation of emission rates from the ground water:

- the temperature at the site was 78°F;
- atmospheric pressure was 1;
- area of the pump room was 20 ft x 30 ft or 5.57×10^5 cm^2;
- time to collect a water sample was 1 second;
- average concentration in the pump room was 10% of the concentration in the production well ground water;
- average concentration of the trailer bays was 90% of the concentration in the production well ground water;
- 15,000 gallons of water are used per day in the trailer rinsing operation.

The emission rates for the pump room and trailer rinsing bays are presented in Tables E-1 and E-2, respectively. These emission rates were used to proportion the concentrations modeled in this appendix.

Production Well

The production well was modeled as a volume source. The dimensions of the building housing the well are 20 feet by 30 feet with a center roof height of 24 feet. The release height of the source was assumed to be equal to 3.65 meters or half of the building height (7.3 meters). The projected width of the building, which is used to determine the initial horizontal dispersion coefficient, was 10.6 meters (35 feet). The initial horizontal and vertical dispersion coefficients were calculated to be 2.5 and 3.4 meters, respectively, The above parameters were used to define the volume source in the air dispersion screening model.

The predicted maximum hourly ground level concentration for emissions from the production well was predicted to be 8,320 micrograms per cubic meter (ug/m^3) at 90 meters from the source, which is the distance to the nearest residence. This was based on a 1.0 g/s emission rate. The meteorological conditions which produced this concentration were a wind speed of 0.5 meters per second (m/s) and neutral atmospheric stability. This value was then multiplied by the emission rate of each chemical of concern in order to derive the predicted maximum hourly ground level concentrations. The results are shown in Table E-3.

The Trailer Rinsing Bays

Operations in the trailer rinsing bays were modeled as a single source. The dimensions of the bays were 60 feet (18.3 meters) by 48 feet (14.6 meters) with a center roof height of 24 feet (7.3 m). The source release height was assumed to be half of the building height. The projected width of the building, which is used to determine the horizontal dispersion coefficient, was

Table E-3

Results Of Air Dispersion Screening Modeling for the Pump Room

Chemical		10% Vol Ei (mg/s)	Hourly Conc. (ug/m3)
Arsenic		0.00E+00	0.00E+00
Lead		0.00E+00	0.00E+00
1,2-Dichlorethane		1.25E-03	1.04E-05
Trichloroethene		2.36E-01	1.96E-03
trans-1,2-Dichloroethene		3.02E-01	2.51E-03
Benzene		4.03E-03	3.35E-05
Vinyl Chloride		8.57E-03	7.13E-05
1,2 -Dichlorobenzene		0.00E+00	0.00E+00

23.14 meters (76 feet). The initial dispersion coefficients were calculated based on the above dimensions. The initial horizontal and vertical dispersion coefficients were calculated to be 5.4 and 3.4 meters, respectively. These parameters along with the release height and emission rate were used to define the volume source.

The maximum hourly ground level concentration for emissions from the trailer rinsing bay area was predicted to be 6,500 micrograms per cubic meter (ug/m^3) at 90 meters from the source, which is the nearest location to a residence. This concentration was based on a 1.0 g/s emission rate. The meteorological conditions producing this concentration were a wind speed of 0.5 meters per second (m/s) and neutral atmospheric stability. This value was multiplied by the emission rate for each chemical of concern in order to derive the predicted maximum hourly ground level concentrations. These results are shown in Table E-4.

Exposure Point Concentrations at Residential Areas

The average concentration in the pump room and the average concentration in the trailer bays was summed to determine the chronic exposure point concentration.

These summed values were entered as exposure point concentrations in Table 4-8 and the resultant subchronic and chronic intakes were calculated.

Table E-4

Results Of Air Dispersion Screening Modeling Of The Trailer Rinsing Bays

Chemical			90% Vol Ei (mg/s)	Hourly Conc. (ug/m3)
Arsenic			0.00E+00	0.00E+00
Lead			0.00E+00	0.00E+00
1,2-Dichloroethane			5.41E-02	3.52E-04
Trichloroethane			1.02E+01	6.63E-02
trans-1,2-Dichloroethene			1.31E+01	8.52E-02
Benzene			1.75E-01	1.14E-03
Vinyl Chloride			3.71E-01	2.41E-03
1,2 -Dichlorobenzene			0.00E+00	0.00E+00

Exposure Point Concentrations for Workers

The exposure point concentrations for the workers in the trailer rinsing operation at the active terminal are determined using a box model. The methods for predicting concentrations directly over an area source are neither well developed nor well tested. However, Schlesinger, et al. has suggested a modified box model that appears to perform adequately. The equation for calculating the concentration is described below:

$$C_i = Q_i/HWu$$

where:

C_i	=	average concentration from component i within the box (grams per cubic meter),
Q_i	=	emission rate of component i from the source (grams per second),
H	=	downwind height in the box (meters),
W	=	width of the box (meters), and
u	=	average wind speed through the box (meters per second).

The source release height was assumed to be half of the building height, or 3.65 meters while the projected width of the building was 23.14 meters. The average wind speed through the box was 0.5 meters/second, at neutral stability. These values were determined in the trailer bay subsection of this appendix.

The exposure point concentrations, which result from the box model, are given on Table E-5 and used in Table 4-8 to determine subchronic and chronic intakes to workers.

