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13. ABSTRACT *(Maximum 200 words)*

THE OBJECTIVE OF THIS REMEDIAL INVESTIGATION (RI) IS TO EVALUATE, AS PART OF THE FIRST OPERABLE UNIT FOR SITE REMEDIATION, THE NATURE AND EXTENT OF CONTAMINATION AS IT RELATES TO THE EXISTING PUBLIC WATER SUPPLY WELLS OPERATED BY THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT. A PUBLIC HEALTH ENDANGERMENT ASSESSMENT WAS CONDUCTED TO IDENTIFY COMPOUNDS WHICH COULD POSE A SIGNIFICANT HEALTH THREAT. THESE INVESTIGATIONS HAVE IDENTIFIED GROUND WATER AS THE MAJOR MIGRATION PATHWAY. THE SIX VOLATILE ORGANIC CHEMICALS OF PRIMARY CONCERN ARE 11DCE, 11DCLE, T12DCE, 111TCE, TRCLE, AND TCLEE.

A COMPREHENSIVE INVESTIGATIVE ANALYSIS WAS CONDUCTED TO 1) CHARACTERIZE THE HYDROGEOLOGIC SYSTEM AND 2) QUANTIFY THE GROUND WATER FLOW AND CONTAMINANT TRANSPORT PROCESSES. A THREE DIMENSIONAL GROUND WATER FLOW AND CONTAMINANT TRANSPORT MODEL WAS DEVELOPED AND CALIBRATED ON A PRELIMINARY BASIS TO AID IN PROJECTION OF FUTURE TRCLE CONCENTRATIONS. THIS FIRST OPERABLE UNIT RI REPORT IS NOT INTENDED TO ADDRESS THE IDENTITY OF CONTRIBUTING SOURCES OR THEIR

14. SUBJECT TERMS
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REM II

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS WASTE SITES

U.S. EPA CONTRACT NO. 68-01-6939

CAMP DRESSER & McKEE INC.
PRIME CONTRACTOR

#7

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

U.S. EPA CONTRACT NO. 68-01-6939

REMEDIAL INVESTIGATION
FIRST OPERABLE UNIT
ROCKY MOUNTAIN ARSENAL
OFF-POST RI/FS SITE

DECEMBER 1986

COMMERCE CITY, COLORADO

EPA Work Assignment No.: 99-8L11.5
REM II Document No.: 198-RI1-RT-DRLM-1

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

U.S. EPA CONTRACT NO. 68-01-6939

REMEDIAL INVESTIGATION
FIRST OPERABLE UNIT
ROCKY MOUNTAIN ARSENAL
OFF-POST RI/FS SITE

DECEMBER 1986

COMMERCE CITY, COLORADO

EPA Work Assignment No.: 99-8L11.5
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EXECUTIVE SUMMARY

This Remedial Investigation (RI) is part of the EPA Rocky Mountain Arsenal Off-Post RI/FS. The RI was authorized under Work Assignment Number 99-8L11, dated April 2, 1985. The objective of this RI is to evaluate, as part of the first operable unit for site remediation, the nature and extent of contamination as it relates to the existing public water supply wells operated by the South Adams County Water and Sanitation District (SACWSD).

The EPA Rocky Mountain Arsenal Off-Post RI/FS site is located approximately 10 miles northeast of the downtown area of Denver. The South Adams County Water and Sanitation District supplies approximately 30,000 customers with water from wells completed in alluvium and bedrock within the study area. Recent studies completed by the EPA, CDH, and SACWSD in the study area indicate that significant concentrations (100 parts per billion range) of organic solvents are present in the local and regional ground water system. Municipal wells located within the study area are contaminated by organic solvents (primarily trichloroethylene - TCE) in excess of criteria established under the Safe Drinking Water Act.

A public health endangerment assessment was conducted to identify compounds which could pose a significant health threat. All available data from ground water sampling conducted through July 1986 by the EPA, SACWSD, CDH and the Army were evaluated during the first operable unit study. These investigations have identified ground water as the major migration pathway with respect to the SACWSD wells. Results show that of the compounds detected in the area, there are six volatile organic chemicals present in ground water in the study area that are of primary concern, due to their wide-spread extent, potential health effects, and relative concentration. The chemicals of primary concern are 1,1-dichloroethylene (DCE), 1,1-dichloroethane (DCA), trans-1,2-dichloroethylene (trans-DCE),

1,1,1-trichloroethane (TCA), trichloroethylene (TCE), and tetrachloroethylene (PCE). Other compounds have been detected in areas potentially upgradient of the SAC alluvial production wells, including benzene, vinyl chloride, pesticides, and other non-volatile organic compounds. Several upgradient potential source areas both on and off the Arsenal have yet to be characterized; therefore, the types of contaminants from these sources cannot be assessed at this time.

The endangerment assessment evaluated the risks associated with exposure by ingestion and inhalation of the primary contaminants of concern and identified TCE, PCE, and DCE as potential human carcinogens for cancer risk assessment. The endangerment assessment indicated that human exposure by ingestion and inhalation of the highest expected levels of contamination in untreated ground water (no action alternative) could pose an unacceptable human health risk of cancer over the lifetime of the exposed individual. A comprehensive investigative analysis was conducted during this RI to characterize the hydrogeologic system and quantify the ground water flow and contaminant transport processes. All six volatile organic compounds mentioned above were evaluated in addition to benzene as indicator chemicals of contamination from multiple source areas. Investigations are currently underway by the EPA and others to identify and characterize the multiple source areas evident from the data collected to date. This first operable unit RI report is not intended to address the identity of contributing sources or their relative contributions to the contamination.

A fully three-dimensional ground water flow and contaminant transport model was developed and calibrated on a preliminary basis to aid in the projection of future TCE concentrations from potential source areas. Future projections were necessary for the Feasibility Study (FS) which was conducted concurrently with the RI and is described in a separate report. Results at a potential receptor in the vicinity of the SACWSD wells show a peak TCE concentration between 100 to 150 ppb within 10 to 15 years from the present time. Subsequent operable units will require a refinement of the present model as more data becomes available.

1.0 OBJECTIVES

In October 1985, the U.S. Environmental Protection Agency (EPA) approved the Work Plan for a Remedial Investigation/Feasibility Study (RI/FS) for the EPA Off-Post RI/FS Site adjacent to the Rocky Mountain Arsenal (RMA). The EPA Off-Post RI/FS Site overlies contaminated ground water that serves as the main source of water for the South Adams County Water and Sanitation District (SACWSD). The EPA site is located approximately 10 miles northeast of the downtown area of Denver, Colorado.

EPA is conducting the Off-Post RI/FS to determine the nature and extent of the threat presented by the release of hazardous substances, pollutants or contaminants, the extent to which the release or threat of release may pose a threat to public health, welfare or the environment, to assist in identification and characterization of sources,and to gather sufficient information to determine the necessity for and proposed extent of remedial actions. As part of the RI/FS, EPA is evaluating the extent to which contaminants may have migrated off-site from RMA and the Sand Creek and Woodbury NPL sites. As explained more fully below, this remedial investigation is limited to the first operable unit for the Off-Post RI/FS site, which consists of evaluating alternatives for treatment of contaminated groundwater prior to its consumption.

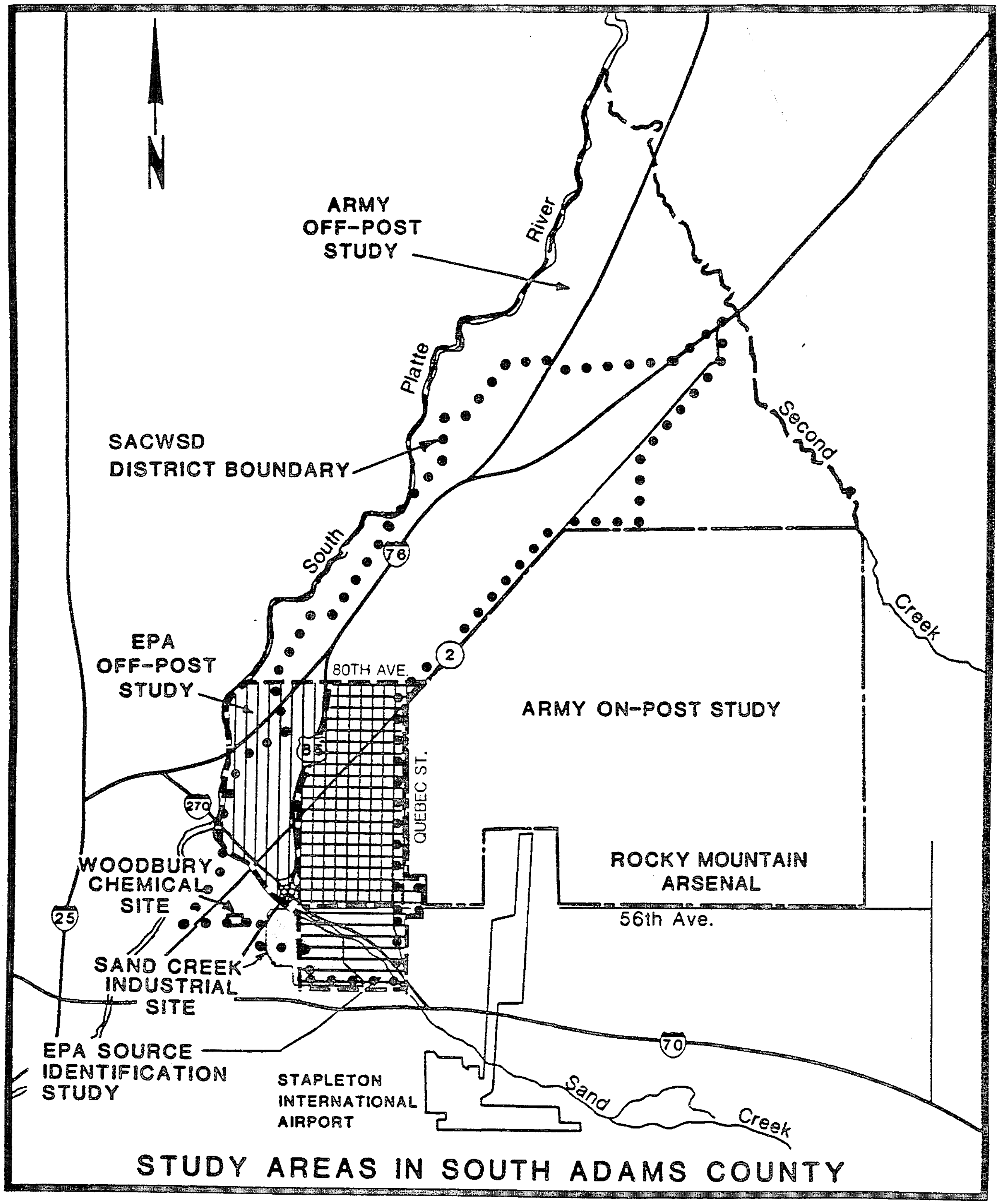
The Rocky Mountain Arsenal was proposed for listing on the National Priorities List ("NPL") in October 1984. EPA has not finally listed the RMA site. RMA is a facility owned and operated by the United States Dept. of the Army. Under Executive Order 12316, the functions vested in the President by Sections 104(a) and (b) of CERCLA were delegated to the Secretary of Defense with respect to releases from Dept. of Defense (DOD) facilities. Thus, the Army is generally responsible for responding to releases from the RMA facility. The Army is currently conducting an RI/FS on the RMA site and off-post areas north of 80th Avenue where it is suspected that RMA is the sole source of contamination.

The EPA and the DOD entered into a Memorandum of Understanding (MOU) on August 12, 1983 to clarify each Agency's responsibilities for conducting response actions authorized by CERCLA. Under the MOU, where there is clear evidence that a current DOD facility is the sole source of contamination, DOD is responsible for conducting and financing response actions. Where there is no clear evidence that DOD is the sole source, EPA is responsible for financing and conducting investigations and studies off-facility to determine the source and extent of contamination and recommended response actions. The MOU expired on December 1, 1985. Prior to that date, EPA and the Army agreed that the Army would conduct investigations north of 80th Avenue and that EPA would conduct its investigation south of 80th Avenue, where there is no clear evidence that RMA is the sole source of contamination (Figure 1-1).

All activities conducted under this Remedial Investigation have been closely coordinated with studies being conducted on- and off-post by the Army, with various other EPA investigations, and with those being undertaken by the South Adams County Water and Sanitation District (SACWSD) and the State of Colorado. Concurrent with the Off-Post RI/FS, the EPA is conducting source investigations to identify other sources of the contamination.

This RI/FS study considers alternatives for treatment of contaminated ground water prior to its use as the first operable unit for site remediation. Based on this objective, this RI report focuses on ground water contamination assessment as it relates to the existing public water supply wells of SACWSD. The first operable unit is based on ground water sampling data collected by the EPA, SACWSD, the Army and the Colorado Department of Health (CDH). Further data for evaluation of site remediation, which may involve control of contaminant migration and contaminant source removal, will be gathered during the second phase of the EPA RI/FS off-post investigation and will be presented in the remedial investigation reports for subsequent operable units.

This first operable unit RI report is not intended to address the identity of contributing sources or their relative contributions to the contamination. Although the Army has indicated that RMA is a contributing source of the ground water contamination, other sources responsible for the contamination have not been identified at this time. The Remedial Investigation has been prepared in accordance with, and in a manner not inconsistent with the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. SS 9601, et seq.), Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (NCP). The U.S. EPA's document Guidance for Remedial Investigations Under CERCLA has also been followed (EPA, 1985).



STUDY AREAS IN SOUTH ADAMS COUNTY

FIGURE 1-1

2.0 BACKGROUND

Contaminated ground water containing organic solvent compounds has been detected sporadically since 1981 throughout the EPA Off-Post RI/FS site, in both individual and municipal supply wells. Surrounding potential sources of contamination include the Rocky Mountain Arsenal (RMA), two Superfund sites directly to the south and southwest, local industries within or outside the site boundaries, or a combination of any of the above. The EPA is currently evaluating the nature and extent of contamination migrating from these sites to determine whether they are sources of south Adams County ground water contamination. Additional data must be gathered and analyzed before any final determinations can be made. This report is not intended to apportion liability or responsibility to any of these sites, but rather to present background information used to evaluate alternatives for treatment of contaminated ground water prior to its use.

The following section describes the physical characteristics and history of the EPA Off-Post RI/FS site that pertains to the present ground water contamination situation. Section 2.2 discusses what is currently known about the characteristics and extent of the contaminants present in the study area and provides a summary of recent contaminant evaluation studies. Several upgradient potential source areas both on and off the Arsenal have yet to be characterized; therefore, the types of contaminants from these sources cannot be assessed at this time.

2.1 SITE DESCRIPTION

2.1.1 ENVIRONMENTAL SETTING

The EPA Rocky Mountain Arsenal Off-Post RI/FS site is located about 10 miles northeast of the downtown area of Denver, Colorado. The site extends westward from Rocky Mountain Arsenal to the South Platte River. The southern boundary is formed by East 56th Avenue and Sand Creek, and the northern boundary by a line along East 80th Avenue from the Arsenal to the South Platte (Figure 1-1). The area is nearly completely developed with residential subdivisions, light and heavy industrial facilities, and gravel operations. The following is a discussion of the environmental characteristics of the site.

Site Physiography

Topographic relief across the site is very low, with elevations ranging from 5,200 feet at the southeast corner of the site to about 5,100 feet (above mean sea level) at the Platte River at the northwest corner of the site (Figure 2-1). The topography slopes gently northwestward toward the South Platte River with a perceptible break in slope at the boundary between the Pleistocene Age Broadway alluvial terrace and the recent alluvial terrace adjacent to the South Platte River.

Site Hydrogeology

The following section provides an overview of the geology and hydrology of the EPA Off-Post RI/FS study area. This report focuses on the unconsolidated surficial deposits and the associated alluvial aquifer. This is due to the extensive organic contamination observed in the alluvium and because most of the SACWSD municipal water supply is developed from the alluvial aquifer. Bedrock strata underlying the alluvium is also discussed since six of the fourteen SACWSD municipal wells tap aquifers and withdraw water from the bedrock formations discussed. At the present time there is no known contamination of the bedrock aquifers. More detailed descriptions of site hydrology and geology are presented in Section 5.0.

The site is located within the Denver Basin, a structural depression extending from the base of the Front Range eastward to the Kansas border, and from Pueblo northward to the Hartville uplift of Wyoming. At least 12,000 feet of sedimentary rocks overlie Precambrian basement rock within the basin (Scopel 1964), which has undergone episodes of tectonic movement

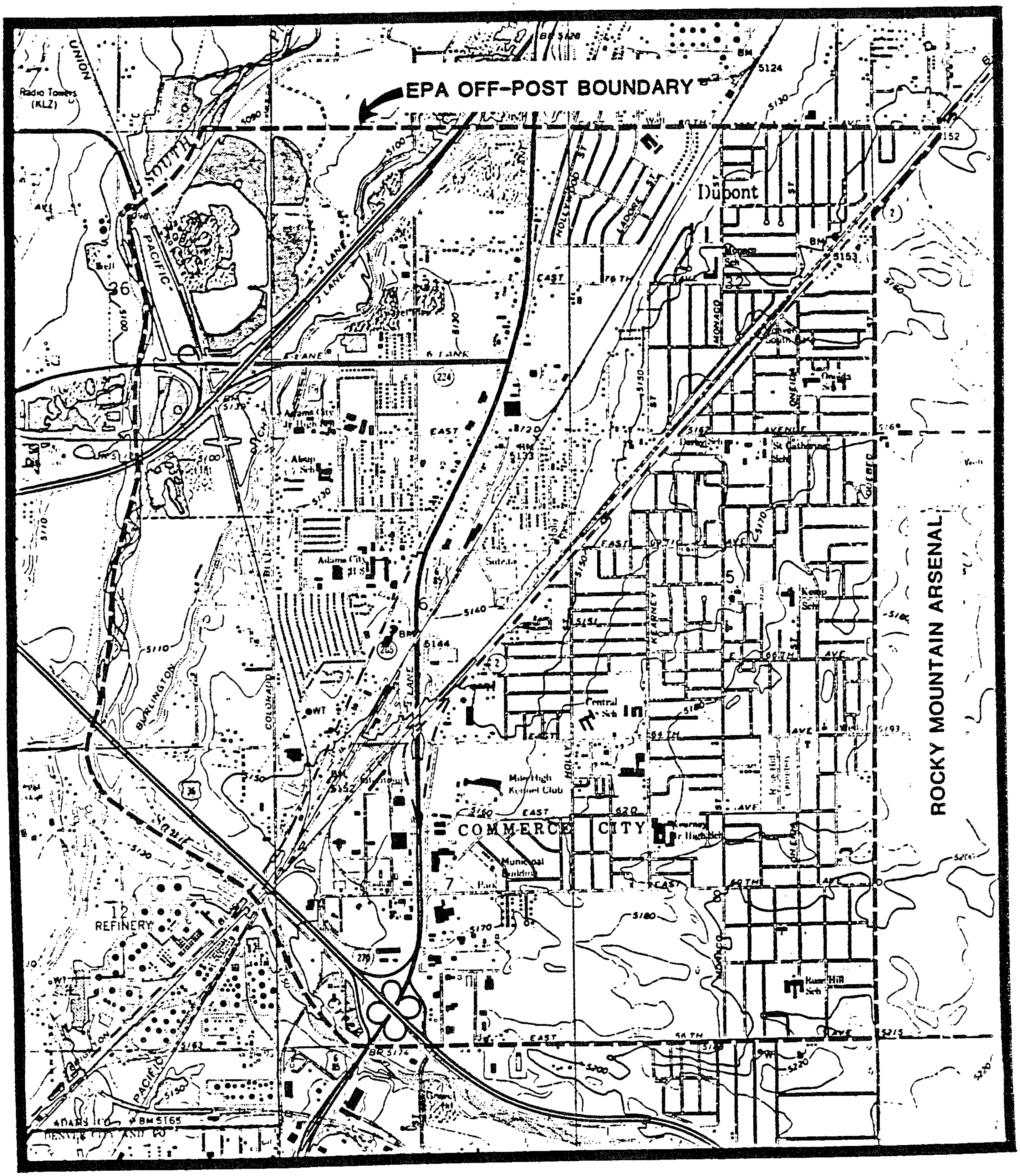


Figure 2-1: Site Location and Physiography

throughout geologic time. The bedrock strata of interest in this investigation are the Arapahoe and overlying Denver formations of the Dawson Group, of Upper Cretaceous to Paleocene age. These bedrock strata are overlain by unconsolidated alluvial and eolian deposits of variable thickness.

The Arapahoe Formation consists of 400 to 700 feet of interbedded conglomerate, sandstone, siltstone and shale (Robson and Romero 1981a). This formation is generally distinguished from the overlying Denver Formation by the greater proportion of conglomerate, absence of significant carbonaceous beds, and generally lighter color (Robson and Romero 1981a). The lenticular nature of the conglomerates and the permeability contrast between the conglomerates and sandstone and the siltstone and shale create a complex confined aquifer system, with an extremely variable ability to transmit water (Robson and Romero 1981a).

The Denver Formation is comprised of 600 to 1,000 feet of interbedded shale, claystone, siltstone and sandstone, with abundant fossil remains and coal seams. The formation is typically olive-gray to brown indicating the presence of andesite and other volcanic rock debris (Robson and Romero 1981b). Lenticular, poorly defined sandstone and siltstone bodies within the Denver are water-bearing, but vary in their ability to transmit water (Robson and Romero 1981b).

The surficial deposits which overlie the Denver Formation in the vicinity of the site consist of alluvial material deposited by the South Platte River system and windblown sand, silt and clay. The thickness of these unconsolidated deposits is variable, ranging from less than 10 feet to over 100 feet in several paleochannels eroded into the upper surface of the Denver Formation by the ancestral South Platte River and its tributaries. The entire thickness of the unconsolidated sands, gravels, silts, and clays are considered a single water-bearing unit throughout the site (ESE 1985b).

In some areas, the alluvial material may be hydraulically connected with the underlying Denver Formation. This will be discussed further in Section 5.2.

The water table at the site varies from several feet below ground surface adjacent to the South Platte River, to about 50 feet below ground surface at the eastern boundary of the site. Ground water flows generally north to northwest in the study area. The unconsolidated alluvial material is highly transmissive, as evidenced by a pumping test performed in a SACWSD alluvial well at the 77th and Quebec Street. Transmissivity of the aquifer was calculated at this location at approximately 25,000 ft^2/day (USAWES 1980). Further evidence of the prolific nature of the alluvium was provided during testing of SACWSD well No. 18 located at 84th and Quebec Streets within a thick alluvial sequence over a bedrock channel. The well was test pumped at 4,000 gallons per minute (gpm) with essentially no drawdown observed at the observation wells (Larry Ford, SACWSD manager, personal communication 1985). Yields undoubtedly vary considerably across the site and are lower in areas of thin alluvium and where a higher percentage of fine grain size material is present in the aquifer matrix.

The permeabilities of the Denver and Arapahoe formations are significantly lower than the unconsolidated material. The sandstone lenses of the Denver Formation generally yield from 0.5 to 1.0 gpm per foot of drawdown (Robson and Romero 1981b). The Arapahoe Formation, with proportionally more sandstone and conglomerate than the Denver, can yield up to 10 gpm per foot of drawdown (Robson and Romero 1981a). The SACWSD bedrock wells are completed in the Laramie-Fox Hills, Arapahoe and the Denver, and have reported yields of up to 150 gpm (E & E 1983).

Surface Water

The urban development within the site boundaries has masked any natural surface water drainage. Runoff from precipitation is controlled by street design and storm sewerage. The only surface water bodies on or bordering the site are the South Platte River and Sand Creek, and the Burlington Ditch, a surface water diversion ditch from the South Platte which provides irrigation water to agricultural users. The ditch, which is partially lined with concrete, runs northeastward across the western part of the site.

Air Quality and Meteorology

The site vicinity is generally classified as mid-latitude semi-arid, indicating an area of high summer temperatures, cold winters, and sparse rainfall. Mean maximum temperatures range from 43 degrees Fahrenheit (^{O}F) in January to $88^{O}F$ in July; mean minimum temperatures are $16^{O}F$ in January and $59^{O}F$ in July (ESE 1985a). Precipitation in the vicinity generally amounts to 12 to 16 inches per year with 80 percent of that falling between April 1 and September 30 (ESE 1985a).

Prevailing winds are from the south and southwest, generally paralleling the foothills west of Denver; occasional winds are also out of the north-northwest, north, and east (ESE 1985a). Wind speeds average 9 miles per hour annually; windiest months are March and April, with gusts as high as 65 miles per hour (ESE 1985a). Inversion conditions over the Denver metropolitan area (including the site) are common, often allowing ozone, carbon monoxide, and particulates to accumulate and cause poor air quality. The inversions rarely persist through the day (ESE 1985a).

Site Ecology

Vegetation on the site is typical of an urban area. Residential subdivisions are dominated by landscaped vegetation including bluegrass, shrubs, flowers, and trees, most requiring irrigation for survival. Industrial areas or occasional open areas where disturbance has taken place are dominated by cheatgrass, prickly lettuce, and western ragweed. Cottonwoods and wetland grasses are common along the South Platte.

Wildlife species do not occur on the site itself. The South Platte River corridor and Sand Creek are important habitats primarily for migratory waterfowl such as duck species and herons, and smaller birds such as Eastern Kingbird, Yellow-headed Blackbird, and pheasants (Adams County Planning Dept. 1984). The Rocky Mountain Arsenal, due to its size and the limited development on site, acts as a wildlife refuge and contains some areas of highly significant habitat, particularly near lakes in the southern half of the RMA (Adams County Planning Dept., 1984).

2.1.2 SITE HISTORY

The municipality of Commerce City and adjacent areas grew in response to the rapid post-war proliferation of industry north and east of the City of Denver. In order to provide a water supply and sewage treatment to the residents and businesses, a special governmental district was created in 1953: The South Adams County Water and Sanitation District (SACWSD). The The SACWSD supplies its approximately 30,000 customers with water from wells completed in alluvium and bedrock (E & E 1983). The number of supply wells has increased to fourteen over the years to meet increasing demand. Hundreds of private supply wells have also been in use throughout the south Adams County area. Almost all of the private wells tap the alluvial aquifer. Locations where the private wells were used for drinking water were connected to the SACWSD system during summer 1986 by EPA as part of a removal action.

Water quality was monitored occasionally in the SACWSD wells by the Colorado Health Department between 1953 and 1981 (Larry Ford, SACWSD, personal communication 1985). In the spring of 1981, EPA drinking water personnel sampled three of the supply wells as part of a random survey of drinking water systems across the country. The results showed bromoform at a maximum of 50 micrograms per liter (ug/l) and several other organic compounds (E & E 1983). EPA resampled the wells in August 1982 and January 1985, and both sets of sample analyses showed organic contaminants in the water (E & E 1983, 1985).

The adjacent Rocky Mountain Arsenal, because of the history of chemical warfare agents and pesticide manufacturing and disposal on site, was suspected as one of the potential sources. Off-post excursions of contaminants from the Arsenal have previously been documented, beginning in June 1954 when Mr. Jesse Powers complained of crop damage at his farm just northwest of the Arsenal (Walker 1961). Investigations performed at that time showed that damage to crops off-site was caused by a compound similar to the herbicide 2,4-D; such compounds may have migrated northwest from the unlined disposal basins at the Arsenal to the South Platte River, contaminating wells. This discovery led to the construction in 1957 of Basin F, the first of any of the Arsenal disposal basins to be lined, in an effort to contain further off-site migration (D'Appolonia 1979). Abandoned Basin C was filled with fresh water between 1957 and 1959 to dilute contamination in the shallow aquifer, but this effort resulted in only a temporary decrease in concentrations (Bauer, 1965).

Additional off-post contamination was discovered in 1974, when both diisopropylmethylphosphonate (DIMP), a byproduct of nerve agent production, and dicylopentadiene (DCPD), a chemical used in insecticide manufacture, were detected in surface water draining northward from the Arsenal. The presence of these chemicals, although in very low concentrations, indicated off-post chemical migration and prompted CDH to issue three cease and desist orders on April 7, 1975. These orders stated that off-post discharge of DIMP and DCPD must stop immediately, that appropriate action must be taken to prevent future off-post discharge, and that a surveillance plan be developed to verify compliance with the foregoing orders. RMA began another series of studies designed to determine the characteristics of the ground water flow system and mitigate contamination. This led to the construction of the North Boundary Pilot Containment System in 1977, consisting of an impermeable barrier, dewatering wells, treatment plant, and reinjection wells. In 1981, the system was expanded to 6,700 feet, presumably cutting off and treating the majority of northward ground water flow from RMA (Stollar et al., undated). The location of this containment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EAST 72ND AVE & ELM STREET
DAHLIA STREET
COLORADO BLVD

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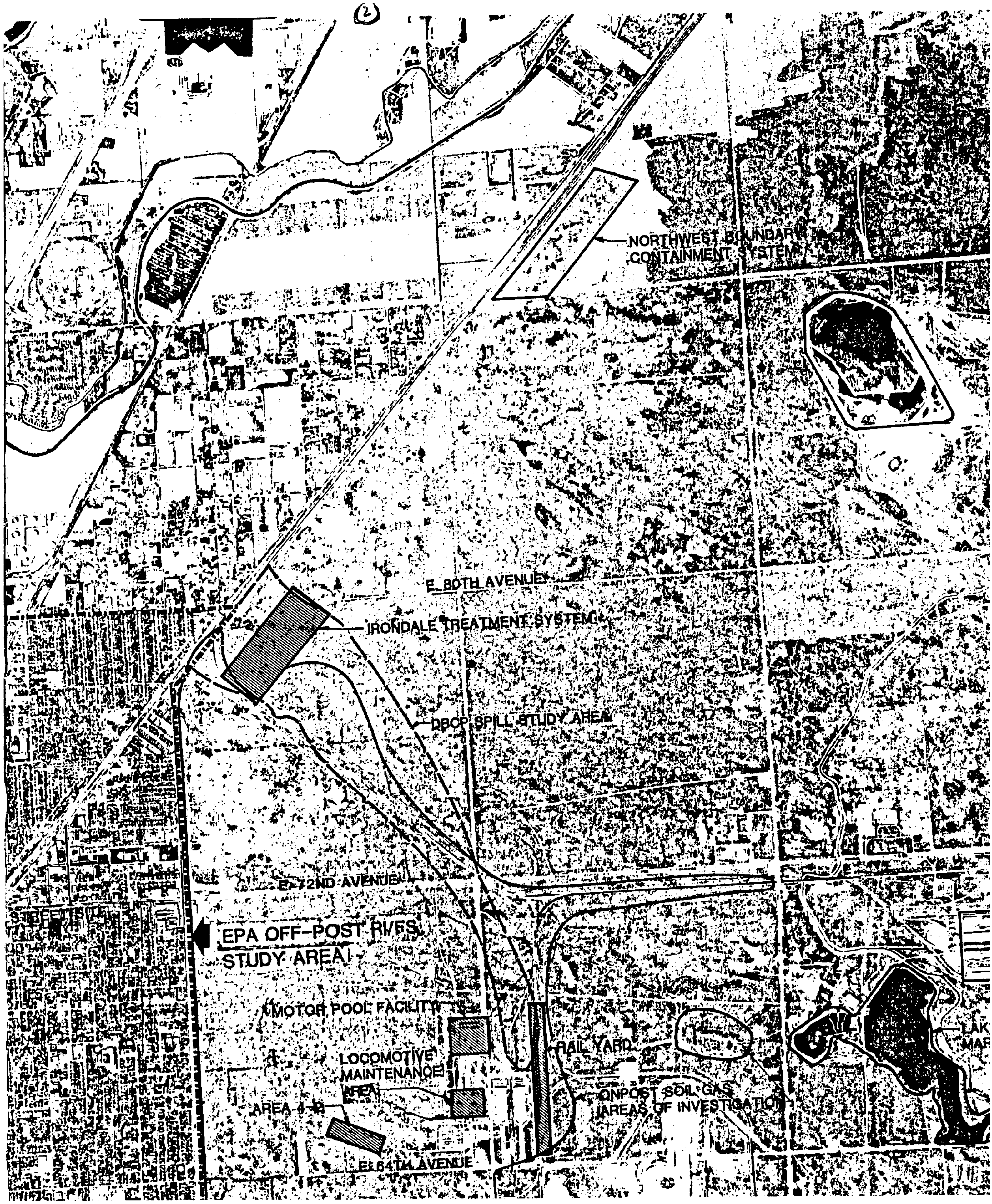
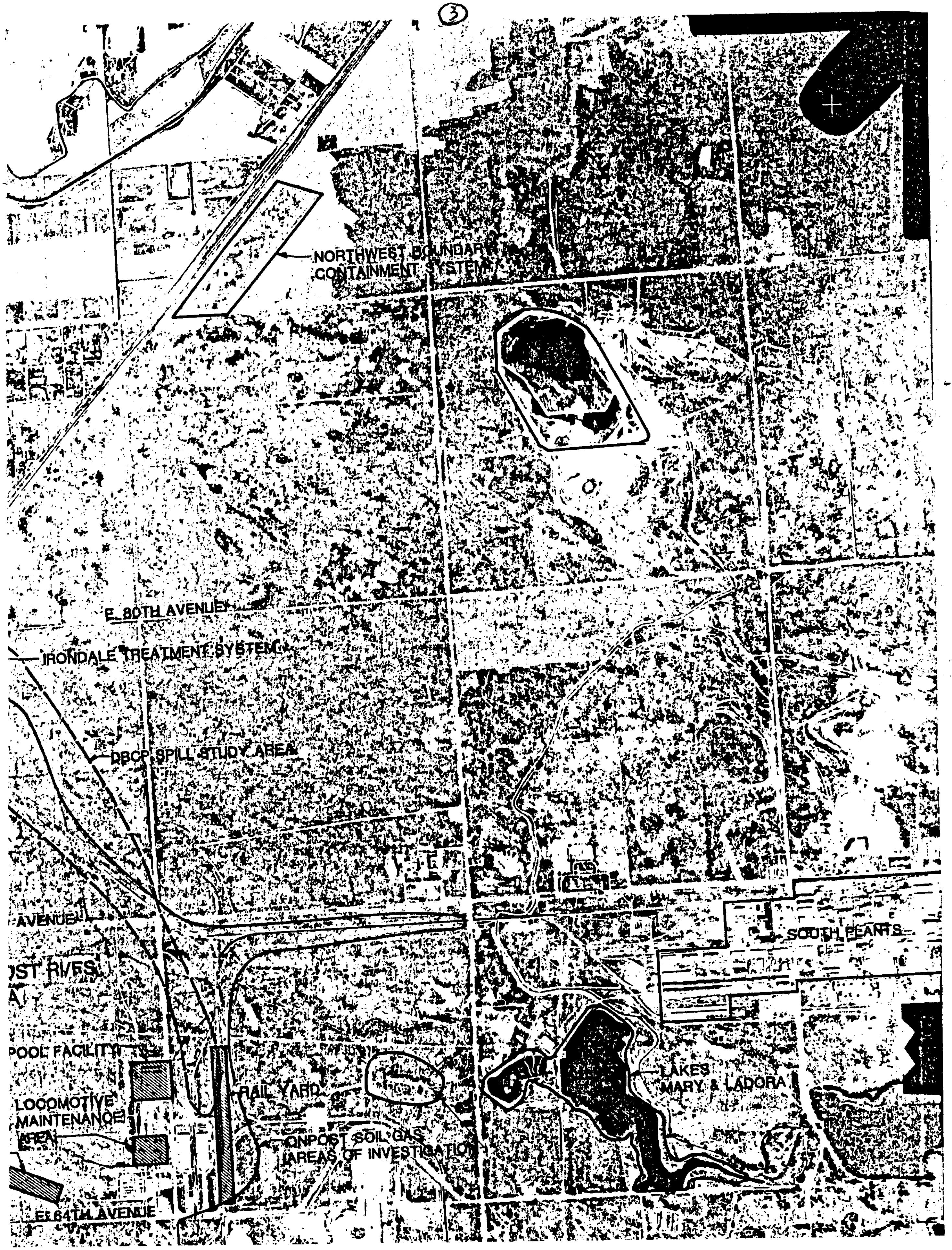

NORTHWEST BOUNDARY
CONTAINMENT SYSTEM
E. 80TH AVENUE
IRONDALE TREATMENT SYSTEM
DBCP SPILL STUDY AREA
E. 72ND AVENUE
STREET
EPA OFF-POST RI/FS
STUDY AREA
MOTOR POOL FACILITY
LOCOMOTIVE
MAINTENANCE
AREA
AREA 4-2
RAIL YARD
ONPOST SOIL GAS
AREAS OF INVESTIGATION
E. 64TH AVENUE
LAK
MAR


NORTHWEST BOUNDARY CONTAINMENT SYSTEM
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IRONDALE TREATMENT SYSTEM
DBCP SPILL STUDY AREA
AVENUE
SOUTH PLANTS
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POOL FACILITY
RAIL YARD
LAKES MARY & LADORA
LOCOMOTIVE MAINTENANCE AREA
ONPOST SOIL GAS AREAS OF INVESTIGATION
E. 64TH AVENUE


152000, 180000
EAST 72ND AVE & ELM STREET
EAST 64TH AVE & I-270 SITE
COLORADO BLVD
TOWN & COUNTRY
MUTUAL WATER
COMPANY WELLS
SAND CREEK
WOODBURY
CHEMICAL SITE
SAND CREEK
EPA RI/FS
STUDY AREA
MONACO PKWY

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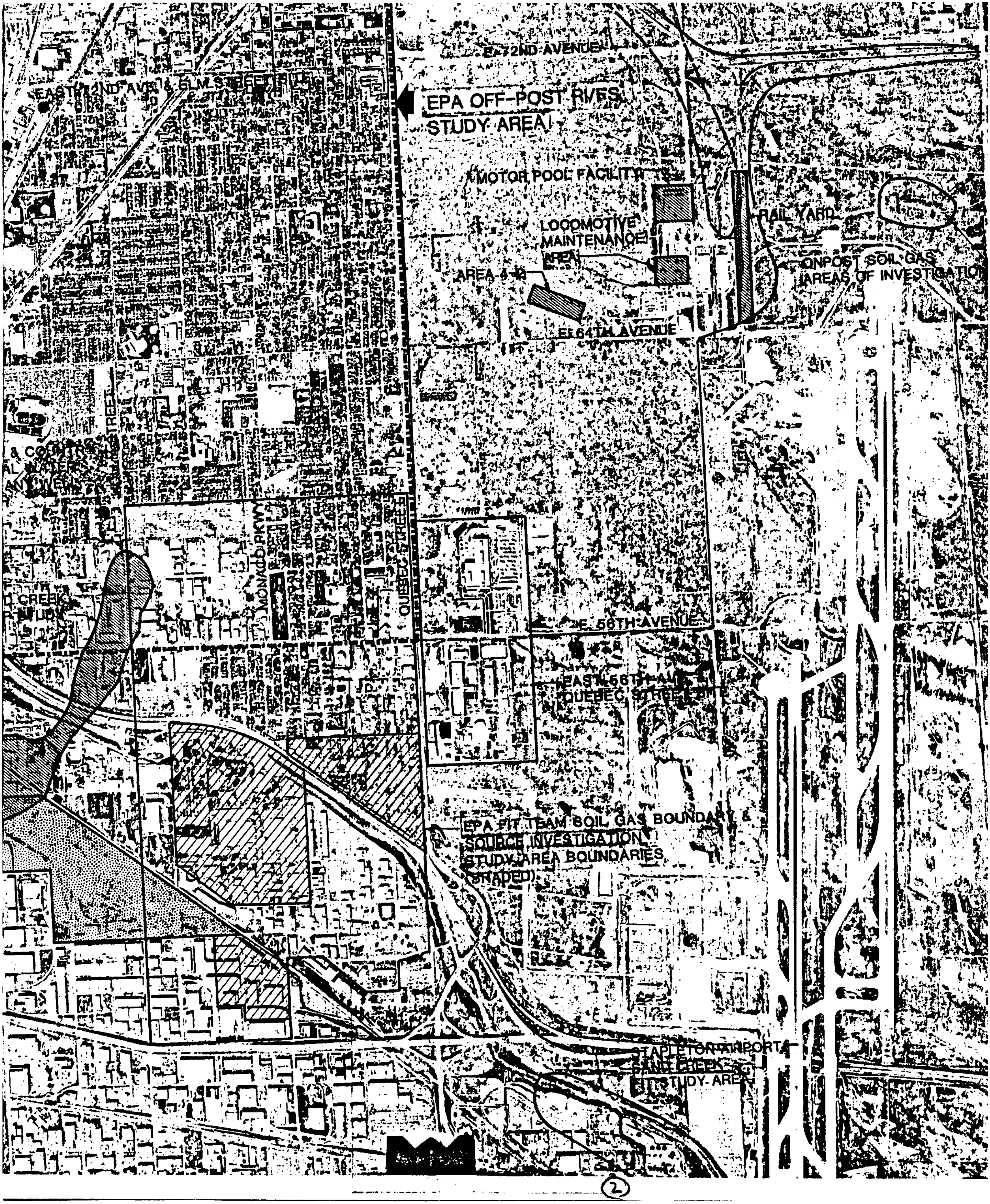
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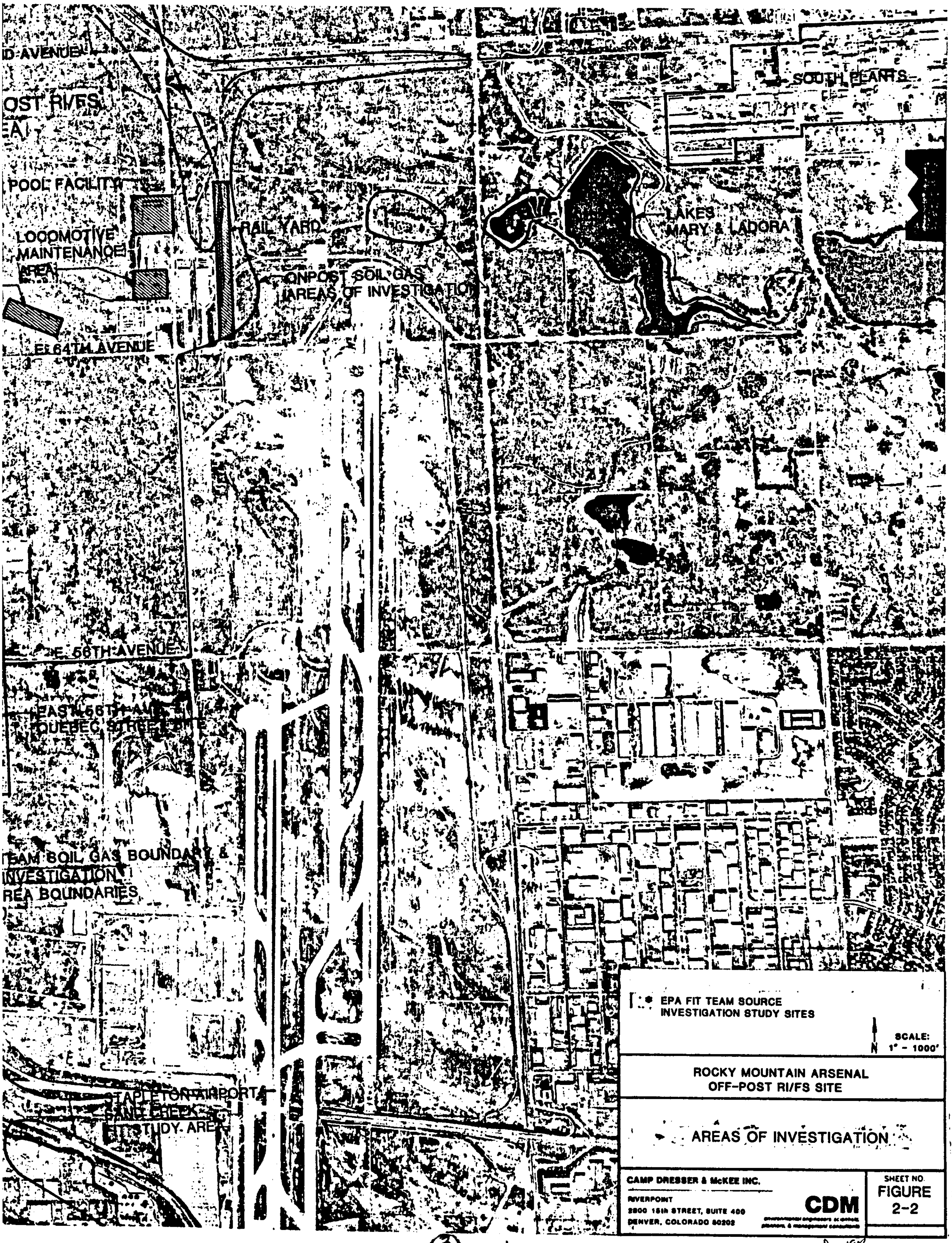
EAST 72ND AVE & ELM STREET
EPA OFF-POST RI/FS
STUDY AREA
MOTOR POOL FACILITY
LOCOMOTIVE
MAINTENANCE
AREA
RAIL YARD
AREA 4-4
ONPOST SOIL GAS
AREAS OF INVESTIGATION
E. 64TH AVENUE
& COUNTY
STREET
MONACO PKWY
QUEBEC STREET
D CREEK
R STUDY
E. 56TH AVENUE
EAST 56TH AVE &
QUEBEC STREET
EPA FIT TEAM SOIL GAS BOUNDARY &
SOURCE INVESTIGATION
STUDY AREA BOUNDARIES
(SHADED)
STAPLETON AIRPORT
SAND CREEK
STUDY AREA



EPA FIT TEAM SOURCE INVESTIGATION STUDY SITES

ROCKY MOUNTAIN ARSENAL
OFF-POST RI/FS SITE

AREAS OF INVESTIGATION

CAMP DRESSER & McKEE INC.
RIVERPOINT
2800 15th STREET, SUITE 400
DENVER, COLORADO 80202

CDM
environmental engineers, scientists, planners, & management consultants

SHEET NO.
FIGURE
2-2

Dec. 1986

SACWSD became actively involved in the ongoing investigations because of the contamination affecting their water supply source aquifer. SACWSD hired a consultant in mid-1984 to sample selected wells independent of the EPA sampling; their results indicated measurable haloforms, and volatile organics in several of the District's wells (HRS, 1984). Highest values were observed in the eastern part of the site. Private well samples showed measurable values of chlorinated solvents along the southern boundary of the site. The District implemented a program of monitoring well installation in the fall of 1985 in which nine additional wells were installed in the alluvial aquifer in areas suspected to be contaminated. Monthly sampling of these monitoring wells, alluvial and bedrock production wells, and finished water tap samples has been conducted since November 1985 by the District.