TABLE E-5
CONCENTRATION INHALED BY WORKERS IN TRAILER RINSING BAYS
RESULTS OF THE BOX MODEL

Indicator	Ei mg/ sec	H meter	W meter	μ meter/sec	Ci mg/cubic m
Arsenic	0.00E+00	3.65E+00	2.31E+01	5.00E-01	0.00E+00
Lead	0.00E+00	3.65E+00	2.31E+01	5.00E-01	0.00E+00
1,2-Dichloroethane	2.70E-02	3.65E+00	2.31E+01	5.00E-01	6.39E-04
Trichloroethene	1.71E+00	3.65E+00	2.31E+01	5.00E-01	4.05E-02
trans-1,2-Dichloroethene	2.61E+00	3.65E+00	2.31E+01	5.00E-01	6.18E-02
Benzene	3.60E-02	3.65E+00	2.31E+01	5.00E-01	8.52E-04
Vinyl chloride	1.80E-02	3.65E+00	2.31E+01	5.00E-01	4.26E-04
1,2-Dichlorobenzene	0.00E+00	3.65E+00	2.31E+01	5.00E-01	0.00E+00

$Ci = Ei / (H*W*\mu)$

where

H = source release height from air dispersion modelling, (meter)

W = projected building width, (meter)

μ = wind speed at neutral stability, (meter/second)

Ei = Emission rate of a compound from water into air, (mg/sec)

Ci values are entered into Table 4-8 to determine intakes.

APPENDIX F

SAMPLE CALCULATIONS FOR INTAKES

Table F-1

EXAMPLE CALCULATIONS FOR EXPOSURE OF ADULTS (RESIDENTS) TO TRICHLOROETHENE

(concentrations are from Table 4-8, shallow/intermediate ground water subzones and parameters are given in Table F-3)

LWCI = lifetime weighted chronic intake
SI = subchronic intake (not weighted)

Lifetime-weighting for adults = 58 yrs/68yrs
Lifetime-weighting for children 6-12 = 6 yrs/68 yrs
Lifetime-weighting for children 2-6 = 4 yrs/68 yrs

Inhalation

1. Exposure to contaminants in ground water while bathing

LWCI

= [AVE mg/L] [((VW x AAR x B x %AA)/(2 x VS)) + ((AAR x EXB x VW x %AA)/VB)] x 1/BW

= [0.430 mg/L] [((200L x 0.83 m^3/hr x 0.33 hr x 1)/ (2 x 3 m^3)) + ((0.83 m^3/hr x 0.17 hr x 200L x 1)/10 m^3)] x 1/70 kg x $\frac{58 \text{ yrs}}{68 \text{ yrs}}$

= **0.0627 mg/kg/day**

SI

= same as chronic intake except short-term or maximum concentration used

= **0.821 mg/kg/day**

2. Inhalation of vapors from trailer rinsing operation

LWCI

= [mg/m^3] x AAR x EXPR x %AA x 1/BW

= 0.000106 mg/m^3 x 0.83 m^3/hr x (24 hr/d x $\frac{312 \text{ d}}{365 \text{ d}}$) x 1 x 1/70 kg x $\frac{58 \text{ yr}}{68 \text{ yr}}$

= 0.0000219 **mg/kg/day**

Table F-1 continued

Dermal - bathing

LWCI

$$= [\text{AVE mg/L}] \times \frac{1\ \text{L}}{10^6\ \text{mg}} \times \text{SA} \times \%\text{SA} \times \text{MF} \times 1/\text{BW} \times \text{B}$$

$$= 0.43\ \text{mg/L} \times \frac{1\ \text{L}}{10^6\ \text{mg}} \times 18150\ \text{cm}^2 \times 1 \times 0.5\ \text{mg/cm}^2\text{/hr} \times \frac{1}{70\ \text{kg}} \times 0.33\ \text{hr} \times \frac{58\ \text{yr}}{68\ \text{yr}}$$

$$= 0.0000157\ \textbf{mg/kg/day}$$

SI

= same as LWCI except maximum concentration

$$= 4.8\ \text{mg/L} \times \frac{1\ \text{L}}{10^6\ \text{mg}} \times 18150\ \text{cm}^2 \times 0.5\ \text{mg/cm}^2 \times 1\ \text{hr} \times \frac{1}{70\ \text{kg}} \times 0.33\ \text{hr}$$

$$= 0.000205\ \textbf{mg/kg/day}$$

Ingestion

LWCI

$$= [\text{AVE mg/L}] \times \text{W} \times 1/\text{BW} \times \%\text{ING} \times \%\text{WU}$$

$$= 0.43\ \text{mg/L} \times 2\text{L} \times \frac{1}{70\ \text{kg}} \times 1 \times 0.75 \times \frac{58\ \text{yr}}{68\ \text{yr}}$$

$$= 0.00785\ \textbf{mg/kg/day}$$

SI

$$= 4.8\ \text{mg/L} \times 2\text{L} \times 1/70\ \text{kg} \times 0.75 \times 1$$

$$= 0.103\ \textbf{mg/kg/day}$$

For children 6-12 and children 2-6, make appropriate changes in standard values to determine the subchronic and chronic intakes.