Contaminants have also been found at different times and in different locations throughout the site, in both private and SACWSD wells in samples collected by the Field Investigation Team (FIT) up to January 1985 (E&E, 1985b). Several studies have been conducted since that time for the Army, SACWSD and EPA to further characterize the nature and extent of contamination in the region and to identify the contributing sources. These have included facility inspections, soil and ground water sampling, soil gas surveys and additional monitoring well installation off- and on-post. These will be discussed further in the following section.

This RI/FS effort commenced with approval of a work plan on October 2, 1985. This Remedial Investigation report describes the site characteristics, contamination definition, investigation methodologies and analyses used to determine what response actions are appropriate as part of the first operable unit of the overall site remediation. Activities planned under Phase 2 of the RI/FS investigation include monitor well installation and sampling, further private well sampling, and ground water modeling to assess various aquifer remediation scenarios. These activities will be discussed in future operable unit reports.

2.2 CONTAMINATION PROBLEM DEFINITION

Results from the ground water sampling efforts, discussed in the previous section, suggested the potential for significant contamination of the alluvial aquifer which underlies the study area. The sampling results also indicated the need to further characterize the extent of contamination and to identify the compounds contributing to the contamination in the study area. To address these needs, Camp Dresser & McKee Inc. (CDM), contractor for the EPA RI/FS Off-Post study, initiated a ground water sampling program in December 1985. The details of this sampling program are discussed in Section 3.2.1 and the analytical data are presented in Section 4.0.

Ground water sampling conducted through July 1986 by the EPA, SACWSD, and the Army confirmed the presence of numerous organic compounds in the alluvial aquifer. There has been no significant contamination reported due to inorganic compounds. The organic compounds which are of particular concern are discussed in the following sections. Section 2.2.1 gives organic compounds and the degree of ground water contamination present at various areas that have been investigated, both outside and within the EPA RI/FS study area boundary. A review of the mobility and toxicity of detected compounds was conducted and a subset of seven compounds of primary concern was identified. Section 2.2.2 summarizes the geochemical characteristics of seven volatile organic compounds considered to be most significant with respect to the ground water contamination present at the site, and Section 2.2.3 discusses the contamination migration pathways present.

2.2.1 AREAS UNDER INVESTIGATION AND DEGREE OF CONTAMINATION

The EPA Off-Post RI/FS study was initiated to determine, among other goals, if migration of contaminants from the RMA is responsible for the observed ground water degradation in the south Adams County area. However, several other areas may contribute contamination to the EPA Off-Post RI/FS site. These sources may exist both on and off the EPA study site and may include refineries, trucking firms, machine and repair shops, and other light and heavy industry plus several abandoned landfills (E&E, 1985c). Many of these operations often require the use of degreasing solvents, including TCE and other chlorinated hydrocarbons. Two of these, Woodbury Chemical and the Sand Creek Industrial site, are listed on the National Priorities List (NPL) as CERCLA sites. The following is a discussion of some of the sites which have been investigated or are under current investigations, a description of the contaminants detected and, to the extent known, the history of operation at each facility. Several upgradient potential source areas both on and off the Arsenal have yet to be characterized; therefore, the types of contaminants cannot be assessed at this time.

2.2.1.1 Rocky Mountain Arsenal

The Rocky Mountain Arsenal is currently proposed for inclusion on the NPL as a CERCLA site. It was established in 1942 with the primary mission of manufacturing and assembling chemical and incendiary munitions to support the war effort. Actual plant production began in December of 1942. During World War II, RMA manufactured 87,000 tons of chemical, intermediate, and toxic products, and 155,000 tons of incendiary munitions. A selected listing of actual items and quantities produced during World War II is shown below (History of RMA, author unknown 1980):

- Chlorine - 63,360,000 lbs.
- Levinstein Mustard - 7,132,000 lbs.
- Distilled Mustard - 23,912,000 lbs.
- Lewisite - 9,106,000 lbs.
- Arsenic Trichloride - 5,360,000 lbs.

After the closing of hostilities in 1945, portions of RMA were leased to private industry. In 1947, Colorado Fuel and Iron (CFI) leased a portion of the facility to produce chlorinated benzene and other chemicals. Julius Hyman and Company also began the manufacture of a variety of pesticides, insecticides, and herbicides at this time. In 1950 Hyman assumed the CFI lease; in 1951 Shell Chemical Company assumed the Hyman lease (ESE 1985a). Shell continued manufacturing until 1982, although the lease does not expire until 1987.

At the beginning of the Korean Conflict in 1950, a facility was constructed at RMA for the production of nerve agent. Manufacture of this toxic agent, which affects the parasympathetic nervous system (methylisopropoxy-fluoro-phosphine oxide), occurred between 1953 and 1957. Munitions filling operations continued until 1969 (ESE 1985a). Other items produced included a biological anti-crop agent which causes wheat rust; white phosphorus grenades and shells for the Southeast Asian conflict; and a facility for the blending of rocket fuel using hydrazine and unsymmetrical dimethylhydrazine. Although the exact manufacturing processes employed to produce the various chemicals are not available, it is known that at least some of the processes required large amounts of organic solvents.

Most of the waste products from all of these various manufacturing processes were disposed of in a series of unlined basins. The original disposal area was Basin A, located in Section 36 of the RMA; it received liquid waste from 1943 to 1956. Any overflow from Basin A continued through open drainages to a series of successive open basins (B, C, D, and E). Other areas within Section 36 received a variety of liquid and solid wastes, generally in open pits or trenches which were subsequently covered. Evidence of off-post migration of chlorates, and other contaminants produced by chemical mixing within the waste basins was first noted in 1955. As a result, a lined basin (Basin F) was constructed in 1957, which received subsequent wastes in hopes that it would contain these wastes. The previous 14 years of uncontrolled disposal, however, had allowed wastes to reach the water table.

In addition, numerous spills of raw materials, process intermediates, and final products have occurred within the manufacturing complexes and have contributed to the ground water contaminant plumes. For instance, a large benzene spill from CF&I occurred in 1947 in the South Plants Area (ESE 1985a).

The number of source contaminants at the RMA is very large due to the variety of manufacturing processes as well as experimental pilot studies that occurred. The following is a listing of organic source contaminants of concern at RMA, particularly in the South Plants and Basin A areas, developed by ESE (1985a):

Benzene
Aldrin
Endrin
Dieldrin
Isodrin
Dibromochloropropane (DBCP)
Malathion
Parathion
Methylisobutylketone (MIBK)
Chlorophenylmethylsulfide (CPM Sulfide)
Chlorophenylmethylsulfoxide (CPM Sulfoxide)
Chlorophenylmethylsulfone (CPM Cellophane)
Dicylcopentadiene (DCPD)
Hexachlorocyclopentadiene (HCCPD)
Azodrin
Bicycloheptadiene
P,p-DDE
Dimethyldisulfide (DMDS)
Chloroform
Diisopropylmethylphosphonate (DIMP)
Dimethylmethylphosphonate (DAMP)
Dithiane
1,4-Oxathiane/1,4-Dithiane
1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Carbon tetrachloride
Methylene chloride
1,2-trans-dichloroethylene
Toluene
Xylenes (o-, m-, p-)
Chlorobenzene
Tetrachloroethylene
Trichloroethylene
Chlordane
Supona
p,p-DDT
Atrazine

In addition, several inorganic compounds were used widely and disposed of in ways which may have introduced them into the ground water, including chloride (derived primarily from brine disposal) and fluoride (from the use of hydrofluoric acid in the manufacture of chemical agent).

The railyard area in the western part of Section 3, shown in Figure 2-2, was the presumed source of the DBCP plume detected in the Irondale area in 1980 (May and Whitten, 1982). The buildings and area immediately west of the railyard in Section 4 have been the focus of several recent investigations. These investigations were prompted by the results of ground water sampling conducted on-post in which a monitoring well located near the motor pool facility (Figure 2-2) has shown TCE concentrations as high as 210 ug/l (USATHAMA, 1985, 1986) and were expedited at EPA's September 1985 request as an aid to this study. A soil gas study was undertaken by EBASCO Services Inc., a contractor for the Army, in February 1986. Their study covered most of Sections 4 and 33 (Figure 2-2) and was directed at determining the presence of TCE, PCE and other volatile organics (EBASCO, 1985a).

The EBASCO study determined two areas of high soil gas concentrations of TCE, with soil gas plumes in the hydraulic downgradient direction (north-northwest) of each. The highs are located in the rail maintenance area and potential source area 4-2, both located in Section 4 (Figure 2-2). Based on the soil gas survey, EBASCO installed wells at 8 sites in Sections 4 and 33, including two nested wells. These wells were sampled in June 1986; the volatile organic results are included in this report. Full characterization of these sources has not yet been conducted, thus the presence of compounds other than volatiles cannot be addressed at this time. Other wells were installed under Army contract in Sections 4, 9, and 33; sampling results are not yet available.

2.2.1.2 Woodbury Chemical Site

The Woodbury Chemical site is listed on the NPL as a CERCLA site. It is located southwest of the EPA off-post RI/FS study area, at 54th Avenue and Garfield Street. Pesticide and volatile organic contamination is known to exist in soils and ground water at the site. It is not likely to be a significant contributor to ground water contamination within the EPA off-post study area, however, due to the prevailing north to northwest ground water flow direction present in the area and the presence of a minor ground water divide separating the SACWSD wells from flow paths directly downgradient of the Woodbury site.

2.2.1.3 Sand Creek Industrial Site

The Sand Creek Industrial CERCLA site consists of four potential source areas located in the vicinity of 52nd Avenue and Dahlia Street. They include a municipal landfill operated between 1968 and 1973, the former site of an oil refinery, a pesticide formulation facility, and several acid waste disposal pits (now covered). Ground water downgradient of all four potential source areas at the Sand Creek site was sampled in 1977 by the Colorado Department of Health. This water exceeded the Safe Drinking Water Act and Clean Water Act Criteria for hexavalent chromium, iron, manganese, zinc, sulfate, and total dissolved solids. Sampling results to date from the May 1986 sampling show that the ground water is contaminated with a variety of volatile and semi-volatile organic compounds and numerous pesticides and metals. These data are included in Figures 5-24 through 5-30.

The landfill at 48th Avenue and Holly Street covered an approximate 16-square block area extending from 48th Avenue on the south to 52nd Avenue and the Colorado and Eastern Railroad tracks on the north; and from Ivy Street on the east to Dahlia Street on the west. The landfill was operated by Landfill, Incorporated, which accepted household, industrial, institutional, commercial, and agricultural wastes. The disposal area was unlined, and the fill and soil cover were watered occasionally to aid in compaction. The landfill began receiving attention when in the summer of 1977, two workmen were killed and five injured in an explosion at a Denver Water Department construction site at 52nd Avenue, just west of Dahlia. Studies by the Colorado Department of Health concluded that the explosion was due to migration of methane gas from the landfill (CH2M Hill 1985). Between 1978 and the early 1980s, methane venting systems were installed by the property owners to alleviate the gas accumulation problem. However, contaminated ground water and surface water have been observed in the vicinity (CH2M Hill 1985). In 1982, ground water sampling was performed by Fred C. Hart Associates as part of EPA's Field Investigation Team. Ground water in the vicinity of the landfill exceeded the Safe Drinking Water Act or Clean Water Act Criteria for arsenic, DCE, and TCA. Sampling at similar locations near the landfill by Burlington Northern in 1983 showed values exceeding criteria for arsenic, antimony, lead, mercury, nickel, selenium, and phenols. EPA ground water sampling in 1984 near the landfill showed exceedences for benzene, 1,2 dichloroethane, DCE and cadmium. Ground water sampling from EPA monitoring wells installed in early 1986 near the eastern edge of the landfill showed readings of 840 ppb TCE, 350 ppb PCE and 350 ppb trans-DCE in addition to low levels of several pesticides when sampled in May 1986 (CDM, 1986f).

The Oriental Refinery, located at the northwest corner of 52nd and Dahlia, had a history of gasoline excursions which caused contamination of nearby wells (Gahr, 1961). The refinery experienced a fire in 1955, which resulted in the release of about 48,000 gallons of refined petroleum products onto the site. The refinery was not rebuilt, and the only remaining evidence of the buildings are rubble and foundations. Sampling by Tri-County Health Department in June of 1977 revealed hydrocarbon contamination of soils at the site to a depth of 28 feet (CH2M Hill 1985). Ground water sampling of a well located between the former Oriental Refinery and Colorado Organic Chemical Company was performed by an EPA contractor, Fred C. Hart Associates, in 1982. This water exceeded Safe Drinking Water Act or Clean Water Act criteria for chlorobenzene, chloroform, ethylbenzene, PCE, toluene, and TCA. High concentrations of a number of volatile and semivolatile organic compounds were found downgradient of the site in recent EPA sampling results conducted in May 1986 (CDM, 1986f).

The Colorado Organic Chemical Company located just northwest of the Oriental Refinery site was first operated by Times Chemical in or around 1960. The name was later changed to Colorado International Corporation (CIC). A fire in 1968 destroyed three buildings at the site. Between 1968 and 1977, site inspections by Tri-County Health Department revealed poor waste management practices, very poor worker safety conditions, improper storage of drums containing pesticides and insecticides, and off-site drainage of highly contaminated water towards Sand Creek. CIC was cited for OSHA violations in November 1976. In December of 1977, another fire at the site released parathion fumes which hospitalized several firemen. The Sate issued an Emergency Cease and Desist Order against CIC to clean up the site; CIC declared bankruptcy but reopened the facility under the name of Colorado Organic Chemical (COC) in the same year. Some contaminated site soils were excavated and disposed of at Lowry Landfill in October 1978, but improper drum storage continued unchanged. Pesticide or insecticide contamination has been noted in site soils, surface water, and ground water. Recent EPA sampling has detected concentrations of TCE, PCE trans-DCE, benzene and total xylenes in ground water that are significantly higher than background levels (CDM, 1986f).

A fourth potential source within the Sand Creek CERCLA site is the area formerly operated by L.C. Corporation, almost immediately adjacent to Sand Creek. L.C. Corporation apparently received and disposed of acid wastes from Shell Chemical Corporation, generated during the manufacture of Planavin, an insecticide. Between 7,800 and 8,100 tons of the waste, containing 65 percent sulfuric acid, were dumped into "rubber-lined" pits at the site. In the fall of 1974, livestock which wandered onto the property were severely burned by contact with the acid. This brought the site to the attention of Tri-County Health Department, which sampled the pits and found the liquid to have a pH of less than 1.0. Lime was added to the pits and they were covered with fill. However, acidic seepage into Sand Creek in 1975 and 1976 was directly linked to L.C. Corporation through the presence of sulfone, a specific byproduct of Planavin manufacture (CH2M Hill 1985). Ground water contamination at the site due to sulfone was discovered in 1977. Some remedial action has been undertaken at the site by L.C. Corporation, but RI/FS investigations are currently underway to more fully determine the extent of contamination.

2.2.1.4 Additional Areas Under Investigation

In addition to studies conducted at the RMA and the CERCLA sites mentioned above, numerous investigations have been undertaken in the vicinity of the EPA Off-Post RI/FS study area to characterize the nature and extent of contamination and to investigate potential source areas. The EPA RI/FS investigation conducted by CDM involved an extensive program of ground water sampling, conducted in December 1985 and January and June 1986. These investigations are described and the results of this sampling effort are discussed in detail in Sections 4.0 and 5.3. The following section describes other field investigations conducted by the EPA through the Field Investigation Team (FIT) contractors.

EAST 72ND AVENUE AND ELM STREET

These sites were investigated by the EPA's FIT contractor in 1985. The sites are located near East 72nd Ave. and Elm Street, within the EPA RI/FS study area (Figure 2-2). The facilities investigated were involved in the transport, storage and recycling of waste oils and solvents (E&E, 1985a). The FIT team sampled seven monitoring wells in July and October, 1985. They found elevated concentrations of DCE, trans-DCE, TCA, TCE and other solvents, but did not identify a source of these contaminants.

EAST 64TH AVENUE AND I-270

The EPA FIT contractor conducted an investigation of this site in March 1985. Little is known about the history of the site until 1974, when it was operated as a municipal landfill for Commerce City until 1977 (E&E, 1985d). The site encompassed an area of approximately 95 acres and is thought to contain sanitary sewage sludge and industrial and household wastes (E&E, 1985d). Existing on-site wells and off-site private wells that were sampled contained numerous volatile and semi-volatile compounds (E&E, 1986a).

EAST 56TH AVENUE AND QUEBEC STREET

Two facilities have been investigated in this area by the FIT. Both are located east of Quebec Street, one being north of East 56th Avenue in Section 9, and the other being south of East 56th Avenue in Section 16. Underground storage tanks containing waste oil and solvents are present at both facilities (E&E, 1985e; 1985f). Seven monitoring wells were installed around the site and were sampled in February, 1986. Trace concentrations of TCE, DCA, and trans-DCE, acetone and phenol were detected in several of the monitor wells. In one background well located adjacent to a Stapleton International Airport runway the volatile organic compound TCA was reported at 66 ug/l (E&E, 1986b). Further investigations are planned or are underway at this site.

STAPLETON AIRPORT - SAND CREEK

The FIT conducted a study in August 1985 along Sand Creek near Stapleton International Airport to determine the nature and extent of contamination, if any, associated with the Airport (Figure 2-2). As interpreted from aerial photographs, landfill and/or dumping activities occurred along Sand Creek in Section 21 during the 1950s and 1960s (E&E, 1985g). Slightly elevated levels of DCA, trans-DCE, TCE, PCE and other solvents were detected in two of the seven monitoring wells installed in this investigation. Further investigations are planned or are underway at this site.

SOUTH ADAMS COUNTY SOIL GAS SURVEY

A survey of over 446 acres in portions of south Adams County and Denver County involving soil gas collectors was undertaken by a FIT subcontractor in April 1986 (Figure 2-2). The purpose of this soil gas survey was to detect and map halogenated volatile organic compounds in near-surface soils in the study area and to recommend areas for more extensive study. TCE and

PCE were the two most abundant compounds detected. TCA, DCE, DBCP and chloroform were also detected infrequently (E&E, 1986c).

SAND CREEK PETROLEUM SEEP

Several sampling studies were undertaken by the EPA Emergency Response Branch near the southern boundary of the EPA RI/FS study area in response to a petroleum product seep discovered along the north and south banks of Sand Creek, in August 1985. Results of laboratory analyses indicated that although the petroleum products sampled on both banks were similar in age, their chemical composition differed and thus suggested the possibility of two separate contaminant occurrences (Enecotec, 1986c). Fifty-nine monitoring wells and test borings were drilled and sampled north and south of Sand Creek to define the general configuration of the plume. The sampling program revealed petroleum products in the ground water from southwest of the Sand Creek EPA RI/FS study area extending north across Sand Creek to approximately East 59th Ave. and Holly Street (Figure 2-2; Enecotec, 1986b).

CONTAMINANT SOURCE IDENTIFICATION

In September 1985, the FIT initiated a study to identify potential sources of contamination found in ground water in the SACWSD (E&E 1985c). A preliminary screening of 29 sites resulted in nine sites being selected to undergo field sampling. The sites selected for field sampling activities are identified with asterisks on Figure 2-2.

No ground water samples were collected during this study, however some surface and subsurface soil samples contained PCE, TCA and a variety of semi-volatiles and pesticides. Furthermore, soil gas studies indicated the presence of TCE and PCE at several sites (E&E, 1986d).

CURRENT EFFORTS

As a result of the South Adams County Soil Gas Survey, the FIT submitted sampling plans in July 1986, to conduct detailed contaminant source identification studies in three areas south of East 56th Avenue and north of East 48th Avenue between Ivy and Qeubec Streets as shown in Figure 2-2. Monitoring wells have been installed at these sites and sampled, however, results of this sampling have not yet been through quality assurance review.

There are a large number and variety of potential sources which have the potential to contribute to the contamination problem within the EPA RI/FS study area. These sources may exist within and/or outside of the study area. Furthermore, sources other than the NPL and non-NPL sites discussed above may prove to be significant. Further EPA studies will be conducted to define these sources.

2.2.2 CHARACTERISTICS OF CONTAMINANTS

An assessment of contaminants detected currently at the SACWSD alluvial production wells and at other sampled wells was conducted to define contaminants of concern for the first operable unit involving treatment of the public water supply. A significant number of organic compounds listed as hazardous substances have been sporadically detected at various times in areas potentially upgradient of SACWSD production wells. These detected compounds include volatiles, semi-volatile and non-volatile organics and pesticides. A subset of contaminants of primary concern was identified by selection of compounds that are relatively mobile in a subsurface ground water environment, exhibited spatial correlation suggesting presence of a plume rather than spot occurrences, and present actual or potential health concerns. This selection process resulted in definition of seven volatile organic compounds described below. Several sources both on and off the

Arsenal are upgradient of SACWSD wells and have not yet been characterized, therefore, presence of other potential contaminants from these sources cannot be addressed at the present time.

In this section, the characteristics of the contaminants of primary concern are discussed with respect to their mobility and transport in ground water. In the first section, the environmental fate and processes affecting the fate of the compounds are discussed. The last two sections provide information concerning the two major fate processes, biodegradation and sorption. In the last section on sorption, the retardation factors used in modeling for the chemicals of concern are calculated and discussed.

2.2.2.1 Environmental Fate

Most organic chemicals when released into the environment, undergo a variety of reactions or processes that effect their final fate. These processes may include:

- Photolysis
- Oxidation
- Hydrolysis
- Volatilization
- Sorption
- Bioaccumulation
- Biotransformation and biodegradation

In the following paragraphs, each of these processes is discussed briefly in relationship to the six halogenated hydrocarbons of concern. These six compounds include:

Trichoroethylene (TCE)
Tetrachloroethylene (PCE)
Trans-1,2-dichloroethylene (trans-DCE)
1,1-dichloroethylene (DCE)
1,1,1-trichloroethane (TCA)
1,1-dichloroethane (DCA)

The final compound of concern, benzene, is not a halogenated hydrocarbon and will therefore be discussed separately following this section.

Photolysis

Photodissociation in the terrestrial environment would not be expected to occur for the compounds shown above because these compounds have no chromophores which absorb radiation in the visible or near ultraviolet region of the electromagnetic spectrum. However, the compounds are quite volatile and, as a result, are transported to the troposphere where they can undergo photodissociation due to the presence of higher energy, shorter wavelength ultraviolet light. Reaction with hydroxyl radicals in the troposphere may also occur. Because the major transport mechanism of concern at the site is ground water and no light will enter this medium, photolysis is not an important process and will not be discussed further.

Oxidation

As previously discussed, the compounds of interest are quite volatile and readily transported in the troposphere. Once in the troposphere, the compounds undergo fairly rapid photooxidation via hydroxyl radical reactions. Products may include formic acid, hydrochloric acid, phosgene, carbon monoxide, etc., depending upon the starting compound. Evidence also exists for oxidation in surface waters; however, this reaction appears to be dependent upon sunlight. Based upon the fact that ground water is the main pathway of concern at the site and oxidation appears to be photo-induced, oxidation will not be considered a major fate process of concern and will not be discussed further. Typically, ground waters contain little free oxygen and have relatively moderate to low oxidation-reduction potentials. Therefore, the occurrence of direct oxidation in ground water systems is not probable.

Hydrolysis

Some of the compounds of concern are apparently not hydrolyzed by water. However others, e.g., TCE, TCA and PCE, undergo reaction with water to produce such compounds as acetic acid, hydrochloric acid, trichloroacetic acid and hydrogen chloride. Small amounts of vinylidene chloride (DCE) have also been reported from the hydrolysis of TCA at elevated temperatures. The half lives of the compounds ranged from 6 to 11 months. The reaction rates appear to be pH dependent and increase in the presence of metallic ions. Although hydrolysis could be a viable fate process in ground water, the reaction rates appear to be too slow for it to be a significant process. However, the process will be evaluated in the discussion of each individual compound later in this section.

Volatilization

As previously mentioned, the six compounds of concern are quite volatile. In fact, volatilization appears to be the major pathway by which the halogenated hydrocarbons of concern are lost from water. In controlled laboratory experiments with stirring, the half lives of the compounds of concern ranged from 20 to 30 minutes. In partially open, non-laboratory conditions, the half-lives increase significantly to a period of three to eight days. The half-lives appear to be directly proportioned to the solution depth and square root of the molecular weight of the halocarbon. Overall, the process of volatilization occurs at a more rapid rate than hydrolysis or oxidation and, therefore, is the major fate process. However, in ground water systems, volatilization is significantly decreased due to the depth of the water. The fact that chlorinated hydrocarbons were observed by near surface, soil gas measurements during studies conducted by the Army and EPA FIT indicates that some volatilization does occur from ground water regimes. The importance of volatilization will be discussed for each individual compound in the next section.

Sorption

In the EPA's summary of the water related fate of priority pollutants (EPA, 1979), the literature concerning sorption of halogenated hydrocarbons was reviewed and the conclusion made that sorption was probably not an important fate process. However, in relatively closed systems such as ground water aquifers where volatilization is not the dominating process, other more minor processes may become relatively more important. Thus in ground water regimes, sorption may be an important process. The importance of sorption depends significantly upon the characteristics of the aquifer material which acts as the sorbing medium. In particular, sorption of hydrophobic organic compounds has been shown to be a function of the amount of organic carbon in the aquifer matrix. Much research has been performed to quantify the relationship between sorption and organic matter. These relationships are discussed in detail in Section 2.2.2.3.

Recent studies have also shown that besides the organic matter in the aquifer matrix, the inorganic matrix material itself (e.g., quartz, smectite, etc.) can also adsorb organic compounds. Typically, the sorption by the organic material is a more important process than sorption by inorganic material. However, at very low concentrations of organic carbon, inorganic adsorption may dominate. The lower limit at which contributions of the inorganic fraction dominates adsorption have been estimated by several researchers (McCarty et al., 1981; Griffin and Roy, 1985).

Schwarzenbach et al. (1983) have calculated the following retardation factors (velocity of the ground water divided by the velocity of the contamination) for several halogenated hydrocarbons based on ground water data at a test site:

	Organic Carbon Fraction		
Compound	0.01-0.02	0.001-0.01	<0.001
TCA	3.4-11	1.2-6	1-1.2
TCE	4-13	1.3-7	1-1.3
PCE	9-31	1.8-16	1-1.8

These data indicate that the critical level of organic matter at which inorganic adsorption dominates may be approximately 0.001. Based on limited data from the site and the proximity to river sediments, the fraction of organic carbon at the site is above the critical value and adsorption by organic carbon will probably dominate.

In summary, sorption appears to be an important process fate and will be discussed in detail in the following sections.

Bioaccumulation

Literature data and low octanol/water partition coefficients indicate that the compounds of concern will probably not be bioaccumulated to any significant extent. Therefore, bioaccumulation is not considered an important fate process and will not be discussed further.

Biodegradation and Biotransformation

EPA's summary of the water-related fate of priority pollutants (EPA 1979) concluded that biodegradation of the halogenated hydrocarbons was very slow and probably not significant. Since this time, several researchers have conducted laboratory studies on many organic compounds. The work of Tabak, et al. (1981) concluded that TCE and PCE experienced significant degradation while TCA experienced moderate degradation. The degradation rate for all three compounds was relatively slow compared to the rate of other organic compounds such as chloroform.

Bouwer and McCarty (1982) reported complete degradation of TCA and PCE during an eight week batch test. TCE was only 40 percent degraded at the end of eight weeks. TCE was reported as an intermediate product during degradation of PCE.

In ground water aquifers, the final fate of many organic compounds may be biodegradation. However, many trace organic contaminants are often below the minimum concentration to support the bacteria. Degradation below the minimum concentration can occur only if an abundant primary substrate (food source) and bacteria capable of decomposing both the primary substrate and the contaminant of concern (secondary substrate) are present.

Because the overall biodegradation of the halogenated hydrocarbons is relatively slow, a relatively long residence time in the aquifer is required. That is, in high velocity ground water regimes, very little degradation is observed. Due to the relatively high ground water flow velocities in the study area, biodegredation of the contaminants may not be significant.

However, biodegradation could be an important fate process in areas of lower ground water flow velocity and will be discussed further in the next sections.

Physical and Chemical Characteristics

Based upon review of the major fate process, the main properties that determine the fate of the chemicals of concern in the environment are summarized in Table 2-1. These properties include vapor pressure, solubility, Henry's Law Constant (H), and the octanol-water partition coefficient (Kow). By using the values shown in Table 2-1, the relative quantity of the compounds partitioning into the environmental compartments of air, water, soil and biota can be calculated. These calculations

TABLE 2-1

PHYSICAL AND CHEMICAL PROPERTIES

Compound	Acronym	Molecular Weight (g/mole)	Vapor Pressure (torr)	Density (g/cm^3)	Solubility (mg/L)	H ($atm-m^3/mole$)	Log (Kow)
Trichloroethylene	TCE	131.39	57.9	1.46	1,100	1.0×10^{-2}	2.29
Tetrachloroethylene	PCE	165.83	14	1.63	200	8.3×10^{-3}	2.88
Trans-1,2-dichloroethylene	trans-DCE	96.44	200	1.27	600	6.6×10^{-3}	1.48
1,1-dichloroethylene	DCE	96.94	591	1.17	400	3.4×10^{-2}	1.48
1,1,1-trichloroethane	TCA	133.41	96	1.35	4,400	1.8×10^{-2}	2.17
1,1-dichloroethane	DCA	98.96	180	1.17	5,500	4.3×10^{-3}	1.79
Benzene	—	78.12	95.2	0.878	1,780	5.6×10^{-3}	2.13

performed for the contaminants of concern in ground water indicate that the majority (usually over 90 percent) of the compound is found in the water phase.

In the water phase, the compounds can undergo a variety of reactions. These reaction processes have previously been discussed for the group of halogenated hydrocarbons as a whole. In the next section the fate of each individual compound is briefly discussed.

Trichloroethylene (TCE) - As shown in Table 2-1, TCE exhibits a high solubility, very high vapor pressure and Henry's Law Constant (H) and a moderate Kow. Based upon these properties, the ultimate fate process would be volatilization. Once in the air, TCE can undergo oxidation. However, in a ground water aquifer, little volatilization occurs. In the ground water system, sorption and biodegradation are relatively important processes. However, neither process is dominant and TCE tends to be transported relatively unaffected in the ground water regime. (Sorption and biodegradation will be discussed in more detail later). Hydrolysis probably occurs too slowly to be a significant fate process.

Tetrachloroethylene (PCE) - Although lower than TCE, the solubility and vapor pressure of PCE are still relatively high. Therefore, in an open system volatilization followed by oxidation would be the ultimate fate of PCE. However, in the ground water system, these processes are not significant. Of the compounds shown in Table 2-1, PCE has the largest Kow and therefore tends to be sorbed to a larger degree than the other compounds. Some evidence exists for biodegradation and this process will be discussed later. Hydrolysis occurs too slowly to be a significant process.

Trans-1,2-dichloroethylene (trans-DCE) - As shown in Table 2-1, trans-DCE has a very high vapor pressure, high solubility and moderate Kow. Like TCE and PCE, volatilization followed by oxidation would be the major fate process in an open system. However, these processes are not important in the ground water regime in which sorption processes are more important. Relative to the group of compounds shown in Table 2-1, trans-DCE along with DCE has the lowest Kow value indicating the lowest capacity for sorption. Both hydrolysis and biodegradation occur at too slow of rates to be important fate mechanisms.

1,1-dichloroethylene (DCE) - As shown in Table 2-1, DCE has the highest vapor pressure of the group of compounds; however as previously discussed, volatilization is probably not an important fate process in a ground water aquifer. The Kow value indicates that sorption is low to moderate; however, overall this process may be the major process fate. Like other compounds in the group, biodegradation appears slow but may be relatively important over long time periods.

1,1,1-trichloroethane (TCA) - Similar to other compounds discussed above, volatilization followed by oxidation would be the ultimate fate process. However, in the ground water regime, sorption and biodegradation are more important fate related processes. Overall, due to the very high solubility and relatively low sorption potential, TCA is very mobile in the ground water. This will be discussed further in the next section.

1,1-dichloroethane (DCA) - As with other compounds discussed, volatilization and oxidation would be the ultimate fate process for this compound. Due to its very high solubility and relatively low sorption potential, DCA is the most mobile compound shown on Table 2-1. Some evidence also exists for biodegradation. Like other compounds discussed above, hydrolysis appears to occur slowly and is probably not an important fate process.

Benzene - As previously discussed, benzene is chemically distinct from the previous compounds in that it is an aromatic hydrocarbon and contains no halogens. However, based on the properties provided in Table 2-1, benzene has similar vapor pressure, solubility, H and Kow when compared to the other compounds of concern. The most notable difference in properties is the density. All the halogenated hydrocarbons have densities greater than water and will therefore sink while benzene has a density less than one and will therefore float on water. This is only an important distinction in a two phase system which is not observed on the site. Essentially, the dissolved phase is the only phase present. However nearer the source area, the density difference may be very important. Overall, the properties shown on Table 2-1 are similar and therefore many of the fate related processes may be similar. Each of the fate processes for benzene are discussed briefly below.

Photolysis does not appear to be an important fate process because benzene does not absorb wave lengths of light present on the earth's surface. Direct oxidation in surface water under ambient conditions does not appear to be an important process. However, after volatilization, benzene is effectively depleted by reaction with hydroxyl radicals in the atmosphere. As previously discussed, in ground water this is not an important process. The hydrolysis of benzene is also an unlikely process under environmental conditions since nucleophilic attach of the aromatic ring by water or hydroxyl ion is not likely. As shown in Table 2-1, benzene has a very high vapor pressure and will easily be volatilized from systems. However, as with the other compounds discussed, volatilization from groundwater regimes will be limited and will not be the dominating process as is surface water and other open systems. Even though the Kow for benzene is relatively low (see Table 2-1), sorption will still be an important fate success in the ground water. As with the other compounds discussed, bioaccumulation will be low and is not considered an important process in ground water. Based on the chemical structures with its aromatic symmetry and electron delocalization, benzene is likely to be quite resistant to biodegradation. Several bacteria have been identified that can use benzene as a primary source of carbon. However, overall, these reactions appear to be relatively slow and thus biodegradation is not likely in a relatively high velocity aquifer.

Summary of Environmental Fate - Given the chemical and physical properties of the hydrocarbons of concern, sorption and biodegradation processes would typically not be the major fate processes. However, in the ground water regime, these two processes, although not substantial compared to other groups of compounds, appear to be the major fate processes. These two processes are discussed in the next two sections.

2.2.2.2 Biodegradation

The biodegradation of the hydrocarbons discussed above is dependent upon many factors including oxic/anoxic conditions, flow rates, nature of the aquifer material, types of contaminants and abundance of substrate material. Overall the biological process for halogenated compounds in ground water is not well understood, but dehalogenation probably occurs according to the following reaction paths.

PCE ——> TCE ——> DCE ——> vinyl chloride
TCA ——> DCA ——> chloroethane

Documentation of the following reaction in ground water also exists:

TCE ——> DCA ——> vinyl chloride
TCA ——> DCE

These reactions are most likely to occur under anaerobic conditions. Overall, the reactions are kinetically slow and therefore will only occur in ground water regimes with substantial residence times. In many instances where ground water velocities are relatively rapid, no degradation is observed. Due to the unknown nature of biodegradation at the site, this process is not considered in the transport model. However, the extent of biodegradation will be examined in detail and, if appropriate, considered during the modeling for future operable units.

2.2.2.3 Adsorption

Migration of halogenated hydrocarbon in soil-water systems is governed by convection-dispersion processes and geochemical characteristics of the medium. One of the most important geochemical parameters affecting the rate of migration of these chemicals is the distribution coefficient dictating the partitioning of the selected chemical between the liquid phase and the solid matrix. One of the most significant reactions contributing to this portioning is the sorption to and desorption from the solid matrix. Under appropriate conditions and assumptions, the distribution coefficient can be used to define the retardation factor which expresses the velocity of the selected chemical compounds migration relative to the ground water velocity.

Different methods have been used to arrive at sorption-desorption behavior of contaminants. The most common approach is laboratory column leach studies where effluent concentrations are measured in order to describe the overall interaction between the liquid phase and the solid matrix. The applicability of such laboratory tests to field conditions is often of question and concern. Another method is based on field measurement of contaminant concentrations in the soil samples collected at various depths during drilling and also in the adjacent ground water during subsequent monitoring well sampling. The last method (a theoretical method) calculates the distribution coefficient based on the total organic carbon content of the soil. Because appropriate data (soil with adjacent water samples) have not yet been collected and column studies will not be performed, the theoretical method will be used to calculate distribution coefficients and retardation factors for this report. Under appropriate conditions, the retardation factor for selected chemicals can be used to predict the rate of their migration in soil-water systems.

Background Theory - The one-dimensional transport of a single sorbing solute in a homogeneous porous medium under saturated steady state water flow conditions can be described as:

$$\frac{\partial C}{\partial t} = \frac{D\partial^2 C}{\partial x^2} - \frac{v\partial C}{\partial x} + \frac{p\partial S}{n\partial t} \qquad (2.1)$$

where

C = Solution concentration, mg/l
t = time, sec
D = Dispersion coefficient, cm^2/sec
x = Distance, cm
v = Average linear pore water velocity, cm/sec
p = Soil bulk density, $\mathrm{g/cm}^3$
n = Effective porosity
S = Sorbed concentration, mg/Kg

In equation (2.1), the last term represents the interaction between the solid phase and the liquid phase. Different mechanisms may be responsible for attenuation of chemical compounds in soil-water systems. Sorption is the main mechanism contributing to attenuation of the compounds of concern (Bedient, et al., 1982). The partitioning of these compounds between the solid phase and the solution phase may follow a particular isotherm depending on the properties of the material, interactions between the two phases, and their concentrations. In general, the partitioning between the two phases can be written as (Helfferich, 1962):

$$S = K_d C^N \qquad (2.2)$$

where

K_d = Freundlich adsorption constant
N = Freundlich exponent
(S and C as previously defined)

Equation 2.2 is known as the Freundlich isotherm. For some pesticides and complex organic compounds, N in equation 2.2 is not equal to unity (Hamaker and Thompson, 1972; Rao and Davidson, 1979) indicating a nonlinear adsorption behavior. On the other hand, for a variety of chemicals and under many circumstances, N = 1 and thus equation 2.2 reduces to:

$$S = K_d C \tag{2.3}$$

which is referred to as a linear adsorption isotherm. K_d is a valid representation of the partitioning between the solution phase and the solid phase only if the reactions that cause the partitioning are fast (compared to the flow velocity), reversible, and only if the isotherm is linear. Many organic compounds are reported to follow a linear adsorption isotherm. Examples include: several halogenated aliphatic hydrocarbons (Chiou, et al., 1979), polynuclear aromatic hydrocarbons (Means, et al., 1980), dibenzothiophene (Hassett, et al., 1980), benzene (Rogers, et al., 1980), and halogenated hydrocarbons and some substituted benzene compounds (Wilson, et al., 1981). Based on the literature, it is assumed that the chemicals of interest to this study obey a linear adsorption isotherm.

If $K_d = 0$, the chemical species of concern is not affected by physico-chemical reactions and migrates at the same velocity as the water based on convective-dispersive mechanisms. If $K_d > 0$, the chemical species will be retarded. Assuming equation 2.3 is valid, substitution of equation 2.3 in equation 2.1 yields:

$$R \frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} - v \frac{\partial C}{\partial x} \tag{2.4}$$

where R is the retardation factor, expressed as:

$$R = 1 + \frac{p}{n} K_d = \frac{v}{v_c} \tag{2.5}$$

where v_c in equation 2.5 represents the average velocity of the retarded constituent. The previous assumptions concerning the rapid rate and reversibility of reactions and linearity of the isotherm also apply to equation 2.5.

Methods of K_d Determination - In this evaluation, K_d of the organic compounds of interest detected at the site will be reported using the theoretical method.

The methods of calculating a theoretical K_d are primarily based on organic carbon content of the soil. The work of Lambert (1967, 1968) and co-workers (Lambert et al., 1965) have demonstrated that the sorption of neutral organic pesticides are correlated with the organic carbon content of a given soil. Lambert also suggested that the role of organic matter is similar to that of an organic solvent in a solvent extraction process. Thus, partitioning of a neutral organic compound between soil organic matter and water should correlate well with its partitioning between water and an immiscible organic solvent. Chiou, et al. (1979) also showed that the transfer of nonionic organic compounds from water to soil could be due to partitioning in the soil organic matter. They demonstrated linear adsorption isotherms over a wide range of concentrations. Karickhoff et. al., (1979) investigated the role of particle size and organic matter on sorption of a number of aromatic and chlorinated hydrocarbons. The correlation of sorption with sorbate aqueous solubility and octanol/water distribution coefficient was also studied by these authors. Weed and Weber (1974) demonstrated that the retention of pesticides by soil is most closely related to the amount of organic matter in the soil.

The distribution coefficient, K_d, is related to organic carbon content fraction according to:

$$K_d = (K_{oc})(f_{oc}) \qquad (2.6)$$

where K_{oc} is the adsorption constant based on organic carbon content and f_{oc} is the fraction of total organic carbon content in terms of grams of organic carbon per gram of soil. A typical value of organic matter in minerals soils in 3.25 percent (Brady, 1974). The amount of organic matter is approximately 1.9 times the amount of organic carbon; therefore, a typical value for organic carbon content is 1.7 percent. However, specific data for soils from the Vona series in Adams County indicate that organic matter content ranges from 0.5 to 1.0 percent (United States Dept. of Agriculture, 1974; Soil Interpretation Record, 1979). Therefore, the value for organic carbon would range from 0.26 to 0.52 percent. As a conservative, worst case condition of minimum adsorption, the value of 0.0026 was used for organic carbon content. This value may still be high for the relatively clean, coarser-grained sands in the aquifer. Because of the critical nature of this value, it will be measured on actual samples collected during future field investigations. The selected value appears to be larger than the critical level of organic matter given the assumptions previously discussed and therefore adsorption by the organic matter dominates adsorption by the inorganic matter.

K_d defined in equation 2.6 is also referred to as the partition coefficient and is the same as K_d in equation 2.3. Karickhoff et al. (1979) showed that K_d for pyrene and methoxychlor in a given soil varies linearly with the organic carbon fraction. They further demonstrated good correlation between K_{oc}, water solubility, and octanol/water distribution coefficients.

In the present study, four different relations for calculating K_{oc} were utilized. These four relations represent the best documented relations currently available. The first relation was suggested by Kenaga (1980) and is expressed as:

$$\log K_{oc} = 3.64 - 0.55 \log W_1 \tag{2.7}$$

where W_1 is the water solubility of the chemical in mg/L. The second relation was suggested by Chiou et al. (1979) and is based on data from a number of chlorinated hydrocarbons (e.g., 1,2-dichloroethane, 1,1,1-trichloroethane, etc.) in a silty loam soil. This relation follows:

$$\log G = 4.04 - 0.557 \log W_2 \quad (2.8)$$

where G is the soil organics-water distribution coefficient and W_2 is the water solubility in umole/L. G and K_{oc} are empirically related by the following equation:

$$K_{oc} = \frac{G}{1.724} \quad (2.9)$$

The third expression used in calculating K_{oc} was derived by Karickhoff et al. (1979) and is expressed as:

$$K_{oc} = 0.63\ K_{ow} \quad (2.10)$$

where K_{ow} is the octanol/water partition coefficient. Values for K_{ow} were taken from the literature and are provided in Table 2-1.

The fourth expression used was also derived by Karickhoff et al. (1979):

$$\log K_{oc} = 5.3^{*} - 0.54 \log W_3 \quad (2.11)$$

where W_3 is the water solubility of the chemical in terms of mole fraction x 10^9.

Utilizing equations 2.6 through 2.11, the reported solubility values (Table 2-1), the K_{ow} values (Table 2-1) and the assumed carbon content (0.0026), K_d values were calculated. The results are provided in Table 2-2.

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*The value for the intercept shown in the reference is 0.44; however, the data from which the value was calculated yields a correct intercept of 5.3.

In all cases, the largest reported solubility value in the literature (see Table 2-1) was used. This will result in conservatively low K_d values (less adsorption).

Table 2-2 shows that highest K_d values were obtained when the Karickhoff et al. (1979) method was used. The lowest K_d values result from the method using Chiou et al. (1979). These smaller values may be more appropriate because the data used to develop the theoretical relationship was based on experiments using chlorinated hydrocarbons. Furthermore, the average K for TCE reported by Mehran and Olsen (1984, 1986) using field measurements of TCE in soil and water was 0.20. This agrees most closely with the value calculated using Chiou et al. (1979).

After evaluation of the results, the values given by Karickhoff et al. (1979) were eliminated and the remaining three values averaged to give the following results:

Compound	K_d
TCE	0.22
PCE	0.73
trans-DCE	0.17
DCE	0.21
TCA	0.14
DCA	0.078
Benzene	0.15

The procedure of eliminating the extreme values is a conservative approach because averaging all values will result in higher K_d values. The resulting value for TCE also agrees fairly well with the literature values.

Calculation of Retardation Factors - Once the best K_d values have been estimated, equation 2.5 can be used to calculate the retardation factor (R). Assuming that the bulk density was 1.86 gm/cm^3 and the effective porosity was 0.215 (average of 20 to 23 percent), the following values for R result:

TABLE 2-2

THEORETICAL DISTRIBUTION COEFFICIENTS (K_d)

Parameters	Kenaga(1)	Chiou(2)	K_{ow}(3)	Karickhoff(4)
TCE	0.24	0.12	0.32	0.83
PCE	0.62	0.32	1.24	2.36
trans-DCE	0.34	0.12	0.051	0.98
DCE	0.42	0.16	0.051	1.22
TCA	0.11	0.051	0.24	0.40
DCA	0.10	0.038	0.10	0.30
Benzene	0.18	0.062	0.22	0.48

(1) $K_d = K_{oc} \times f_{TOC}$

f_{TOC} = fraction of TOC

Log $K_{oc} = 3.64 - 0.55 \log W_1$ (Kenaga, 1980)

W_1 = water solubility in mg/L

(2) $K_d = K_{oc} \times f_{TOC}$

$K_{oc} = G/1.724$

Log $G = 4.04 - 0.557 \log W_2$ (Chiou, et al., 1979)

W_2 = water solubility in umol/L

(3) $K_d = K_{oc} \times f_{TOC}$

$K_{oc} = 0.63\ K_{ow}$ (Karickhoff, et al., 1979)

(4) $K_d = K_{oc} \times f_{TOC}$

Log $K_{oc} = 5.3 - 0.54 \log W_3$ (Karickhoff, et al., 1979)

W_3 = mole fraction x 10^9

Compound	R
TCE	2.9
PCE	7.3
trans-DCE	2.5
DCE	2.9
TCA	2.2
DCA	1.7
Benzene	2.3

These values indicate that the all compounds will migrate at a velocity slightly slower than any advancing water front. For example, TCE will advance at a rate of 2.9 times slower than water.