Table F-2

EXAMPLE CALCULATIONS FOR WORKERS FROM EXPOSURE TO TRICHLOROETHENE

(concentrations are from Table 4-8, shallow/intermediate ground water subzones and parameters are given in Table F-3)

Inhalation of rinse water

LWCI

= $[mg/m^3]$ x AAW x EXPW x %AA x 1/BW

(for concentrations see Appendix E)

= 0.0405 mg/m^3 x 2.8 m^3/hr x (8 hr/d x $\frac{250\ d}{365\ d}$) x 1 x 1/70 kg x $\frac{58\ yrs}{68\ yrs}$

= 0.0756 **mg/kg/day**

Dermal contact with rinse water

LWCI

= [AVE mg/L] x $\frac{1\ L}{10^6\ mg}$ x (SA x %SAW) x MF x 1/BW x EXPW

= 1.90 mg/L x $\frac{1\ L}{10^6\ mg}$ x (18150 cm^2 x 0.2) x 0.5 mg/cm^2 hr x 1/70 kg x (8 hr/d x $\frac{250\ d}{365\ d}$) x $\frac{58\ yr}{68\ yr}$

= 0.000231 **mg/kg/day**

Table F-3

STANDARD PARAMETERS USED FOR CALCULATION OF INTAKES

PARAMETER	SYMBOL		Standard Value Adult	Child age 6-12	Child age 2-6
Physical Characteristics					
Average Body Weight (kg)	BW		70 (a)	29 (b)	16 (b)
Surface Area Available for Dermal Exposure (sq. cm.)	SA	a	18150	10470	6980
Activity Characteristics					
Amount of Water Ingested Daily (Liters)	W	a	2	2	1
Percentage of Surface Area Immersed While Bathing (%)	%SA	a	100	100	100
Length of Exposure While Bathing (minutes)	B	c	20	20	20
Length of Additional Exposure After Bathing (minutes)	EXB	c	10	10	10
Volume of Showerstall (cubic meters)	VS	c	3	3	3
Volume of Bathroom (cubic meters)	VB	c	10	10	10
Volume of Water Used While Showering (liters)	VW	c	200	200	200
Water use	%WU	a	75	75	75
Bathing Frequency	BF	a	1/day	1/day	1/day
Aveolar Air Rates - Resident (cubic meters/hr)	AAR	a	0.83	0.46	0.25
Absorption in Aveolar Spaces (%)	%AA	a	100	100	100
Aveolar Air Rates - Worker (cubic meters/hr)	AAW	a	2.8	NA	NA
Exposure Duration - Worker	EXPW	d	8 hrs/day 250 days/yr	NA	NA
Exposure Duration - Residents	EXPR	d	24 hrs/day 312 days/yr	24 hrs/day 312 days/yr	24 hrs/day 312 days/yr
Percentage Surface Area Exposed - Workers (%)	%SAW		20	NA	NA
Absorption via ingestion (%)	%ING		100	100	100
Material Characteristics					
Mass Flux Rate (water-based) (mg/sq cm/hr)	MF	a	0.5	0.5	0.5

a) Superfund Exposure Assessment Manual (US EPA, 1988)
b) Anderson, et al., 1985
c) K.G. Symms, "An Approximation of the Inhalation Exposure to Volatile Synthetic Organic Compounds from Showering with Contaminated Household Water," paper presented at the Symposium of American College of Toxicologists, 15 November 1985
d) ERM Staff Professional Judgment

NA - Not Applicable

APPENDIX G

TOXICOLOGY PROFILES FOR INDICATORS AT THE CLTL-BRIDGEPORT, NJ TERMINAL

Arsenic
Benzene
1,2-Dichlorobenzene
1,2-Dichloroethane
Lead
trans-1,2-Dichloroethene
Trichloroethene
Vinyl Chloride
Zinc

Arsenic

References: US EPA 1985a; 1985b

Summary of Health Effects Data

The toxicity of arsenic depends upon its chemical form and the route and duration of exposure. In general, arsenites (As^{+3}) are more toxic than arsenates (As^{+5}), soluble compounds are more toxic than insoluble compounds, and inorganic compounds are more toxic than organic derivatives. Short-term effects of arsenic poisoning are similar in humans and animals. With oral exposure, symptoms include muscular cramps, facial edema, gastrointestinal damage, vomiting, diarrhea, and general vascular collapse. Long-term exposure produces effects similar to those observed following short-term exposure, along with signs of entry to the hematopoietic, renal, and nervous systems. In humans, chronic exposure to arsenic is associated with a characteristic pattern of skin lesions. One of the most characteristic effects of chronic arsenic exposure in humans is a pattern of skin disorders, beginning with hyperpigmentation and keratosis, developing in some cases into squamous cell or basal cell carcinoma. Most humans can tolerate the dose of 6.8 mg As^{+3}/day with no adverse effects. The estimated dose of arsenic owing to accidental exposure via ingestion of arsenic-contaminated foods was about 3.5 mg/day for about 33 days.