Previous studies on different geologic media generally support the retardation factor for TCE presented here. Four field observations reported by Wilson et al. (1981) show that a clayey sand with organic carbon content of 0.01 to 0.25 percent exhibits an average retardation factor of about 2.4 for TCE. The results of laboratory and theoretical methods presented by Wilson et al. (1981) provide similar retardation factors ranging from 1.5 to 2.0. The overall average retardation factor using field observation, laboratory experiment and calculated values reported by Wilson et al. (1981) is 2.0 for TCE. The average value from the field data presented by Mehran and Olsen (1984, 1986) give a value of 2.2 for TCE. Therefore, the values calculated for TCE may be slightly high. Literature values confirm other calculated values (e.g., for PCE) may also be slightly high. The review of literature values indicate that the retardation factors may be slightly high. In addition as previously discussed, the organic carbon content used for the calculations' may be high for the relatively clean, coarse-grained materials found in the aquifer of concern. Based on these two observations, the actual modeling was performed using a range of retardation factors. For TCE, the values ranged from 1.3 (the value given by Schwarzenbach, 1983, for organic carbon content of 0.001) to 2.9 (the value calculated using an organic carbon content of 0.0026). By using a range of values, essentially a sensitivity analysis was performed.

In the analyses presented here, it was assumed that adsorption follows a linear isotherm. Recent tabulation by Guswa, et al. (1984) of values of n (equation 2.2) for TCE indicate that n ranged from 0.324 to 0.938 for various solid media. Therefore, further studies are needed to verify the assumption of linearity. Although limited data are available for sorption of TCE on soil, the desorption behavior is not at all well understood (Wilson, 1983). Investigations of desorption behavior will be conducted, if necessary, in future operable unit evaluations.

2.2.3 CONTAMINANT MIGRATION

Migration Pathways

Since the sources of contamination at the EPA Off-Post RI/FS site are not documented, the pathway of concern is that which is transporting the contaminants from off-site and/or on-site sources to the on-site receptors. The principle migration pathway for organic contaminants is in ground water, within the alluvial aquifer that exists at the site. This aquifer is the primary drinking water source for area residents via several SACWSD municipal wells.

Organic compounds have entered the ground water at one or more upgradient locations and have migrated toward on-site water wells. The haloforms and volatile organic compounds of concern are generally more dense than water and may therefore migrate downward through the permeable unconsolidated aquifer at the source. During the vertical migration some of these compounds may accumulate at contrasting permeability interfaces such as exist between the alluvial sand and clay layers and at the alluvium-bedrock contact. The geology of the alluvial deposits and the nature of the alluvium-bedrock contact therefore play an important role in determining the distribution and magnitude of contaminants present in ground water in the area.

Drilling records indicate that several paleochannels exist in the alluvium and that they appear to originate south and east of the EPA RI/FS study area. These paleochannels could serve as preferential transport pathways for dissolved or separate phase organic contamination, due to the greater thickness of high permeability sands and gravels present. Currently observed concentrations suggest that contaminants are moving as dissolved species in the alluvium with flow paths influenced by the location of the paleochannels. This is important in regard to contamination of SACWSD municipal wells, since several of the contaminated wells are located in or near paleochannels. See Sections 5.2 and 5.3 for a detailed discussion of this topic.

For purposes of this operable unit, transport pathways other than ground water are assumed to be insignificant. Investigations will continue to verify that this is the case. Since the source areas have not yet been identified at this time, the atmospheric pathway cannot be fully evaluated. Transport of organics of concern in wind-blown soils from unidentified sources, however, is probably not significant due to the volatile nature of the majority of the compounds. Direct exposure (via ingestion or dermal contact) are also not significant pathways except perhaps in the immediate area of the as yet unidentified sources. Surface water is not a significant pathway because there has been no indication of surface water contamination in the area by the contaminants of concern.

Potential Receptors

The potential receptors exposed to the contaminated ground water include the residents who derive their domestic water supply from either the SACWSD supply wells or private wells. Other receptors include those who work at on-site businesses or industrial facilities where they may ingest contaminated water, but who live off-site.

The number of receptors has been estimated at 30,000 persons. Since wildlife and livestock animals are not located on-site, they are not considered receptors. The small non-domestic animals on site do not have access to ground water and are not considered receptors. Although aquatic life and downstream users of the South Platte could potentially be receptors, the likelihood is very small due to dispersion in the aquifer and mixing with the larger flow in the South Platte. See Section 5.0 for a further discussion.

2.3 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A. Maximum Contaminant Level Goals (MCLGs) and Maximum Contaminant Levels (MCLs) Established Under the Safe Drinking Water Act

MCLGs are nonenforceable health goals which are set at levels which would result in no known or anticipated adverse health effects with an adequate margin of safety. MCLs are enforceable standards and are set as close to the MCLG as is feasible. MCLs are based upon treatment technologies, costs, and other feasibility factors such as availability of analytical methods, treatment technology, and costs for achieving various levels of removal. The EPA is evaluating the extent to which MCLGs may be relevant and appropriate under these circumstances.

Section 121(d) of SARA provides that the selected remedial action must require a level or standard of control which at least attains MCLGs, where such goals are relevant and appropriate under the circumstances of the release or threatened release. MCLGs for substances considered to be probable human carcinogens are set at zero, and MCLGs for substances that are not treated as probable human carcinogens are based upon chronic toxicity or other data.

The remedial action alternatives which EPA is evaluating under this operable unit require a level or standard of control for each hazardous substance, pollutant, or contaminant identified in SACWSD public drinking water wells which at least attain final MCLs established under the Safe Drinking Water Act, or proposed MCLs, where no final MCL has been established. Specifically, the selected remedial action will at least attain: (1) the proposed MCLs for volatile synthetic organic chemicals. See 50 Fed. Reg. 46902, 46904 (13 Nov. 1985); and (2) the final MCLs as set forth in 40 CFR Part 141, Subpart B for organic and inorganic chemicals. Additionally, EPA is evaluating the extent to which final MCLGs for volatile synthetic organic chemicals and inorganic contaminants may be relevant and appropriate under the circumstances of this release or threatened release, in accordance with Section 121(d) of SARA. See 40 CFR Part 141, Subpart F; and 50 Fed. Reg. 46880 (13 Nov. 1985). Finally, EPA is evaluating the extent to which proposed MCLGs for synthetic organic chemicals and inorganic chemicals may be relevant and appropriate under the circumstances of the release or threatened release. See 50 Fed. Reg. 46936 (13 Nov. 1985). These requirements are set forth in Table 2-3.

The Colorado Department of Health (CDH) is the state agency delegated the responsibility to enforce the standards established by the Federal Safe Drinking Water Act (SDWA) (Public Law 93-523). Under the SDWA, Colorado is required to adopt drinking water standards at least as stringent as those promulgated by the EPA. CDH has adopted the maximum contaminant levels (MCLs) for presence in drinking water for inorganic, organic, and trihalomethane chemicals for which there are federal MCLs in the SDWA. The CDH MCLs are the same as the SDWA MCLs.

B. Water Quality Criteria Established Under Sections 303 and 304 of the Clean Water Act

EPA is also evaluating the extent to which water quality criteria established under the Clean Water Act may be relevant and appropriate under the circumstances of this release or threatened release.

TABLE 2-3

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS THAT REMEDY WILL AT LEAST ATTAIN. (ALL ALTERNATIVES UNDER EVALUATION IN THE OPERABLE UNIT FS MEET OR EXCEED THESE REQUIREMENTS)

PROPOSED MCLs FOR VOLATILE SYNTHETIC ORGANIC CHEMICALS	mg/l
Organic	
Trichloroethylene (TCE)	0.005
Carbon Tetrachloride	0.005
Vinyl Chloride	0.001
1,2-Dichloroethane	0.005
1,1,1-Trichloroethane (TCA)	0.200
p-Dichlorobenzene	0.750
Benzene	0.005
1,1 Dichloroethene	0.007

FINAL MCLs FOR ORGANIC AND INORGANIC CHEMICALS	mg/l
Organic	mg/l
Chlorinated hydrocarbons:	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys:	
2,4-D	0.1
2,4,5-TP Silvex	0.01
Total Trihalomethanes	0.10
Inorganic	
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Fluoride	4.0
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UNDER EVALUATION IN ACCORDANCE WITH SECTION 121(d) OF SARA. (NO ALTERNATIVES UNDER EVALUATION IN THIS OPERABLE UNIT FS WILL ATTAIN MCLGS FOR CARCINOGENS SET AT ZERO)

FINAL MCLGs FOR VOLATILE SYNTHETIC ORGANIC CHEMICALS AND FLUORIDE	mg/l
Organic	
Benzene	0
Vinyl Chloride	0
Carbon Tetrachloride	0
1,2 Dichloroethane	0
Trichloroethylene	0
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.200
p-Dichlorobenzene	0.750
Inorganic	
Fluoride	4.000

PROPOSED MCLGs FOR SYNTHETIC ORGANIC CHEMICALS AND INORGANIC CONTAMINANTS	mg/l
Organic	
Acrylamide	0
Alachlor	0
Aidicarb, aldicarb sulfoxide and aldicarb sulfone	0.009
Carbofuran	0.036
Chlordane	0
cis-1,2-Dichloroethylene	0.07
DBCP	0
1,2-Dichloropropane	0.006
0-Dichlorobenzene	0.62
2,4-D	0.07
EDB	0
Epichlorohydrin	0
Ethylbenzene	0.68
Heptachlor	0
Heptachlor epoxide	0
Lindane	0.0002
Methoxychlor	0.34
Monochlorobenzene	0.06
PCBs	0
Pentachlorophenol	0.22
Styrene	0.14
Toluene	2.0
2,4,5-TP	0.052
Toxaphene	0
trans-1,2-Dichloroethylene	0.07
Xylene	0.44
Inorganic	mg/l
Arsenic	0.05
Asbestos (med. & long fibers)	7.1[a]
Barium	1.5
Cadmium	0.005
Chromium (total)	0.12
Copper	1.3
Lead	0.020
Mercury	0.003
Nitrate (as N)	10.0
Nitrite (as N)	1.0
Selenium	0.045

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[a] Million fibers per liter

3.0 INVESTIGATION METHODOLOGIES

The EPA Off-Post RI/FS study for the first operable unit has been a phased investigation. The initial phase involved an extensive review of existing data collected in and around the study area in order to ascertain the types of compounds contributing to the ground water contamination as well as the approximate extent of contamination. Following this data analysis was a sampling program designed to supplement the existing data. The final phase involved preliminary modeling efforts, using the data collected in earlier phases, to further assess existing conditions and to predict future conditions.

The following sections describe the methods of investigation involved in the analysis of ground water contamination within the study area. Section 3.1 identifies the contaminant identification and evaluation studies conducted in the area. Section 3.2 describes the EPA Off-Post RI/FS ground water sampling program. Section 3.3 provides an overview of the methods implemented in the initial phases of the ground water modeling effort.

3.1 CONTAMINATION IDENTIFICATION AND EVALUATION STUDIES

The present study began with a compilation and review of all sampling data collected in the region prior to October 1985, when the EPA Off-Post RI/FS work plan was approved. The pre-existing data showed that volatile organic compounds were the principal contaminants present in ground water in the area. The data also indicated areas requiring further field investigations.

Field investigations have been undertaken since fall 1985, by the EPA FIT, SACWSD, and Army contractors, in addition to the EPA RI/FS contractor. The CDH has also monitored this investigation, and has taken splits (duplicate samples) at some wells. The number and diversity of these studies required a systematic organization of the various sampling locations and sampling results as they became available, in order to assess the nature and extent of ground water contamination in an efficient and expedient manner. Accordingly, ground water sampling efforts were compiled in the form of a table organized by sampling agency, sample date, identification of the sampled wells, and contaminants analyzed for. This information, current as of early September 1986, is given in Table 3-1. The well numbers listed in the table are those that were assigned by the sampling agency. Well identifiers corresponding to those found in Table 3-1 are shown plotted on Figure 3-1, which is a map of the EPA Off-Post RI/FS study area and surrounding region. A unique symbol is given for each sampling agency identified on Figure 3-1.

3.2 SITE EVALUATION

Field investigation data collected prior to the initiation of the EPA Off-Post RI/FS study indicated that ground water is likely the only significant contaminant migration pathway, and that there existed large areas within the site in which data was insufficient to characterize the contaminant distribution. A site evaluation involving ground water sampling was, therefore, deemed necessary. The following sections describe the ground water sampling methods employed and the procedures used to validate the sampling results.

Additional information about both contamination and hydrogeology on the west tier of the Rocky Mountain Arsenal was needed prior to its scheduled collection as part of the Army's ongoing studies. In September, 1985 the EPA requested that the Army expedite its contamination and source identification efforts on the western tier. The resulting data received to date have been included in the EPA Off Post RI/FS data presentations and assessments.

TABLE 3-1

SUMMARY OF GROUND WATER SAMPLING EVENTS IN ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS REGION

Sampling Agency	Approximate Sample Date	No. of Sites Sampled	Well I.D.[(A)]	Organic Contaminants[(B)] Analyzed
EPA - Rocky Mt. Arsenal Off-Post RI/FS	6/15/86	13	CSF101 to CSF113	PCE, TCE
	6/10/86	15	198DW055 to 198DW076	VOA, BNA, Pest
	1/07/86	22	198DW023 to 198DW053	VOA, BNA, Pest
	12/15/85	13	198DW001 to 198DW021	VOA, BNA, Pest
EPA-FIT	2/19/86	7	DC-GW-1,2,3,4 PO-GW-1,2,3	VOA, BNA
EPA-FIT	2/19/86	9	MA-MW-1,2,3A,3B,4A,4B,5,6,7	VOA, BNA
	10/85	7	MA-MW-1,2,3A,3B,4A,5,7	VOA
	8/85	7	MA-MW-1,2,3A,4A,4B,5,6	VOA, BNA, Pest
EPA	8/26/82	7	SAC-12,13,18,5/17,14/8,15/1,16/9	VOA
SACWSD	7/01/86–7/02/86	12	SAC-2,3,5,14,17,18 SAC-MW-1,2,3,5,6,9	PCE, TCE
	6/04/86–6/05/86	14	SAC-5,15,16,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	PCE, TCE
	5/02/86	5	SAC-17 SAC-MW-1,2,5,11	VOA
	3/06/86	7	SAC-2,3,5,15,16,17,18	VOA
	3/06/86	9	SAC-MW-1,2,3,4,5,6,8,9,11	VOA
	2/12/86–2/13/86	16	SAC-2,3,5,15,16,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	VOA
		4	SAC-18; SAC-MW-1,2,3	DBCP
		3	SAC-MW-1,2,3	BNA
		2	SAC-MW-2,3	Pest
	1/02/86–1/03/86	16	SAC-2,3,5,15,16,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	VOA

TABLE 3-1

SUMMARY OF GROUND WATER SAMPLING EVENTS IN ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS REGION (Continued)

Sampling Agency	Approximate Sample Date	No. of Sites Sampled	Well I.D.(A)	Organic Contaminants Analyzed(B)
	12/05/85-12/06/85	15	SAC-2,3,5,15,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	VOA
	11/04/85-11/05/85	19	PW-6195 IVY, PW6081 67th SAC-2,3,5,14,15,16,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	VOA
		16	SAC-2,3,5,15,16,17,18 SAC-MW-1,2,3,4,5,6,8,9,11	VOA, DBCP
	8/08/85-8/09/85	8 1	SAC-2,3,5,14,15,16,17,18 SAC-14	PCE, TCE VOA, DBCP
	1/24/85-1/27/85	7	SAC-2,14,16,17,18 PW-6195 IVY, PW6081 67th	VOA
	5/08/84 & 6/06/84	9	SAC-2,3,5,14,15,16,17,18 PW-6195 IVY	VOA
	10/27/83	8	SAC-2,3,5,14,15,16,17,18	PCE, TCE
	8/26/82	2	SAC-16, 18	PCE, TCE
EPA - Sand Creek RI/FS	5/15/86	17	SC-1 to SC-11, NMW-1, NMW-2, NMW-10, NMW-13, ERB-18, ERB-21	VOA, BNA, Pest
CDH	6/13/86	3	04034, 04035, 04041	VOA, BNA, Pest
	9/1,7,14/83	1	SAC-18	DBCP
	5/20/83	1	SAC-18	DBCP
	3/1/83	1	SAC-18	DBCP
	1/25/83	2	SAC-5, 18	DBCP
	2/15/80	3	Town & Country Wells	DCPD
	1/25/80	2	Town & Country Wells	DCPD

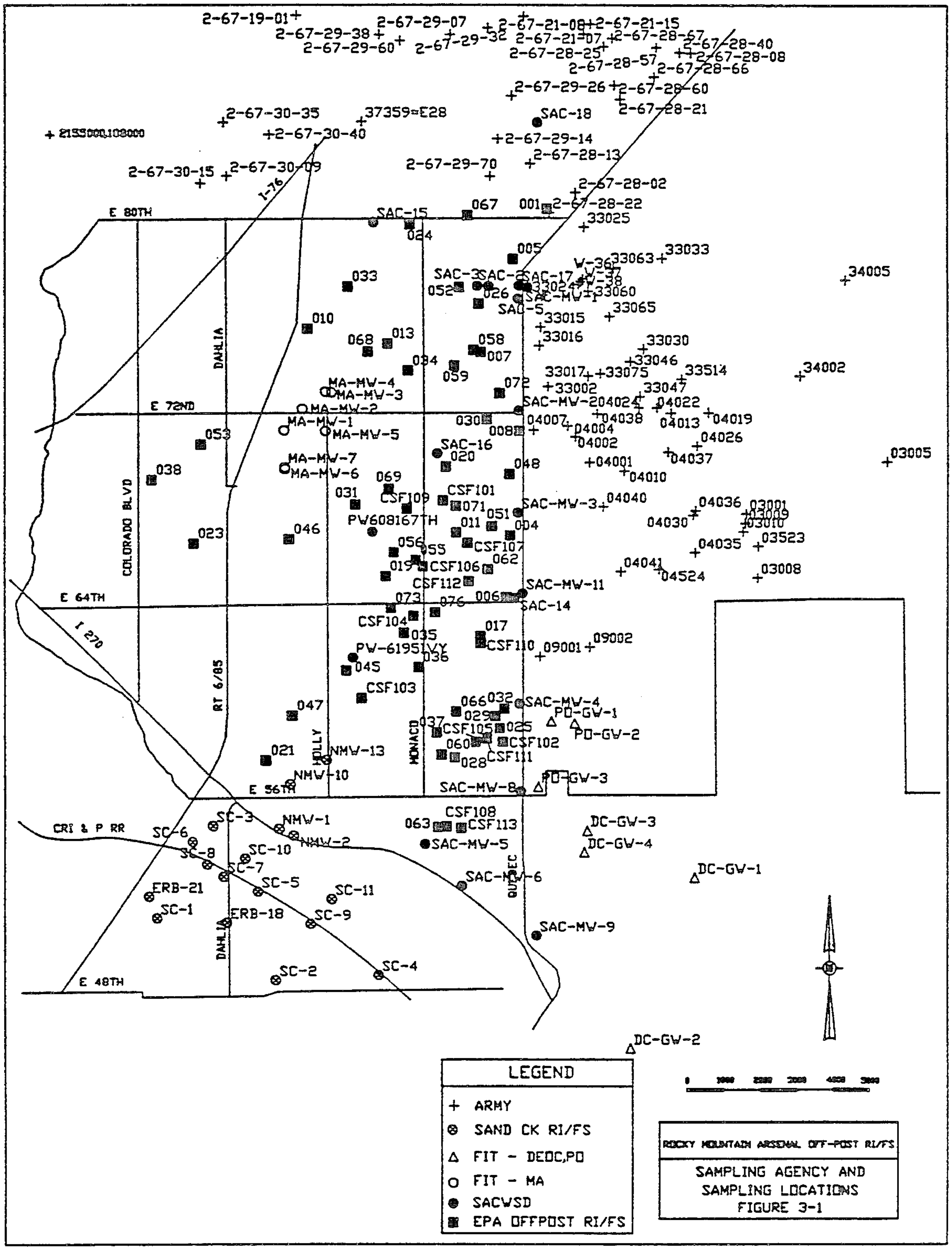
TABLE 3-1

SUMMARY OF GROUND WATER SAMPLING EVENTS IN ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS REGION (Concluded)

Sampling Agency	Approximate Sample Date	No. of Sites Sampled	Well I.D.(A)	Organic Contaminants Analyzed(B)
Army (on-post investigation)	6/10/86-6/25/86	21	04001, 04004, 04022, 04023, 04030, 04035 to 04041 33022, 33024, 33046, 33047, 33064 to 33069, 33074, 33075	VOA, DBCP
	2/17/86	1	04022	VOA, BNA, Pest
	2/03/86	2	04030, 33033	VOA, BNA, Pest
	12/03/85	1	04013	VOA, BNA, Pest
	11/15/85	32	03001 to 03010, 03523, 04001 to 04030, 04524, 09001, 09002, 33002 to 33063, 33514, 34002 to 34005	VOA, BNA, Pest
Shell	1/31/86	3	W-36, 37, 38	TCE
Army (off-post investigation)	10/15/85	33	1-66-20-01, 2-67-19-01, 2-67-20-08, 2-67-20-18, 2-67-20-27, 2-67-20-30, 2-67-20-35, 2-67-20-50, 2-67-21-07, 2-67-21-08, 2-67-21-15, 2-67-28-02, 2-67-28-08, 2-67-28-13, 2-67-28-21, 2-67-28-22, 2-67-28-25, 2-67-28-40, 2-67-28-57, 2-67-28-60, 2-67-28-66, 2-67-28-67, 2-67-29-07, 2-67-29-14, 2-67-29-26, 2-67-29-32, 2-67-29-38, 2-67-29-60, 2-67-29-70, 2-67-30-09, 2-67-30-15, 2-67-30-35, 2-67-30-40	VOA, DBCP, DCPD, Pest
	10/27/83	14	SAC-1,2,3,4,8,9,11,12,13,14,15,16,17,18	VOA, DBCP, DIMP, DCPD

Notes: (A) Well I.D. = the well name/number assigned by the sampling agency. Well locations are shown on Figure 3-1.

(B) VOA = volatile organics series was analyzed for
BNA = base/neutral/acid extractible series, which includes semi-volatiles, was analyzed for
Pest = pesticides were analyzed for



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SAMPLING AGENCY AND
SAMPLING LOCATIONS
FIGURE 3-1

3.2.1 GROUND WATER SAMPLING

The EPA Off-Post RI/FS field sampling investigation was initiated in December 1985 as part of the site evaluation. The objective of the field investigation was to collect ground water samples from existing private well water systems throughout the area in order to better define the extent of contamination in the alluvial aquifer in the Off-Post RI/FS region. Three sampling efforts were conducted under the field sampling investigation, in December 1985, January 1986, and June 1986. A total of 63 wells were sampled during the field investigation.

Sample sites were selected during each effort on the basis of where gaps existed in the data. Tentative sites were selected from a list of permitted wells compiled from the State Engineer's Office, from a list of residents who contacted the Tri-County Health Department volunteering their wells for sampling, and from a later list of residents requesting connection to the SACWSD water supply system. Wells which penetrated only the alluvial aquifer, were located in areas of data deficiency and whose owners gave full permission were selected for sampling.

The sampling procedures followed at each site ensured collection of samples representative of the immediate ground water environmental and minimal cross-contamination of a sample. These procedures included pre-sampling well casing evacuation, immediate sample filtration or preservation if required, thorough equipment and personnel decontamination between sample sites, collection of field and decontamination blanks, and sample custody documentation. It should be noted that use of existing private wells provides additional opportunity for introduction of contaminants to the samples associated with a variety of materials in the well, pumping, and distribution systems, such as contact with solvent welded PVC pipe and casing. The specific field sampling, decontamination, and sample custody protocols are given in the RMA EPA Off-Post RI/FS Final Sampling and Analysis Plan (CDM, 1986c). Other quality control procedures used during sampling are contained in the Final Quality Assurance Project Plan for the

EPA Off-Post RI/FS study (CDM, 1985d). Appropriate personal health and safety procedures, also given in the Sampling and Analysis Plan, were followed throughout the field investigation.

The private wells which were selected for each sampling effort are given in the three Field Sampling Reports, submitted after each sampling effort was completed (CDM, 1986a,b,e). Also found in the Field Sampling Reports are the sample collection and quality assurance/quality control procedures followed, physical data for the wells, and appropriate sample custody forms. The location of the sampled wells are also found on Figure 3-1.

The field investigation discussed above resulted in the collection of ground water samples from 50 wells. The samples were sent to laboratories certified under the EPA Contract Laboratory Program (CLP). Chemical constituents tested for under CLP protocols are given in the Sampling and Analysis Plan (CDM, 1986c), and include a suite of volatile and semi-volatile organics, pesticides, metals, and anions. The specific chemical compounds and sampling results from the EPA RI/FS field investigation are given in Section 4.0 of this report. Thirteen additional wells were sampled and screened for presence of TCE and PCE in CDM's Close Support Laboratory Facility (CSF) in order to finalize site selection for future monitoring wells. These wells are identified on Figure 3-1 by a CSF prefix on the well I.D.

At this time, additional data gaps exist in the western tier of the Rocky Mountain Arsenal, in the north west portion of the EPA Off-Post RI/FS study area and in the area south of East 56th Avenue. Subsequent operable unit RI reports are expected to include pertinent new data for these areas.

3.2.2 DATA VALIDATION

REM II personnel performed data validation review of the data packages at a 100 percent level. This data validation task was performed in accordance with the EPA's CLP Draft Standard Operating Procedure (SOP) for Data Review which conforms to requirements in the National Contingency Plan. A synopsis of the review procedure follows:

1. The data package is checked for the presence of CLP Statement of Work or SAS solicitation required deliverables.
2. All pertinent formulae and calculations are checked.
3. Accurate transcription of the raw data to the QC summaries and data summary forms is verified.
4. All contract required QC parameters are checked and verified as meeting or exceeding contract impressed control limits, including but not limited to laboratory preparation blanks, duplicates samples, control samples, matrix spikes, and all instrument setup and operation checks. Where possible, the reviewer also notes the anedoted results of field QC samples to determine the presence and degree of blank contamination and/or duplicate precision.
5. Based on the review results, appropriate qualifiers are placed on data regarding their status in terms of contract compliance and potential usability.
6. A review summary is written and submitted in triplicate, along with triplicate copies of the data summaries, and the original data package to the Region VIII Deputy Project Officer (DPO) for approval and release of the data.
7. Upon approval of the review and release of the data by the DPO, the review and data are entered into the CDM document control system, along with a copy of the original data package.

3.3 MODELING STUDIES

The initial phases of a ground water flow and solute transport modeling effort were conducted during evaluations associated with the first operable unit remedial investigation. The role of modeling is to provide a rigorous means for organizing information and evaluating components of the complex hydrologic system underlying the study area. The objective of this modeling effort is not an exact duplication of the hydrologic system but rather a quantitative tool useful in obtaining answers of sufficient accuracy to provide guidance to the decision making process. The modeling efforts summarized in this document should be considered preliminary in nature and will be refined as additional data from on site monitoring well installations, source characterization, and other on-going studies become available. The modeling studies for this operable unit have focused on defining the geometry and characteristics of the alluvial aquifer system in order to quantify transport pathways that may affect public water supply wells in the future. No attempt has been made to allocate contributions of contaminants from individual sources to the observed contamination at the existing public wells. The purpose and explanation of the model simulations that relate to contaminant transport are discussed in Section 5.3. Methodology and background information for both the flow and solute transport models are presented below.

3.3.1 GROUND WATER FLOW MODELING

Modeling of ground water flow at the site was conducted using a CDM proprietary program called DYNFLOW, which is part of an integrated flow, transport, and display system. This program uses the Galerkin finite element formulation and is fully three-dimensional. This program is based on conventional equations of flow in porous media and can be used to simulate both steady state and transient responses to a number of different types of natural and artificial stresses. These natural and artificial stresses include recharge and discharge, induced stream infiltration, constant head boundaries, non-homogeneous and anisotropic aquifer hydraulic properties and stress dependent hydraulic properties. A mixture of one, two and three dimensional finite elements may be utilized to simulate complex systems. Both linear (confined) and non-linear (unconfined) flow equations are included, with the ability to handle the transition between confined and unconfined flow. The program code has been subject to extensive validation by comparison of model results with well defined analytical solutions to the same problems. This code and the companion solute transport code has also been subjected to an independent Quality Assurance verification by the International Ground Water Modeling Center at the Holcomb Research Institute at Butler University (Van der Heijde, 1985).

Extensive reporting of the model state is also available to the analyst during simulation to verify that an acceptable mass balance is present.

A model framework is developed based on a compilation of all existing information related to the physical framework, hydraulic properties, water table and potentiometric surface configuration, points of recharge and discharge and location of potential contaminant sources. A conceptual model describing the flow system in the study was formulated and extended to the numerical description necessary for conducting the simulation. This numerical system is discretized onto a three dimensional finite element grid. Discretization is done by layers at each node describing an element. Physical aquifer properties are assigned to each element and each layer. These properties include hydraulic conductivity in both horizontal and vertical directions, storativity (confined storage coefficient) and effective porosity. Recharge is also assigned at each element. Hydraulic boundary conditions are assigned to appropriate node locations to represent pumping locations. The geometry of the resulting grid mesh was developed based on boundaries, such as the South Platte River, and the location of anticipated ground water recharge and discharge points. Actual implementation of this model is described in Section 5.2 of this report.

3.3.2 GROUND WATER SOLUTE TRANSPORT MODELING

Solute transport evaluations were conducted using a companion code to DYNFLOW known as DYNTRACK. This program uses the same physical information as DYNFLOW plus three-dimensional ground water flow velocities calculated in the flow module. DYNTRACK uses the velocities and physical information to simulate contaminant movement either using single particle (advective) tracking or can model three-dimensional contaminant transport for conservative, first order decay constituents, or constituents subject to adsorbtion, with dispersion.

Single particle tracking can be used to follow the expected path of a conservative chemical constituent, to assess potential contaminant sources and to estimate contaminant travel times. For this operable unit, dispersion evaluations were utilized to assess future contaminant concentrations to be expected at public water supply wells, and will be used in future operable unit evaluations concerned with plume management and source remediation alternatives.

The method used in DYNTRACK for solute transport is the Lagrangian approach, which analyzes the variation in time and space of a fixed mass. This method has been implemented in DYNTRACK by using random-walk techniques for a statistically significant number of particles. Transport is simulated by incorporating a large number of particles at a source, each particle having a known mass, decay rate and retardation rate. Constituent concentrations can be determined at any time by summarizing the mass of particles that lie within a given volume of water. Dispersion is simulated by imparting a random deflection to the advective transport, based on the underlying probability density function described by lateral and transverse components of dispersion. The method has considerable advantages including inherent conservation of mass, stability over a wide range of velocities and dispersivities, and a lack of numerical solution problems such as prediction of negative concentrations common with other solution methods. The primary disadvantage lies in the somewhat irregular concentration patterns that can sometimes result. This is a relatively minor problem since excessive refinement of model results to a more aesthetically pleasing level does not lead to improved solutions. Field data has an underlying error and uncertainty, as do the complex natural flow paths that are simplified by necessity due to a lack of field data. The implementation of these methods on the site specific basis for this operable unit is presented in Section 5 of the report.

4.0 INVESTIGATION DATA PRESENTATION

The raw data collected during the EPA off-post RI/FS Field investigation discussed in Section 3.2 is presented in this section. In addition, ground water data collected by SACWSD at their supply and monitoring wells is presented in the form of data tables, and for TCE and PCE, in plots of contaminant concentration versus time. Raw data from other sources that have been used in the EPA off-post RI/FS contaminant assessment, such as the EPA FIT investigations and Army studies, is included in the Appendix or source documents are referenced, as appropriate.

Appendix A.1 lists the full results of the EPA Off-post RI/FS field investigation. Included in the appendix are the chemical compounds that were tested for, the analytical results and any data qualifiers assigned to a result during the data validation process. The definitions of the data qualifiers are found in Tables 4-1a and 4-1b. The sample locations for these data can be found on Figure 3-1. Appendix A.2 contains further compounds from these samples that were detected but could not be identified.

The data contained in Appendix A.1 is summarized in Table 4-2. This table contains organic analytical results only for compounds that were not detected in associated blanks, and were otherwise acceptable for use under EPA data validation criteria. Table 4-2 identifies the volatile, base/neutral/acid extractable and pesticide compounds detected for each sample; all named compounds from Appendix A.1 not listed in Table 4-2 were thus not detected in any EPA off-post RI/FS sample.

SACWSD municipal and monitoring well analytical results from samples collected by SACWSD are listed in Appendix A.3. The results shown in this table are organized in a manner identical to Appendix A.1. Sampling results found in Appendix A.3 cover the time period November, 1985 through May, 1986. Analytical results from samples collected prior to November

Table 4-1a

DEFINITION OF ORGANIC QUALIFIERS
Region 8

Code letters and associated definitions in the analysis summaries are provided below.

BDL - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

J - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

UB - Estimated sample quantitation limit increased. Amount found in sample reported. Compound detected at <5 X the amount in blank (<10 X for methylene chloride, acetone, toluene and phthalates).

UJ - Detection limit is estimated because quality control criteria were not met.

JB - The value is an estimated amount detected below required limits and also detected in the blank.

B - Compound was detected in the blank. Quantity reported is >5 X the amount found in the blank (>10 X for methylene chloride, acetone, toluene, and phthalates).

R - Quality Control indicates that data is not usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

Z - No analytical result.

N - Presumptive evidence of presence of material (tentative identification).

TABLE 4-1b

Definition of Inorganic Qualifiers

(R) = Rejected ('R' used by laboratory indicates recovery problems)
(J) = Estimated
(JHT) = Estimated due to holding time violation
(EJ) = Estimated due to interference problems (ICP serial dilution or no spike recovery by graphite furnace)
(JL) = Estimated due to exceeding ICP linear range
(U) = Undetected
(*) = Duplicate control limits exceeded
(*J) = Estimated due to duplicate control limits being exceeded
(JS) = Estimated due to spike recoveries outside limits
(JC) = Estimated due to instrument calibration problems

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	001	002*	003*	004	005	006	007	008
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	--	--	9.00	--	2.00 J	5.00	10.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	--	--	5.00	--	2.00 J	10.00	--
TRICHLOROETHENE	79-01-6	ug/l	--	--	--	68.00	3.00 J	12.00	55.00	92.00
TETRACHLOROETHENE	127-18-4	ug/l	--	--	--	5.00	--	3.00 J	12.00	4.00 J
1,1-DICHLOROETHENE	75-35-4	ug/l	--	--	--	2.00 J	--	--	5.00	2.00 J
1,1-DICHLOROETHANE	75-34-3	ug/l	--	--	--	3.00 J	--	2.00 J	6.00	2.00 J
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	3.00 J	0.30 J	10.00	0.30 J	0.40 J	0.50 J	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	5.00 J	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	1.00 J	--	--	--	--	--	0.50 J
PHENOL	108-95-2	ug/l	--	--	--	--	0.40 J	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, Z-ETHYL	104767	mg/l	--	--	--	500.00 J	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes. See Figure 3-1 for Sample Locations.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	009*	010	011	012	013	014*	015*	016*
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	10.00	--	1.00 J	1.00 J	--	--	--
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	58.00	3.00 J	3.00 J	3.00 J	--	--	--
TRICHLOROETHENE	79-01-6	ug/l	--	55.00	7.00	6.00	3.00 J	--	--	--
TETRACHLOROETHENE	127-18-4	ug/l	--	15.00	5.00	6.00	3.00 J	--	--	--
1,1-DICHLOROETHENE	75-35-4	ug/l	--	--	--	1.00 J	--	--	--	--
1,1-DICHLOROETHANE	75-34-3	ug/l	--	6.00	3.00 J	2.00 J	3.00 J	--	--	--
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	0.70 J	1.00 J	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	0.40 J	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	74.00	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	89.00	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	5.00 J	--
1-HEXANOL, 2-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

NOTES

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UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR 0 QUALIFIERS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022*	023	024
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	--	6.00 J	5.00	2.00	--	--	2.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	--	8.00 J	7.00	4.00 J	--	--	3.00 J
TRICHLOROETHENE	79-01-6	ug/l	3.00 J	3.00 J	10.00 J	12.00	5.00	--	--	5.00
TETRACHLOROETHENE	127-18-4	ug/l	--	--	8.00 J	8.00	5.00	--	--	3.00 J
1,1-DICHLOROETHENE	75-35-4	ug/l	--	--	3.00 J	3.00 J	--	--	--	1.00 J
1,1-DICHLOROETHANE	75-34-3	ug/l	--	--	7.00 J	6.00	5.00	--	1.00 J	2.00 J
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	1.00 J	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	--	--	--	--	1.00 J
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	2.00 J	--
PHENOL	108-95-2	ug/l	--	1.00 J	2.00 J	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	89.00 J	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, Z-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	0.79 J	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	0.01	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

NOTES

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UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	4.00 J	4.00 J	2.00 J	--	6.00	9.00	1.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	9.00	9.00	2.00 J	--	11.00	--	--
TRICHLOROETHENE	79-01-6	ug/l	5.00 J	39.00	38.00	19.00	5.00	22.00	6.00	13.00
TETRACHLOROETHENE	127-18-4	ug/l	1.00 J	11.00	11.00	1.00 J	1.00 J	15.00	2.00 J	3.00 J
1,1-DICHLOROETHENE	75-35-4	ug/l	--	5.00	5.00	--	--	7.00	3.00 J	2.00 J
1,1-DICHLOROETHANE	75-34-3	ug/l	--	5.00 J	5.00 J	--	--	8.00 J	14.00 J	--
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	1.00 J	1.00 J	--	--	2.00 J	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	4.00 JN	--	--	5.00 J	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, 2-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	0.01	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

NOTES

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ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040*
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	1.00 J	3.00 J	13.00	15.00	9.00	--	--	--
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	3.00 J	7.00	20.00	26.00	5.00	--	--	--
TRICHLOROETHENE	79-01-6	ug/l	6.00	8.00	23.00	91.00	48.00	--	--	--
TETRACHLOROETHENE	127-18-4	ug/l	3.00 J	5.00	17.00	15.00	2.00 J	--	--	--
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 J	3.00 J	9.00 J	11.00	2.00 J	--	--	--
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 J	4.00 J	10.00 J	10.00 J	--	--	--	--
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	1.00 J	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	1.00 J	--	--	--	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	10.00 J	8.00
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	2.00 J	--
PHENOL	108-95-2	ug/l	--	--	--	2.00 J	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, 2-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	1.00 J	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	0.02 J	0.02 J	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

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ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	041*	042*	043*	044*	045	046	047	048
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	--	--	--	5.00	1.00 J	--	10.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	--	--	--	5.00 J	3.00 J	3.00 J	6.00
TRICHLOROETHENE	79-01-6	ug/l	--	--	--	--	4.00 J	2.00 J	6.00	84.00
TETRACHLOROETHENE	127-18-4	ug/l	--	--	--	--	5.00	2.00 J	3.00 J	5.00
1,1-DICHLOROETHENE	75-35-4	ug/l	--	--	--	--	3.00 J	--	--	4.00 J
1,1-DICHLOROETHANE	75-34-3	ug/l	--	--	--	--	5.00	1.00 J	3.00 J	3.00 J
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	3.00 J	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	8.00	8.00	7.00	7.00	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	7.00 N	--	5.00 JN	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, 2-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

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SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	049	050*	051	052	053	054*	055	056
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	10.00	--	12.00	2.00 J	--	--	2.00 J	2.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 J	--	10.00	4.00 J	--	--	3.00 J	5.00
TRICHLOROETHENE	79-01-6	ug/l	86.00	--	88.00	7.00	1.00 J	--	7.00	34.00
TETRACHLOROETHENE	127-18-4	ug/l	6.00	--	9.00	5.00	2.00 J	--	3.00 J	1.00 J
1,1-DICHLOROETHENE	75-35-4	ug/l	4.00 J	--	5.00	1.00 J	--	--	--	--
1,1-DICHLOROETHANE	75-34-3	ug/l	3.00 J	--	4.00 J	3.00 J	--	--	--	--
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	11.00	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	1.00 J	3.00 J	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	1.00 J	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	6.00 J	--	3.00 JN	2.00 JN	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	11.00	--	--	7.00 J	2.00 J
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, Z-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	0.01	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

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SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	057*	058	059	060	061*	062	063	064
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	--	4.00 J	4.00 J	12.00	--	5.00	14.00	13.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	--	9.00	8.00	6.00	--	4.00 J	4.00 J	4.00 J
TRICHLOROETHENE	79-01-6	ug/l	--	33.00	15.00	53.00	--	38.00	120.00	120.00
TETRACHLOROETHENE	127-18-4	ug/l	--	12.00	11.00	5.00	--	3.00 J	1.00 J	1.00 J
1,1-DICHLOROETHENE	75-35-4	ug/l	--	5.00	4.00 J	--	--	--	--	--
1,1-DICHLOROETHANE	75-34-3	ug/l	--	6.00 J	6.00 J	--	--	--	--	--
CARBON TETRACHLORIDE	56-23-5	ug/l	--	--	--	--	--	--	--	--
TOLUENE	108-88-3	ug/l	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	--	--	--	--	--	--	--	--
VINYL CHLORIDE	75-01-4	ug/l	--	--	--	--	--	--	--	--
CHLOROFORM	67-66-3	ug/l	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	--	--	--	--	--	--	--	--
BENZENE	71-43-2	ug/l	--	--	--	--	--	--	--	--
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	2.00 J	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
1-HEXANOL, Z-ETHYL	104767	mg/l	--	--	--	--	--	--	--	--
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
ENDOSULFAN II	33213-65-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes. See Figure 3-1 for Sample Locations.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR B QUALIFIERS

COMPOUND NAME	CAS #	UNITS	065*	066	067	068	069	070*	071	072
VOLATILES										
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	---	2.00 J	---	1.00 J	2.00 J	---	---	5.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	---	---	---	3.00 J	4.00 J	---	2.00 J	6.00
TRICHLOROETHENE	79-01-6	ug/l	---	23.00	8.00	3.00 J	4.00 J	---	4.00 J	56.00
TETRACHLOROETHENE	127-18-4	ug/l	---	1.00 J	2.00 J	2.00 J	3.00 J	---	3.00 J	7.00
1,1-DICHLOROETHENE	75-35-4	ug/l	---	---	---	---	---	---	---	3.00 J
1,1-DICHLOROETHANE	75-34-3	ug/l	---	---	---	3.00 J	6.00	---	---	3.00 J
CARBON TETRACHLORIDE	56-23-5	ug/l	---	---	---	---	---	---	---	---
TOLUENE	108-88-3	ug/l	---	2.00 J	---	---	---	---	---	---
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	---	---	---	---	---	---	---	---
VINYL CHLORIDE	75-01-4	ug/l	---	---	---	---	---	---	---	---
CHLOROFORM	67-66-3	ug/l	---	---	---	---	---	---	---	---
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	---	---	---	---	---	---	---	---
BENZENE	71-43-2	ug/l	---	---	---	---	---	---	---	---
BASE /NEUTRAL/ACID EXTRACTABLE										
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	---	---	---	---	---	---	---	---
PHENOL	108-95-2	ug/l	---	---	---	---	---	---	---	---
DIETHYL PHTHALATE	84-66-2	ug/l	---	---	---	---	---	---	---	---
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	---	---	---	---	---	---	---	---
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	---	---	---	---	---	---	5.00 J	---
DIBROMOCHLOROPROPANE	96-12-18	ng/l	---	---	---	---	---	---	---	---
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	---	---	---	---	---	---	---	---
1-HEXANOL, Z-ETHYL	104767	mg/l	---	---	---	---	---	---	---	---
ANILINE	62-53-3	ug/l	---	---	---	---	---	---	---	---
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	---	---	---	---	---	---	---	---
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	---	---	---	---	---	---	---	---
DIELDRIN	60-57-1	ug/l	---	---	---	---	---	---	---	---
4,4-DDE	72-55-9	ug/l	---	0.02 J	---	---	---	---	---	---
ENDOSULFAN II	33213-65-9	ug/l	---	1.00	---	---	---	---	---	---
4,4-DDD	72-54-8	ug/l	---	1.00	---	---	---	---	---	---

NOTES

Compound Name = commonly used compound terminology.

Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes. See Figure 3-1 for Sample Locations.

CAS # = standardize compound definition in Chemical Abstracts.

RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

TABLE 4-2
SUMMARY OF HITS
RMA ORGANIC CONTAMINANTS WITHOUT U, R, OR 0 QUALIFIERS

COMPOUND NAME	CAS #	UNITS	073	074*	075*	076
VOLATILES						
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	13.00	—	—	16.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	17.00	—	—	25.00 J
TRICHLOROETHENE	79-01-6	ug/l	16.00	—	—	110.00
TETRACHLOROETHENE	127-18-4	ug/l	16.00	—	—	21.00
1,1-DICHLOROETHENE	75-35-4	ug/l	7.00	—	—	11.00
1,1-DICHLOROETHANE	75-34-3	ug/l	10.00	—	—	11.00
CARBON TETRACHLORIDE	56-23-5	ug/l	—	—	—	—
TOLUENE	108-88-3	ug/l	—	—	—	—
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	—	—	—	—
VINYL CHLORIDE	75-01-4	ug/l	1.00 J	—	—	2.00 J
CHLOROFORM	67-66-3	ug/l	—	—	—	—
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	—	—	—	—
BENZENE	71-43-2	ug/l	—	—	—	—
BASE /NEUTRAL/ACID EXTRACTABLE						
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	—	—	—	—
PHENOL	108-95-2	ug/l	—	—	—	—
DIETHYL PHTHALATE	84-66-2	ug/l	—	—	—	—
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	—	—	—	—
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	2.00 J	3.00 J	—	3.00 J
DIBROMOCHLOROPROPANE	96-12-18	ng/l	—	—	—	—
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	—	—	—	—
1-HEXANOL, 2-ETHYL	104767	mg/l	—	—	—	—
ANILINE	62-53-3	ug/l	—	—	—	—
PESTICIDES						
ALPHA-BHC	319-84-6	ug/l	—	—	—	—
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	—	—	—	—
DIELDRIN	60-57-1	ug/l	—	—	—	—
4,4-DDE	72-55-9	ug/l	—	—	—	—
ENDOSULFAN II	33213-65-9	ug/l	—	—	—	—
4,4-DDD	72-54-8	ug/l	—	—	—	—

NOTES

Compound Name = commonly used compound terminology.

Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes. See Figure 3-1 for Sample Locations.

CAS # = standardize compound definition in Chemical Abstracts.

RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

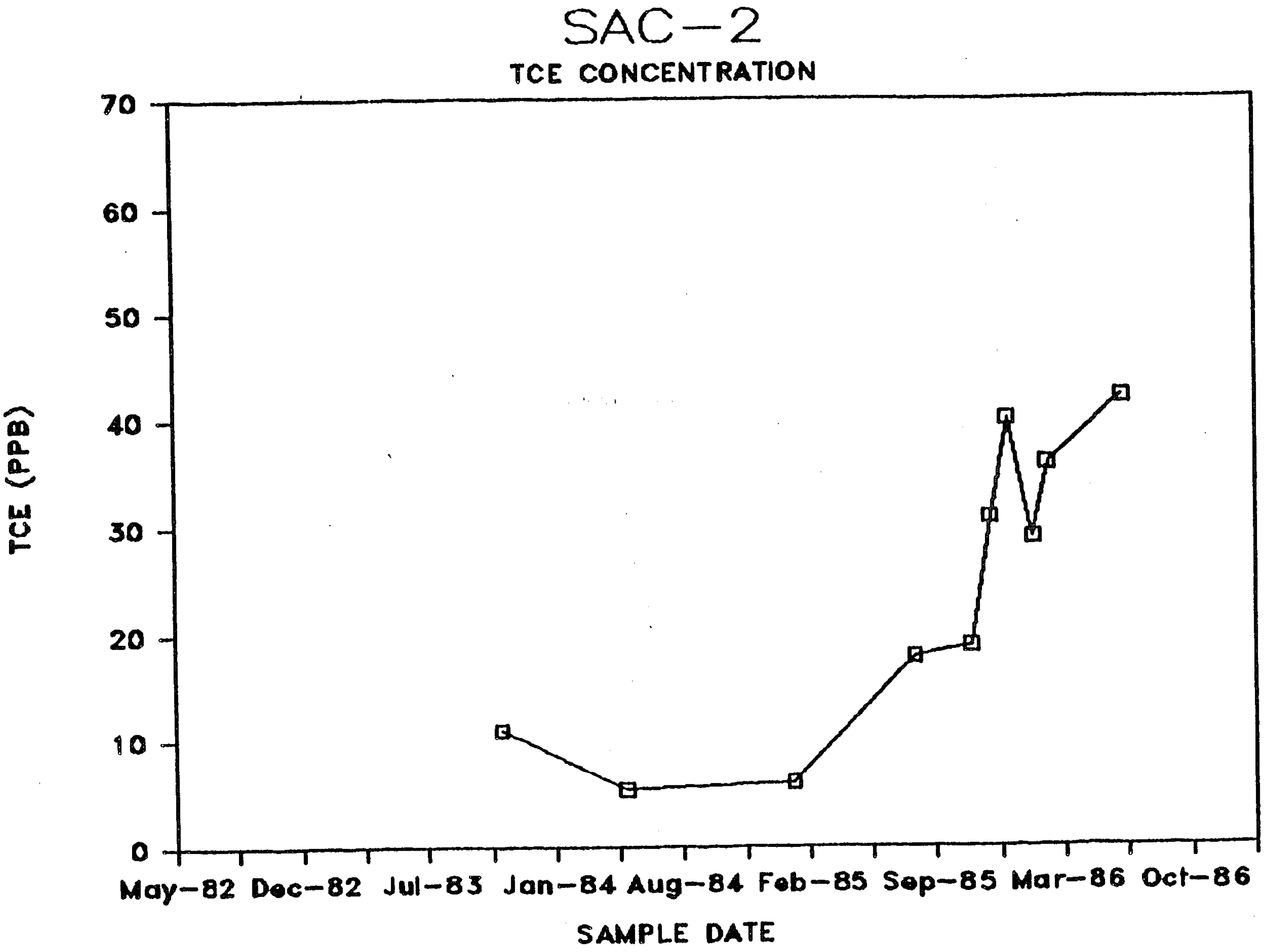
ug/l = micrograms/liter

mg/l = milligrams/liter

1985 can be found in various reports (E&E, 1983; HRS, 1984). It should be noted that the raw data in Appendix A.3 have not undergone data validation according to EPA procedures and no attempt at detection of non-target compounds was made by the laboratory. The SACWSD analytical results should therefore not be given the same credence as the EPA off-post RI/FS data. The results in Appendix A.3, however, do appear to be consistent with the RI/FS analytical results.

The SACWSD municipal and monitoring wells have been sampled periodically by SACWSD since August, 1982 and November, 1985, respectively. By comparing the analytical results at an individual well that has been sampled on numerous occasions, it is possible to identify trends in contaminant concentrations through time. Time trends graphs for TCE and PCE at each of the SACWSD municipal and monitoring wells were prepared and are presented in Appendix B. These graphs present contaminant (TCE or PCE) concentration plotted against sample date. An example of the time trend plots is presented in Figure 4-1, in which TCE concentrations are depicted for SACWSD municipal well #2. Locations of each of the wells for which time trend plots appear are shown on Figure 3-1 by the SACWSD well symbol. Consistent time and concentration scales were used to facilitate comparison between trends at different wells.

Other data used in the current first operable unit contaminant assessment includes RMA on-post sampling results (USATHAMA, 1985; 1986), Army off-post results (ESE, 1985b), and sampling data from several EPA FIT investigations (E&E, 1985a; 1985g; 1986b; 1986d). Additional data, collected in association with the EPA Sand Creek RI/FS study in May 1986, and available through the EPA-Denver offices, were also used in the contaminant assessment. Data from the FIT and Sand Creek sources has been subject to EPA quality assurance review. Data from Army studies has passed their internal quality control and quality assurance criteria which are similar to those used by the EPA.


SAC-2

TCE CONCENTRATION

Figure 4-1

5.0 INVESTIGATIVE ANALYSIS

5.1 SUMMARY

The overall objective of the EPA Off-Post RI first operable unit investigative analysis was to characterize the hydrogeologic system and quantify ground water flow and contaminant transport processes. All existing information was utilized in developing the hydrogeologic framework to aid in the understanding of the future levels of contaminants migrating toward existing public water wells. At the present time, the EPA is unable to characterize the source or sources which contribute contamination to the study area. Investigations are currently underway by the EPA and others, however, to identify and characterize the source areas which have affected ground water quality within the study area.

The chemical compounds consistently present in ground water in the study area which could pose a significant health threat are identified in Section 6 of this report. These compounds are 1,1-dichloroethene (DCE), 1,1-dichloroethane (DCA), trans-1,2-dichloroethene (trans-DCE), 1,1,1-trichloroethane (TCA), trichloroethene (TCE) and tetrachloroethene (PCE). Each of these compounds are in the class of volatile organic chemicals known as halogenated hydrocarbons. They are considered to be of primary concern due to their consistent spatial occurrence, relative concentration in ground water in the study area and potential health risk, as discussed elsewhere in this report. Two of the compounds, DCE and TCE, currently exceed the applicable or relevant and appropriate Federal standards or advisories discussed in Section 2.3 at one or more SACWSD production wells.

Benzene, another highly mobile volatile organic compound, is also of concern. Although it was not detected in any of the ground water samples collected during the EPA Off-Post RI/FS study, high concentrations of benzene have been detected in ground water near the Sand Creek Industrial site and on the RMA. Both areas where benzene have been detected are hydrologically upgradient of receptors within the EPA study area.

There are other compounds present at low concentrations in ground water in the study area in addition to the seven volatile organic contaminants indicated above. These include other volatiles, some semi-volatile compounds, such as phthalates, and certain pesticides. Based on the EPA Off-Post RI/FS, EPA FIT and SACWSD ground water sampling results and as discussed in Section 6 of this report, the additional organic compounds present are not expected to pose a threat to human health. This is due to their sporadic distribution and generally low concentrations. Two of the volatile compounds (carbon tetrachloride and vinyl chloride) did, however, exceed the applicable or relevant and appropriate Federal standards or advisories discussed in Section 2.3. Vinyl chloride has been detected in the study area, but not in SACWSD production wells. However, the use of turbine pumps for sample collection makes this absence uncertain. Vinyl chloride concentrations south of the study area at the eastern end of the Sand Creek Industrial site suggest that biodegradation of TCE to vinyl chloride may be taking place in the aquifer. A large number of tentatively identified compounds were reported in the data set. These compounds were identified by matching retention times and mass spectra against peaks appearing that did not correspond to those compounds that were specifically analyzed for. Most of these tentatively identified compounds are likely due to presence of solvent welded casing or pipe in the sampled wells, and local recharge from septic tank leach fields. There are no inorganic compounds present in the ground water in the study area which are considered to pose any health risk. There were no compounds found from the EPA Off-Post RI/FS sampling program that were detected above the EPA contract required laboratory detection limits for RMA-specific contaminants such as DBCP, DCPD, or DIMP. Of this group, only DBCP has been detected on-post in areas upgradient of the EPA study area.

Source areas for the seven contaminants of concern discussed above have not been identified at this time. Analysis of the distribution of these contaminants, presented in Section 5.3, indicates that there has been some migration of the compounds. Potential contaminant migration pathways were identified using six volatile compounds (DCA, DCE, trans-DCE, TCA, TCE and PCE) as indicator chemicals. Concentration point maps were developed for each of these compounds using the most recently available data. Interpretations from these maps show prominent contamination plumes which are oriented parallel to the existing ground water flow system and which are also upgradient of existing receptors within the study area. One contaminant plume is from the south/southeast oriented towards the north; two other plumes originate from the RMA and are oriented towards the north to northwest.

There are currently no natural or man-made barriers present to prevent the principal contamination plumes from migrating further in the downgradient direction in areas outside the boundaries of the RMA. There are three ground water interception/treatment systems present on the RMA. Two of these containment systems are located on the north and northwest boundaries of the RMA and thus are not upgradient of the EPA Off-Post RI/FS study area. The Irondale system, which is located near the northeast corner of the study area, may intercept a portion of the volatile organic contaminant plumes migrating in the west tier of the RMA.

A fully three-dimensional flow and solute transport model was tentatively calibrated and used for preliminary projections of future contaminant concentrations at receptors. Results of this analysis indicate that movement of the plumes will result in a peak concentration between 100 to 120 ppb of TCE within 10-15 years from the present time, based on current estimates of concentrations at the 77th Street well field. The companion FS report evaluates options for treating the public water supply, based on the current best conservative estimate of 150 ppb future TCE levels. Major data gaps prevent full characterization of the complex contaminant transport processes at the current time. Of particular importance is the sensitivity of the model to hydraulic properties along the paleo channels which are potentially major contaminant pathways, the currently undefined hydraulic connection between Sand Creek and the alluvial aquifer and potential adsorption mechanisms active in the aquifer. Additionally, inadequate source identification and characterization both on and off the Arsenal precludes high reliability estimates of future concentrations.

5.2 HYDROGEOLOGIC FRAMEWORK

Several comprehensive studies of the geology and hydrology of the RI/FS off-post study area and adjacent areas have been completed in the past by various investigators, and have been used extensively in formulating the conceptual hydrogeologic model described herein. A summary of the geology and ground water resources of the area is available in USGS Water Supply Paper 1658 (Smith,et. al., 1964). This publication describes the geology and hydrology of the South Platte Valley deposits and adjacent thick alluvial deposits. Additional detailed maps depicting water levels and bedrock surface in the reach of the South Platte adjacent to and north of the current study area are presented in a USGS Open File report (#72-332) (Hurr, et. al., 1972). Information on the regional hydrogeology of bedrock aquifers of the Denver Basin is summarized in Robson and Romero (1981a). A surficial geologic map covering the current study area was published by Lindvall (1980). Extensive information on geology and hydrology from studies conducted on the RMA are available; two comprehensive reviews that include much of the relevant knowledge of hydrologic systems on the RMA are presented in May (1982b) and in Stollar (1981). The following sections describe the conceptual hydrogeologic framework of the site and specific data sources utilized in the extension of this conceptual framework to the numerical modeling.

Bedrock Hydrogeology

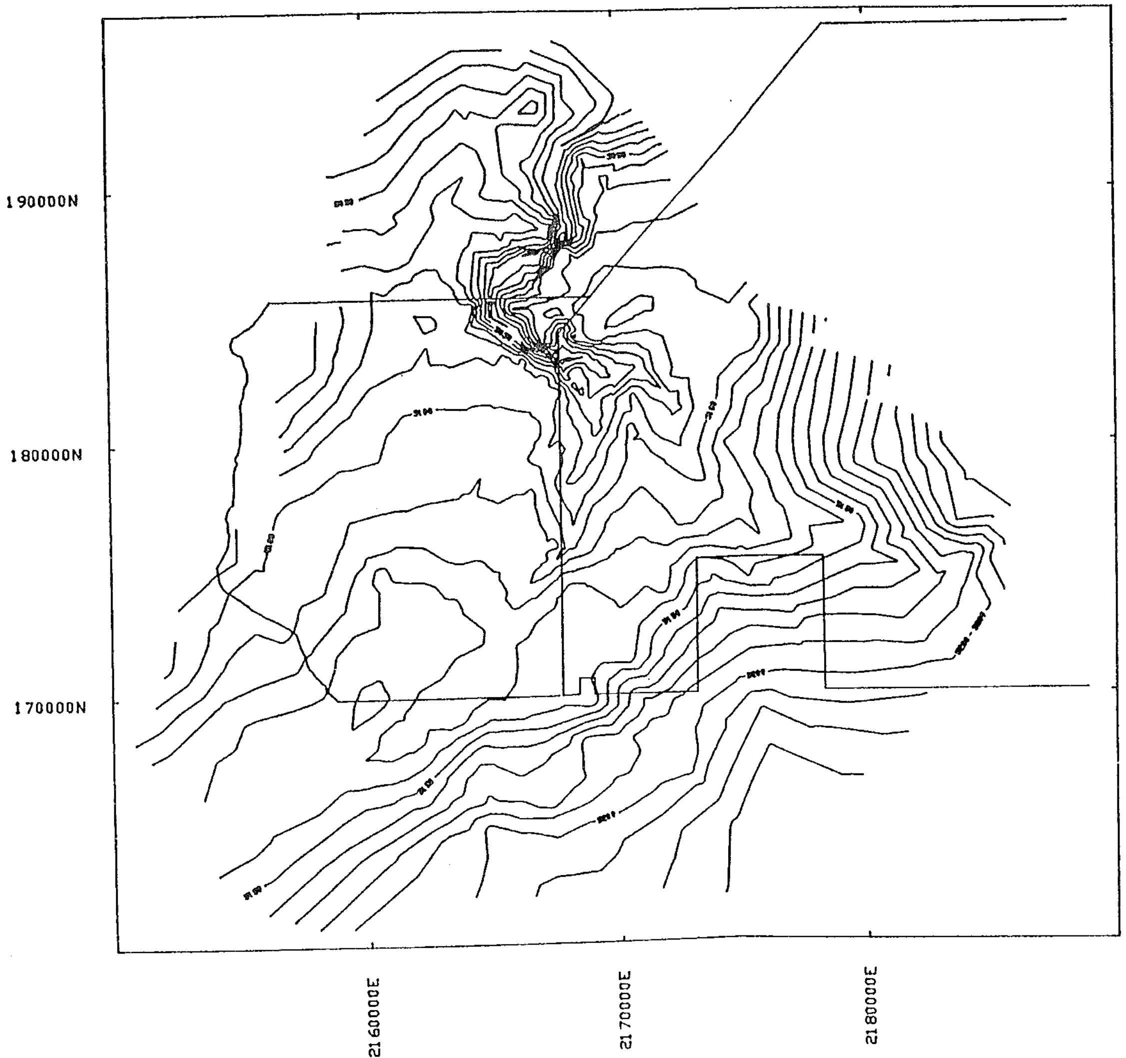
As summarized in section 2.1.1 of this report, the study area is underlain by two important bedrock aquifers of regional significance. The most prolific of these is the Arapahoe Formation. This unit is up to about 700 feet in total thickness, with the productive sands comprising only a portion of this thickness. The elevation of the top of the Arapahoe averages about 4800 feet in the study area. Overlying the Arapahoe Formation is the Denver Formation. This unit occurs from the top of the Arapahoe to the base of the alluvial deposits and is 600 to 1,000 feet in thickness where it has not been eroded in other parts of the Denver Basin (Robson and Romero, 1981b). Productive units within the Denver are located in lenticular sandstone bodies of variable areal extent. Investigations on the RMA suggest individual sandstone lenses may be traced over a several mile distance. Since the primary pathway for contamination migration lies in the alluvial deposits, detailed bedrock aquifer assessments have not been conducted for this operable unit evaluation. Little reliable information is available within the study area from detailed lithologic or geophysical logging of wells in the Denver Formation. Further bedrock data will be collected for subsequent operable units, if necessary.

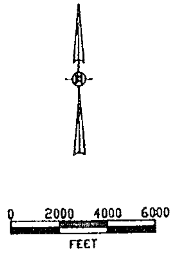
Alluvial Aquifer Hydrogeology

The portion of the aquifer of primary concern for purposes of this operable unit RI is within alluvial deposits filling paleo-channels eroded in the bedrock surface. The channel-fill deposits are coarse and relatively thick and thus contain much of the ground water flow within the alluvium. A lesser amount of flow takes place in the thinner terrace sand and gravel deposits adjacent to these paleo-channels. These channels were formed during periods of rapid tectonic uplift in the region, by downcutting and erosion of the ancestoral South Platte and its tributaries. Extensive stream piracy was occurring during this time period that resulted in major shifts in the location of the main trunk of these drainages (Smith, et al., 1964). Subsequent changes in base levels of the early streams over time resulted in extensive infilling of these valleys with sediment and, in some cases, migration of present streams away from the location of the ancient valleys.

The alluvial aquifer hydrology within the study area is dominated by two paleo-channels, a north-south trending channel near Quebec Street, and another tributary which traverses the RMA that joins the north-south trending channel near the SACWSD well field located at 77th and Quebec. Figure 5-1 illustrates the configuration of the elevation of the bedrock surface within the model area and shows the location of these channels based on available data and professional judgement. Figure 5-2 shows the location of control points of variable reliability used to develop this contour map of bedrock elevation. These control points include all available monitor wells, borings, productions wells, and private wells with logs indicating that bedrock was encountered. It should be noted that many of these logs are from records of private water wells on file with the Colorado State Engineers office. In many cases these wells have only very general geologic logs, and somewhat uncertain locations for many of the older wells. The records that were used in these assessments were those judged to be the most reliable. None of these records from the State private well data base, however, can be considered as validated information under the quality assurance criteria for geologic data, since in most cases the logs were developed by the drilling contractors rather than by geologists or engineers. Because of the degree of uncertainty in geologic information from some of these wells, professional judgment was used in development of the contour map presented in Figure 5-1.

In order to evaluate the three-dimensional configuration of individual units within the alluvial deposits, a series of four north-south and five east-west geologic cross-sections were developed using the most reliable of the lithologic logs available in the area. The location of these control points and the path of the nine cross-sections is shown on Figure 5-3. These cross sections were developed by first selecting lithologic logs that were developed by engineers or geologists, and supplementing these where necessary for additional control, with logs from the State private wells data base that had sufficient detail to suggest careful logging was conducted during drilling. Incomplete logs, or logs with questionable locations were not used in the assessments. Strip logs were then prepared





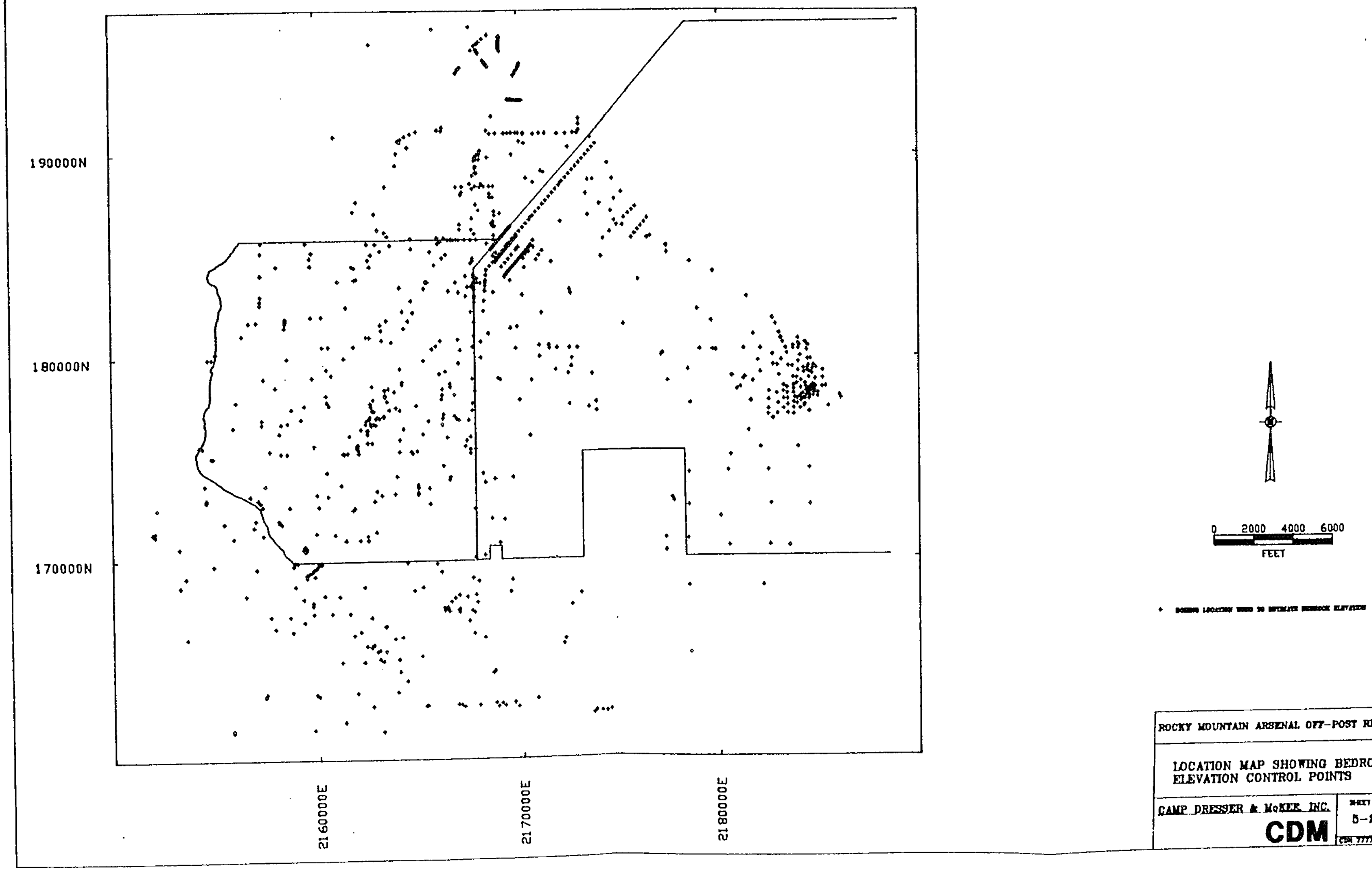
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

ELEVATION OF BEDROCK SURFACE

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-1



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

LOCATION MAP SHOWING BEDROCK
ELEVATION CONTROL POINTS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-2

CDM 7777-190

and plotted to develop correlations and to develop simplified unit descriptions. As an additional check, logs that were inconsistent with adjacent data were discarded from the sections. The simplified geologic descriptions selected during this stage and the codes shown on the cross-sections are identified on Table 5-1. These simplified geologic cross-sections are presented as Figures 5-4 through 5-12 which are sections N-1 through N-4 and E-1 through E-5, respectively. These sections present materials only to the bedrock surface due to the lack of reliable information on the lithology of bedrock.

Several important aspects should be noted from the cross-sections. The configurations of the paleo-channels are shown very well, particularly on sections N-3 and E-2. The east-west cross-sections also show the terraced nature of the bedrock surface. The basal unit in the alluvium in almost all cases is gravel or a sand and gravel mixture, even on the bedrock highs separating the paleo-channels. This basal unit is the most important unit in evaluating both the flow system and transport of contaminants because of its relatively high permeability and lateral continuity and because, as discussed in Section 2.2.2, the volatile organic contaminants are likely to migrate into the lower portions of the aquifer. There is less consistency of lithologies overlying the basal gravel unit, although correlation of the overlying units is possible. The overlying units typically are fine-grained with a transitional change to interbedded fine and coarse grain sediments. The uppermost units through much of the study area consist of eaolian sands.

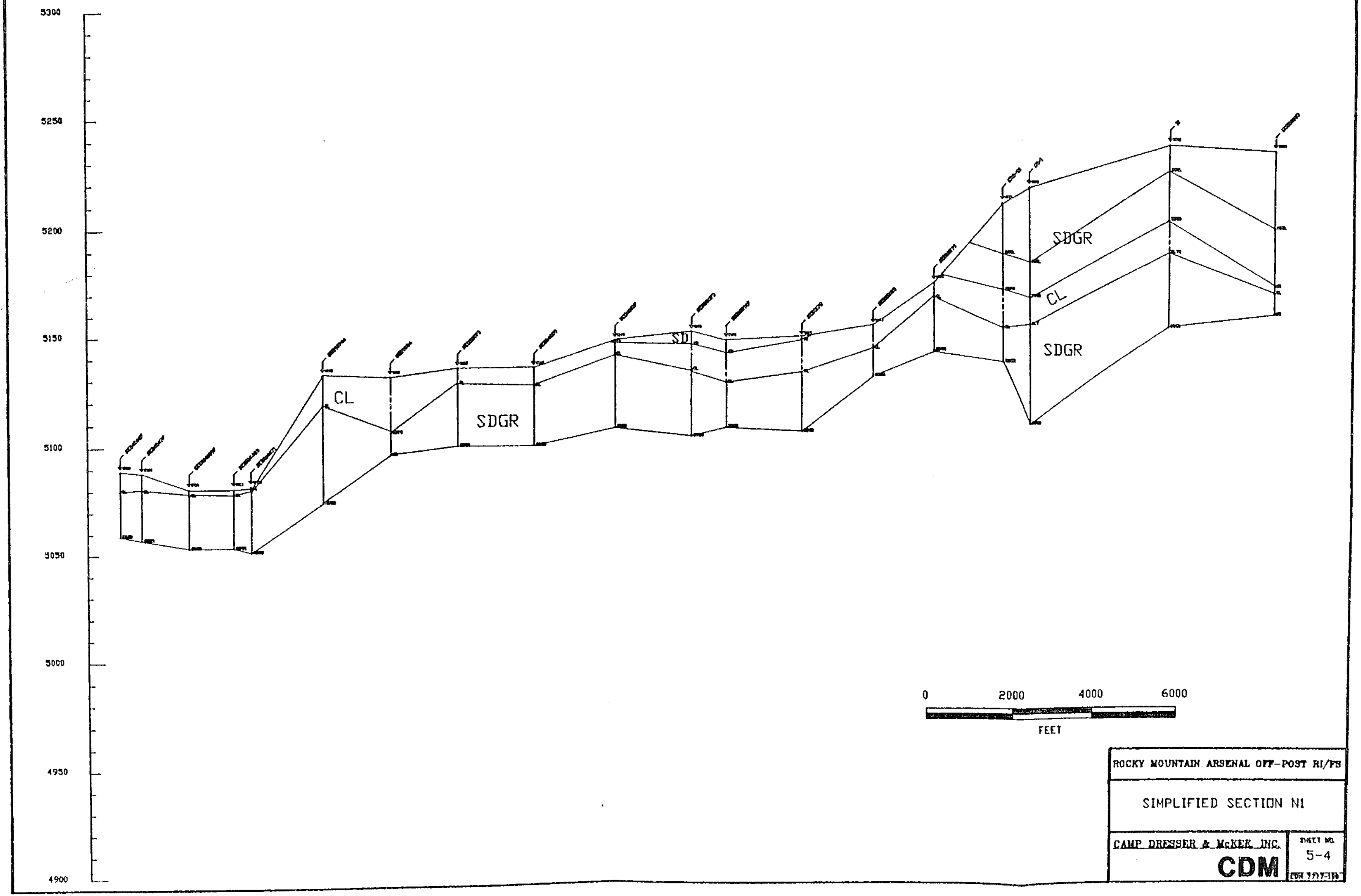
Alluvial Aquifer Hydraulic Characteristics

A major hydraulic parameter of concern in any evaluation of contaminant transport pathways is the hydraulic conductivity of the material through which the contaminants are moving. Four formal aquifer tests have been conducted in and adjacent to the study area, either by the SACWSD or the RMA. In addition, a test was attempted at the SACWSD production well SAC-18 located at 84th and Quebec. During pumping of this well at a rate of 4000

TABLE 5-1

DEFINITIONS OF SYMBOLS APPEARING ON SIMPLIFIED CROSS SECTIONS

Symbol	Corresponding Lithology
CL	Clay
CLGR	Clay and gravel, interbedded
GR	Gravel
SD	Sand
SDCL	Sand and clay, interbedded
SDGR	Sand and gravel, interbedded
SDYC	Sandy clay

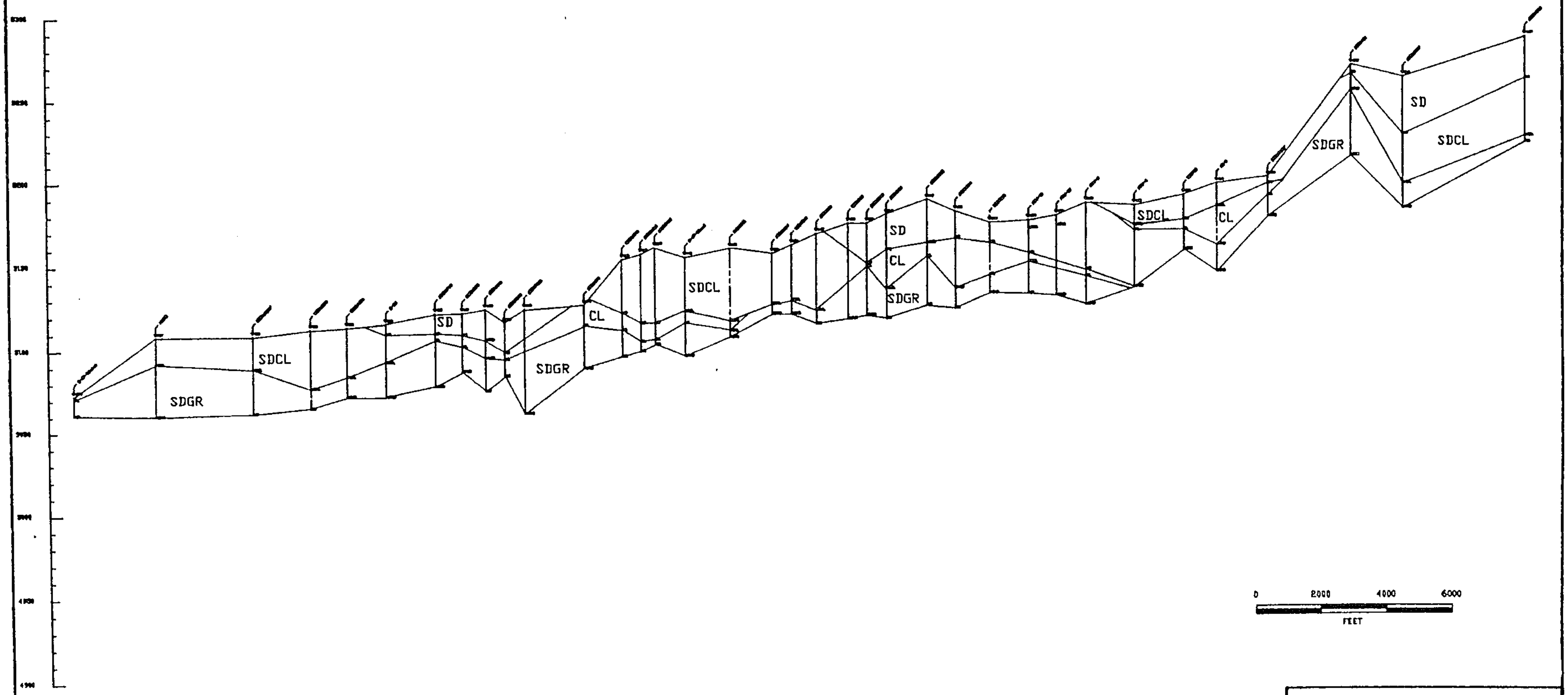


ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION N1

CAMP DRESSER & McKEE INC.
CDM

SHEET NO.
5-4



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

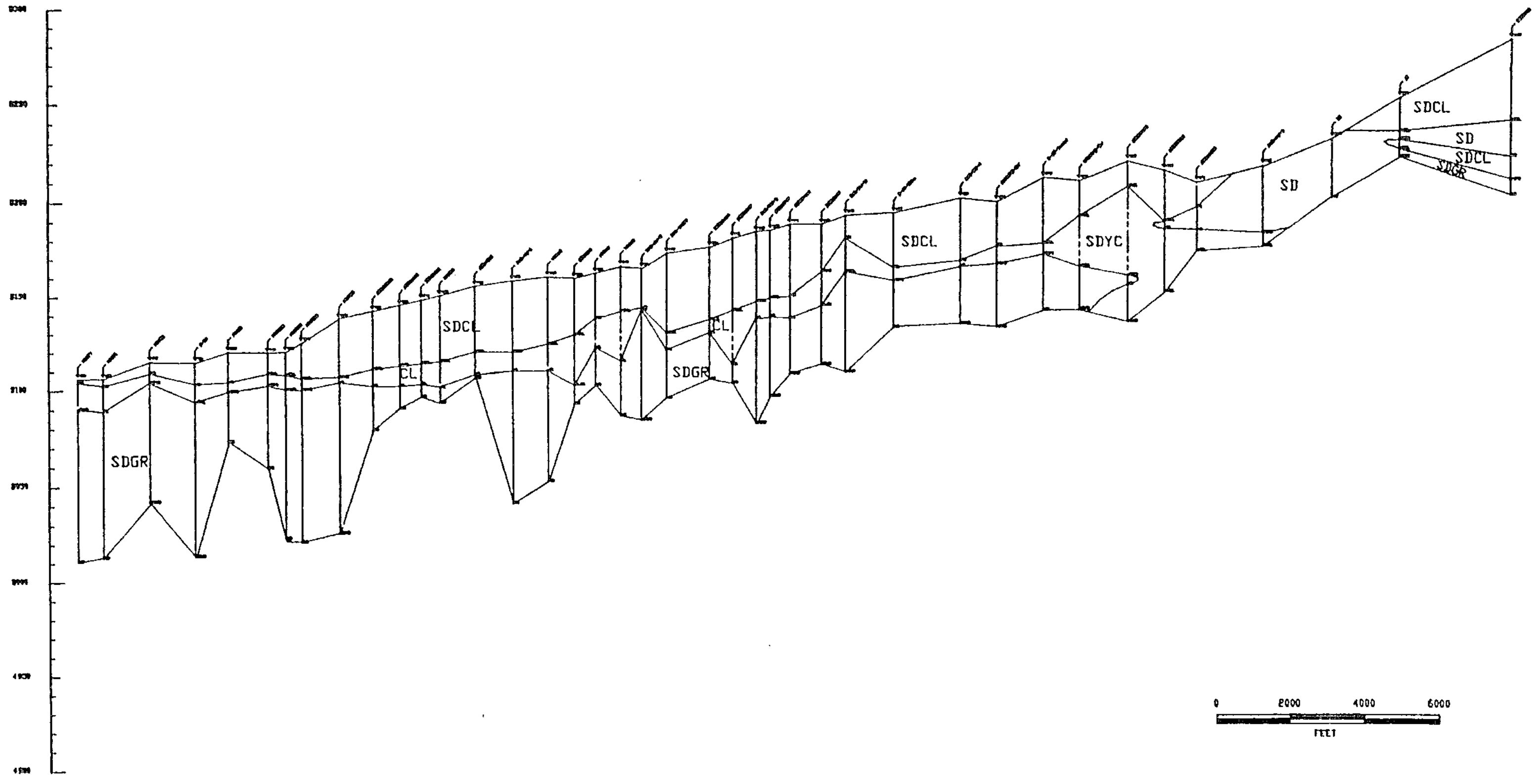
SIMPLIFIED SECTION N2

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-5

CDM 7777-190



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

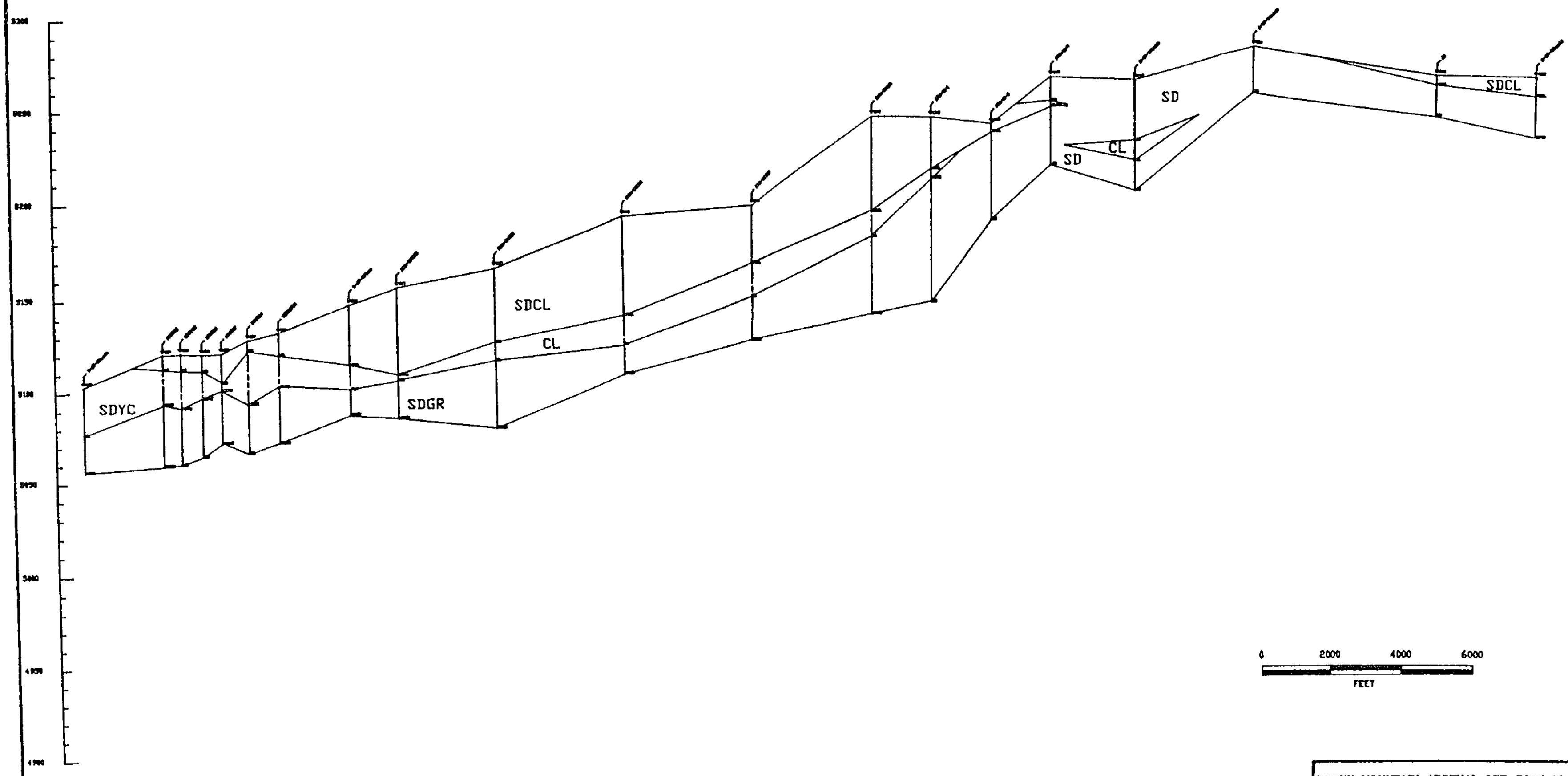
SIMPLIFIED SECTION N3

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-6

CDN 7797-198



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

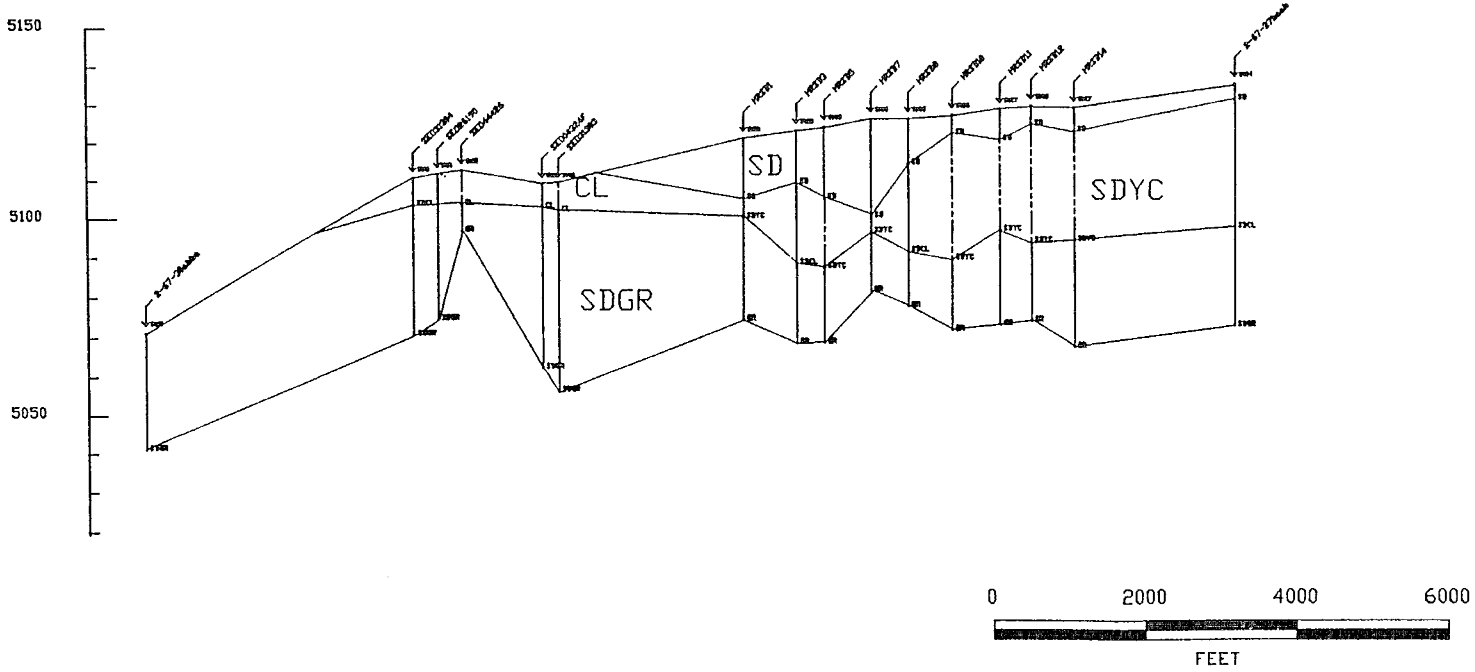
SIMPLIFIED SECTION N4

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-7

CDM 7/07-1987



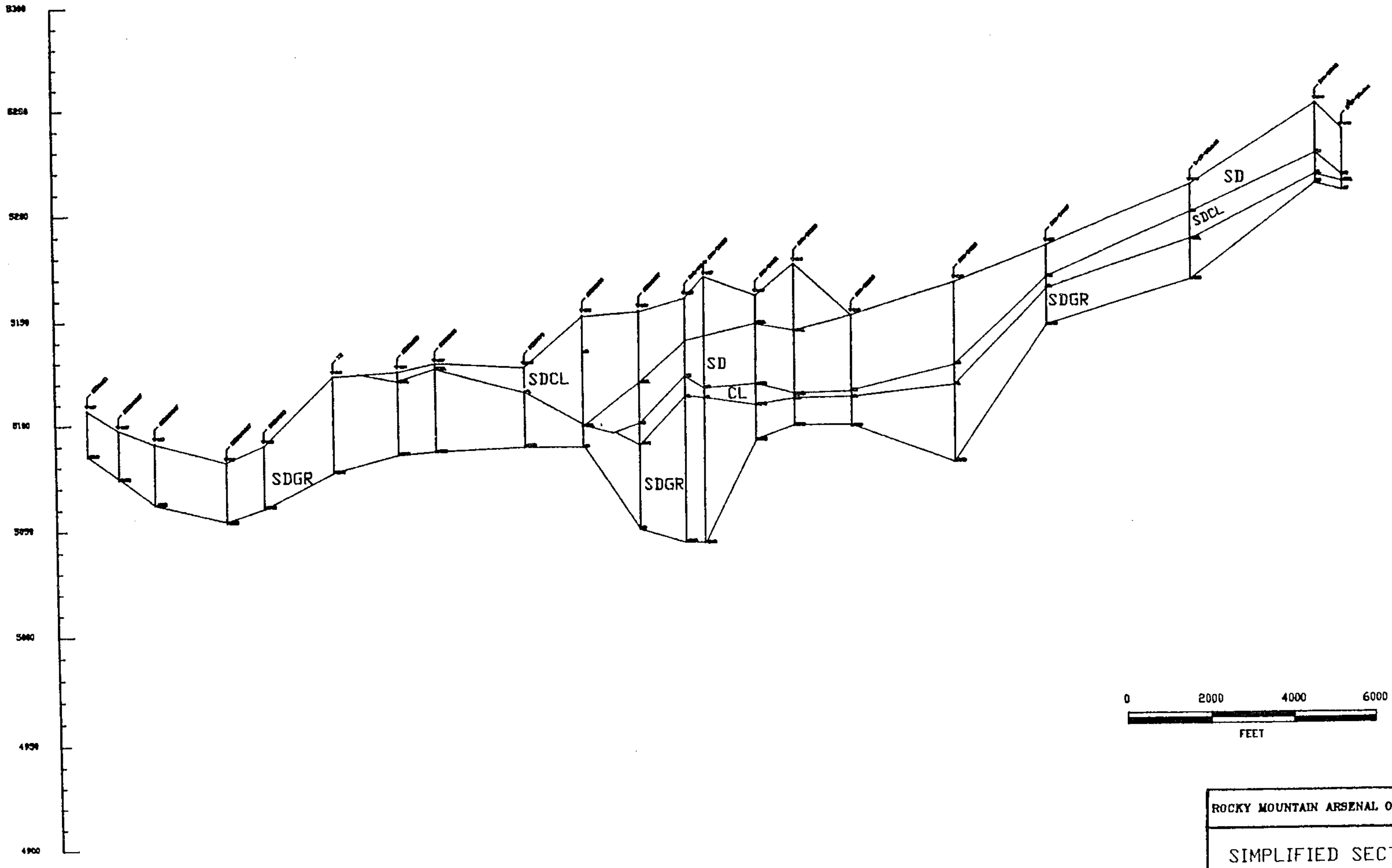
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION E1