Pharmacokinetics and Metabolism

Arsenic can be absorbed into the body by ingestion or by inhalation. Analysis of human tissues at autopsy indicates that arsenic distributes throughout the body and accumulates with time in hair, nails, bone, and skin. In animals dosed either with arsenic (+3) or arsenic (+5), the arsenic initially distributes in the soft tissues (liver, kidney, lung, spleen, skin, brain) but is cleared quickly from these, except for skin and brain. Inorganic arsenic compounds undergo methylation in mammalian species as well as humans to produce monomethyl and dimethyl arsenic. In humans ingesting arsenic-rich wine, about 80 percent of the arsenic ingested was excreted in the urine in 61 hours. Of this, 63 percent was dimethyl arsenic acid, 18 percent was monomethyl arsenic acid, and about 9 percent each were inorganic As^{+3} and As^{+5}. Reduction of administered As^{+5} to As^{+3} has been demonstrated in rats, mice, and rabbits, but *in vivo* reduction has not been well documented in humans. Excretion of arsenic is primarily via the urine, initially in the same form as the ingested dose and later as the methylated derivatives. The rate of clearance depends somewhat on valence and dose, but typically 50 to 90 percent is excreted by humans within 2 to 4 days. In contrast to its behavior in humans, arsenic is retained in red blood cells of the rat, with a half-life of 60 to 90 days.

Toxic and/or Carcinogenic Effects

Acute symptoms of arsenic poisoning are similar in both man and experimental animals. The acute symptoms associated with oral exposure include severe gastrointestinal damage resulting in vomiting and diarrhea and general vascular collapse, leading to shock, coma, and death. Other acute effects are muscular cramps, facial edema, and cardiovascular reactions. Airborne exposure at high levels also results in severe irritation of the nasal mucosa, larynx, and bronchi. An aftereffect of acute contact with inorganic arsenic includes peripheral nervous system disturbances and slow recovery and reversible effects on the hepatopoitic system. Levels of exposure associated with acute arsenic toxicity vary with the valence form of the element, the trivalent state being approximately 4-fold more toxic than the pentavalent arsenic. Oral LD_{50} values for trivalent arsenic vary from 15 to 293 mg/kg body weight in rats, and from 10-150 mg/kg in other test species.

The collective evidence at the present time for the etiological role of inorganic arsenic in human cancers is strongest for the cancers of the skin and lung. In man, chronic oral exposure to arsenic induces a series of changes in the skin epithelium, proceeding from hyperpigmentation to hyperkeratosis, characterized as keratin and proliferation of the verrucose nature, and leading in some cases to late onset skin cancers.

As previously mentioned, EPA as well as IARC have classified arsenic as a human carcinogen. The Carcinogen Assessment Group (CAG) of EPA has determined a carcinogenic potency factor of 1.8 ($mg/kg/day^{-1}$) by ingestion and 50 ($mg/kg/day^{-1}$) by inhalation.

BENZENE

References: US EPA 1984a; 1985a; 1985b

Summary of Health Effects Data

Benzene is a recognized human carcinogen. Several epidemiological studies provide sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Benzene is a known inducer of aplastic anemia in humans, with a latency period of up to 10 years. It produces leukopenia and thrombocytopenia, which may progress to pancytopenia. Similar adverse effects on the blood cell-producing system occur in animals exposed to benzene. In both humans and animals, benzene exposure is associated with chromosomal damage, although it is not mutagenic in microorganisms. Benzene is fetotoxic and causes embryolethality in experimental animals.

Pharmacokinetics and Metabolism

The absorption routes of benzene into the body are dermal, inhalation, and oral. Dermal and oral absorptions are presumed minor compared to inhalation. Inhalation is the most important absorption route of occupational workers, due to the high volatility of benzene. An estimated 12-50% of benzene-contaminated inspired air is expired unchanged by humans. In the body, benzene undergoes metabolism via the mixed function oxidase system to an intermediate-benzene epoxide. This unstable intermediate interacts with cellular constituents to form a major metabolite, phenol, and minor metabolites, hydroquinone and catechol. It appears that hydroquinone is the metabolite responsible for pancytopenia, anemic and leukemogenic effects of benzene. Futher metabolism occurs to alkaline salts and glucuronide conjugates. Eventually all metabolites are excreted in the urine.

Toxic and/or Carcinogenic Effects

Exposure to very high concentrations of benzene [about 20,000 ppm (66,000 mg/m^3) in air] can be fatal within minutes. The prominent signs are central nervous system depression and convulsions, with death usually following as a consequence of cardiovascular collapse. Milder exposures can produce vertigo, drowsiness, headache, nausea, and eventually unconsciousness if exposure continues. Deaths from cardiac sensitization and cardiac arrhythmias have also been reported after exposure to unknown concentrations. Although most benzene hazards are associated with inhalation exposure, dermal adsorption of liquid benzene may occur, and prolonged or repeated skin contact may produce blistering, erythema, and a dry, scaly dermatitis.

Depression and increased susceptibility to tuberculosis and pneumonia have been attributed to benzene intakes.

No supporting evidence suggests that benzene is teratogenic, however, it is a potent inhibitor of growth in utero in animals. Benzene was found to be nonmutagenic in several assays, but some positive results were found in sister chromatid exchange experiments in mice.

CAG has evaluated benzene among more than fifty chemicals for relative carcinogenic potency as suspected human carcinogens. The level of evidence for benzene's carcinogenicity is sufficient in both animal and human studies to classify the compound as a CAG Group A and IARC Class 1 ("known" human) carcinogen.

1,2-DICHLOROBENZENE

References: US EPA 1984c; Harris et al. 1981

Summary of Health Effects Data

This summary refers to dichlorobenzenes in general. Inhalation of dichlorobenzene causes eye and upper respiratory tract irritation, central nervous system depression, and liver and kidney damage in experimental animals. LD_{20} of approximately 4900 $mg/m^3/7$ hrs is reported for the rat. No toxic effects were observed after daily 7-hour inhalation exposures of up to 516 mg/m^3 for as much as seven months in several species of experimental animals. Hepatic porphyria is reported to occur in rats after daily tracheal intubation of 455 mg/m^3 for up to 15 days. Oral exposure results in stimulation of liver microsomal enyzme systems and cumulative toxicity. The oral LD_{50} for the rat is 500 mg/kg. Chronic oral exposure to 188 mg/kg/day causes liver and kidney damage in rats. Exposure to 0.01 to 0.1 mg/kg/day produced changes in the hematopoietic system, increased prothrombin time, and altered conditioned reflexes and enyzme activities in chronically exposed rats. In general, toxicity increases in the order of 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene. The 48-hour and 96-hour LD_{50} values for Daphnia and bluegills tested under static conditions, were 2.44 and 5.59 mg/L respectively, for 1,2-dichlorobenzene.

Pharmacokinetics and Metabolism

1,2-Dichlorobenzene is rapidly absorbed through the lungs, gastrointestinal tract, and somewhat slower through the skin in both man and rodents. Skin absorption, however, has not been adequately tested. 1,2-Dichlorobenzene is rapidly distributed by the blood to the adipose, kidney, lung, liver, heart, brain, and muscle tissues. Metabolism of 1,2-dichlorobenzene has been studied in animals where the primary metabolite is 3,4-dichlorophenol along with glucuronic and sulphuric acid conjugates which are excreted in the urine. The dichlorophenol further metabolizes to epoxidase and arene oxide intermediates. Minor metabolites include 4,5- and 3,4-dichlorocatechols and 3,4-dichlorophenolmercapturic acids. Excretion is primarily through the urine of unchanged 1,2-dichlorobenzene and its subsequent metabolites.

Toxic and/or Carcinogenic Studies

1,2-Dichlorobenzene vapor at high concentrations is toxic to the liver and kidneys in animals. Rats died from exposure to 977 ppm for 7 hours, but survived when exposed for only 2 hours; animals survived exposure to 539 ppm for 3 hours and at necropsy showed marked centrolobular necrosis of the liver, as well as cloudy swelling of the tubular epithelium of the kidneys. Several species of animals exposed repeatedly to 93 ppm for 7 hours daily showed no adverse effects. The liquid instilled in the rabbit eye produced apparent distress and slight conjunctival irritation. Eye irritation is not usually evident below 20 ppm but becomes noticeable at 25 to 30 ppm and painful to some at 60 to 100 ppm if exposures are for more than a few minutes duration. Some acclimatization may occur, but its extent is not great. Workers exposed daily to an average of 15 ppm showed no indication of injury. The liquid left on the skin may produce blistering. Sensitization dermatitis has been reported.

The compound 1,2-dichlorobenzene does not appear to present carcinogenic risks based upon data available at this time. Dichlorobenzene is reported to be nonmutagenic in Salmonella typhimurium tester strains. Mutagenic and clastogenic activity reportedly occurs in some plant test systems. No data are available for evaluating teratogenic or reproductive effects in animals or humans. An acceptable daily intake (ADI) has been adjusted for drinking water exposure and is estimated to be 6.3 mg/day.

1,2-DICHLOROETHANE(EDC)

References: US EPA 1984a; 1985b;

Summary of Health Effects Data

The circulatory, respiratory, and nervous systems as well as liver and kidney are adversely affected by exposure to EDC. Most mammalian species (presumably man also) can metabolize EDC to 2-chloroethanol and chloroacetic acid, with urine and expired breath as the excretion routes. Elevated incidence of squamous-cell carcinoma of the forestomach, hemangiosarcoma, and mammary adenocarcinoma have been observed in Osborne-Mendel rats while doses of EDC in B6C3F1 mice resulted in alveolar/bronchiolar tumors, mammary adenocarcinomas, and endometrial tumors. This disparity in animal data results leads to a cautious consideration of EDC as a carcinogen. Reproductive studies are negative but mutations have been produced. In humans, exposure to EDC by inhalation for long periods of time have lead to chronic symptoms (e.g. central nervous system (CNS) depression, gastrointestinal (GI) upset, and kidney and liver damage). Oral exposure has lead to death in some cases.

Pharmacokinetics and Metabolism

The major routes of EDC's absorption into the body are inhalation and ingestion. The compound is also readily absorbed through the skin. Ingestion of EDC may be through either direct intake of water or food or via inhalation during chewing and swallowing. Once in the body, EDC is transported by the blood to the respiratory and gastrointestinal areas where absorption occurs. EDC accumulates in the blood, liver, and adipose tissues. Relative tissue distribution in rats following oral, intravenous and inhalation exposures are similar except oral exposure has higher blood concentrations than inhalation for the same doses. Most mammalian species, and presumably man, metabolize EDC to 2-chloroethanol and chloroacetic acid. Elimination in rats is biphasic and dose-dependent, suggesting elimination may be a saturable process. Excretion occurs primarily in urine and expired air.