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-8



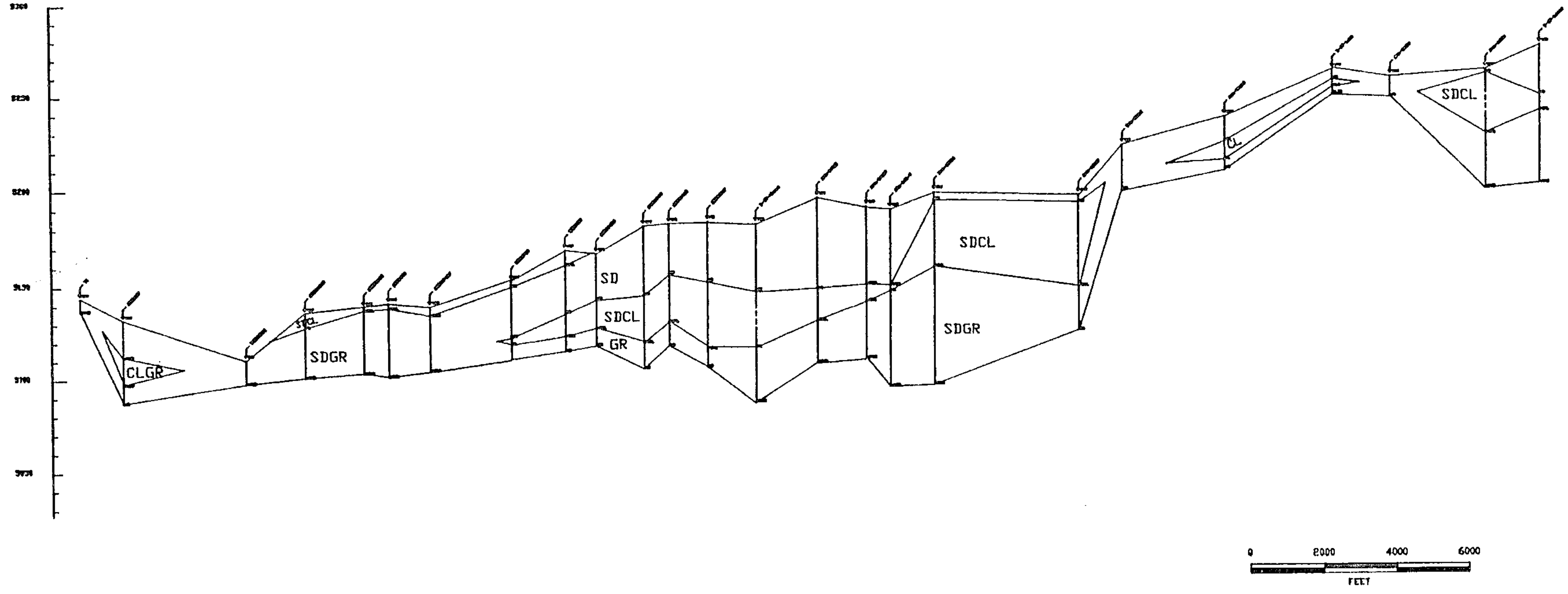
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION E2

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-9



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION E3

CAMP DRESSER & McKEE INC.
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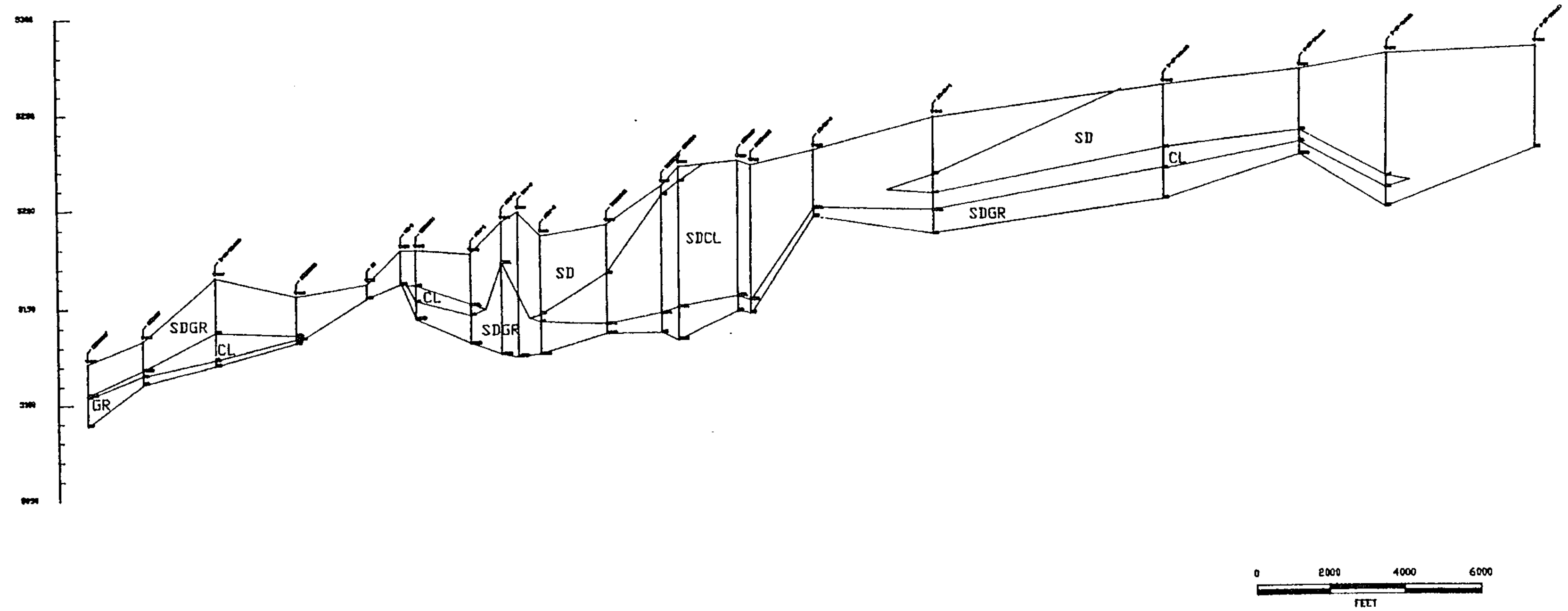
CDM 7777-190



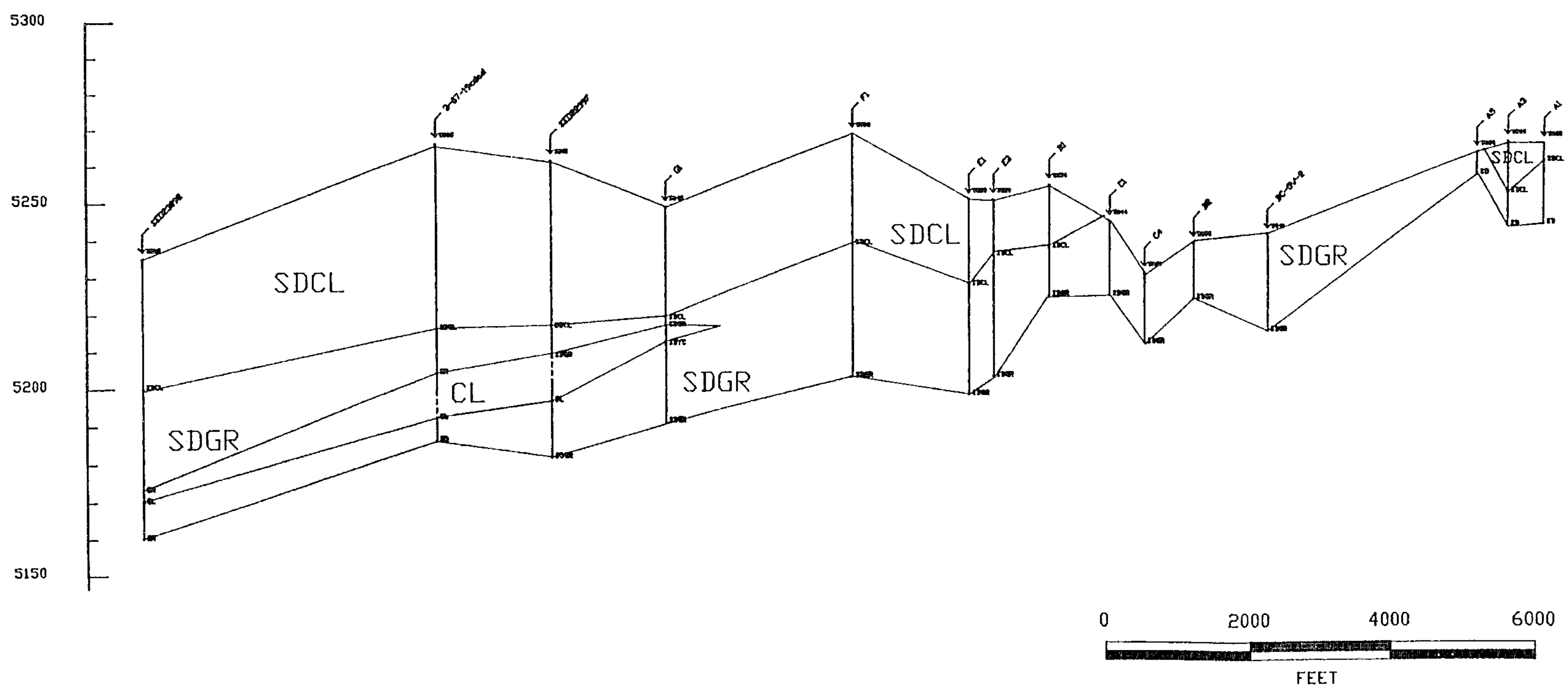
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION E4

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-11



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

SIMPLIFIED SECTION E5

CAMP DRESSER & McKEE INC.

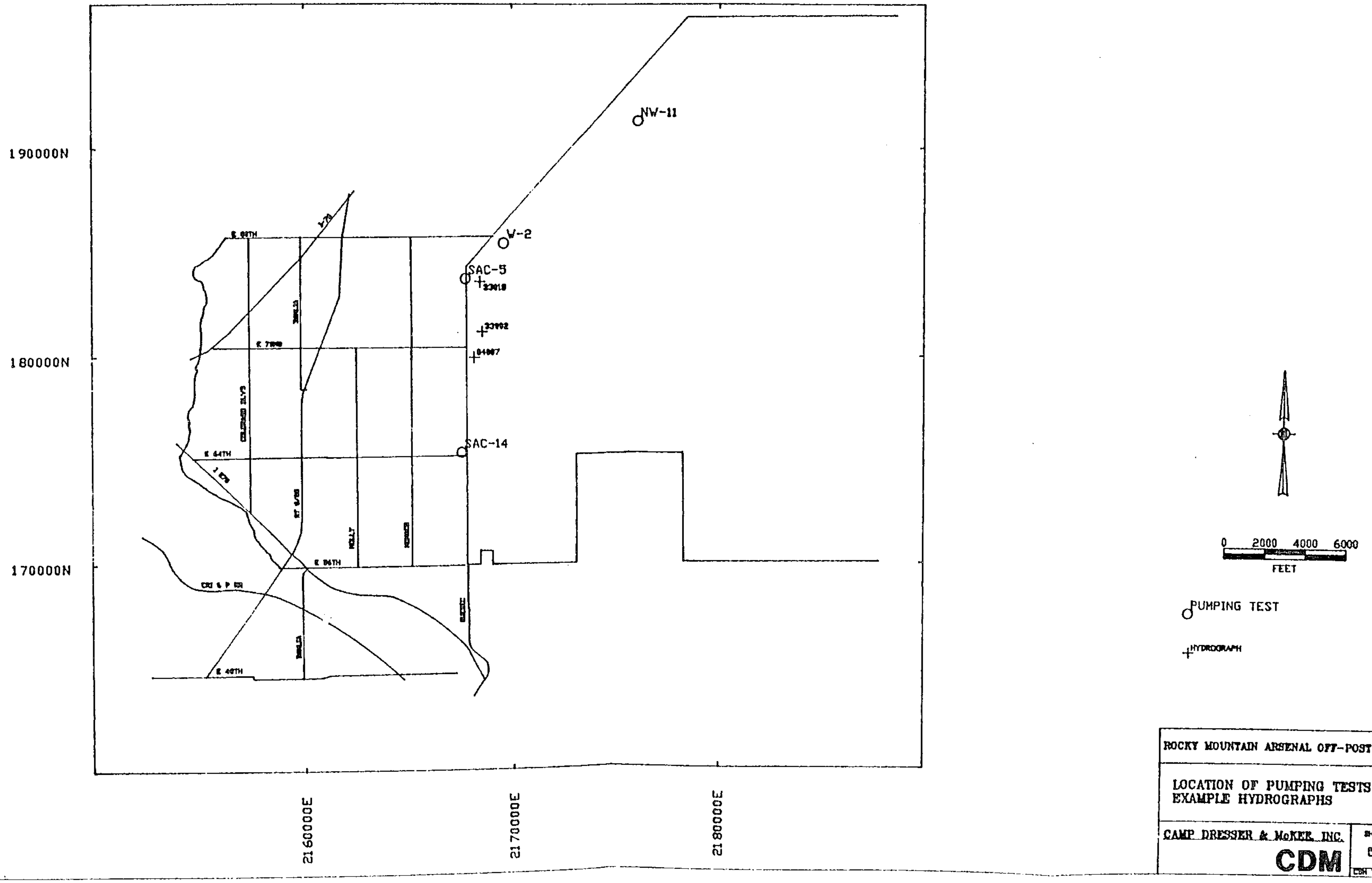
CDM

SHEET NO.
5-12

gallons per minute, no drawdown was observed at a nearby observation well during the term of the test (Larry Ford, SACWSD manager, personal communication). Figure 5-13 shows the location of wells for which formal tests have been conducted and for which values of aquifer properties such as transmissivity, hydraulic conductivity, and storage coefficient have been calculated. Nearly all of these tests have been conducted in wells located within the prolific basal alluvial channel gravel deposits. Table 5-2 summarizes the range of calculated hydraulic parameters estimated from these tests. Significant variability is present in this data, with reported hydraulic conductivities ranging from 230 to 5625 ft/day. The most likely range is estimated to be from 400 to 900 ft/day based on the above data. None of the tests were able to develop full drainage conditions that would allow accurate determination of specific yield of the aquifer, which is the storage coefficient under water table conditions. The specific yield is therefore estimated to be about 20% for the channel gravel deposits. No information on the properties of upland terrace sands and gravels is available.

Alluvial Aquifer Water Table Configuration

Determination of the configuration of the water table is estimated from point measurements taken at wells completed in the alluvial aquifer. The most complete data set for the area is for May, 1984 (HRS, 1985). Measurements at 85 wells in the RI/FS study area, plus all wells in the on-post monitoring program are available for this time period. Over 300 wells are available to describe the water table configuration as shown on Figure 5-14. In addition, data from recently installed monitoring wells were incorporated to refine the estimated water table elevation. Data from most of the on-post wells is based on surveyed well-head elevations, while most of the off-post well-head elevation data has not been surveyed, but is based instead on estimates from the US Geological Survey topographic maps. The indicated accuracy in the elevations for the non-surveyed wells is thus ± 5 feet. Figure 5-15 presents the water table elevation for the May 1984 time period and updated with the more recent data. Figure 5-15 indicates a



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

LOCATION OF PUMPING TESTS AND
EXAMPLE HYDROGRAPHS

CAMP DRESSER & McKEE INC.
CDM

SHEET NO.
5-13

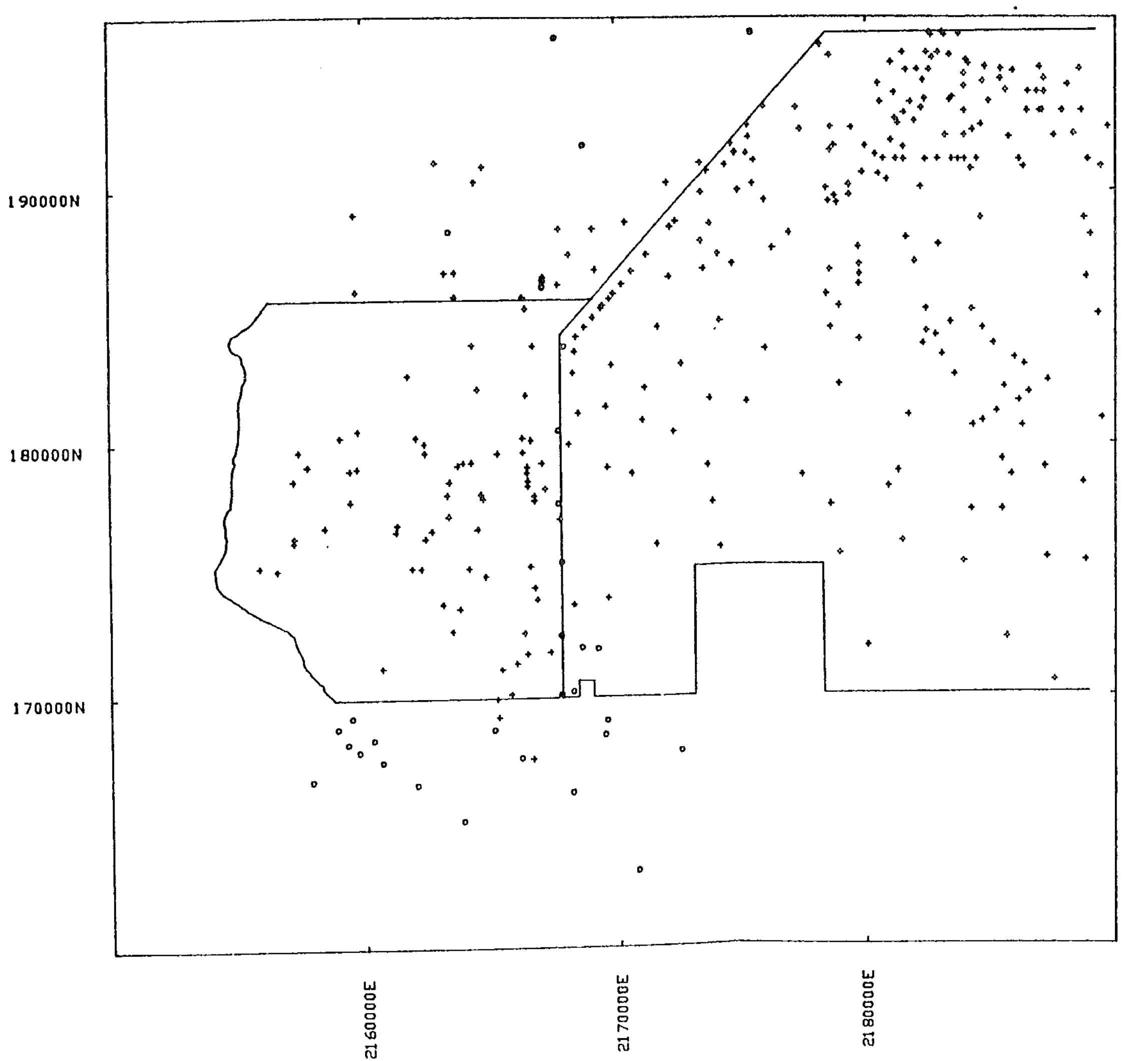
CDM 7777-193

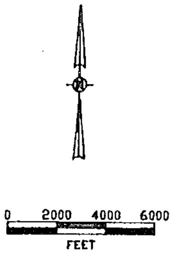
TABLE 5-2

SUMMARY OF AQUIFER TEST RESULTS

Well Number (Figure 5-13)	NW-11[a]	W-2[a]	SAC-5[a]	SAC-14[b]
Performed by:	RMA	RMA	RMA	SACWSD
Number of Observation Wells	12	8	10	1
Pumping Rate (gpm)	125	150	1,966	475
Test Duration (hours)	70	72	70	2.5
Transmissivity Range (ft^2/day)	45,482-63,025	406-33,089	22,455-29,402	10,428-135,027
Hydraulic Conductivity Range (ft/day)	1,982-2,747	231-3,921	345-462	434-5,626

[a] From May 1982b
[b] From HRS 1986





+ PRIMARY CALIBRATION POINTS
MAY 1984 DATA
SOURCE: HLA, 1985; RMA DATA TAPES, 1986

○ SECONDARY CONTROL POINT
1986 DATA

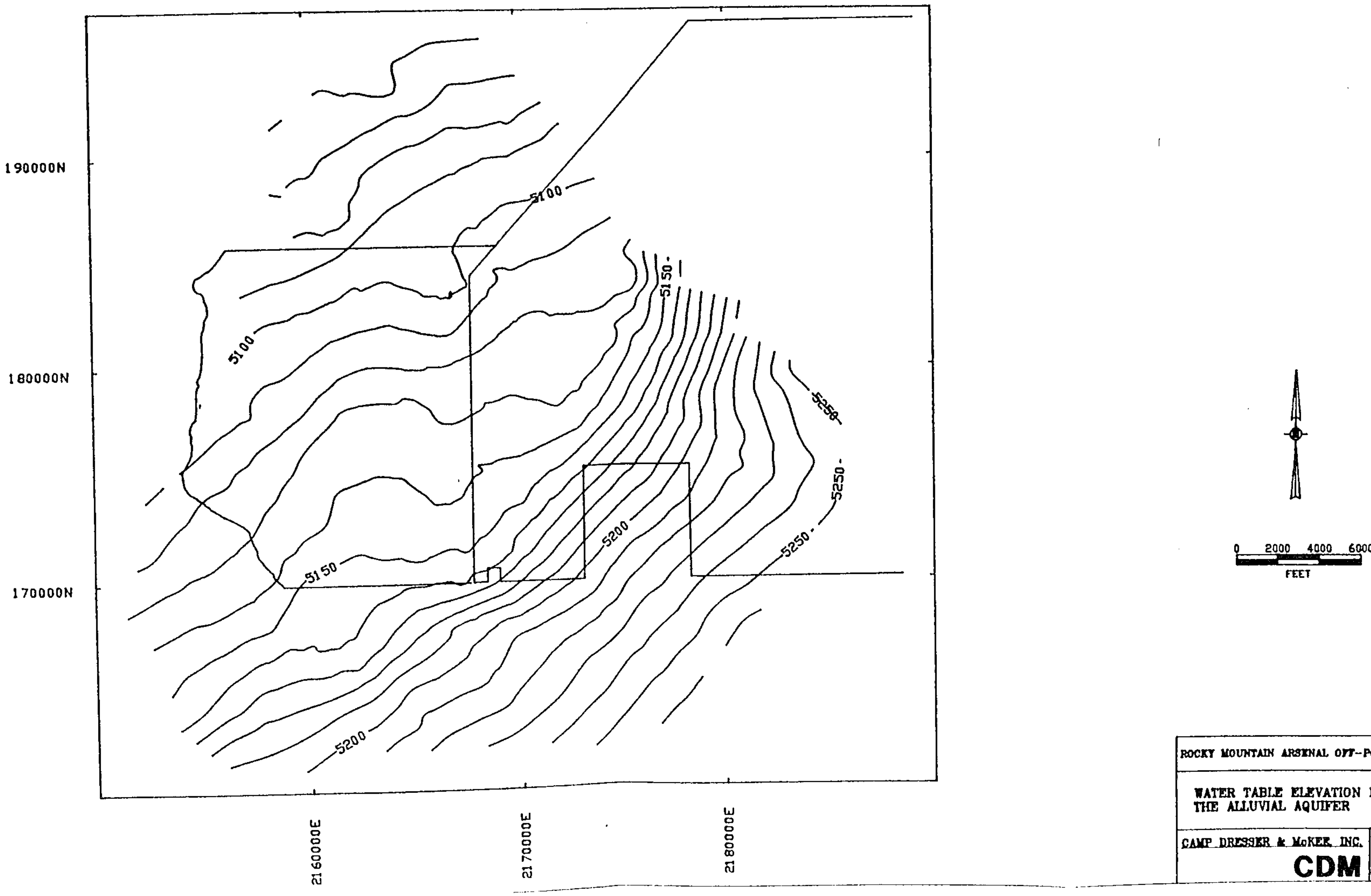
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

LOCATION OF WELLS USED TO
DETERMINE WATER TABLE ELEVATION

CAMP DRESSER & McKEE INC.
CDM

SHEET NO.
5-14

CDM 7777-198



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

WATER TABLE ELEVATION IN
THE ALLUVIAL AQUIFER

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-15

CDM 7777-190

general flow direction within the study area toward the north, with hydraulic gradients controlled by the location of the thick, high permeability deposits in the paleo-channels.

Information from monitoring programs conducted on the RMA provide extensive data on the degree of seasonal fluctuation observed in the alluvial aquifer. Figures 5-16 through 5-18 present typical hydrographs of west tier wells (locations on Figure 5-13) that illustrate seasonal variation of about 5 feet at the two southern wells, and up to 16 feet at well 33018. This latter well is located in a major paleo-channel near both the Irondale recovery system and the 77th and Quebec well field. The observation wells 33002 and 33018 both exhibit a seasonal low in August, which is a result of heavy summer pumping by SACWSD.

Information on vertical hydraulic gradients within the alluvium is available from several well nests that have been completed on the RMA in the west tier sections adjacent to the study area. The majority of these wells indicate a downward hydraulic gradient. This vertical downward flow direction is to be expected in the flow regime in the study area. Theoretical consideration would also suggest an upward ground water flow direction near the South Platte River, which is a regional ground water discharge zone.

AQUIFER RECHARGE

Evaluation of the sources of recharge and discharge is necessary in order to develop a realistic water budget for the site model. Water flowing under the study area originates from several sources, including inflow from surrounding areas, percolation of natural precipitation past the root zone, infiltration from irrigation in urban areas, recharge from surface water bodies such as Sand Creek, and leakage from water conveyance structures such as irrigation canals and storm sewers. Each of these sources of water is discussed below.

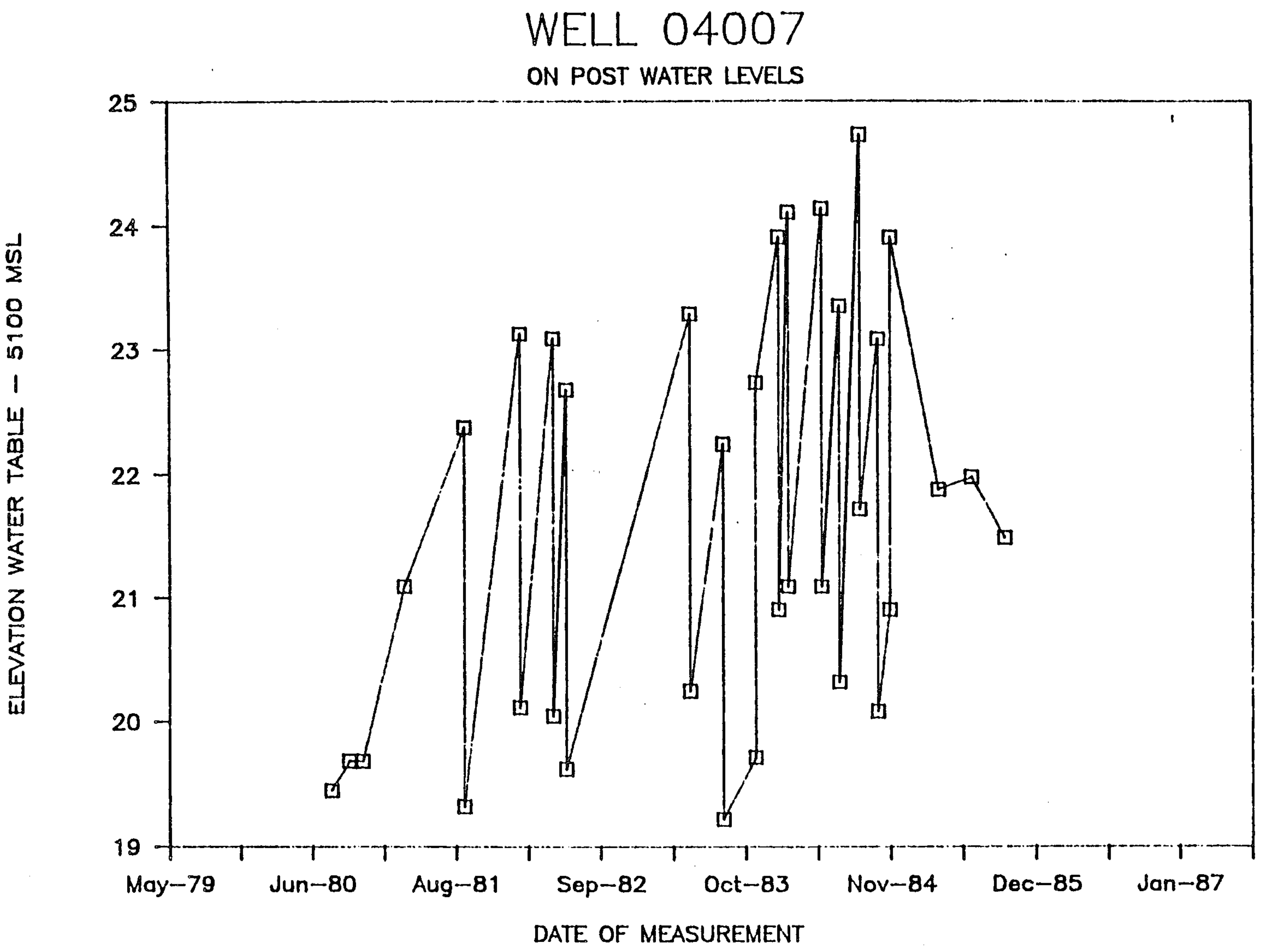

WELL 04007
ON POST WATER LEVELS
ELEVATION WATER TABLE — 5100 MSL
25
24
23
22
21
20
19
May—79
Jun—80
Aug—81
Sep—82
Oct—83
Nov—84
Dec—85
Jan—87
DATE OF MEASUREMENT

Figure 5-16

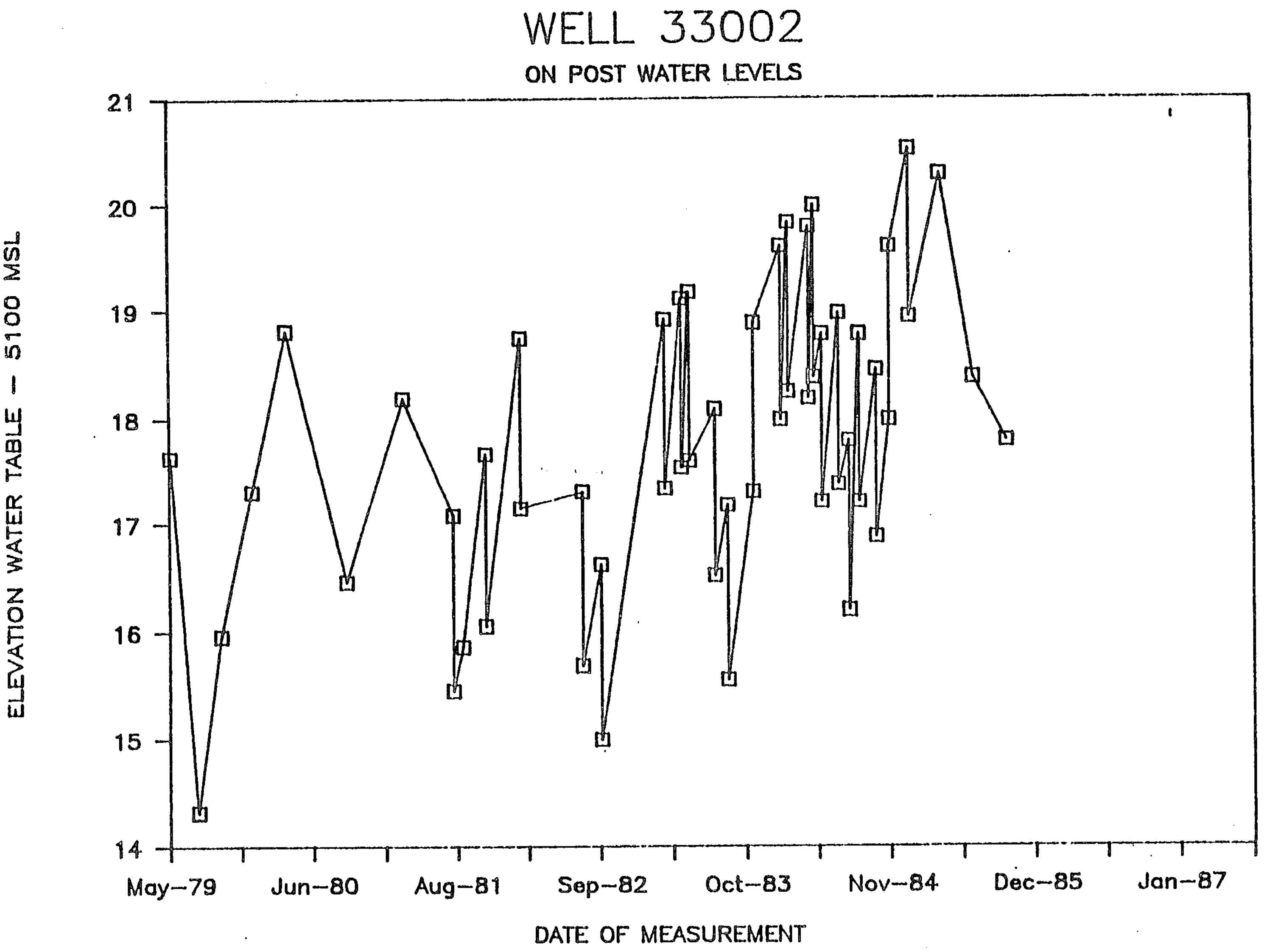

WELL 33002
ON POST WATER LEVELS
ELEVATION WATER TABLE — 5100 MSL
21
20
19
18
17
16
15
14
May—79
Jun—80
Aug—81
Sep—82
Oct—83
Nov—84
Dec—85
Jan—87
DATE OF MEASUREMENT

Figure 5-17

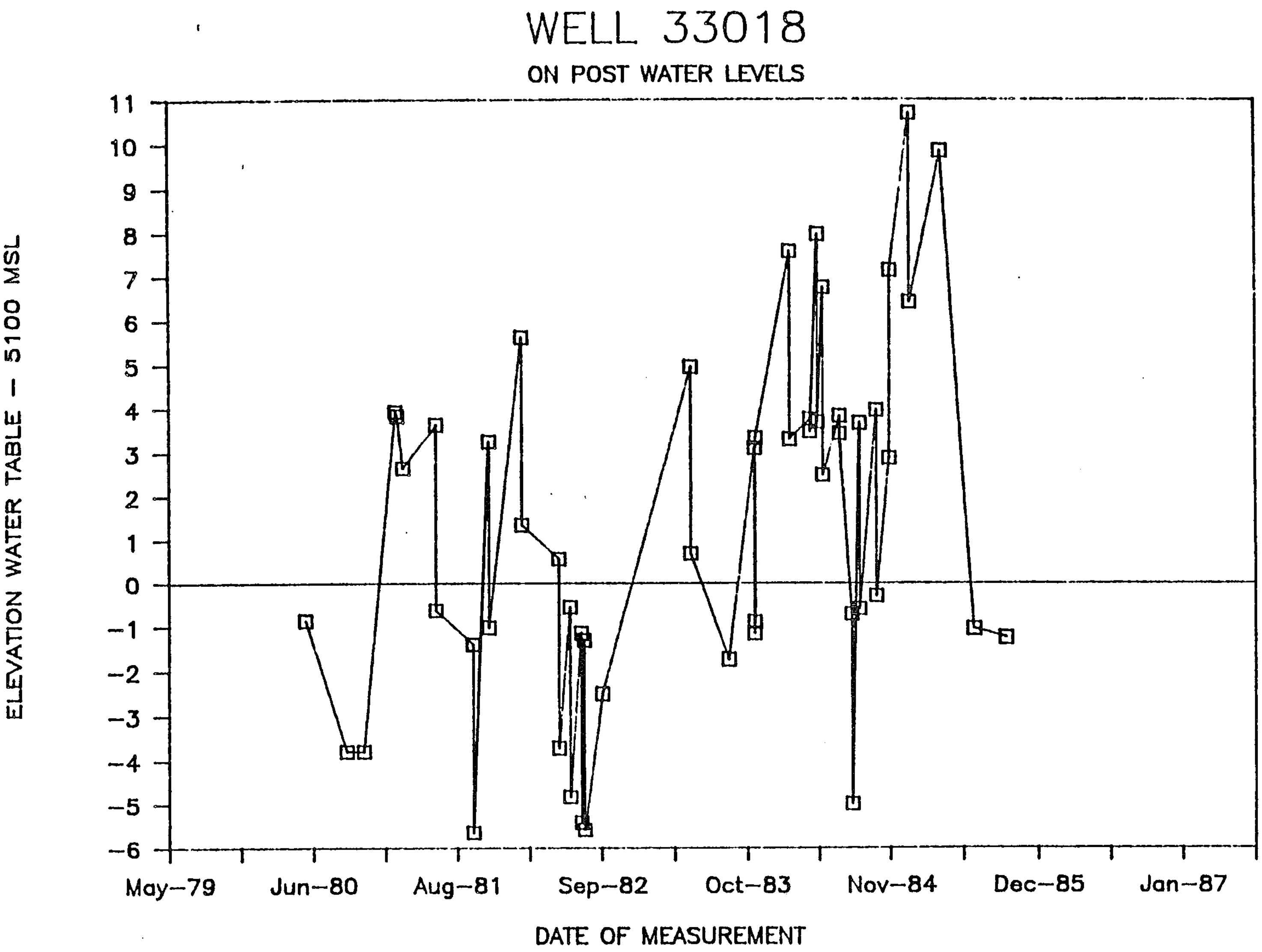

WELL 33018
ON POST WATER LEVELS
ELEVATION WATER TABLE — 5100 MSL
11
10
9
8
7
6
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
May−79
Jun−80
Aug−81
Sep−82
Oct−83
Nov−84
Dec−85
Jan−87
DATE OF MEASUREMENT

Figure 5-18

The semi-arid climate in the Denver area is not conducive to the generation of large amounts of water percolation past the rooting zone of vegetation. Quantitative estimates of recharge in both irrigated urban areas and in native vegetation areas were calculated using methods implemented in the USEPA model HELP (Hydrologic Evaluation of Landfill Performance; Schroeder, et. al., 1984). Calculation of deep percolation, the infiltrated water which ultimately recharges the ground water, requires information on soil characteristics, vegetation and climatological factors. In this evaluation, soil characteristics were determined from Soil Conservation Service surveys of the study area. Temperature and precipitation data from the Stapleton airport weather station for the period 1974 through 1978 were used as the basis for calculating the evapotranspiration component of the water budget. Figure 5-19 illustrates the average precipitation for the evaluation period. Average estimated irrigation application for the urban area of the SACWSD is also shown on this figure. The calculated unit recharge rate in the native areas is 1.7 inches per year. A great deal of uncertainty is present in this figure since many factors which control deep percolation have not been measured. The presence of closed basins on the RMA in the eaolean deposits may tend to increase the net quantity of recharge from undeveloped areas, since water will tend to collect in these depressions.

Estimation of the recharge in irrigated urban areas was done by increasing the precipitation amount to include both natural precipitation and applied water. The calculated unit recharge rate under irrigated urban conditions is 2.9 inches per year. The urban area recharge was reduced to account for the presence of impermeable areas. This reduction is counteracted to some degree by increased runoff from streets and rooftops if it ponds and then percolates. The resulting estimated net recharge in irrigated urban areas is 2.3 inches per year. Some additional recharge may originate from leakage of storm sewers and irrigation canals in the area but was not considered in the recharge calculations. The Burlington Ditch is concrete lined through most of the area and is considered only a minor source of recharge. No data were available to estimate leakage from storm sewers.

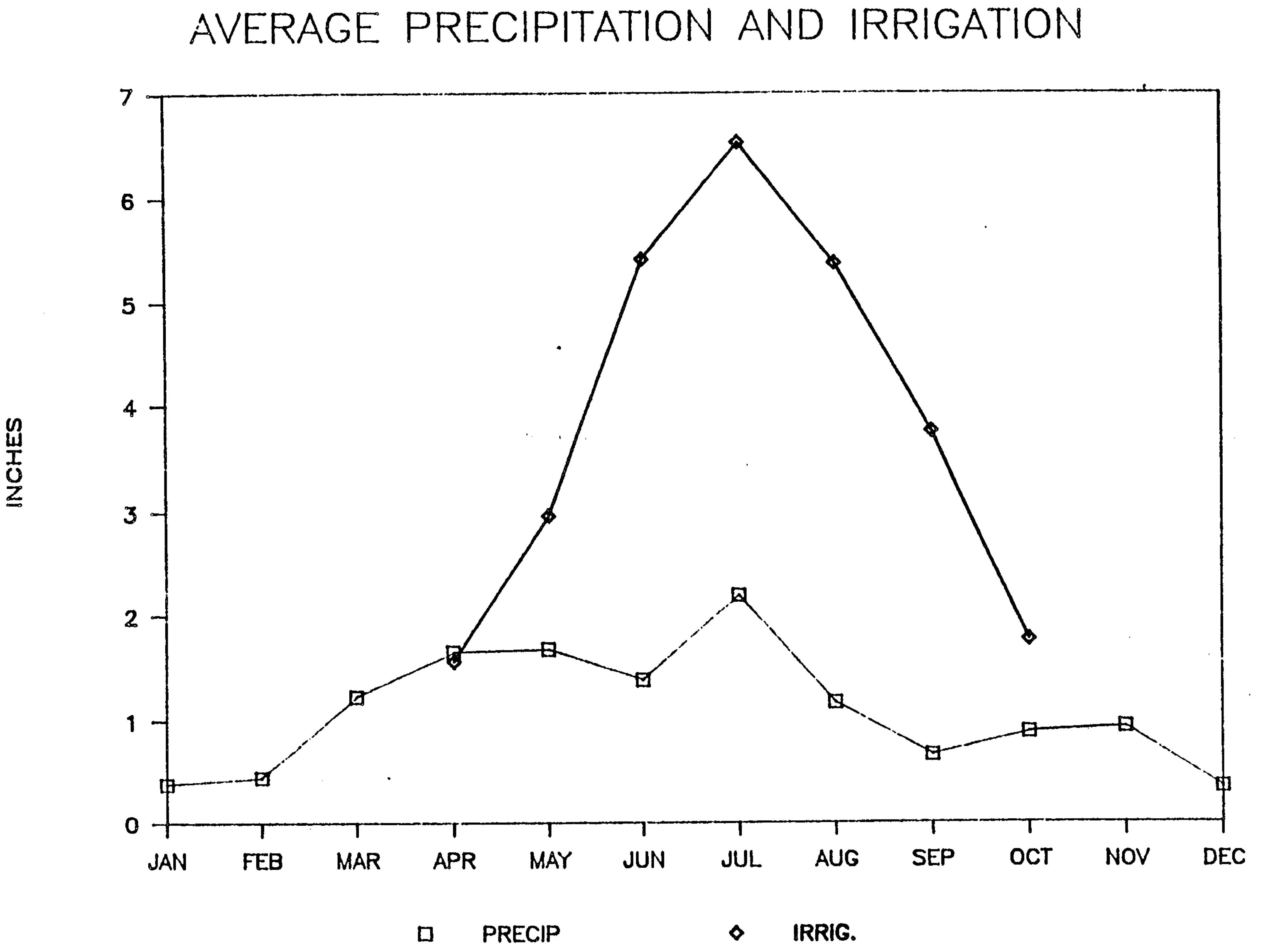

AVERAGE PRECIPITATION AND IRRIGATION
INCHES
0
1
2
3
4
5
6
7
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
□ PRECIP
◇ IRRIG.

Figure 5-19

The largest component of the water budget in the area consists of ground water entering upgradient of the study area as underflow from the south, and from the south east in the alluvium filling the paleo-channels. The major source of recharge from the southeast originates on the RMA in the Derby and Ladora Lakes area. A paleo-channel extends from the 77th and Quebec well field area upgradient to the Derby lakes and beyond as shown in Figure 5-1. The other major source of recharge, from the south, includes both major amounts of seepage from Sand Creek, especially in the vicinity of check dams, and regional ground water underflow that originates south of Sand Creek and flows northward under the stream.

AQUIFER DISCHARGE

The SACWSD pumps large quantities of ground water from the alluvial aquifer associated with paleo-channels underlying the area. Figure 5-20 shows the monthly production from the five major pumping centers during the period January 1980 through November 1985. Significant seasonal variation in pumped quantities is apparent from the data. During the period October through April when no irrigation of domestic lawn areas is underway, alluvial production averages about 55 million gallons per month. During the summer months, lawn irrigation increases the demand to its peak of about 190 million gallons per month in July or August. The SACWSD wells intercept only a portion of the underflow moving in the alluvial system, the remainder continues to flow north and northwest to eventual discharge points at irrigation wells in the alluvium or as seepage to the South Platte River.