Toxic and Carcinogenic Studies

1,2-Dichloroethane is among the more than fifty chemicals evaluated by the EPA's Carcinogenic Assessment Group (CAG) for relative carcinogenic potencies as suspected human carcinogens. A level of evidence in animals indicates that sufficient studies have been conducted to determine the carcinogenicity of 1,2-dichloroethane. However, inadequate studies have been conducted to determine the level of carcinogenic evidence in humans. Therefore, EPA has ranked 1,2-dichloroethane as a B2 ("probable" human) carcinogen based upon the level of evidence in

animal studies. The IARC has not ranked 1,2-dichloroethane based on lack of evidence in human studies. CAG has determined a carcinogenic potency factor of 9.1×10^{-2} $(mg/kg/day)^{-1}$ for 1,2-dichloroethane which places it in the lowest quatrile of probable carcinogens.

Lead

References: US EPA 1985a; 1985b

Summary of Health Effects Data

Chronic lead exposure has been shown to cause mental retardation, anemia and anomalies in skeletal development. The available evidence indicates that lead presents a hazard to reproduction and exerts a toxic effect on conception, pregnancy and the fetus in human and experimental animals. There is equivocal evidence that several lead salts are carcinogenic in mice or rats, causing tumors of the kidneys after either oral or parenteral administration. Data concerning the carcinogenicity of lead in humans are inclusive. The available data are not sufficient to evaluate the carcinogenicity of organic lead compounds or metallic lead.

Pharmacokinetics and Metabolism

Lead can be adsorbed into the body through injection or inhalation. Based on long-term metabolic studies with adult human volunteers, approximately 10 percent of the dietary lead is estimated to be adsorbed from the human gut. Ingested lead is rapidly adsorbed into the blood which established an equilibrium among the various body organs and tissues. Children, particularly infants, retain a significantly higher amount of lead in the body than do adults (35 versus 3.5). Lead crosses the placenta beginning in the 12th week of life and continues until after birth. In adults, approximately 90 percent of the ingested lead is eliminated in the feces without prior gastrointestinal absorption. The primary elimination route for lead is urine, representing about 95 percent of the total output of adsorbed lead.

Toxic and/or Carcinogenic Studies

Many lead compounds are sufficiently soluble in body fluids to be toxic. Exposure of humans or experimental animals to lead can result in toxic effects in the brain and central nervous system, the peripheral nervous system, the kidneys and the hematopoietic system. Chronic exposure to inorganic lead by ingestion or inhalation can cause lead encephalopathy, and severe cases can result in permanent brain damage. Lead poisoning can cause peripheral neuropathy in adults and children, and permanent learning disabilities that are chronically undetectable in children may be caused by exposure to relatively low levels. Short-term exposure to lead can cause reversible kidney damage, but prolonged exposure at high concentrations may result in progressive kidney damage and possibly kidney failure. Anemia, due to inhibition of hemoglobin synthesis and a reduction in the life span of circulating red blood cells, is an early

manifestation of lead poisoning. Several studies with experimental animals suggest that lead may interfere with various aspects of immune response. Short-term or acute exposures to lead through drinking water of ten days or less do not have any adverse effects. The health effects resulting from lead exposure become manifest only after blood lead level exceeds 15 ug/dL. It takes a minimum of 35 days to achieve the blood lead level and some unspecified time after that to express the effect. Lead interacts adversely with several key enzymes involved in heme biosynthesis, i.e., delta-aminolevulinic acid dehydratase (ALA-D), cerrochetalase, and delta-aminolevulinic acid synthetase. The blood lead level that will inhibit ALA-D is as low as 12 ug/dL in adults. Ferrochetalase inhibition produces measurable zinc protoporphyrin (ZPP) after a lack of several weeks; ZPP will persist long after the termination of exposure to lead. In children, the threshold for ZPP accumulation is between 15.5 and 1.5 ug/dL. Lead also causes decreased red blood cell survival. Inhibition of pyrimidine-5-nucleotidase (Py-5-N) occurs as a result of lead exposure and decreases red blood cell survival by increasing membrane virgility.

Lead does not appear to present carcinogenic results based upon data available at this time. Therefore, the EPA has classified lead as a non-carcinogen. A primary drinking water standard has been established at 0.05 mg/L for lead. The EPA maximum contamination level goal (MCLG) for lead is 0.02 mg/L and it has been proposed that this become the MCL. Acceptable intakes for chronic exposure via the oral and inhalation routes are 1.40×10^{-3} and 4.30×10^{-4} mg/kg/day, respectively.

trans-1,2-Dichloroethene

References: US EPA 1985a; 1985b

Summary of Health Effects Data

Very little information concerning exposure only to trans-1,2-DCE is available. There are no reports of carcinogenic or teratogenic activity by trans-1,2-DCE in animals or humans. The compound is reportedly nonmutagenic in a variety of test systems. Like other members of the chlorinated ethene series, trans-1,2,-DCE has anesthetic properties. Exposure to high vapor concentrations has been found to cause nausea, vomiting, weakness, tremor, and cramps in humans. Repeated exposure via inhalation of 800 mg/m^3 (8 hours/day, 5 days/week, for 16 weeks) was reported to produce fatty degeneration of the liver in rats. The intraperitoneal injection LD_{50} value for the rat is 7,536 mg/kg.

Pharmacokinetics and Metabolism

trans-1,2-Dichloroethene can affect the body if it is inhaled, comes into contact with the eyes and skin, or is ingested. Kinetic data defining the distribution of trans-1,2-DCE in the body is not available. However, if this isomer acts similar to 1,1-dichloroethene, the highest concentrations will be found in the liver and kidney. trans-1,2-Dichloroethene is metabolized *in vitro* by mammalian liver microsomes to dichloroacetic acid and dichloroethanol. The trans-isomer is metabolized to a lesser extent than the cis-isomer. Both isomers are metabolized to the aforementioned compounds. Elimination of trans-1,2-dichloroethene from the body is primarily through expired air, while the transformed compound is eliminated through the urine.

Toxic and/or Carcinogenic Effects

trans-1,2-Dichloroethene vapor is a narcotic and a mucous-membrane irritant. The trans-isomer is about twice as potent as the cis-isomer in depressing the central nervous system. Short-term exposure in animals at high levels resulted in general anesthetic and narcotic effects. Lower, but still acutely toxic levels of exposure, are expected to affect the liver and kidneys. The oral and intraperitoneal LD_{50} values for the rat are 1300 and 7800 mg/kg, respectively. The inhalation LCLO value for the cat and mouse are 43,000 mg/m^3 after 6 hours and 75,000 mg/m^3 after 2 hours, respectively. Rats, rabbits, guinea pigs, and dogs exposed (7 hours/day, 5 days/week, 6 months) to either 500 or 1000 ppm of 1,2-dichloroethene showed no changes in growth, mortality, body and/or organ weight, hematology, clinical chemistry, or gross and microscopic pathology. Rats exposed for 8 hours to 1000 ppm dichloroethene in air showed reductions in

serum albumin, urea nitrogen, and alkaline phosphatase. trans-1,2-Dichloroethene is not mutagenic in a variety of tested strains. No data are available on the teratogenic (reproductive) effects of trans-1,2-dichloroethene.

TRICHLOROETHENE

References: US EPA 1984a; 1985b

Summary of Health Effects Data

Trichloroethene (TCE) has a low acute toxicity with an acute oral LD_{50} value in several species ranging from 6000-7000 mg/kg. Chronic exposure in rodents have been found to cause adverse effects on liver and kidneys at high doses. In long-term studies TCE has induced hepatocellular carcinomas in mice. Due to presence of carcinogenic impurities in the test compounds and other factors, the significance of these findings are not clear. Extensive epidemiological investigations have failed to substantiate an increased carcinogenic risk in man. Also, results from short-term testing have been ambiguous.

Pharmacokinetics and Metabolism

Trichloroethene can be absorbed by dermal or oral contact or by inhalation. Direct contact with the pure liquid which will permit some absorption which normally is not sufficiently high as to elicit toxic effects. Upon ingestion trichloroethene is readily absorbed, but inhalation usually represents the major route of absorption. Pulmonary uptake of the substance is rapid and distribution occurs to all body tissues with a considerable fraction in adipose tissue. An appreciable part of the TCE absorbed is rapidly excreted unchanged in exhaled air. But the substance is also extensively metabolized (in man 40-70% of the retained dose) mainly by the liver into exhaled carbon dioxide (minor metabolite) as well as into the urinary metabolites trichloroethanol, trichloroacetic acid (major metabolite), and a glucoronide conjugate of trichloroethanol. Although elimination from fatty tissues occurs at a slower rate, virtually all TCE is excreted within 48 hours after administration of a single high dose of TCE.

Toxic and Carcinogenic Studies

TCE has a low acute toxicity in mammals. In man higher concentrations of this volatile substance have anesthetic and analgesic properties and is known to occasionally elicit cardiac arrythmias. Chronic exposure has been reported to induce neurotoxic symptoms like ataxia, sleep disturbances and psychotic episodes as well as trigeminal neuropathy.

In rodents TCE causes toxic effects to the kidney tubuli and liver. No significant signs of developmental toxicity have been found in inhalation experiments using these experimental animals.

Vinyl Chloride

References: US EPA 1985a; 1986b

Summary of Health Effects Data

Vinyl chloride is a known human carcinogen that causes angiosarcomas of the liver and tumors of the brain, lung, and hemolymphopoietic system. There is suggested evidence that vinyl chloride has teratogenic and reproductive effects in both humans and animals. Chronic human exposure to vinyl chloride is associated with multiple systemic disorders, including a sclerotic syndrome, acro-osteolysis, and liver damage. Acute human exposure to high concentrations can cause narcosis, respiratory tract irritation, bronchitis, and memory disturbances. Chronic exposure by animals can result in lesions of the liver, kidney, spleen, and lungs. Concentrations encountered by workers in industries using or producing vinyl chloride are reportedly quite variable and may range from less than the limit of detection to several grams per cubic meter. Acute inhalation exposure of experimental animals to high levels of vinyl chloride can result in narcosis or death. The 2-hour LC_{50} value for rats is 390 g/m^3. Chronic exposure of experimental animals to vinyl chloride can result in growth disturbances and has caused histopathological and histochemical lesions in the liver, kidney, spleen, and lungs.

Pharmacokinetics and Metabolism

Vinyl chloride is readily absorbed by inhalation or from the gastrointestinal tract when dissolved in a suitable carrier. The substance is rapidly distributed throughout the body. Part of the absorbed dose is excreted unchanged via expired air but the substance is also metabolized via epoxidation to various polar end products which are excreted in the urine.