AQUIFER SIMULATION

A fully three-dimensional ground water flow model was set up for the study area and calibrated on a preliminary basis in order to aid in understanding the flow system and to aid simulation of contaminant transport processes. The computer program described in Section 3 of this report was used in the simulations. The initial step, after formulation of the conceptual model

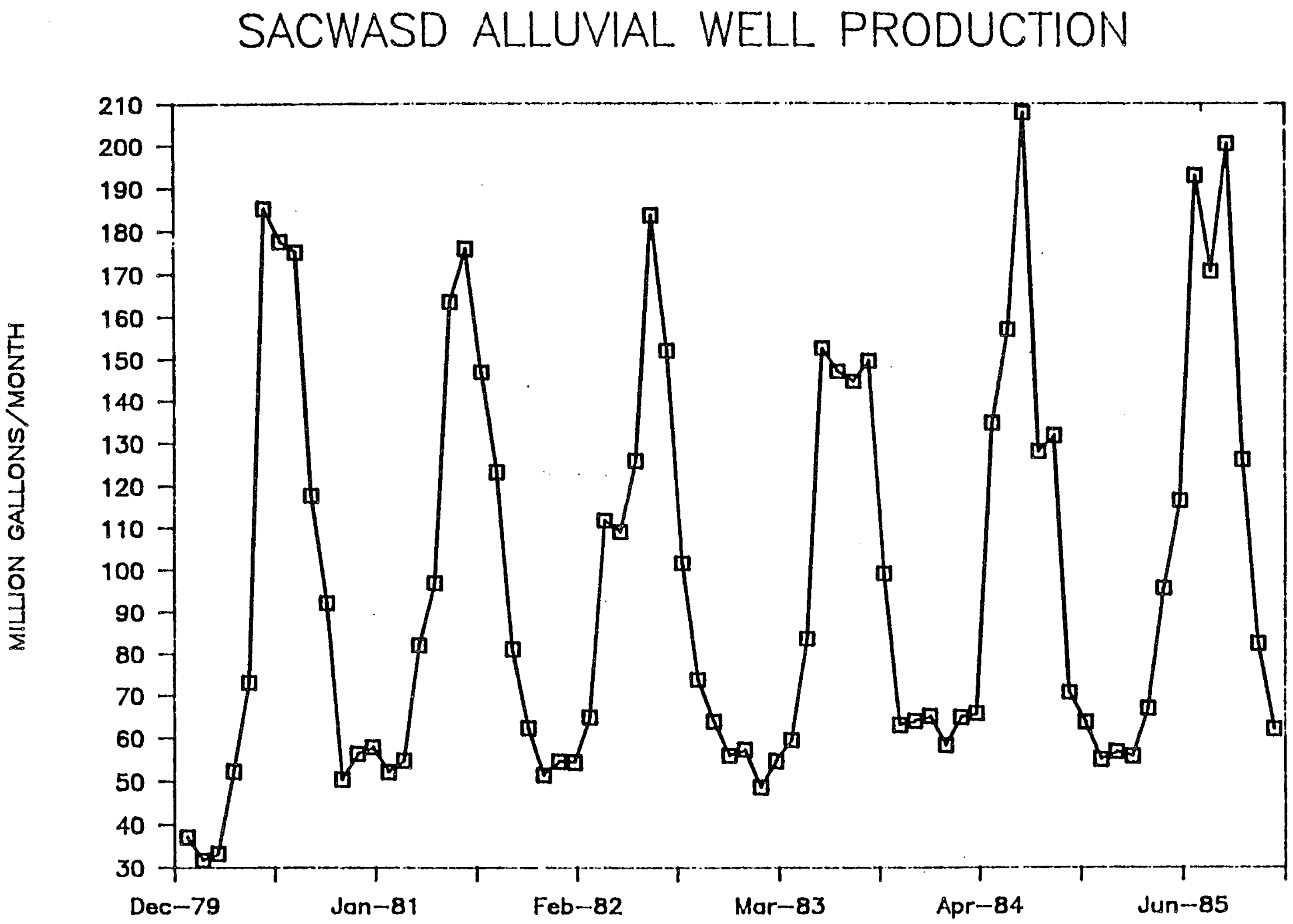
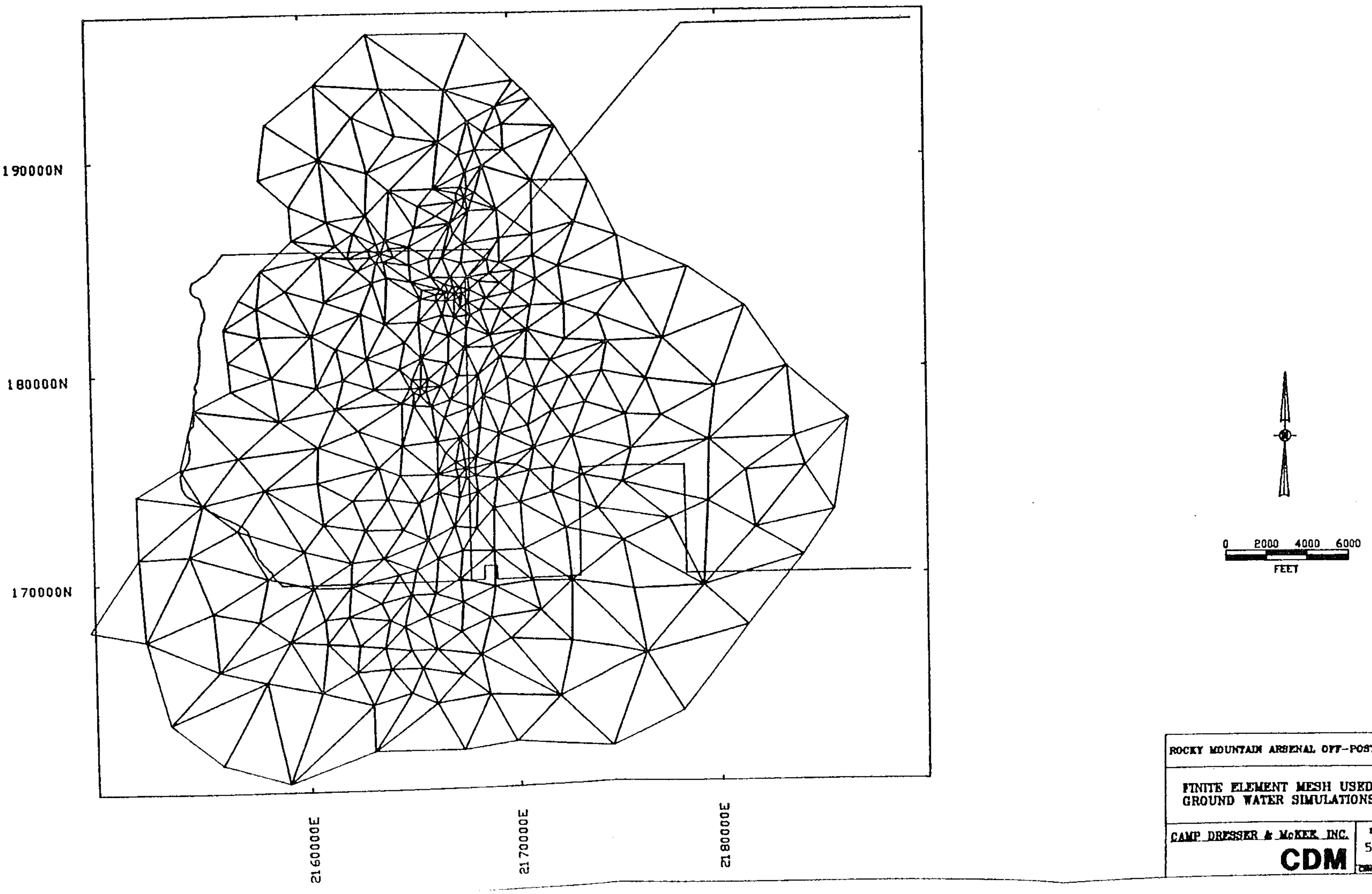

SACWASD ALLUVIAL WELL PRODUCTION
MILLION GALLONS/MONTH
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
Dec—79
Jan—81
Feb—82
Mar—83
Apr—84
Jun—85

Figure 5-20

framework, was design of the finite element grid. Figure 5-21 presents the finite element grid mesh in plan view. In this grid, smaller elements were developed in areas where active plumes are known to exist, in areas near the pumping wells and in areas of high contrast in hydraulic conductivities across adjacent elements. Sufficient spatial detail was also developed, based on well logs, in the paleo-channel areas to allow adequate representation of their geometry. The vertical dimension of the grid consists of three layers to represent the stratigraphy of the alluvial deposits. The lowermost layer represents the most consistent and permeable of the units. The two overlying layers represent the predominantly finer grain and interbeded facies present in the alluvium in the study area. These upper two layers were coded into the model by examining isopach maps developed from the cross-sections and supplemental control shown on Figure 5-3. This stratigraphic framework was coded into the model by entering the elevations of each unit contact at each node and each level. Material properties were estimated based on previous pumping tests conducted by other parties and from interpretation of lithologic information from logs. Hydraulic conductivity was one of the primary parameters that was modified during the preliminary calibration effort. Table 5-3 lists the material property codes and the corresponding range of hydraulic conductivities for the units. Vertical hydraulic conductivity was estimated at 10 percent of horizontal conductivity. The hydraulic conductivity of the lower layer was the primary parameter modified during the preliminary calibration.

After the initial coding of framework information, all boundary conditions for the model were defined. Several types of boundaries were used in the preliminarily calibrated model. The hydraulically upgradient (south and east) side of the grid was defined as a constant head boundary in order to simulate flow entering from the south of Sand Creek and from the Derby lakes area. This boundary condition causes sufficient water to flow into the system to maintain the potentiometric head at the specified level based on actual water levels (heads). Fixed heads were also specified at seven of the nodes along the South Platte river on the west and northwest boundary to simulate the discharge from the system. A specified flux



ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

FINITE ELEMENT MESH USED FOR
GROUND WATER SIMULATIONS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-21

CDM 7777-1[illegible]

TABLE 5-3

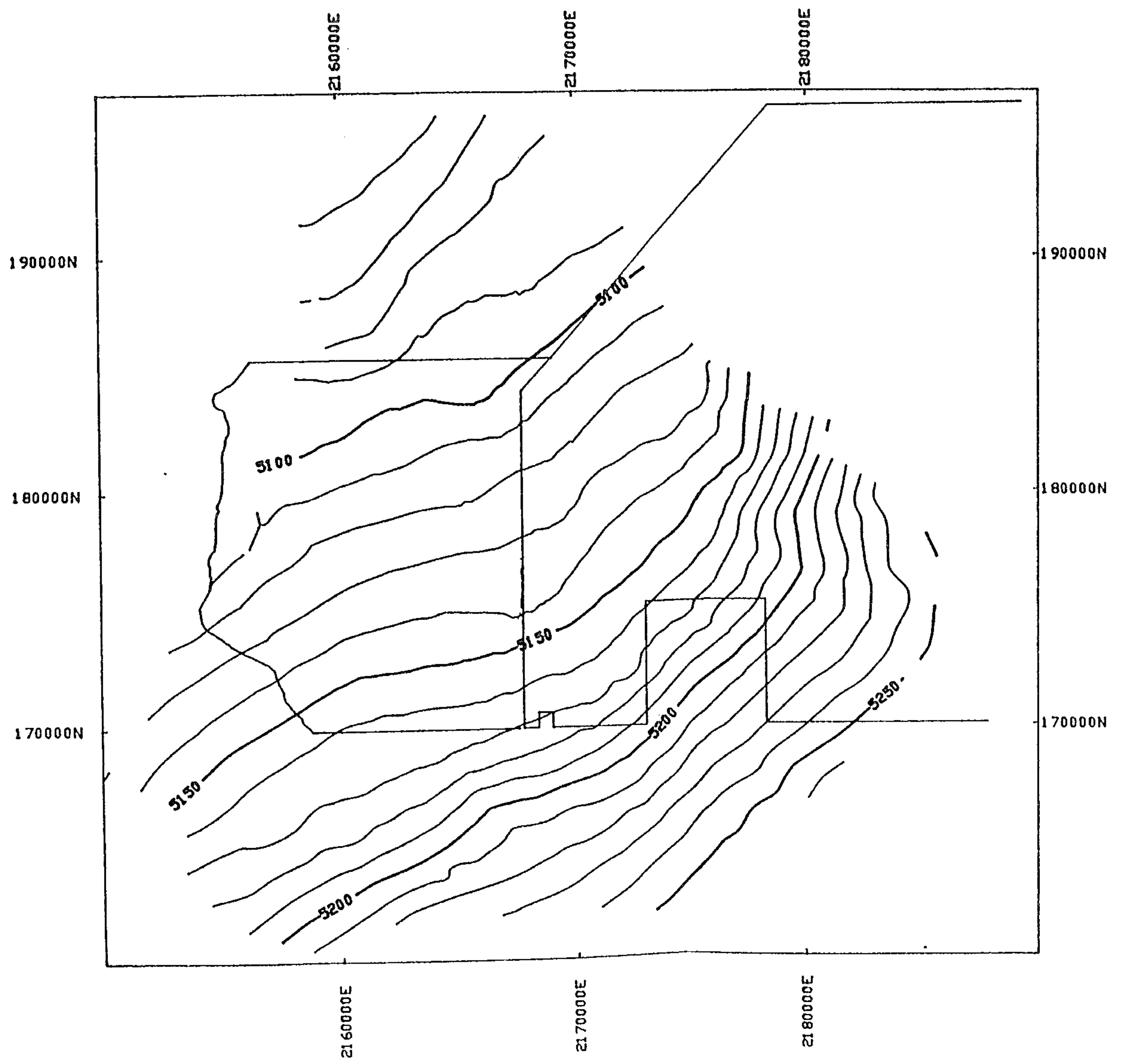
SUMMARY OF AQUIFER PROPERTIES

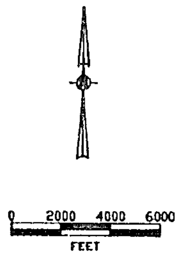
Symbol	Corresponding Lithology	Hydraulic Conductivity Range (ft/day)
CL	Clay	.009
CLGR	Clay and gravel, interbedded	.09
GR	Gravel	700
SD	Sand	180
SDCL	Sand and clay, interbedded	90
SDGR	Sand and gravel, interbedded	200-900
SDYC	Sandy clay	4.5

condition was specified at each of the SACWSD alluvial well sites to simulate pumpage based on average annual pumping rates. The southeastern portion of Sand Creek within the model area was also treated as a flux type boundary condition to simulate seepage through the stream bottom. The model is not overly sensitive to these specified conditions because each of these boundaries are at a sufficient distance from the area of primary interest at receptor wells.

Model calibration was conducted by using a steady state solution for average year around pumpage. Steady state flow is justified as an approximation for this operable unit based on water level data which show little seasonal fluctuations annually on a regional basis (ESE, 1986). During this preliminary calibration, comparisons of predicted vs. observed head at individual observation wells and comparison of the general shape of the simulated and actual water table were used as criteria for determining the adequacy of the simulated results. Repeated simulations were conducted, modifying the selected hydraulic characteristics at each run and comparing simulated results with observed conditions.

Since the objective of this preliminary modeling is evaluation of treatment at existing wells, the emphasis was placed on matching the general trends. Figure 5-22 presents the simulated water table configuration at the end of the preliminary calibration. Water level elevation at over 300 wells were used as the calibration target data set. The locations of these wells are shown on Figure 5-14. Figure 5-23 presents a graph of the observed water level elevation vs. the simulation results for the calibration target data set. Ideally, a unit slope on the graph would indicate a perfect match and calibration. However, this can never be achieved under realistic conditions and slight deviations are to be expected at individual wells. As previously discussed, most wells in the off-post study have not yet been surveyed, therefore, a water table accuracy of ±5 feet is indicated. Comparison of the simulated and observed water table maps indicate good agreement in the general trends at a sufficient degree of accuracy to meet the objectives of this operable unit RI/FS. It should be noted that the





ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

WATER TABLE ELEVATION FROM
PRELIMINARY MODEL CALIBRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-22

SIMULATED VS OBSERVED WATER LEVELS

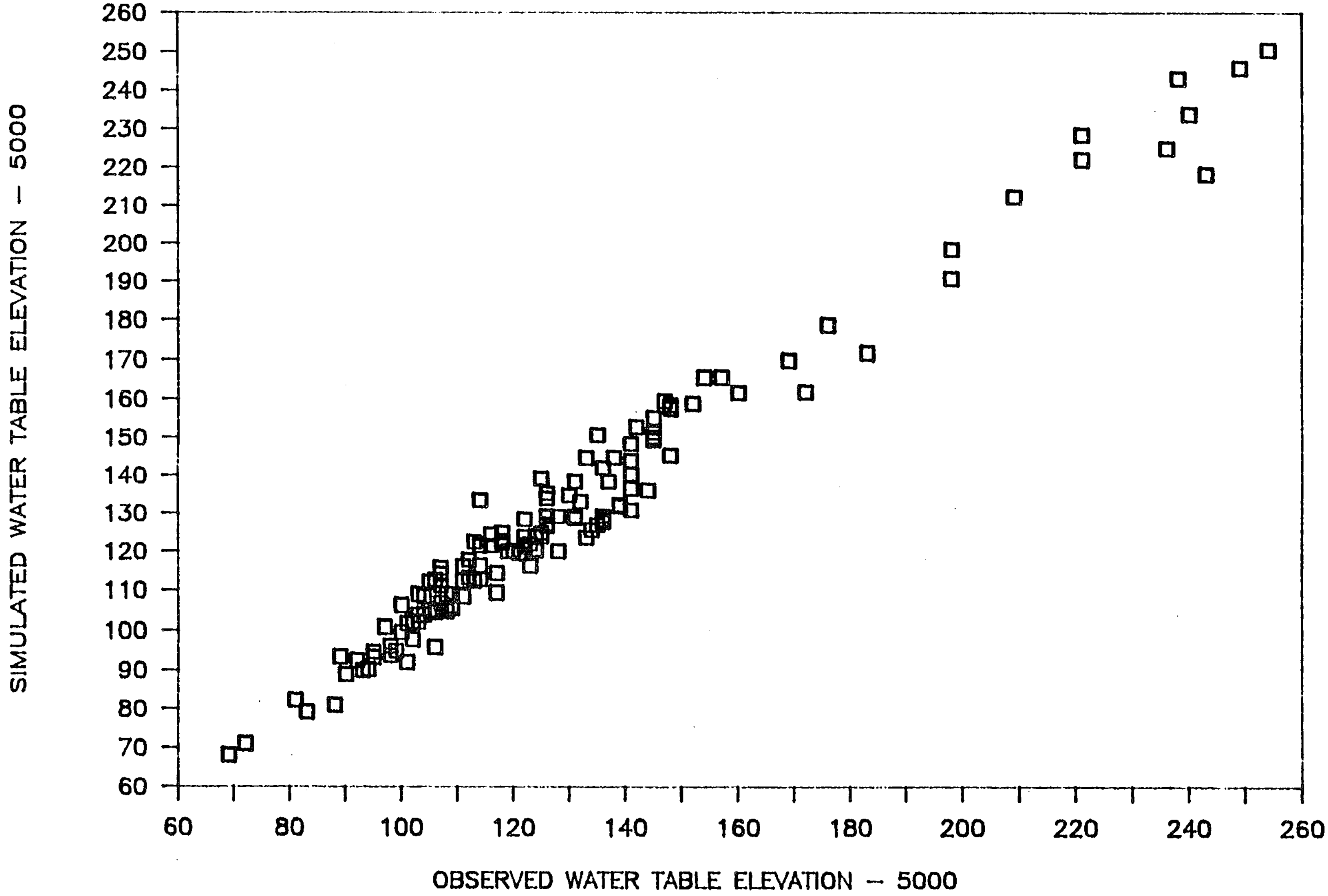


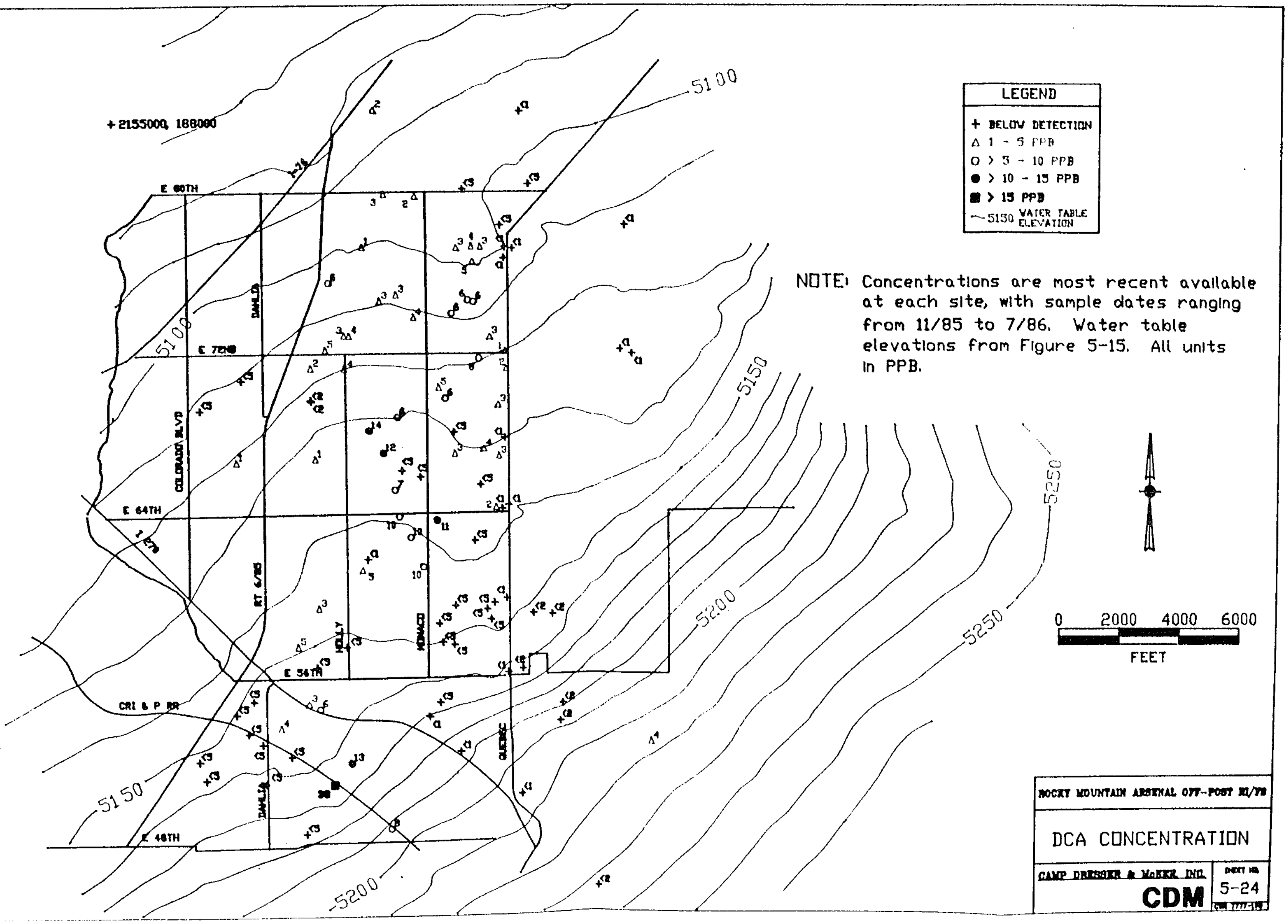
Figure 5-23

flow vector direction does not match the observed data at all locations and thus will require refinement during final calibration. Several areas of disagreement suggest areas where refinement of the data base will be necessary in later phases of the RI. The properties of the terrace sand and gravel deposits need to be determined in more detail before the calibration can be significantly improved. These investigations are currently planned.

5.3 CONTAMINANT DISTRIBUTION

Section 4 of this document presents the results of chemical characterization of private wells sampled under the EPA off-post RI/FS, and monitoring wells and production wells used by the district. Table 4-2 provides a summary of all the constituents that were detected in the EPA off-post RI/FS sampling. The primary constituents that have been detected and are of major concern include DCA, DCE, trans-DCE, TCA, TCE, PCE and benzene. There are other volatile, semi-volatile and pesticide compounds present in ground water in the study area, as indicated in Table 4-2 and in Appendix A. Due to their limited and sporadic distribution and low concentrations, they are not expected to pose a health threat as related to the existing SACWSD public supply system. None of the compounds specific to the RMA (DBCP, DCPD and DIMP) were found to be present above contract required detection limits for the EPA Off-Post RI/FS sampling results. Some of these arsenal specific compounds are known to exist on-post in areas that may be upgradient of the study area. Additional data including EPA FIT and Army results have also been used to characterize the type and degree of contamination present at the site.

A series of point value maps present a summary of all available data collected by all parties active in the area during the period November 1985 through September 1986. Figures 5-24 through 5-30 show point concentration maps for DCA , DCE, trans-DCE, TCA, TCE, PCE, and benzene respectively. Only analyses conducted by the REM II and FIT contractors meet all quality assurance guidelines, although other data were used to extend the



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

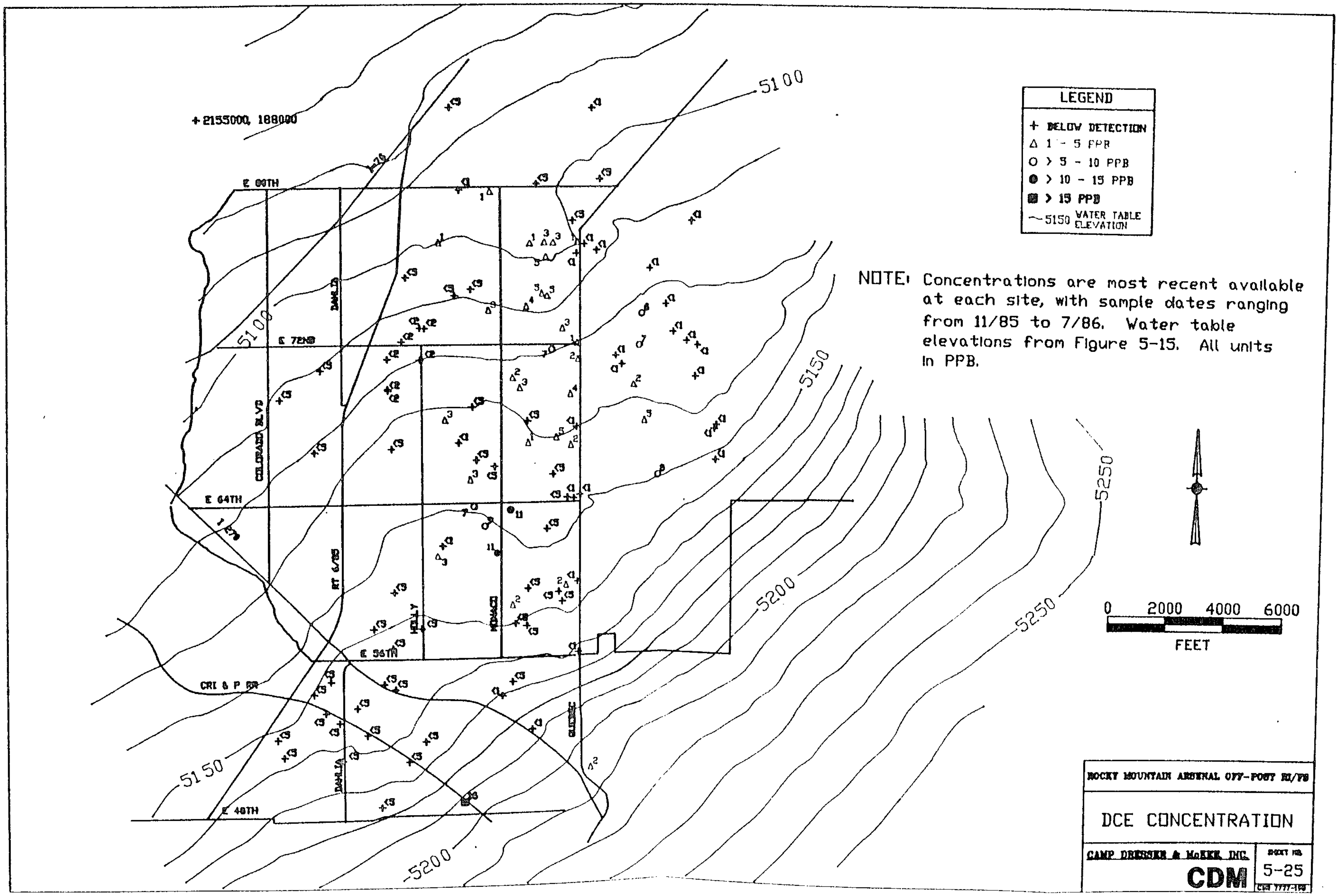
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

DCA CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-24



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

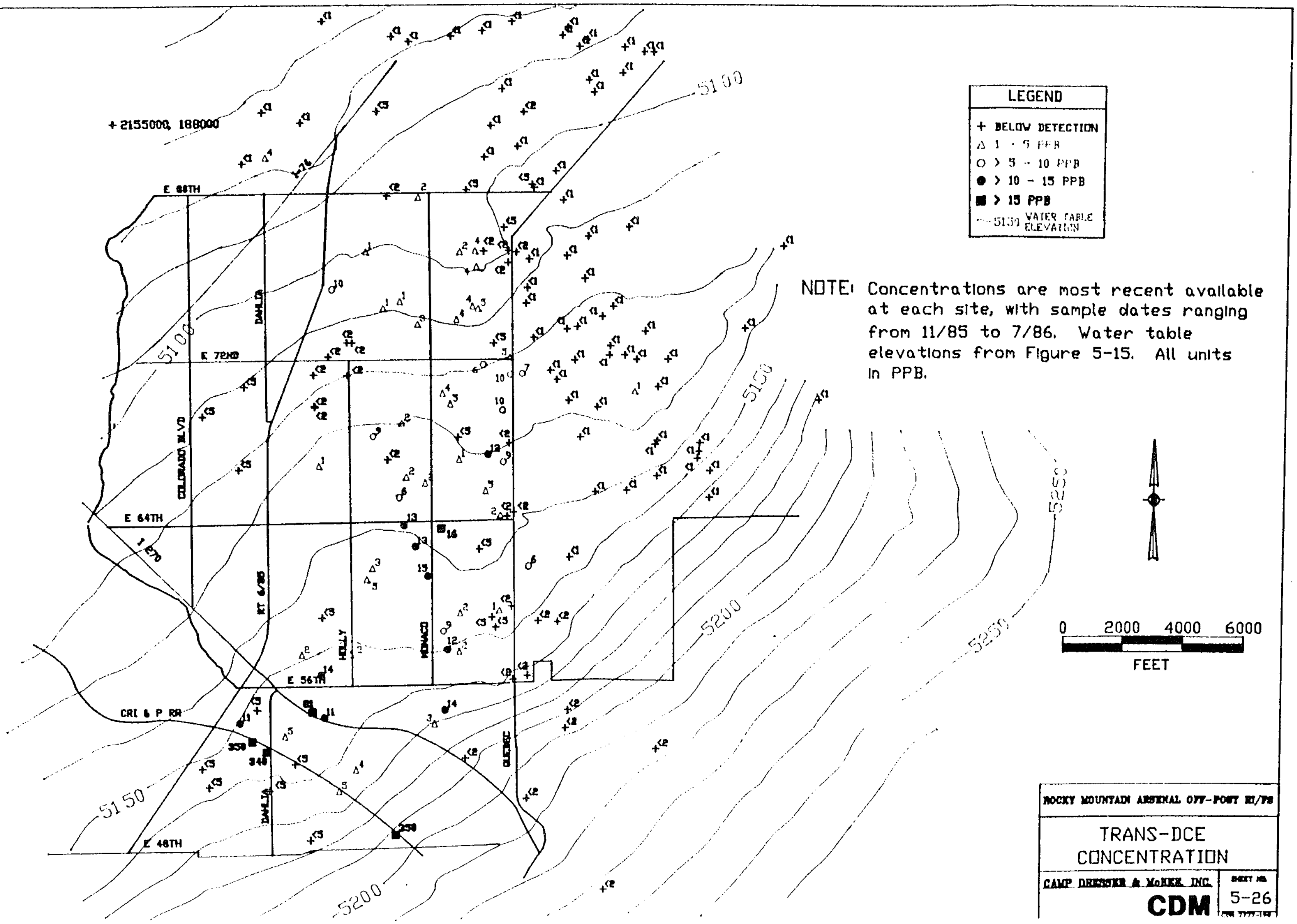
DCE CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-25

CDM 7777-1??



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

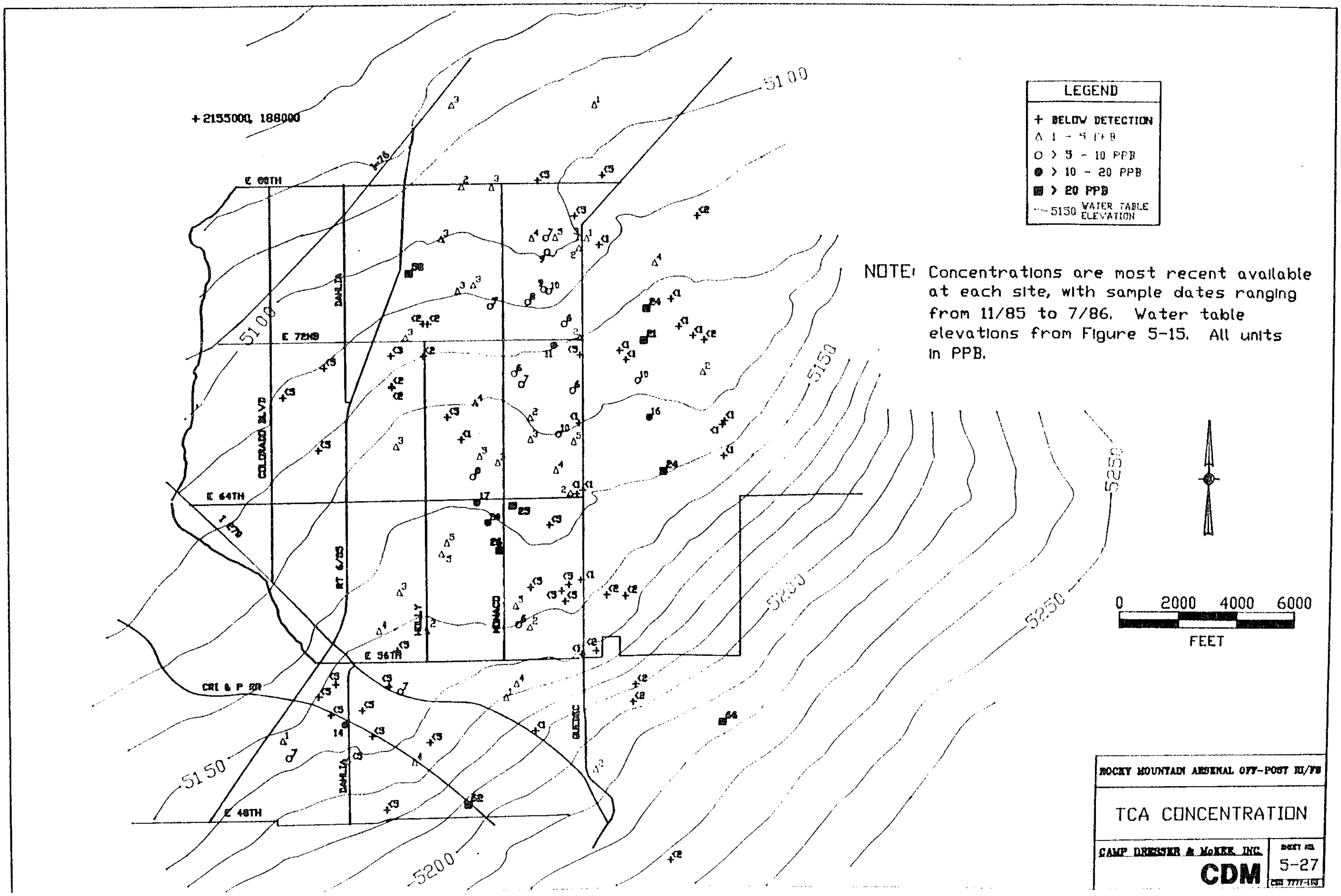
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

TRANS-DCE CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO. 5-26



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

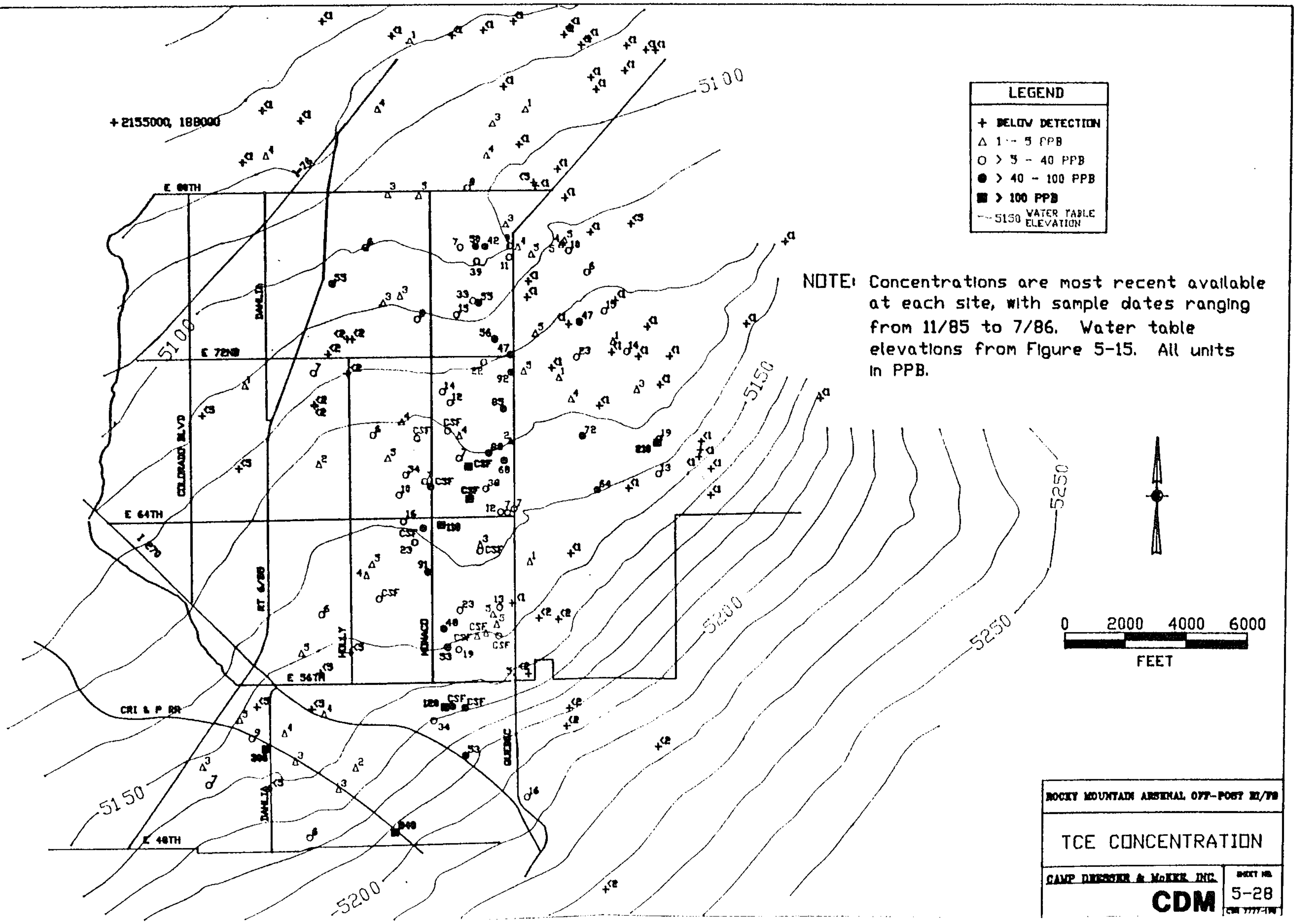
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

TCA CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO. 5-27



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

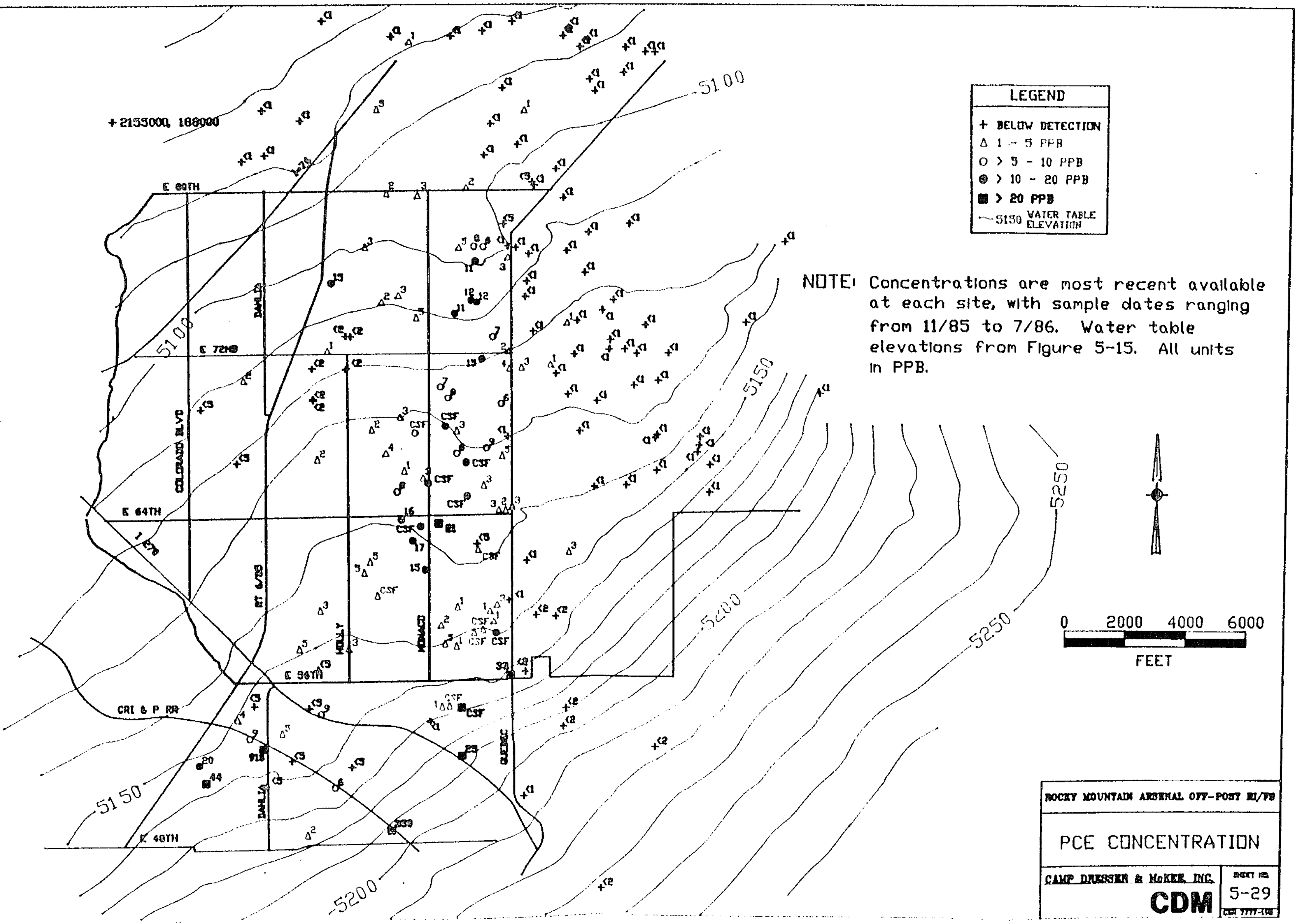
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

TCE CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-28



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

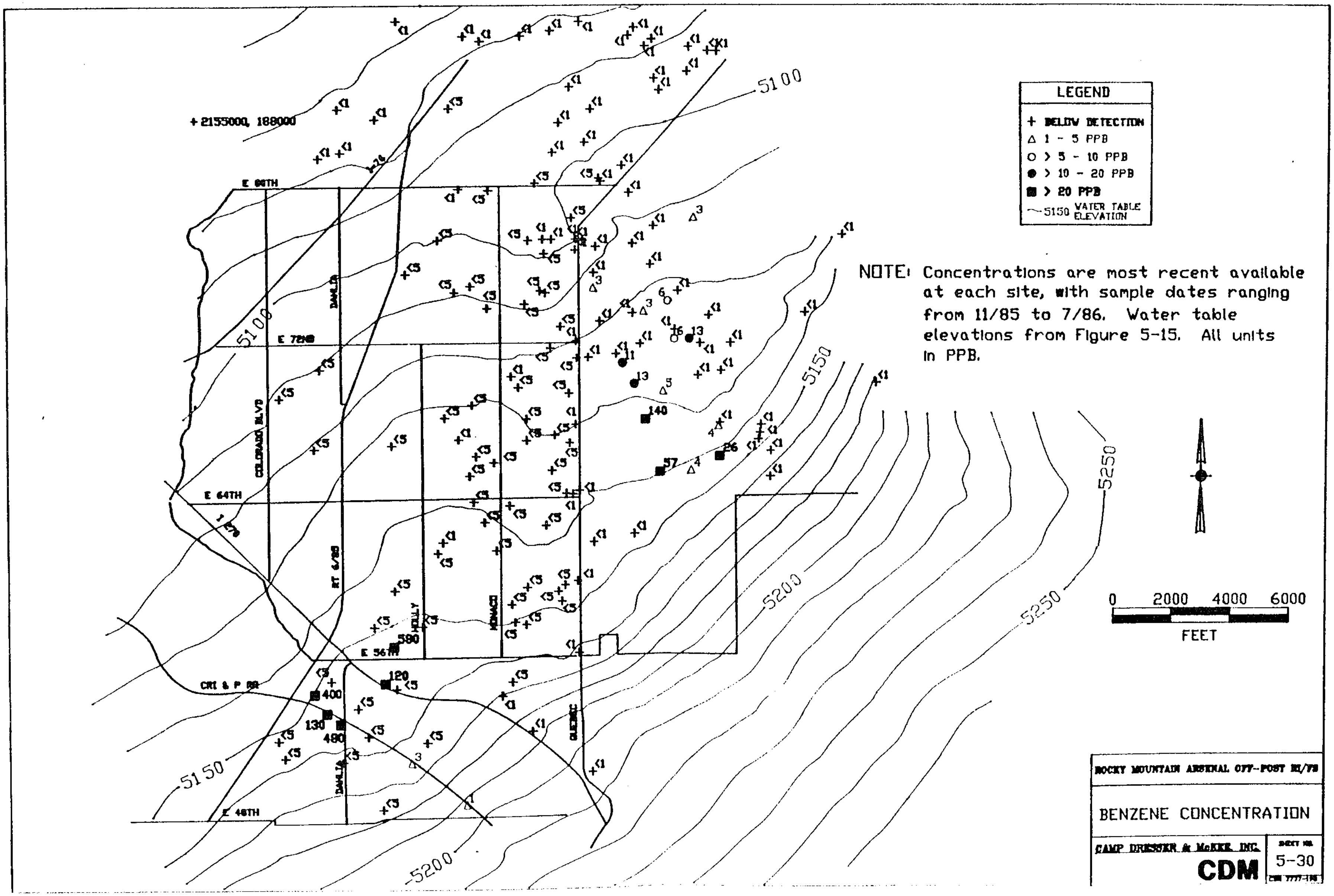
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

PCE CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.
5-29



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

BENZENE CONCENTRATION

CAMP DRESSER & McKEE INC.