Toxic and/or Carcinogenic Effects

The acute toxicity of vinyl chloride is low, and short-term human exposure to high concentrations mainly causes depression of the central nervous system. Chronic exposure to vinyl chloride has been associated with multiple systemic disorders involving scleroderma tous skin damage, acro-osteolysis, Raynaud's phenomenon, and hepatic and renal damage. There is also evidence in experimental animals and in humans suggesting that vinyl chloride has teratogenic as well as toxic effects on reproduction.

Vinyl chloride causes tumors at multiple sites (liver, lung, brain, kidney) in experimental animals (mice, rats, and hamsters) after oral administration or upon inhalation. In man exposure has been associated with angiosarcomas of the liver and tumors of the brain, lung, and hepatopoietic and lymphatic systems.

Reports of increased incidences of tumors of the digestive system, urinary tract, and breast have been judged inadequate by IARC to evaluate the carcinogenicity of vinyl chloride for these sites. The substance has been found to be genotoxic in several short-term tests.

EPA and IARC have classified vinyl chloride as a known human carcinogen (EPA Class A, IARC class 1) . The Carcinogen Assessment Group of EPA has determined a carcinogenicity potency factor of 0.295 ($mg/kg/day^{-1}$) by inhalation and 2.3 ($mg/kg/day^{-1}$) by ingestion for this carcinogen.

Zinc

References: (U.S. EPA 1985a; 1985c)

Summary of Health Effects Data

Zinc is an essential trace element in human and animal nutrition. In the body it is found in high concentrations in male reproductive organs, pancreatic islets, muscle, kidney, liver and bone. It is essential for the activity of some enzymes. The human Recommended Daily Allowance (RDA) of zinc for adults is 15 mg. Zinc appears to be toxic only at levels at least an order of magnitude greater than the RDA; toxicity appears to result from an overload of the homeostatic mechanism for absorption and excretion of zinc.

Pharmacokinetics and Metabolism

Zinc is present in all living organism and ranks with the most abundant of the trace metals in man. As far as is known, all living things require zinc. It is a constituent of all cells and serves as a cofactor in many essential enzyme systems. Zinc compounds can affect the body if they are inhaled, ingested, or come in contact with the eyes. An average daily intake of zinc in man is 10 to 15 mg. The largest storage depot of zinc is striated muscle, where 62.6 percent of the body total is found. Zinc is also found in the bone, liver, blood, gastrointestinal tract, and skin. The smooth and cardiac muscle combined contain almost 2.3 percent of the zinc in the body; no other trace element known is stored in muscle to this extent. Excretion of zinc is primarily through the urine.

Toxic and/or Carcinogenic Effects

Zinc is an essential trace element that is involved in enzyme functions, protein synthesis, and carbohydrate metabolism. Ingestion of excessive amounts of zinc may cause fever, vomiting, stomach cramps, and diarrhea. Fumes of freshly formed zinc oxide can penetrate deep into the alveoli and cause metal fume fever. Zinc oxide dust does not produce this disorder. Contact with zinc chloride can cause skin and eye irritation. Inhalation of mists or fumes may irritate the respiratory and gastrointestinal tracts. Zinc in excess of 0.25% in the diet of rats causes growth retardation, hypochromic anemia, and defective mineralization of bone. No zinc toxicity is observed at dietary levels below 0.25%.

Studies with animals and humans indicate that metabolic changes may occur due to the interaction of zinc and other metals in the diet. Exposure to cadmium can cause changes in the distribution of zinc, with increases in the liver and kidneys, organs where cadmium also accumulates. Excessive intake of zinc may cause copper deficiencies and result in anemia. Interaction of zinc with iron or lead may also lead to changes that are not produced when the metals are ingested individually.

Zinc chloride fumes irritate the eyes, mucous membranes, and skin, and cause delayed pulmonary edema. Toxicological studies in experimental animals indicate that up to 2500 ppm of zinc in the diet has no effect on rats, although 5000 to 10,000 ppm induces severe anemia. Acute oral LD_{50} values in laboratory animals range from 96 to 168 mg zinc/kg. Possible interactions of zinc with other metals may contribute to the toxicity of zinc. In humans, in those cases in which high concentrations of zinc (150 mg/day) have been ingested, no adverse effects other than gastric disturbances and diarrhea have been reported. No experimental evidence exists to suggest that ingestion or parenteral administration of zinc is either carcinogenic or mutagenic, with the exception of zinc's ability to induce testicular tumors following direct ingestion. EPA has classified zinc as a noncarcinogen and IARC has classified zinc as a Group 3 compound.

Applicable and Relevant Standards

The recognized applicable and relevant standards for zinc are summarized in the attached table. The ambient water quality criterion for the protection of fresh water life is 0.047 mg/L. A Maximum Contaminant Level (MCL) has been proposed for zinc in drinking water at 5.0 mg/L. The acceptable intake for chronic and subchronic exposures via the oral route is 2.1×10^{-1} mg/kg/day. The acceptable intakes for chronic and subchronic exposures via the inhalation route are 1.0×10^{-2} and 1.0×10^{-1} mg/kg/day, respectively. The regulatory level for workplace exposure to zinc have been set by OSHA and ACGIH at 1 mg/m^3. As previously noted, zinc is considered to be a noncarcinogen by EPA.