CDM

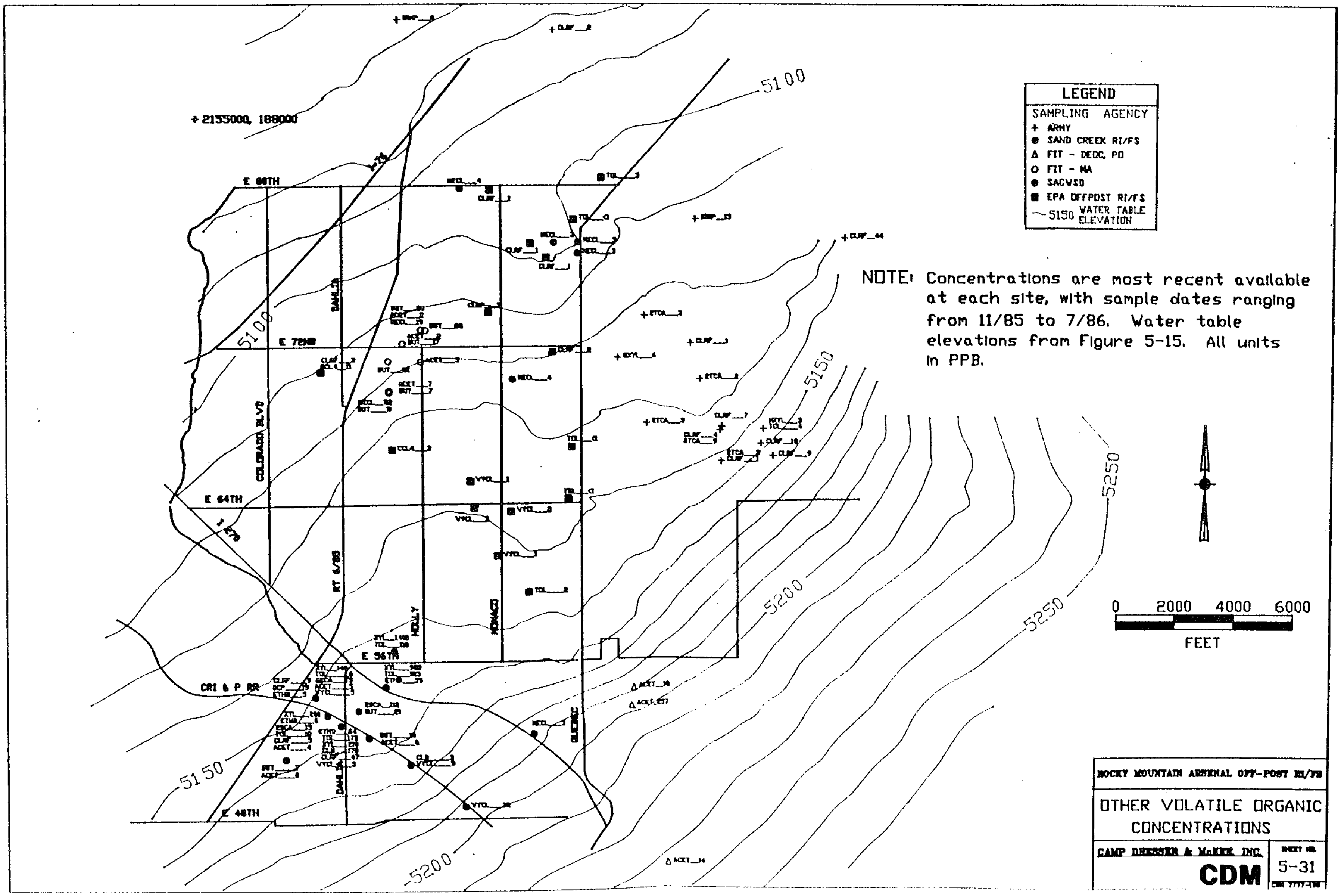
SHEET NO.
5-30

interpretation since they appear to be consistent with the validated data. Army data were validated under their own quality assurance criteria, which is similar to that followed by the EPA. Figure 3-1 shows the sampling agencies responsible for the data shown. The concentration values indicated on Figures 5-24 through 5-30 are identified by various symbols.

These symbols represent specific concentration ranges, as defined in the legend on each map, and aid in showing the extent of the contaminants and the configuration of any contamination plumes. Sample locations identified with a cross indicate, for example, that at the time of sampling the ground water contained concentrations below laboratory detection limits for the compound shown. Conversely, sample locations shown by solid circles and squares indicate the ground water at those sites contains successively greater concentrations of the compound shown. The water table map from May 1984 is also shown on each of these figures for reference.

Figures 5-31 through 5-34 are point concentration maps showing concentration for other volatile organics, semi-volatile and non-volatile organics, pesticides, and tentatively identified semi-volatile and non-volatile organics. Table 5-4 lists parameter codes used on these maps. Figure 5-34 represents the sum of concentrations for the detected tentatively identified compounds for samples collected as part of this RI and the Sand Creek Industrial site RI. A complete listing of the encountered compounds is provided in Appendix A. Each of these figures also has the May 1984 water table superimposed for reference.

Analysis of Figures 5-24 through 5-29 indicate that similar contaminant patterns are present on each of the volatile contamination contour maps. High concentrations appear to originate south and/or southeast of the site and are being carried northward with the prevailing ground water flow. In addition, some compounds also appear to originate on the RMA and are being carried north to northwest. Existing data gaps near the western edge of the RMA leave some uncertainty on the relationship between these two prevailing contamination plumes. The contamination plumes are actively



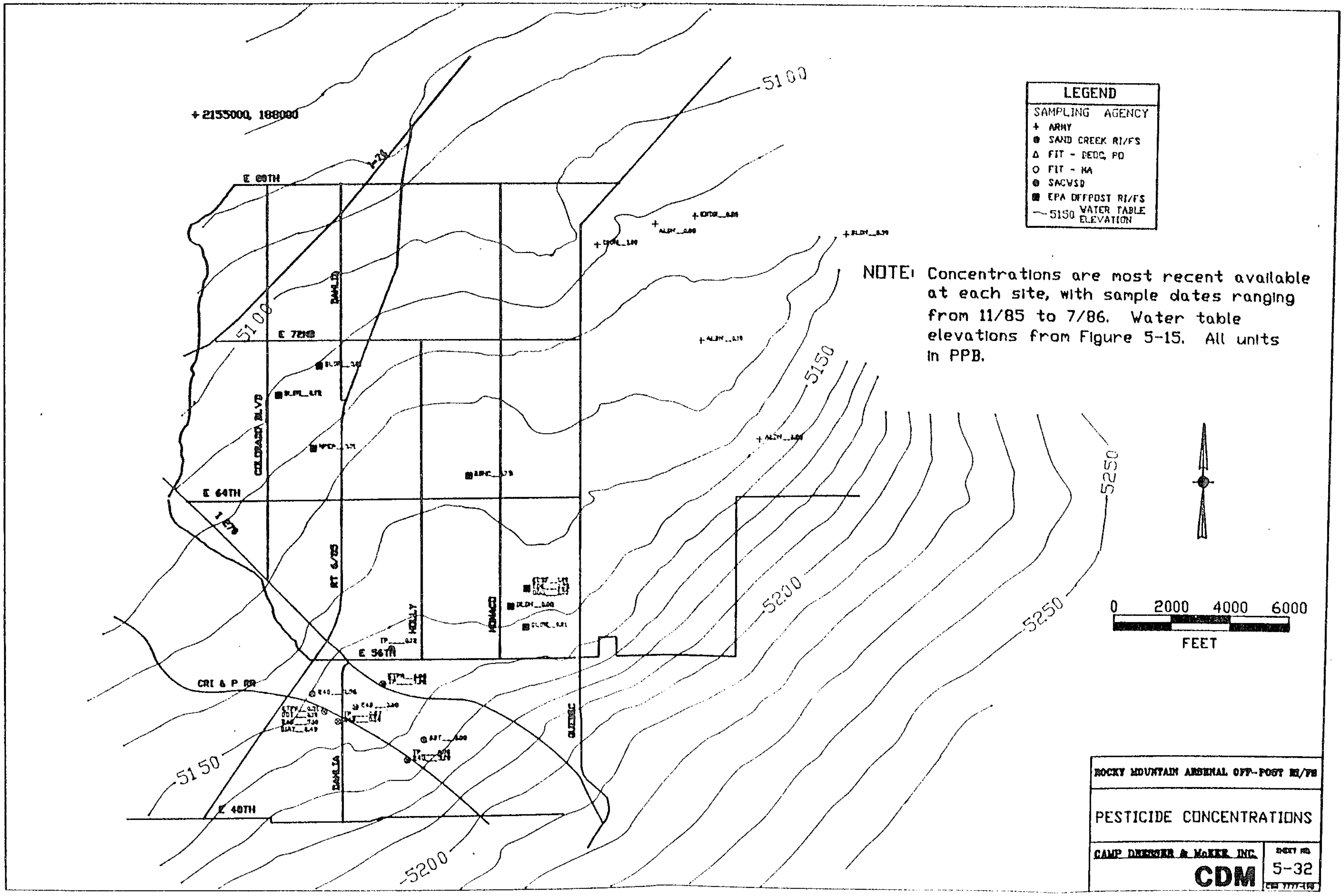
NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

OTHER VOLATILE ORGANIC CONCENTRATIONS

CAMP DRESSER & McKEE INC.
CDM

SHEET NO.
5-31
CDM 7777-146



LEGEND

SAMPLING AGENCY
- \+ ARMY
- ● SAND CREEK RI/FS
- △ FIT - DEDC, PD
- ○ FIT - MA
- ● SACWSD
- ■ EPA OFFPOST RI/FS
- —5150 WATER TABLE ELEVATION

NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

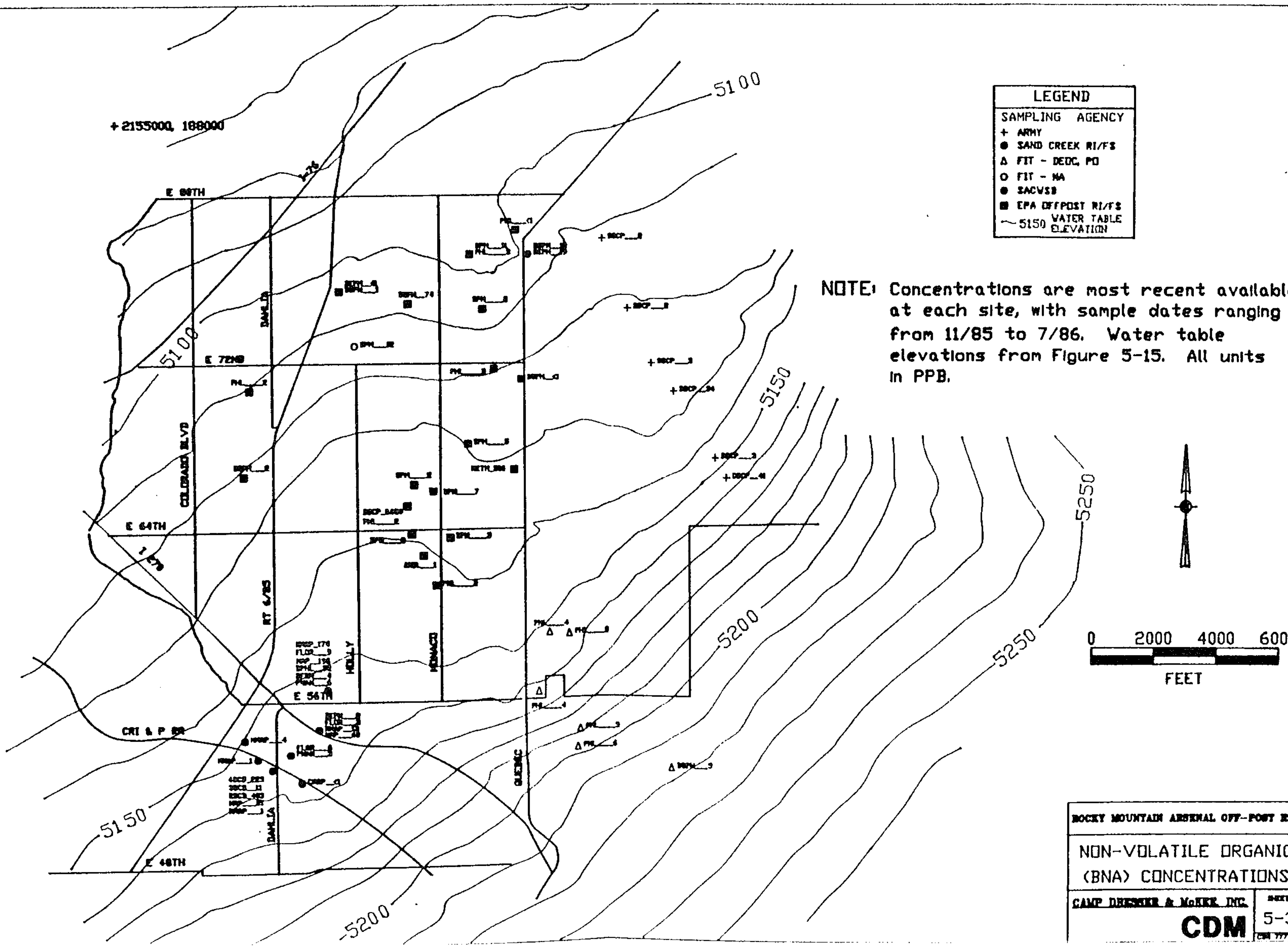
PESTICIDE CONCENTRATIONS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO. 5-32

CDM 7777-159



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB.

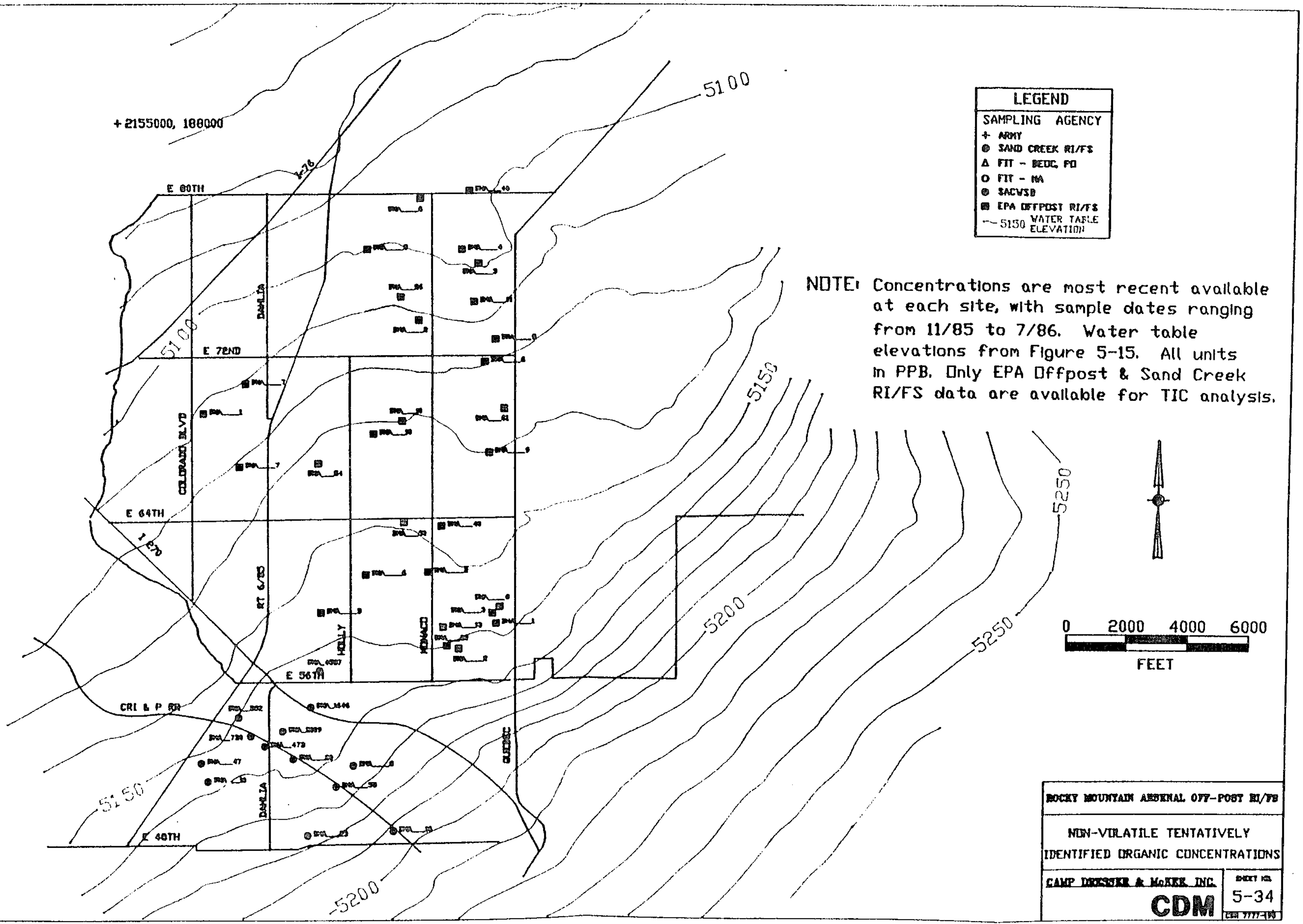
ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

NON-VOLATILE ORGANIC (BNA) CONCENTRATIONS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO. 5-33



NOTE: Concentrations are most recent available at each site, with sample dates ranging from 11/85 to 7/86. Water table elevations from Figure 5-15. All units in PPB. Only EPA Offpost & Sand Creek RI/FS data are available for TIC analysis.

ROCKY MOUNTAIN ARSENAL OFF-POST RI/FS

NON-VOLATILE TENTATIVELY IDENTIFIED ORGANIC CONCENTRATIONS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO. 5-34

CDM 7777-190

TABLE 5-4 OTHER DETECTED ORGANIC COMPOUNDS

Abbreviation[(a)]	Compound	CAS #
MECL	methylene chloride	75-09-2
ACET	acetone	67-64-1
CCL4	carbon tetrachloride	56-23-5
TOL	toluene	108-88-3
VYCL	vinyl chloride	75-01-4
CLRF	chloroform	67-66-3
2DCA	1,2 DCA	107-06-2
DIMP	DIMP	DIMP
XYL	total xylenes	1330-20-7
ETHB	ethyl benzene	100-41-4
CLB	chlorobenzene	108-90-7
DCP	1,2 dichloropropane	78-87-5
2TCA	1,1,2 TCA	79-00-5
MXYL	m-xylene	?
OXYL	o,p-xylene	?
BUT	2-butonone	78-93-3
FLOR	fluorene	86-73-7
PHL	phenol	108-95-2
PNAN	phenanthrene	85-01-8
PHTH	phthalate	?
BBPH	butylbenzylphthalate	85-68-7
DEPH	diethyl phthalate	84-66-2
DBPH	di-N-butylphthalate	84-74-2
NAP	napthalene	91-20-13
MNAP	2-methylnapthalene	91-57-6
DPHL	2,4 dimethylphenol	106-44-5
HETH	1-hexanol 2-ethyl	104-76-7
DFRN	dibenzofuran	132-64-9
BPH	bis (2 ethyl hexyl) phthalate	117-81-7
ANIL	analine	62-53-3
CNAP	chloronapthalene	91-58-7
2DCB	1,2,dichlorobenzene	95-50-1
3DCB	1,3 dichlorobenzene	541-73-1
4DCB	1,4 dichlorobenzene	106-46-7
DBCP	DBCP	96-12-18

TABLE 5-4 OTHER DETECTED ORGANIC COMPOUNDS (Continued)

Abbreviation[(a)]	Compound	CAS #
DIAZ	diazinon	333-41-5
ABHC	alpha-BHC	319-84-6
DDT	4,4 DDT	50-29-3
24D	2,4-D	94-75-7
TP	2,4,5-TP	93-72-1
DDD	4,4 DDD	72-54-8
HPEP	heptachlor epoxide	1024-57-3
ALDN	aldrin	309-00-2
ISDN	isodrin	?
ENDN	endrin	72-20-8
DLDN	dieldrin	60-57-1
DDE	4,4 DDE	72-55-9
EDSF	endosulfan II	33213-65-9
ETPR	ethylparathion	56-38-2

(a) Abbreviation code used on figures 5-31 through 5-34.

moving through the area and none of the highest concentrations appear to have yet reached the main SACWSD pumping centers. The highest concentrations in the plumes exist south of East 64th Ave. at the current time. As inferred from Figure 5-30, benzene plumes are present both to the southwest near the Sand Creek Industrial Site and to the east on the RMA, with maximum reported concentrations of 580 and 140 ppb, respectively (CDM, 1985a; USATHAMA, 1986).

Figure 5-31 provides information on the distribution of other volatiles detected in the area. This map shows an extensive suite of volatiles at the west end of the Sand Creek site. Vinyl chloride exhibits consistent occurrence near the areas of highest TCE concentration south of 64th Avenue. The occurrence of this compound is likely from anaerobic biodegradation of TCE, but could also be related to contact of the samples with PVC pipe and casing. Values of vinyl chloride were encountered at the Sand Creek Industrial site that would indicate the biodegradation mechanism is occurring. Since all samples collected for this operable unit investigation and by SACWSD used sampling methods that may not be capable of reliably detecting vinyl chloride at the low part per billion level, uncertainty exists regarding the potential presence of vinyl chloride at these levels. Future specialized sampling is planned to resolve this uncertainty. Low levels of chloroform are also sporadically distributed both on and off the arsenal. Several of the compounds, including methylene chloride and acetone may be related to laboratory contamination or to sample device decontamination procedures which utilize these solvents for cleaning.

Figure 5-32 shows pesticides that were detected in the area. Several low level detections of dieldrin in the southeast and west parts of the study area at the .01 to .02 ppb level were found. Higher concentrations of dieldrin and related pesticides have been found in the western third of the RMA. The area near the west end of the Sand Creek site indicates the presence of a number of pesticides.

Figure 5-33 summarizes the semi-volatile and non-volatile compounds that were detected. Compounds that were detected in areas upgradient of SAC production wells include various pthalates, analine at 1 ppb, phenol at concentrations up to 6 ppb, and a single detection of 1-hexanol, 2-ether below the normal detection limit. A single detection of DBCP at a level below the normal detection limit was found in the study area. A consistent DBCP plume is present on the Arsenal upgradient of the Irondale interception system.

Figure 5-34 provides a summarization map of all of the tentatively identified compounds that were detected. Most of these compounds are suspected to originate from sampling of solvent welded PVC casing or recharge from septic systems. It should be noted that only the off-post RI/FS data and the Sand Creek Industrial site data had this information available.

Statistical analysis of the volatile data was conducted in order to assess the relationship between compounds. Frequency distributions for each of volatile compounds of primary concern were examined to verify if they follow the Gaussian distribution after any necessary transformation. Most of the classical multi-variate statistical techniques that were used require that normally distributed data be utilized in the assessment. A log base 10 transformation allowed this assumption to be met when threshold of detection data was taken into account. Factor analysis was used to determine associations between the compounds independent of the strong geographic correlation obvious from the point concentration maps for each compound. From a factor analysis of the entire data set, several strong associations became apparent. DCA, DCE, and TCA are highly associated and independent of the other compounds. PCE and trans-DCE are also similarly associated. TCE does not group strongly with any of the other constituents. This suggests that the TCE contamination may have occurred at a different time from the contamination, or it may simply be a result of different migration rates for each of the compounds. More detailed statistical analyses will be conducted to confirm these relationships in later operable unit evaluations.

A simulation of ground water contaminant transport processes was undertaken to assess potential future concentrations that may be expected at the primary extraction points. The particle tracking method described in section 3 was implemented to accomplish this objective. It should be noted that this simulation is very preliminary since no source characterization data is yet available and model calibration is incomplete. The source term strength is a major controlling factor in using the modeling method for future predictions. Some uncertainty remains regarding hydraulic properties and the geometry of the paleo-channels along the path of the plumes. Due to this uncertainty, the accuracy of the flow paths for the plumes is questionable and can only be used to generally characterize rates of migration, and probable concentrations in the future, rather than for plume characterization. This further quantification will await completion of planned plume characterization and monitoring and source characterization both on and off the RMA. With these limitations in mind, the results of the simulations can be assessed.

A contaminant transport simulation was performed for TCE using three assumed source areas. One source area is in the south, as indicated by observed data presented in Figure 5-28, two other source areas are on the RMA. It is emphasized that since the exact flow path for the plumes could not be modeled, results should only be considered as a general guideline. Source strengths were approximated to yield concentrations similar to that observed in the existing TCE plumes. A retardation factor of 2.4 was used as an upper end estimate. Use of the low end estimate for retardation factor would decrease the travel time but not affect concentration. Calculations leading to this estimate were presented earlier in Section 2.2.2.3. Longitudinal and lateral dispersion coefficients were assumed to be 20 and 2 respectively. The present scope of the contaminant transport modeling does not include matching observed concentrations, hence the sensitivity of these parameters on predicted concentrations was not determined. Future studies are planned to allow quantification of both hydraulic parameters and retardation.

Transport simulations were conducted to assess future concentrations of TCE to be expected at the 77th and Quebec receptor. Source strengths were defined to yield concentration fields similar to those currently observed for TCE. The transport calculations were done to identify future concentrations to be expected at the primary SAC receptor well. Figure 5-35 illustrates the expected TCE concentration versus time from the preliminary calibrated model. By extrapolating the time trend curve, it is estimated that there will be a peak concentration of TCE of approximately 120 ppb at this location within 10-15 years from the present time. Due to the uncertainty in the exact source locations, strengths and the preliminary nature of the model calibration, a conservative estimate of the peak concentrations of TCE would range between 100 to 150 ppb at the primary receptors. Further quantification of future conditions will require more information from source characterization studies currently in progress by various parties including the RMA and the EPA. The companion FS report for this operable unit evaluates options for treating the public water supply based on this current best conservative estimate of 150 ppb for future TCE concentrations.

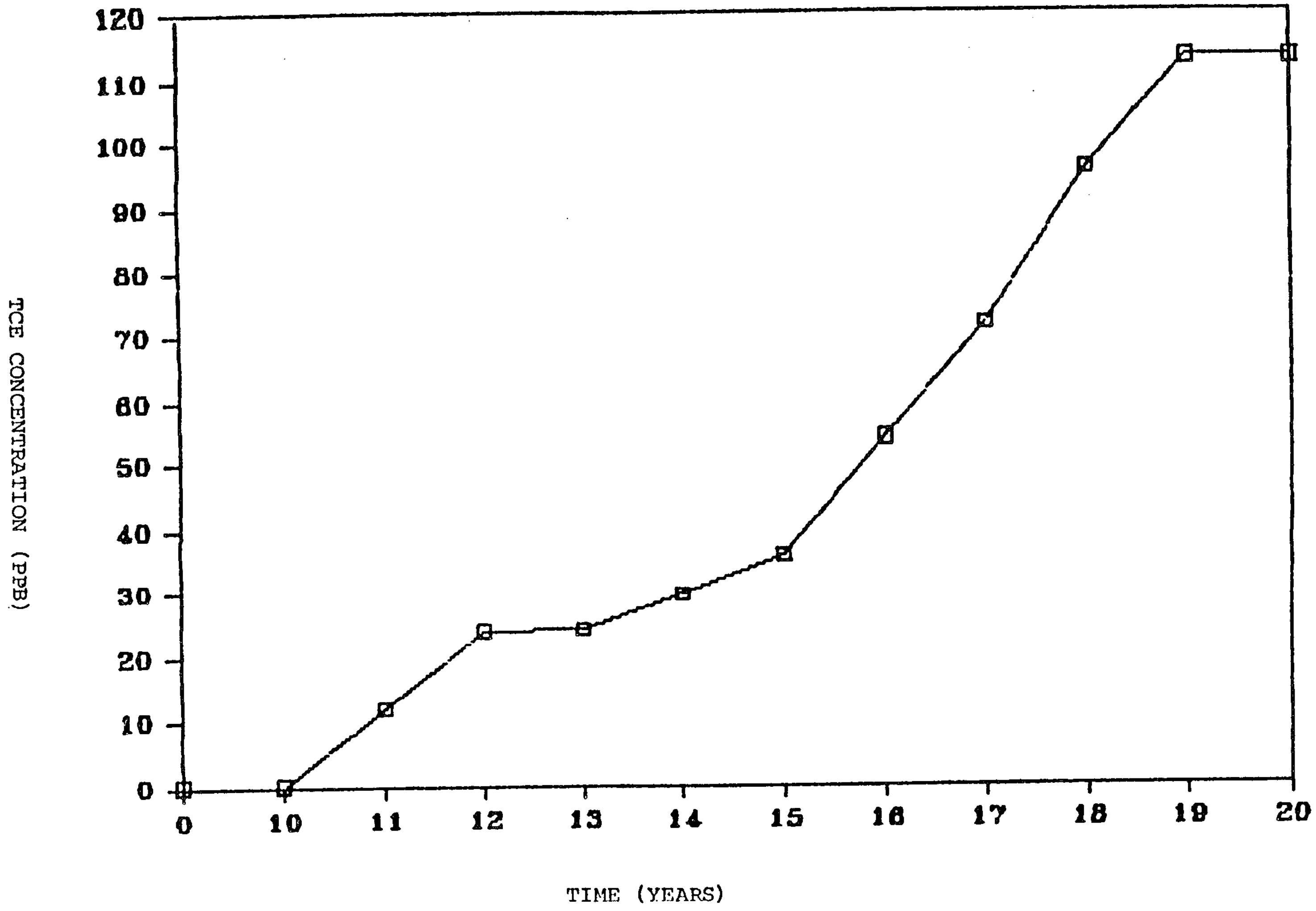


FIGURE 5-35. TCE CONCENTRATION VS. TIME AT A DOWNGRADIENT NODAL LOCATION

6.0 ENDANGERMENT ASSESSMENT

6.1 INTRODUCTION

This section is the baseline endangerment assessment that forms part of the EPA Off-Post Remedial Investigation/Feasibility Study (RI/FS) for the Rocky Mountain Arsenal site. The Rocky Mountain Arsenal (RMA) site is located about 10 miles northeast of Denver, Colorado, in the central part of the state. The site extends westward from the Rocky Mountain Arsenal to the South Platte River. The southern boundary is formed by East 56th Avenue and Sand Creek, and the northern boundary by a line along East 80th Avenue from the Rocky Mountain Arsenal to the South Platte. The site encompasses a large part of the municipality of Commerce City and a portion of unincorporated Adams County. The area is nearly completely developed with residential subdivisions, light and heavy industrial facilities, gravel operations, and a few small farms.

Groundwater contamination, consisting primarily of elevated levels of organic solvents and related compounds, has been detected throughout the area in both private and municipal wells. The data currently available suggest that the contamination is confined to the shallow alluvial aquifer and has not reached deeper bedrock aquifers. The groundwater degradation observed at the EPA Off-Post site may stem from several sources, including the RMA, the Woodbury Chemical site, and the Sand Creek Industrial site, all of which are Superfund sites, or from other as yet unidentified sources within or outside of the RI/FS area.

In response to a directive from the EPA, this RI/FS focuses on remediation of public water supply contamination in the Off-Post RI/FS study area. Accordingly, this endangerment assessment evaluates potential public health hazards associated with use of water supplied by the South Adams County Water and Sanitation District (SACWSD) based on currently available data. SACWSD supplies approximately 30,000 customers in Commerce City, Adams City, and adjacent areas of Adams County with water from wells completed in alluvium or bedrock in the EPA Off-Post RI/FS area. There are currently 15 supply wells, 8 of which are completed in alluvium and 7 in bedrock. In 1981, the results of a random EPA drinking water survey revealed the presence of several organic compounds in the SACWSD system. Sampling and analyses conducted since 1981 indicate the continued presence of organic contaminants. This endangerment assessment is based primarily on results of analyses for chlorinated hydrocarbon compounds in drinking water samples obtained during the period from November 1985 through May 1986.

As a Superfund removal action instituted by EPA Region VIII in May 1986, water from five shallow wells currently undergoes granular activated carbon (GAC) treatment before distribution to SACWSD customers, as a temporary measure. It is anticipated that the temporary GAC units will operate until permanent treatment units are constructed. In areas where contamination is currently present or likely to be encountered in the near future, private well users were connected in summer 1986 to the SACWSD system as another removal program action by EPA. This Endangerment Assessment addresses contamination of the public water supply in the absence of treatment with the temporary GAC system. This operable unit RI/FS is to lead to a decision on what permanent treatment system, if any, to fund before removal of the temporary system currently in use.

Water supplied by SACWSD from individual municipal wells may be blended with waters from other wells to some extent as it is distributed through common pipelines beyond the individual wellheads and stored in holding tanks throughout the system. However, depending on proximity to a particular well field and on system operating parameters at a given time, some customers may receive water supplied almost exclusively by a single well. Water is treated by chlorination before it is distributed to SACWSD's customers. From October to April, SACWSD supplies approximately 3 million gallons of water per day (MGD), most of which is used for domestic purposes such as drinking, cooking, washing, and bathing. Water use increases to approximately 11 MGD from May to September. Most of the increased volume is used for irrigation of lawns, shrubs, and gardens. Maximum future water usage for the SACWSD system, within the 1986 District boundaries, is projected to be 4 MGD from October to April and 12 MGD from May to September.

This endangerment assessment does not consider the full range of potential hazards to public health, welfare, or the environment associated with contamination in the EPA Off-Post RI and Field Investigation Team study area. Future work will require consideration of potential exposure pathways other than the SACWSD distribution system and a more detailed development of potential future exposure scenarios. In this regard, it will be necessary to evaluate the extent to which potential releases from the RMA, Woodbury Chemical, or Sand Creek Industrial sites may adversely affect other potential receptors in the study area and to develop appropriate remediation strategies. Contributions from local, currently undefined sources will also be considered to the extent that they modify the potential effects of contributions from the three defined potential sources.

6.2 EXPOSURE ASSESSMENT

In this section of the endangerment assessment, a subset of chemicals found at the EPA Off-Post site that pose the greatest potential human health risks is selected. These chemicals are referred to as indicator chemicals. Then the potential pathways of exposure to these contaminants are described and exposure scenarios under current conditions and potential future conditions are developed.

6.2.1 SELECTION OF CHEMICALS FOR ASSESSMENT

Investigations of the occurrence and migration of contaminants at the EPA Off-Post site have been conducted by the EPA (EPA-FIT data and RI/FS data), by the state (Colorado Department of Health), by the Army on the RMA, and by HRS Water Consultants, Inc. (HRS) for SACWSD. Only the results of the EPA RI/FS and Field Investigation Team (FIT) analyses of water from monitoring wells and from private drinking water wells in the study area have been validated through EPA's Contract Laboratory Program (CLP), and in some cases these values are estimates. Nevertheless, they provide a reasonable indication of current groundwater contaminant levels in the EPA Off-Post study area and allow projection of the likely future levels and extent of contamination. Although recent HRS monitoring data for SACWSD municipal wells are not CLP-validated, they provide the best available information regarding current contaminant levels within the SACWSD distribution system. The currently available data are presented in this section of the RI only to the extent that

TABLE 6-1

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

FREQUENTLY REPORTED CHEMICALS IN RECENT CLP-VALIDATED ANALYTICAL RESULTS FOR GROUNDWATER MONITORING WELLS IN THE OFF-POST STUDY AREA

Chemical	Maximum Reported Concentration March - July 1986 (ug/liter)
1,1-Dichloroethane	14[a]
1,1-Dichloroethylene	11
trans-1,2-Dichloroethylene	16
1,1,1-Trichloroethane	58
Trichloroethylene	120
Tetrachloroethylene	21

[a] This value is an estimated quantity because quality control criteria were not met. Highest reported unqualified value is 6 ug/liter.

SOURCE: Report of Groundwater Analyses—Adams County Wells (CDM 1986 a,b,e).

they actually are used in the endangerment assessment. More complete presentations and analyses of the available sampling and analytical data are presented in other sections of the RI report.

The chemicals reported most frequently and at the highest concentrations in CLP-validated monitoring well and private well data are shown in Table 6-1, along with the highest groundwater concentrations reported for the period from March to July 1986. These chemicals may be considered groundwater contaminants of primary concern. A number of other organic chemicals including toluene, cis-1,3-dichloropropene, phenol, vinyl chloride, dibromochloropropane, aniline, methylene chloride, carbon tetrachloride, chloroform, heptachlor epoxide, dieldrin, and several phthalate esters also were detected in some groundwater samples from the EPA Off-Post study area. However, these chemicals were detected infrequently and generally at low concentrations. Furthermore, many of these chemicals are common laboratory or field sampling contaminants. Consequently, these chemicals are not considered to reliably represent current groundwater contamination. Among inorganic chemicals, nitrate concentrations were somewhat elevated in some groundwater samples. However, elevated nitrate concentrations were only reported for a few samples and thus appear to represent a more localized phenomenon. It should be noted that selection of indicator chemicals for this endangerment assessment was based on analysis of currently available data. As more information characterizing groundwater in the study area become available, it may be necessary to consider additional chemicals as indicators, including some of the volatile and nonvolatile organic compounds mentioned above.

Higher concentrations than those shown in Table 6-1 for a number of organic solvents, including some of the indicator chemicals, have been identified in areas adjacent to and upgradient of the current study area. Any changes in concentration detected by the continuing monitoring program will be used to update the estimation of risk in the future.

Table 6-2 summarizes the monitoring results for chemicals detected in SACWSD municipal wells for the time period from November 1985 to May 1986. Only

TABLE 6-2

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

RECENT ANALYTICAL RESULTS FOR SACWSD MUNICIPAL WELLS
(ug/liter)

	Sampling Date					
Chemical	Nov. 85	Dec. 85	Jan. 86	Feb. 86	Mar. 86	May 86
Well No. 1						
Methylene chloride	NS	NS	NS	4[b]	NS	NS
Well No. 2						
1,1-Dichloroethane	6	4	<1[a]	<1	<1	NS
1,1,1-Trichloroethane	7	5	6	3	3	NS
Trichloroethylene	19	31	40	29	36	NS
Tetrachloroethylene	11	7	5	4	<1	NS
Methylene chloride	<1	9	<1	3[b]	<1	NS
Well No. 3						
1,1,1-Trichloroethane	5	4	6	3	4	NS
Trichloroethylene	46	39	40	40	47	NS
Trans -1,2-Dichloroethylene	3	<2	<2	<2	<2	NS
Methylene chloride	<1	9	<1	<1	<1	NS
Tetrachloroethylene	8	5	4	5	5	NS
Well No. 5						
Trichloroethylene	11	6	7	7	7	NS
Tetrachloroethylene	4	3	<1	3	<1	NS
Bromoform	14	<1	<1	<1	<1	NS
Methylene chloride	<1	7	<1	3[b]	<1	NS
1,1,1-Trichloroethane	<1	<1	<1	1	<1	NS
Well No. 12						
Trichloroethylene	NS	NS	NS	3	NS	NS
Well No. 14						
Trichloroethylene	8	NS	NS	NS	NS	NS
Tetrachloroethylene	2	NS	NS	NS	NS	NS

TABLE 6-2 (Continued)

Chemical	Sampling Date Nov. 85	 Dec. 85	 Jan. 86	 Feb. 86	 Mar. 86	 May 86
Well No. 15						
Methylene chloride	NS	5	<1[a]	4[b]	<1	NS
1,1,1-Trichloroethane	NS	<1	<1	1	2	NS
1,1-Dichloroethane	NS	<1	<1	2	<1	NS
Trans 1,3-Dichloropropene	NS	<1	<1	2	<1	NS
Well No. 16						
1,1,1-Trichloroethane	5	NS	4	5	5	NS
Trichloroethylene	15	NS	13	14	11	NS
Tetrachloroethylene	8	NS	5	5	<1	NS
Chloroform	<1	NS	2	<1	<1	NS
Methylene chloride	<1	NS	<1	4[b]	<1	NS
1,1-Dichloroethane	<1	NS	<1	4	6	NS
Well No. 17						
1,1,1-Trichloroethane	4	3	5	3	5	3
Trichloroethylene	10	8	8	9	9	12
Tetrachloroethylene	1	<1	<1	<1	<1	2
Methylene chloride	<1	4	<1	3[b]	<1	4
1,1-Dichloroethylene	<1	<1	<1	<1	<1	2
Well No. 18						
1,1,1-Trichloroethane	1	<1	3	<1	<1	NS
Tetrachloroethylene	1	<1	<1	<1	<1	NS
1,1,2,2-Tetrachloroethane	2	<1	<1	<1	<1	NS
Methylene chloride	<1	11	<1	<1	<1	NS
Trichloroethylene	<1	2	2	<1	<1	NS
Toluene	<1	2	<1	<1	<1	NS

NS = Not sampled

[a] Concentrations are below the approximate method/sample detection limit listed.

[b] Methylene chloride was also found in the laboratory blank at 4 ug/liter.

SOURCE: HRS Water Consultants, Inc. Summary data and Cenref Labs Laboratory Reports.

municipal wells correspond qualitatively with the recent CLP-validated results for monitoring wells and private wells located in the EPA Off-Post study area. That is, chemicals detected most frequently and at the highest concentrations in EPA RI/FS groundwater samples (see CLP validated data shown in Table 6-1) also have been detected in SACWSD municipal wells. The chemicals detected in SACWSD municipal wells (see Table 6-2) that were not also listed as groundwater contaminants of concern in Table 6-1 are methylene chloride, toluene, bromoform, 1,1,2,2-tetrachloroethane, chloroform, and trans-1,3,-dichloropropene. All of these chemicals, except methylene chloride, were only detected once at relatively low concentrations. Consequently, they are not considered to reliably represent current contamination of the public water supply and are not considered in this endangerment assessment. Because methylene chloride has been reported only sporadically in the analytical results for the SACWSD municipal wells and has been reported as a laboratory contaminant in some of the testing rounds, this chemical also will not be considered.

Trihalomethanes are potentially hazardous compounds that may be introduced into drinking water by the reaction of naturally occurring substances with chlorine used in the course of municipal water treatment. The actual level of trihalomethanes in drinking water varies depending upon the season, chlorine contact time, water temperature, pH, type and chemical composition of raw water, and treatment methodology. In general, since the natural organic precursors of trihalomethanes are more commonly found in surface waters, water taken from a surface source is ordinarily more likely than groundwater to produce high trihalomethane levels. Two trihalomethanes, bromoform and chloroform, have been detected sporadically and relatively infrequently in SACWSD municipal drinking water. As noted above, however, these compounds each have been reported only once in recent monitoring data (November 1985 to May 1986). Furthermore, the concentration of total trihalomethanes in SACWSD municipal water has not been reported to exceed the Interim Primary Drinking Water Maximum Contaminant Level (MCL) of 0.1 mg/liter for this group of chemicals in monitoring data collected since 1982. The intent of the MCL for trihalomethanes is to achieve a balance between providing biologically safe water (by killing pathogens in the water) and minimizing the occurrence of potentially harmful byproducts of the water treatment process. Because trihalomethanes have been reported infrequently in SACWSD water, have not exceeded the MCL for these compounds, and are the byproducts of a beneficial water treatment process, these compounds are not considered further in this endangerment assessment. It is assumed that the beneficial effects associated with providing biologically safe water outweigh the potential adverse health effects of introducing trihalomethanes as a byproduct.

Although benzene has not been reported in CLP-validated monitoring data or in SACWSD municipal well monitoring data, this compound does occur in groundwater underlying the Rocky Mountain Arsenal at concentrations as high as 140 ug/liter and in the Commerce City area south of the study area at concentrations as high as 580 ug/liter. Available data suggest that groundwater containing benzene may eventually move through areas of the EPA Off-Post RI/FS Site that are downgradient of the benzene sources. This is of concern with regard to potential human health risks associated with use of benezene-contaminated groundwater. A profile discussing in detail the toxicity of benzene is included in Appendix D. Toxic effects of benzene in humans and experimental animals include central nervous system effects, hematological effects, and effects on the immune system. Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, benzene has been classified in Group A, Human Carcinogen. This category indicates that there is sufficient evidence from epidemiologic studies to support a casual association between benzene and the incidence of cancer. Because this compound is not currently reported to occur in SACWSD water, benzene will not be considered in this endangerment assessment. However, it should be noted that the presence of benzene in groundwater used as a potable water supply increased risks to human health.

Based on consideration of recent groundwater and municipal well water monitoring data, six indicator chemicals have been selected for evaluation of human health risks in this endangerment assessment: 1,1-dichloroethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene. These chemicals have been reported frequently and at relatively high concentrations in EPA RI/FS groundwater monitoring results or in SACWSD municipal well monitoring.

results. Although the recent SACWSD municipal well data have not been CLP-validated, it is likely that these results are a reliable quantitative estimate of current chemical concentrations to which SACWSD customers may actually be exposed. Therefore, these data will be used as a basis for estimating current potential human exposure point concentrations in the absence of remediation. EPA RI/FS groundwater monitoring results along with appropriate modeling techniques, as described in other sections of the RI report, are used as a basis for projecting potential future contaminant concentrations.

6.2.2 IDENTIFICATION OF EXPOSURE PATHWAYS

As noted above, only the potential human health risks associated with use of water form the SACWSD distribution system will be considered in this endangerment assessment. The endangerment assessment is futher limited to consideration of available data for the six volatile chlorinated hydrocarbons selected as indicator chemicals in section 6.2.1. Human receptors can be exposed to volatile organic contaminants present in water while using the water for drinking, bathing, cooking, cleaning, irrigation, and other routine domestic activities. Exposure may be through ingestion, inhalation, or dermal contact. A preliminary evaluation suggests that the potential incremental health risks associated with direct ingestion of water and inhalation of volatilized contaminants while showering can be quantified reasonably well and are likely to outweigh the risks associated with other potential exposure pathways. Additionally, estimation of potential exposure by direct ingestion of water and during showering would be likely to provide a reasonable order-of-magnitude estimate for exposure by all routes. Therefore, only exposure by these two pathways will be considered in this assessment.

Individuals using water from the SACWSD distribution system or from private wells for irrigation of landscaping plants or vegetable gardens could be minimally exposed to volatile organic contaminants that may be present in the water. Exposure may occur by inhalation of volatilized chamicals during irrigation or by ingestion of contaminants taken up into food plants. Limited experimental data suggest that organic compounds may be translocated and transpired to some extent in food plants. However, a major portion of the compounds present in SACWSD water would be likely to volatilize into ambient air or be transpired by the plants and disperse relatively rapidly, thus limiting human exposure by inhalation and reducing the amount of contaminants available to plants. Potential exposure via this pathway is likely to vary greatly depending on individual water use and gardening patterns. Overall, however, use of contaminated groundwater at the EPA Off-Post site for irrigation purposes does not appear to represent a substantial source of exposure to volatile organic compounds and will not be considered further in this assessment.

The use of SACWSD water during two exposure periods will be considered in this risk assessment: (1) the 1- to 2-year period needed to complete the RI/FS and follow-up activities for the SACWSD system, and (2) an indefinite or lifetime period. The 1- to 2-year exposure would also be appropriate for evaluation of potential health risks to a transient subpopulation only living in the EPA Off-Post study area for a limited time period. As discussed below, levels of contamination in the SACWSD distribution system are used as a basis for estimating exposure point concentrations for persons drinking the water. These concentrations are also incorporated into a mathematical exposure model, summarized in Appendix C, which estimates the airborne concentrations of these contaminants while showering.

For the purposes of this risk assessment, it is assumed that subscribers to the system ingest approximately 2 liters (2,000 milliliters) of SACWSD water per day, and that individuals shower for 10 minutes each day. The assumption that individuals ingest 2 liters of tap water per day is conservative, in a protective sense. Although daily fluid intake may vary greatly depending on temperature, humidity, physical activity, and other factors, values of from 1,000 to 2,400 mls are commonly cited (ICRP 1975). However, direct intake of tap water is likely to represent only a fraction of the total amount of fluids ingested each day. For example, of the 1,000 to 2,400 ml total daily fluid intake noted above, milk, tap water, and water-based drinks (tea, coffee, soft drinks, juice, alcoholic beverages, etc.) are estimated to contribute 120-450, 45-730, and 320-1,450 mls, respectively (ICRP 1975). Efforts are underway to refine these estimates for use in future assessments. In the meantime, however, as recommended in current EPA guidance documents (ICF 1985, Versar 1986), a conservative drinking water ingestion rate of 2 liters per day is assumed for this assessment.

A detailed assessment of the risks associated with the use of water from the SACWSD wells should take into account past and future contaminant levels. However, information that would allow estimation of these levels with confidence is incomplete. Past monitoring data are limited, and information on the sources of contamination, as well as the characteristics of the contaminant plume and its migration pattern, has not been fully developed. Consequently, potential human health risks associated with 1- to 2-year and lifetime exposure to SACWSD water will be considered for exposure under current conditions and under potential future conditions. In this endangerment assessment, recent monitoring data are used as an indication of the current level of contamination in the SACWSD system. Groundwater modeling data prepared for the EPA Off-Post study area are used to estimate future levels of contamination. It is assumed that the levels of contamination estimated for each of the current and future exposure scenarios are based on conditions in the absence of remediation and would remain the same throughout the exposure periods considered for assessment of risks.

Chemical concentrations and identities in groundwater may change as the contaminant plumes present at the EPA Off-Post site moves through this area. Furthermore, changes in water withdrawal patterns from the SACWSD wells also may affect the extent and level of contaminants observed in the public water system. Therefore, using available monitoring data and appropriate modeling techniques, contaminant concentrations that may occur in the future in SACWSD water have been projected. This information will be used as the basis for a semiquantitative assessment of potential health risks associated with exposure to these compounds under potential future conditions.

6.2.3 EXPOSURE POINT CONCENTRATIONS

Levels of contamination in the SACWSD distribution system are used as a basis for estimating exposure point concentrations under current conditions for persons drinking the water. These concentrations are also incorporated into a mathematical exposure model, summarized in Appendix C, which estimates the airborne concentrations of these contaminants while showering. Exposure point concentrations under potential future conditions are based on available monitoring data and appropriate modeling techniques.

Drinking Water Concentrations

Exposure point concentrations in drinking water of the chemicals considered in this endangerment assessment are presented below. Values for current use and future use scenarios are included.

Current Conditions. For this analysis, recent monitoring data for SACWSD municipal wells (see Table 6-2) are used as a basis for estimating human health risks associated with use of water from the SACWSD distribution system. As noted in section 6.1, water reaching SACWSD customers at the tap may be derived almost exclusively from a single municipal well or may be a mixture of water from more than one of the municipal wells. Accordingly, individual customers may be exposed to very little or no volatile organic chemical contamination or to levels of contamination approaching the maximum concentrations currently observed in municipal wells. This endangerment assessment evaluates the potential health risks that would be experienced by persons actually exposed to volatile organic contaminants in the SACWSD distribution system. The minimum, mean, and maximum detected concentrations of indicator chemicals selected in section 6.2.1 will therefore be used to evaluate the range of potential health risks associated with use of water from SACWSD municipal wells. These values are shown in Table 6-3.

Future Conditions. The data base currently available for modeling the future extent and degree of groundwater contamination in the EPA Off-Post study area is incomplete and therefore somewhat limited. As a result, estimated future concentrations of the groundwater contaminants that may intercept SACWSD supply wells and that are considered in this assessment are preliminary and approximate. Accordingly, only a semi-quantitative evaluation of the potential health risks associated with the use of SACWSD water under projected future conditions is presented in this report.

As discussed in detail in section 5.0, a groundwater flow and contaminant transport model was developed and calibrated on a preliminary basis to aid in the projection of future contaminant concentrations from potential source areas. A relatively high rate of contaminant plume migration was established by projecting into the future using presently observed trichloroethylene concentrations at the potential source areas. Results at a potential receptor indicate that a peak concentration between 100 and 120 ug/liter of trichloroethylene within 10-15 years from the present time is to be expected. It should be noted, however, that major data gaps prevent adequate characterization of complex transport processes likely to operate in the study area. Furthermore, inadequate source characterization data prevented matching of simulated versus observed concentration levels.

The extent and degree of contamination by indicator chemicals other than trichloroethylene considered in this assessment are even less well characterized. However, available data suggest that future concentrations of these chemicals will increase by amounts relatively comparable to the increase estimated for trichloroethylene (i.e., by a factor of approximately ten times the mean levels currently seen in SACWSD supply wells as reported in Table 6-3). Furthermore, it is likely that chemical concentrations will remain elevated for an extended period of time as the contaminant plumes slowly travel through the alluvial aquifer at the EPA Off-Ost site. It is therefore assumed that future potential concentrations of the indicator chemicals considered in this endangerment assessment will be approximately 10 times higher than current mean concentrations shown in Table 6-3. It should be noted, however, that this assumption may overestimate or undersestimate actual contaminant concentrations in any individual SACWSD well or at any specific time in the future.

Air Concentrations While Showering

Exposure point concentrations for inhalation of organic chemicals while showering are presented below. Values for current use and future use scenarios are included.

Current Conditions. The recent contaminant levels in SACWSD municipal wells, as discussed in the preceding section and summarized in Table 6-3, are used to estimate the air concentrations that might be expected while showering. Using a theoretical exposure model, outlined in Appendix C (Foster and Chrostowski 1986), the transfer of volatile organic compounds from shower droplets into the air and their subsequent inhalation were estimated.

The duration of exposure while showering is assumed to be 10 minutes per day. It is also assumed that once inhaled, the volatilized organic compounds being considered are all absorbed across the lung lining with 75% efficiency. Although lower absorption efficiencies have been reported by some investigators, no estimated pulmonary absorption efficiencies greater than 75% have been reported in the available literature, and conservative assumptions regarding pulmonary absorption were made. This model does not estimate the potential dermal absorption of contaminants while showering. However, given the exposure scenario and the physical and chemical properties of the organic compounds considered in this assessment, dermal absorption is likely to be minimal in comparison to exposure via inhalation.

In efforts to estimate the magnitude of potential inhalation exposures while showering, other researchers have employed simpler assumptions to describe the amount of contaminant transfer from shower water to air. Some approaches have been based on the assumption that 100% of the contaminant in water would be volatilized (Highland and Rodricks 1982), while others assumed that potential exposures via ingestion and inhalation while showering would be equivalent (Cothern at al. 1985). The limited experimental data currently available (Andelman et al. 1986, Andelman 1985) suggest that inhalation exposure to volatile organic chemicals in showers may be substantial in comparison with exposure by direct ingestion of water. The degree of potential exposure depends on a number of factors including the chemical under consideration and its concentration in shower water, water temperature, and physical characteristics of the shower and shower room.

A sensitivity analysis of the shower model (Foster and Chrostowski 1986) indicated that the total estimated exposure for an individual assumed to shower once per day is most sensistive to changes in tap water concentration, increasing by 1% for each 1% increase in concentration. Estimated exposures are somewhat less sensitive to other model input variables, changing by approximately 0.5% for each 1% change in the magnitude of the model input variable. Under the assumptions made in this report, the model employed predicts that approximately 25% of a volatile organic compound in shower water transfers to shower air. Given the uncertainties associated with selection of model input variables, exposure estimates derived from the shower room air model should be viewed as order of magnitude, relative estimates rather than absolute values.

Based on this exposure model, potential inhalation exposures to the groundwater contaminants considered in this report (see Tables 6-2 and 6-3), all of which are volatile organic compounds, were quantified. The model yields estimates of the intake level (in ug/day), rather than estimates of the ambient air concentrations that might be expected while showering. These values are shown in Table 6-3 for the minimum, mean, and maximum concentrations of the contaminants present in SACWSD municipal wells. Estimates of the daily intake attributable to the ingestion of contaminated drinking water are also provided for comparison. In general, a comparison of the estimates for exposure via ingestion of drinking water and of inhalation while showering indicate that approximately 30% of the total exposure can be attributed to the inhalation of volatile organic compounds. This is based on an assumption that individuals ingest 2 liters of tap water per day. If a lower daily ingestion rate is assumed, the relative contribution of inhalation during showering to total exposure would be correspondingly greater.

The exposure estimates predicted by the shower model are, as mentioned previously, sensitive to the model input variables selected, and these variables are not, in many cases, well characterized. Accordingly, use of these values to characterize potential adverse health effects introduces an added degree of uncertainty to the overall risk assessment. These estimates may be most useful in comparing exposures via different routes (i.e., ingestion versus inhalation), rather than in determining absolute levels of exposure. Nevertheless, the quantitative results obtained are presented to provide a general indication of the potential levels of exposure that could occur.

Future Conditions. Only a semi-quantitative assessment of potential health risks associated with use of SACWSD water under projected future conditions is presented in this report. Therefore, chemical-specific exposure estimates are not predicted for future exposure conditions using the shower model discussed above. Rather, it is assumed that potential inhalation exposures to the

TABLE 6-3

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

ESTIMATED INGESTION AND INHALATION EXPOSURES TO VOLATILE ORGANIC CHEMICALS IN SACWSD TAP WATER

Chemical	Concentration[a] (ug/liter)	Ingestion Exposure[b] (ug/day)	Inhalation Exposure[c] (ug/day)
1,1-Dichloroethane	2	4	2
	4	8	4
	6	12	6
1,1-Dichloroethylene[d]	2	4	2
trans -1,2-Dichloroethylene[d]	3	6	3
1,1,1-Trichloroethane	1	2	1
	3	6	3
	7	14	6
Trichloroethylene	2	4	2
	13	26	11
	47	94	40
Tetrachloroethylene	1	2	1
	4	8	3
	11	22	9

---

[a] Minimum, geometric mean, and maximum concentrations reported in recent SACWSD municipal well monitoring data (Nov. 1985 - May 1986). As noted in the text, only contaminant concentrations greater than the analytical method detection limits are considered in this assessment.

[b] Ingestion exposure is based on the assumption that, on average, a person drinks 2 liters of water per day.

[c] Model used to estimate inhalation exposure is outlined in Appendix C.

[d] Chemical was detected only once in recent SACWSD monitoring data. However, because it has been found relatively frequently in other groundwater samples in the EPA Off-Post study area it is considered in this assessment. The single reported concentration is considered to be a maximum potential exposure concentration.

indicator chemicals considered in this report will be approximately one order of magnitude greater than estimated exposures based on current mean contaminant concentrations.

6.3 HAZARD ASSESSMENT

The effects on both humans and experimental animals of the organic compounds present in the SACWSD system and considered in this report (Table 6-3) are described in the toxicity profiles in Appendix D. These profiles also list the standards and criteria that EPA has developed to protect the health of persons exposed to these chemicals under specific conditions. The profiles summarize the information used to derive these standards and criteria, and, where appropriate, review and summarize the results of more recent studies that provide significant new information.

In its "Guidance on Feasibility Studies Under CERCLA" (EPA 1985), EPA directs that concentrations of contaminants at exposure points should be compared with the applicable or relevant and appropriate standards and criteria. Following the guidelines outlined in the EPA Draft Superfund Public Health Evaluation Manual (ICF 1985) and in other EPA documents, the most appropriate criteria for the exposure conditions considered in this assessment [i.e., exposure by ingestion or inhalation to contaminants present in drinking water for 1 to 2 years or over a lifetime (70 years)] were selected or derived where appropriate. These criteria are presented in Tables 6-4 and 6-5. These tables also list the 95% upper-bound carcinogenicity potency factors (unit risks) for the three potential human carcinogens considered in this report (1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene).

Carcinogenicity potency factors are used to estimate the potential excess cancer risks associated with exposure to these compounds. These values are an upper bound in the sense that the true potency factor, which is unknown, is unlikely to exceed the upper bound and may even be substantially lower, with a lower bound approaching zero. According to EPA's system for characterization of the overall weight-of-evidence for carcinogenicity, both trichloroethylene and tetrachloroethylene are currently classified in Group B2, meaning they are probable human carcinogens based on sufficient evidence in experimental

TABLE 6-4

ROCKY MOUNTAIN ARSENAL
USEPA OFF-POST RI/FS SITE

SUGGESTED CRITERIA FOR THE PROTECTION OF HUMAN HEALTH
EXPOSURE BY INGESTION

	Noncarcinogenic Effects[a]		Carcinogenic Effects[b]	
Chemical	1 to 2 Years (ug/liter)	Lifetime (ug/liter)	Lifetime[c] (ug/liter)	Carcinogenic Potency[d] $(ug/liter)^{-1}$
1,2-Dichloroethylenes	$3.5x10^3$ (HA)	70 (HA)	NA	NA
Tetrachloroethylene	$6.8x10^3$ (HA)	—	0.7	$1.5x10^{-6}$ [B2]
1,1,1-Trichloroethane	$1.2x10^5$ (HA)	$1.9x10^4$ (HEA) 200 (RMCL)	NA	NA
Trichloroethylene	(e)	(f)	3.2 (f)	$3.1x10^{-7}$ [B2]
1,1-Dichloroethylene	$3.5x10^3$ (HA)	(g)	0.06	$1.7x10^{-5}$ [C]
1,1-Dichloroethane	$4.0x10^4$ (HEA)	$4.0x10^3$ (HEA)	NA	NA

[a] Concentrations in drinking water intended to protect against noncarcinogenic effects.

[b] Derived from data presented in the EPA Health Effects Assessments.

[c] Concentrations in drinking water associated with a projected upper 95% confidence limit on excess cancer risk of 10^{-6} (i.e., one excess cancer could possibly occur in each 1 million individuals exposed throughout a 70-year average lifetime).

[d] Estimate of the excess cancer risk associated with 1 ug/liter of a contaminant in drinking water. It is obtained from the upper 95% confidence limit of the slope of the dose-response curve derived from an appropriate extrapolation model. Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen.

[e] Suitable data are not available for derivation of a guideline to protect against noncarcinogenic effects.

[f] A maximum concentration limit (MCL) of 5 ug/liter has recently been proposed; however, this is not a health based guideline, and is not currently a final federally enforceable standard.

TABLE 6-4 (Continued)

[g] An MCL of 7 ug/liter has recently been proposed; because 1,1-dichloroethylene is a Group C compound, EPA based its MCL on chronic toxicity, but incorporated on extra safety factor of 10 to account for its potential carcinogenicity.

NOTE: The derivations of these criteria are discussed in the toxicity profiles in Appendix D.

NA = Not applicable for noncarcinogenic compounds.
HA = EPA Office of Drinking Water Health Advisory
HEA = Derived from data presented in the EPA Health Effects Assessment
RMCL = Recommended maximum concentration limit as developed under Safe Drinking Water Act.

TABLE 6-5

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

SUGGESTED CRITERIA FOR THE PROTECTION OF HUMAN HEALTH EXPOSURE BY INHALATION

Chemical	Noncarcinogenic Effects[a]		Carcinogenic Effects
	1 to 2 Years (ug/day)	Lifetime (ug/day)	Carcinogenic Potency[b] $(ug/day)^{-1}$
1,2-Dichloroethylenes	7.0×10^{3} (HA)	7.0×10^{2} (HA)	NA
Tetrachloroethylene	(c)	(c)	2.4×10^{-8} [B2]
1,1,1-Trichloroethane	7.7×10^{5} (HEA)	4.4×10^{5} (HEA)	NA
Trichloroethylene	(c)	(c)	6.6×10^{-8} [B2]
1,1-Dichloroethylene	(c)	(c)	1.7×10^{-5} [C]
1,1-Dichloroethane	9.7×10^{4} (HEA)	9.7×10^{3} (HEA)	NA

[a] Daily intake intended to protect against noncarcinogenic effects.

[b] Derived from data presented in the EPA Health Effects Assessments. Estimate of the excess cancer risk associated with absorption by inhalation of 1 ug/day of a contaminant by a 70 kg person. Obtained from the upper confidence limit of the slope of the dose-response curve derived from an appropriate extrapolation model. Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-Dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen.

[c] Suitable data are not available for derivation of a guideline to protect against noncarcinogenic effects.

NOTE: The derivations of these criteria are discussed in the toxicity profiles in Appendix D.

NA = Not applicable for noncarcinogenic compounds.

HA: EPA Office of Drinking Water Health Advisory

HEA: Derived from data presented in the EPA Health Effects Assessments.

animals. 1,1-Dichloroethylene is classified in Group C, meaning it is a possible human carcinogen based on limited evidence of carcinogenicity in animals. 1,1,1-Trichloroethane, 1,1-dichloroethane, and the 1,2-dichloroethylenes are all classified in Group D, meaning they are not classified as to potential human carcinogenicity because of inadequate experimental evidence in animals. Weight-of-evidence designations are presented in brackets following the carcinogenicity potency factors or carcinogenicity risk estimates presented throughout this report.

6.4 RISK ASSESSMENT

In the first subsection of this risk assessment, general toxicological principles used and assumptions made in evaluating potential human health risks are discussed. Uncertainties inherent in preparing the risk assessment also are addressed. Human health risks under current and future exposure conditions are discussed in the succeeding two subsections.

6.4.1 GENERAL PRINCIPLES

The potential health risks associated with the use of water from the SACWSD distribution system are discussed in this section of the risk assessment. This baseline evaluation assesses the risks associated with the no-action alternative; i.e., it is assumed that no remedial actions will be performed at the EPA Off-Post site after the current temporary treatment system is removed.

According to the procedures for endangerment assessments developed by EPA, the potential adverse effects on human health and the environment should be assessed where possible by comparing the concentrations found at or near the site with relevant standards or criteria that have been developed for the protection of human health or the environment. EPA considers the Maximum Contaminant Levels (MCLs) developed under the Safe Drinking Water Act and the National Ambient Air Quality Standards (NAAQS) to be the most relevant and applicable standards for the protection of human health that can be used in risk assessments of Superfund sites. State drinking water and air quality standards are additional requirements which are considered by EPA. If appropriate standards are not available for all of the selected indicator chemicals and for the exposures considered, a quantitative risk assessment must be performed for all of the contaminants, according to EPA guidelines (ICF 1985). Because no applicable or relevant and appropriate standards exist for the EPA Off-Post indicator chemicals, a quantitative risk assessment was performed.

The potential health risks associated with the use of water from the SACWSD distribution system are addressed below. The procedures and inputs used to assess potential human health risks in this evaluation are subject to a wide variety of uncertainties. In general, there are six main sources of uncertainty:

- Environmental chemistry sampling and analysis
- Environmental parameter measurement
- Fate and transport modeling
- Exposure parameter estimation
- Toxicological data
- Errors through combinations of the above

Environmental chemistry sampling and analysis error can stem from the error inherent in the procedures, from a failure to take an adequate number of samples to arrive at sufficient areal resolution, from mistakes on the part of the sampler, or from the heterogeneity of the matrix being sampled. One of the most effective ways of minimizing procedural or systematic error is to subject the data to a strict quality control review. Even with all data rigorously quality assured, however, there is still error inherent in all analytical procedures.

Environmental parameter measurements primarily contribute to uncertainty due to their absence. Lack of site-specific measurements dictates that estimates must be made based on literature values, regression equations, extrapolations, and/or best professional judgment.

Modeling error arises primarily from the use of an inappropriate model or the use of an appropriate model but with inappropriate boundary conditions. Other model errors can stem from a lack of validation or verification of the models. Typically, an order of magnitude result is considered to be satisfactory for most complex modeling scenarios.

There are inherent uncertainties in determining the exposure parameters that are combined with toxicological information to assess risk. For example, some of the uncertainties regarding assumptions in estimating drinking water concentrations based on SACWSD municipal well data and in estimating inhalation exposure using the shower model have been discussed in previous sections of this report.

Toxicological data error is probably the largest source of uncertainty in this risk assessment. As EPA noted in its Guidelines for Carcinogenic Risk Assessment (EPA 1986):

> There are major uncertainties in extrapolating both from animals to humans and from high to low doses. There are important species differences in uptake, metabolism, and organ distribution of carcinogens, as well as species and strain differences in target site susceptibility. Human populations are variable with respect to geometric constitution, diet, occupational and home environment, activity patterns, and other cultural factors.

All of these individual errors from different sources may be propagated into larger errors by mathematical combination in the risk assessment. For purposes of evaluating remedial alternatives under Superfund, however, risk assessment may provide a useful decision-making tool despite the uncertainties. Our assessment of the potential human health risks associated with use of water from the SACWSD distribution system follows.

Evaluation of the risks associated with exposure by ingestion or inhalation to the noncarcinogenic contaminants of concern, 1,2-dichloroethylene, 1,1,1-trichloroethane, and 1,1-dichloroethane is based primarily on a comparison of the chemical concentrations in water or daily intake by inhalation with appropriate guidelines for the protection of human health. These guidelines are derived primarily from studies on experimental animals. For the potential human carcinogens, tetrachloroethylene, 1,1-dichloroethylene, and trichloroethylene, the estimated excess cancer risks associated with exposure by ingestion and inhalation are calculated using EPA-derived carcinogenicity potency factors. EPA recommends that the total carcinogenic risk to individuals resulting from exposure at a Superfund site be reduced to zero where possible. However, according to agency policy, the target total individual carcinogenic risk resulting from exposures may range between 10^{-4} and 10^{-7} (i.e., one excess cancer in every 10,000 and 10,000,000 individuals, respectively, exposed throughout their lifetime) (ICF 1985). Thus, an excess cancer risk of 10^{-6} is commonly used as an approximate guideline for determining an acceptable level of exposure within one or two orders of magnitude. The procedures outlined in EPA's Superfund Public Health Evaluation Manual (ICF 1985) and other EPA publications were used in performing this risk assessment.

In this assessment, the effects of exposure to each of the contaminants present in municipal well water have initially been considered separately. However, the pollutants occur together at the site, and individuals may be exposed to mixtures of contaminants, including many of the indicator chemicals and some of the other chemicals detected at the site. Consequently, it is important to recognize the potential adverse effects that these mixtures can have on humans. As suggested in EPA's Superfund Public Health Evaluation Manual (ICF 1985) and in EPA's Guidelines for the Health Risk Assessment of Chemical Mixtures (Federal Register 51:34014-34023, September 24, 1986), it also may be useful to sum the excess cancer risks or to calculate hazard indices for chemical mixtures. Suitable data are not available to characterize the effects of a chemical mixture similar to that present in groundwater at the EPA Off-Post site. Consequently, since the chemicals present elicit similar effects, they are assumed to act additively.

The excess cancer risks are calculated using carcinogenicity potency factors estimated for potential human carcinogens. The unit risks for three potential carcinogens considered in this assessment (tetrachloroethylene, 1,1-dichloroethylene, and trichloroethylene) are shown in Table 6-4 for exposure by ingestion and in Table 6-5 for exposure by inhalation; the derivations of the unit risks are discussed more completely in the toxicity profiles in Appendix D. A hazard index is the sum of the ratios of the environmental concentrations of noncarcinogenic substances to their corresponding relevant criteria. Hazard indices are not absolute measures of the potential endangerment to human health, but they provide indications of the relative risks associated with mixtures of chemicals. A hazard index of less than 1 indicates that endangerment of human health is unlikely to result from a given exposure; an index greater than 1 suggests a cause for concern. This approach to assessing the risks associated with mixtures of chemicals is based on the assumption that there are no synergistic or antagonistic interactions among the compounds involved and that all compounds have the same toxic end points and mechanisms of action. If these assumptions are incorrect, the actual risk could be under- or overestimated. These procedures may be useful in assessing the relative degree of hazard, but because of the uncertainties involved, they should not be regarded as measures of absolute risk.

As will be shown below, the potential human health risks associated with the noncarcinogenic contaminants present in SACWSD water are insignificant in comparison with those associated with the carcinogenic contaminants. Consequently, the conclusions reached in this assessment are based primarily on the carcinogenic risks associated with exposure to the potential human carcinogens, trichloroethylene, 1,1-dichloroethylene, and tetrachloroethylene.

6.4.2 HUMAN HEALTH RISKS UNDER CURRENT EXPOSURE CONDITIONS

The potential endangerment to human health associated with exposure by ingestion and inhalation to contaminants at concentrations currently observed in SACWSD municipal well water are discussed in this subsection. Selection of the indicator chemicals evaluated and estimation of exposure point concentrations are discussed more completely in section 6.2 of this report.

Exposure by Ingestion

The potential risks associated with ingestion of water from SACWSD municipal wells for 1- to 2-year and lifetime exposure periods are addressed below. Drinking water contaminant concentrations used in this portion of the endangerment assessment are shown in Table 6-3.

1- to 2-Year Exposure. Suitable guidelines are not available for evaluation of the potential noncarcinogenic, systemic toxic effects associated with exposure by ingestion to trichloroethylene for 1 to 2 years. However, available data suggest that, with regard to human health risks at the exposure levels being considered, the potential carcinogenic effects of this compound are relatively more important than its noncarcinogenic effects. Consequently, only the excess cancer risks associated with exposure to this compound for this period will be estimated.

Minimum, mean, and maximum concentrations of 1,1-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane recently detected in SACWSD municipal wells (see Table 6-3) are all more than two orders of magnitude below the corresponding 1- to 2-year criteria for protection against noncarcinogenic health effects shown in Table 6-4. The cumulative hazard index for these compounds is less than 1. Thus, it appears that noncarcinogenic health effects are not likely to result from exposure, either individually or concurrently, to these five contaminants at concentrations present in water from SACWSD wells.

The excess cancer risks associated with exposure for 2 years to the assumed minimum, mean, and maximum levels of the three potential human carcinogens considered in this assessment (tetrachloroethylene, 1,1-dichloroethylene, and trichloroethylene) are shown in Table 6-6. As can be seen, the risks associated with exposure to each of the compounds individually is less than or equal to $1x10^{-6}$ at all exposure concentrations. However, the total excess risk for concurrent exposure to these compounds is somewhat greater than 10^{-6} when maximum potential exposure concentrations are considered.

An upper 95% confidence limit on total excess cancer risk of $2x10^{-6}$ for exposure to the maximum potential contaminant concentrations is shown in Table 6-6. This indicates that 2 excess cancers could possibly occur in every 1 million individuals exposed. It should be noted that the greatest portion of this risk is posed by exposure to 1,1-dichloroethylene. This compound has been reported only once in the recent SACWSD municipal well monitoring results, and the value reported thus may not reliably represent likely exposure concentrations. It was considered for completeness in this endangerment assessment because it has been detected relatively frequently in groundwater monitoring samples throughout the EPA Off-Post study area. EPA has recently promulgated a final RMCL and a proposed MCL of 7 ug/liter for 1,1-dichloroethylene, a Group C chemical. In setting the 7 ug/liter RMCL, EPA determined that limited but insufficient evidence of carcinogenicity

TABLE 6-6

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

EXCESS CANCER RISKS ASSOCIATED WITH INGESTION OF WATER CONTAMINATED WITH ORGANIC COMPOUNDS— SACWSD MUNICIPAL WELLS

Chemical	Concentration (ug/liter)	Risk Associated With Ingestion for 2 years[a]	Risk Associated With Lifetime Ingestion
	Minimum		
1,1-Dichloroethylene[b]	—	—	—
Trichloroethylene	2	$2x10^{-8}$ [B2]	6x10-7 [B2]
Tetrachloroethylene	1	$4x10^{-8}$ [B2]	$1x10^{-6}$ [B2]
Total Risk		$6x10^{-8}$	$2x10^{-6}$
	Mean		
1,1-Dichloroethylene[b]	—	—	—
Trichloroethylene	13	$1x10^{-7}$ [B2]	$4x10^{-6}$ [B2]
Tetrachloroethylene	4	$2x10^{-7}$ [B2]	$6x10^{-6}$ [B2]
Total Risk		$3x10^{-7}$	$1x10^{-5}$
	Maximum		
1,1-Dichloroethylene[b]	2	$1x10^{-6}$ [C]	$3x10^{-5}$ [C]
Trichloroethylene	47	$4x10^{-7}$ [B2]	$1x10^{-5}$ [B2]
Tetrachloroethylene	11	$5x10^{-7}$ [B2]	$2x10^{-5}$ [B2]
Total Risk		$2x10^{-6}$	$1x10^{-4}$

[a] For this analysis, the cumulative dose received over 2 years was expressed as an average daily exposure prorated over a 70-year lifetime risk, and the corresponding lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (Federal Register 51:33998, September 24, 1986). Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-Dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen.

TABLE 6-6 (continued)

[b] 1,1-Dichloroethylene was reported only once in recent SACWSD monitoring data. However, because it has been found relatively frequently in other groundwater samples in the EPA Off-Post study area it is considered in this assessment. The single reported concentration of 2 ug/liter is considered to be a maximum potential exposure concentration.

associated with exposure by ingestion exists for this compound. The RMCL was based on chronic toxicity data with incorporation of an additional safety factor to account for potential carcinogenicity. Thus, using EPA's current regulatory approach, 1,1-dichloroethylene concentrations less than 7 ug/liter would not be likely to pose risks to human health with an adequate margin of safety. Accordingly, estimated excess cancer risks associated with 1- to 2-year exposure to the SACWSD municipal water supply would be less than 10^{-6} at all concentrations evaluated.

Lifetime Exposure. None of the noncarcinogenic organic contaminants detected in samples from SACWSD wells (1,2-dichloroethylene, 1,1-dichloroethane, and 1,1,1-trichloroethane) are present at concentrations that exceed the available lifetime criteria for protection against adverse health effects following ingestion of these compounds. Thus, based on a comparison with the available criteria, it appears that adverse health effects are not likely to result from lifetime exposure to the noncarcinogenic contaminants present in water from the SACWSD municipal water supply. Furthermore, the cumulative hazard index for these compounds, which was computed using the lifetime criteria listed in Table 6-4, is less than 1. This suggests that even concurrent exposure to these compounds throughout a lifetime is unlikely to endanger the health of exposed individuals.

The excess cancer risks associated with lifetime exposure to the three potential human carcinogens evaluated in this assessment are shown in Table 6-6. As can be seen, the risks associated with each of the compounds individually exceed 10^{-6} at the mean and maximum exposure concentrations examined. The total estimated excess cancer risks for concurrent exposure to these compounds exceed 1×10^{-6} at all exposure levels and range from 2×10^{-6} to 1×10^{-4}, depending on the level of exposure considered. Contributions to excess cancer risks by each of the chemicals are approximately equal when the mean and maximum chemical concentrations are considered. As noted in the preceding section, the uncertainty regarding the potential carcinogenicity of 1,1-dichloroethylene and the potential for exposure to this compound in the public water supply should be considered when interpreting data concerning human health risks. Nevertheless, the major source of potential endangerment to human health due to ingestion of SACWSD water is associated with exposure to the potential carcinogens present.

Exposure by Inhalation

The potential health risks associated with inhalation, while showering, of contaminants present in the SACWSD distribution system are assessed in this subsection. One to 2-year and lifetime exposure periods are considered. Contaminant concentrations in SACWSD water and the corresponding inhalation exposure used in this portion of the endangerment assessment are shown in Table 6-3. As discussed in section 6.2.3 and in Appendix C, inhalation exposures predicted using the shower inhalation exposure model have not been verified experimentally. Nevertheless, available data suggest that the model gives reasonable order-of-magnitude estimates.

1- to 2-Year Exposure. Suitable guidelines are not available for evaluation of the potential noncarcinogenic, systemic toxic effects associated with exposure by inhalation to the potential human carcinogens, tetrachloroethylene, 1,1-dichloroethylene, and trichloroethylene, over a period of 1 to 2 years. However, available data suggest that, with regard to human health risks at the exposure levels being considered, the potential carcinogenic effects of these compounds are of relatively greater importance than their noncarcinogenic effects. Consequently, only the excess cancer risks associated with exposure to these compounds for this period will be estimated.

The estimated amounts of 1,1-dichloroethane, 1,2-dichloroethylene, and 1,1,1-trichloroethane absorbed as a result of inhalation of these compounds while showering (see Table 6-3) are more than three orders of magnitude less than the corresponding 1- to 2-year criteria shown in Table 6-5. The cumulative hazard index for these compounds is less than 1. Thus, it appears that noncarcinogenic health effects are not likely to result from inhalation exposure, either individually or concurrently, to these two contaminants while showering with water contaminated at the minimum, mean, or maximum levels observed in SACWSD wells.

The excess cancer risks associated with 2 year exposure to 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene volatilized, while showering, from water contaminated at the minimum, mean, and maximum levels considered are shown in Table 6-7. As can be seen, the risks associated with exposure by inhalation to these compounds, either individually or concurrently, are less than or equal to 10^{-6}. The major portion of the risk estimated for maximum contaminant levels is posed by exposure to 1,1-dichloroethylene, a compound whose presence has recently been reported only once in SACWSD municipal wells. As discussed in the previous section and in the Appendix D toxicity profile for this compound, there is uncertainty regarding its potential human carcinogenicity. However, because 1,1-dichloroethylene has produced renal adenocarcinomas in experimental animals exposed by inhalation, it may be more appropriate to consider the potential carcinogenic effects in humans exposed by this route.

Lifetime Exposure. As can be seen by inspection of inhalation exposures in Table 6-3 and criteria in Table 6-5, 1,1-dichloroethane, 1,2-dichloroethylene, and 1,1,1-trichloroethane are not present in water from SACWSD wells at concentrations that would result in an inhalation exposure, while showering, which would exceed available lifetime criteria for protection against adverse health effects. Furthermore, the cumulative hazard index for these compounds is also less than 1. This suggests that even concurrent exposure to these compounds throughout a lifetime at the reported levels is unlikely to endanger the health of exposed individuals.

The excess cancer risks associated with lifetime inhalation exposure to 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene are shown in Table 6-7. Risks associated with exposure to trichloroethylene and tetrachloroethylene, either individually or concurrently, at minimum and mean exposure concentrations are less than 10^{-6}. At the maximum exposure concentrations considered the risk associated with tetrachloroethylene is less than 10^{-6}. However, the risks associated with 1,1-dichloroethylene and trichloroethylene, and thus the total risk for concurrent exposure to all of the compounds, exceeds 10^{-6}. Therefore, the major source of potential endangerment to human health due to inhalation exposure is associated with exposure to the potential carcinogens present.

TABLE 6-7

ROCKY MOUNTAIN ARSENAL
EPA OFF-POST RI/FS SITE

EXCESS CANCER RISKS ASSOCIATED WITH INHALATION OF VOLATILIZED ORGANIC CONTAMINANTS WHILE SHOWERING—SACWSD MUNICIPAL WELLS

Chemical	Estimated Inhalation Exposure[a] (ug/day)	Risk Associated with Exposure for 2 Years[b]	Risk Associated with Lifetime Exposure
	Minimum		
1,1-Dichloroethylene[c]	—	—	—
Trichloroethylene	2	$4x10^{-9}$[B2]	$1x10^{-7}$[B2]
Tetrachloroethylene	1	$7x10^{-10}$[B2]	$2x10^{-8}$[B2]
Total Risk		$5x10^{-9}$	$1x10^{-7}$
	Mean		
1,1-Dichloroethylene[c]	—	—	—
Trichloroethylene	11	$2x10^{-8}$[B2]	$7x10^{-7}$[B2]
Tetrachloroethylene	3	$2x10^{-9}$[B2]	$7x10^{-8}$[B2]
Total Risk		$2x10^{-8}$	$8x10^{-7}$
	Maximum		
1,1-Dichloroethylene[c]	2	$1x10^{-6}$[C]	$3x10^{-5}$[C]
Trichloroethylene	40	$8x10^{-8}$[B2]	$3x10^{-6}$[B2]
Tetrachloroethylene	9	$6x10^{-9}$[B2]	$2x10^{-7}$[B2]
Total Risk		$1x10^{-6}$	$3x10^{-5}$

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[a] Model used to estimate inhalation exposure is outlined in Appendix A. Results should be considered order-of-magnitude estimates.

[b] For this analysis, the cumulative dose received over 2 years was expressed as an average daily exposure prorated over a 70-year lifetime, and the corresponding lifetime risk was calculated accordingly. This procedure is recommended in EPA's "Guidelines for Carcinogen Risk Assessment" (Federal Register 51:33998, September 24, 1986). Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-Dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen.

TABLE 6-7 (continued)

[c] 1,1-Dichloroethylene was reported only once in recent SACWSD monitoring data. However, because it has been found relative frequently in other groundwater samples in the EPA Off-Post study area it is considered in this assessment. The single reported concentration of 2 ug/liter is considered to be a maximum potential exposure concentration.

Total Risks Associated With Exposure by Ingestion and Inhalation

As discussed in previous sections, suitable criteria for protection against noncarcinogenic health risks associated with exposure to 1,1-dichloroethylene, trichloroethylene, and tetrachloroethylene are not available for each exposure period and route. However, the cumulative hazard index for either 1- to 2-year or lifetime exposure by inhalation and ingestion to noncarcinogenic compounds having suitable criteria is less than 1. Thus, based on available information, it is unlikely that noncarcinogenic health effects will occur as a result of exposure, either individually or concurrently, to these compounds at concentrations recently found in SACWSD municipal wells.

The total excess cancer risks associated with exposure by ingestion and inhalation to 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene in water from SACWSD wells are shown in Table 6-8. The risks associated with 2-year exposure at the minimum and mean concentrations considered by either ingestion or inhalation, and the total risk for concurrent exposure by both routes are less than 10^{-6}. At maximum exposure concentrations, the risks for exposure by either ingestion or inhalation or for concurrent exposure by both routes equal or exceed 10^{-6}. These risks are due primarily to exposure to 1,1-dichloroethylene, especially for exposure by inhalation. The additive excess cancer risks associated with lifetime exposure to contaminants in SACWSD wells by ingestion and inhalation ranges from 10^{-6} to 10^{-4} for the three exposure levels considered.

6.4.3 HUMAN HEALTH RISKS UNDER FUTURE EXPOSURE CONDITIONS

Even at concentrations approximately 10 times the current mean levels observed in SACWSD wells, exposure by ingestion or inhalation to the noncarcinogenic indicator chemicals considered in this assessment would not exceed the available 1- to 2-year or lifetime criteria for these compounds. Furthermore, the cumulative hazard index for either 1- to 2-year or lifetime exposure by inhalation and ingestion to noncarcinogenic compounds having suitable criteria would be less than 1. Thus, based on available information, it is unlikely that noncarcinogenic health effects will occur as a result of exposure, either individually or concurrently, at concentrations that may occur in the future in SACWSD municipal wells in the absence of remediation.

TABLE 6-8

ROCKY MOUNTAIN ARSENAL
EPA OFF POST RI/FS SITE

TOTAL POTENTIAL EXCESS CANCER RISKS ASSOCIATED WITH INGESTION AND INHALATION EXPOSURE ROUTES—SACWSD MUNICIPAL WELLS[a]

Route of Exposure	Additive Cancer Risk for 2-Year Exposure	Additive Cancer Risk for Lifetime Exposure
		Minimum Exposure
Ingestion	$6x10^{-8}$	$2x10^{-6}$
Inhalation	$5x10^{-9}$	$1x10^{-7}$
Total Risk	$6x10^{-8}$	$2x10^{-6}$
		Mean Exposure
Ingestion	$3x10^{-7}$	$1x10^{-5}$
Inhalation	$2x10^{-8}$	$8x10^{-7}$
Total Risk	$3x10^{-7}$	$1x10^{-5}$
		Maximum Exposure
Ingestion	$2x10^{-6}$	$1x10^{-4}$
Inhalation	$1x10^{-6}$	$3x10^{-5}$
Total Risk	$3x10^{-6}$	$1x10^{-4}$

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[a] Total excess cancer risks were obtained by summing the risks associated with ingestion and inhalation exposure to 1,1-dichloroethylene, trichloroethylene, and tetrachloroethylene shown in Tables 6-6 and 6-7, respectively. Trichloroethylene and tetrachloroethylene are classified in EPA's weight-of-evidence for carcinogenicity Group B2, meaning they are considered probable human carcinogens. 1,1-Dichloroethylene is classified in Group C, meaning it is considered a possible human carcinogen. Exposure to 1,1-dichloroethylene is only considered under the maximum exposure concentration scenario.

If 1,1-dichloroethylene, tetrachloroethylene, and trichloroethylene were present in SACWSD water at concentrations 10 times higher than current mean concentrations, the total excess cancer risks associated with exposure by ingestion and inhalation could potentially exceed 10^{-6} by approximately 1 and 3 orders of magnitude for 2-year and lifetime exposure periods, respectively. These risks are due in large part to the presence of 1,1-dichloroethylene. However, even in the absence of this compound, excess cancer risks could exceed 10^{-6} by about 1 and 2 orders of magnitude for 2-year and lifetime exposure periods, respectively.

6.5 SUMMARY AND CONCLUSIONS

Groundwater monitoring data for the Rocky Mountain Arsenal EPA Off-Post RI/FS site have shown the presence of several chemical contaminants throughout the study area from as yet incompletely characterized sources. Laboratory analyses of the water from the SACWSD water distribution system, a public water supply system in the study area, have revealed elevated concentrations of several organic compounds. This endangerment assessment and the RI/FS of which it is a part focus on this public water supply system. Under the baseline evaluation it is assumed that no remedial actions are taken.

The potential endangerment to human health associated with 1- and 2-year and lifetime exposures to contaminants present in the SACWSD system were evaluated. Direct ingestion of contaminants in drinking water and inhalation of contaminants volatilized from shower water were determined to be two major pathways of exposure to the organic compounds in SACWSD water that could be quantified reasonably well. Consequently, the potential human health risks associated with exposure to contaminants via these pathways were assessed, and are thought to represent reasonable order-of-magnitude estimates of the overall risks associated with domestic use of SACWSD water. Two scenarios were considered in the assessment: (1) exposure under current conditions and (2) exposure under projected future conditions. These two scenarios were selected because it is undertain whether contaminants present in SACWSD municipal well water will remain at current levels or will increase in the future.

Estimation of risks under current exposure conditions is based on consideration of a range of contaminant concentrations recently detected in SACWSD municipal wells with the assumption that current concentrations will not increase in the future. Individual SACWSD customers can potentially be exposed to water that is derived primarily from a single municipal well or that is blended with water from more than one well. As a result, individuals may be exposed to very little or no chemical contamination, or to levels of contamination approaching the maximum concentrations currently observed in municipal wells. However, it is not possible to reliably quantify the number of individuals exposed to any specific level of contamination. Therefore, the potential health risks associated with exposure to a range of contaminant concentrations was evaluated. In order to provide a conservative risk assessment, and because it is assumed that any individual can potentially be exposed to some degree of contamination, minimum, mean, and maximum exposure levels based only on results in which contaminant concentrations exceeded analytical method detection limits were evaluated. The chemicals selected as indicators of potential contamination in the SACWSD water distribution system are 1,1-dichloroethane, 1,1-dichloroethylene, 1,2-dichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene.

Estimation of risks under future exposure conditions is based on results of groundwater modeling data prepared for the EPA Off-Post study area. These data suggest that future contaminant concentrations may exceed current mean concentrations observed in the SACWSD system by one order of magnitude. However, results of the groundwater modeling efforts are preliminary and somewhat incomplete. Consequently, only a semi-quantitative evaluation of health risks associated with future exposure scenarios is presented.

Evaluation of human health risks associated with use of water from the SACWSD system is based primarily on consideration of the risks associated with exposure to the potential carcinogens, 1,1-dichloroethylene, trichloroethylene, and tetrachloroethylene, present in the water. 1,2-Dichloroethylene, 1,1-dichloroethane, and 1,1,1-trichloroethane, considered to be noncarcinogenic systemic toxicants in this assessment, are not present at sufficiently high concentrations to pose significant health risks under either of the exposure scenarios considered. However, exposure to 1,1-dichloroethylene, trichloroethylene, tetrachloroethylene, or to all the chemicals concurrently may result in significant health risks.

As discussed in the introduction to Section 6.4.1, a potential excess cancer risk of 10^{-6} (i.e., one excess cancer in every one million individuals exposed throughout their lifetimes) is commonly used as an approximate guideline for determining an acceptable level of exposure within one or two orders of magnitude. The 95% upper limit incremental increase in cancer risk associated with 1- to 2-year exposure to contaminants in SACWSD water under current conditions by either ingestion or inhalation, or by both routes concurrently, is less than 10^{-6} at the minimum and mean exposure concentrations considered, but not at the maximum exposure concentration considered. The major portion of the excess cancer risk associated with exposure to SACWSD water contaminated at the maximum observed levels for 1- to 2-years is due to the presence of 1,1-dichloroethylene. This chemical has been detected only once in recent SACWSD municipal well samples but is considered in this assessment because of its relatively frequent occurrence in other groundwater samples collected throughout the EPA Off-Post study area. It is also of note that there is considerable uncertainty regarding the potential human carcinogenicity of 1,1-dichloroethylene, especially for exposure by ingestion. Nevertheless, if this chemical is present in SACWSD water at the level evaluated (2 ug/liter) and it is a human carcinogen, exposure for 1 to 2 years may pose an unacceptable health risk. The excess cancer risk associated with exposure for 1- to 2-years by ingestion and inhalation to SACWSD under future conditions exceeds 10^{-6} even if 1,1-dichloroethylene were not present.

Exposure throughout a 70-year average lifetime by ingestion or inhalation, or by both routes concurrently, to water from the SACWSD system under current or future conditions may pose an unacceptable health risk. The additive excess cancer risks for lifetime exposure by ingestion and inhalation range from 2×10^{-6} to 1×10^{-4} for the minimum, mean, and maximum contaminant concentrations considered under current exposure conditions. Under future exposure conditions, the 95% upper limit excess cancer risks could exceed 10^{-6} by approximately 3 orders of magnitude if 1,1-dichloroethylene were present at

10 times the concentration currently reported for one SACWSD well. However, even without considering the potential exposure to this compound, the potential lifetime excess cancer risks would exceed 10^{-6} and may therefore pose an unacceptable health risk.

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APPENDIX A

Tables of Analytical Results

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	001	002*	003 *	004	005	006	007	008
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	10.00 UJ	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 UJ	5.00 J	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	3.00 JB	9.00 UB	5.00 UB	2.00 JB	2.00 JB	5.00 B	6.00 UB	4.00 JB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
TETRACHLOROETHENE	127-18-4	ug/l	5.00 U	5.00 U	5.00 U	5.00	5.00 U	3.00 J	12.00	4.00 J
TOLUENE	108-88-3	ug/l	3.00 J	0.30 J	10.00	0.30 J	0.40 J	0.50 J	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	5.00 U	5.00 U	9.00	5.00 U	2.00 J	5.00	10.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 U	5.00 U	5.00 U	5.00	5.00 U	2.00 J	10.00	5.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRICHLOROETHENE	79-01-6	ug/l	5.00 U	5.00 U	5.00 U	68.00	3.00 J	12.00	55.00	92.00
ACETONE	67-64-1	ug/l	11.00 UJB	7.00 UJB	30.00 UB	7.00 JB	20.00 U	5.00 UJB	6.00 UJB	6.00 JB
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	20.00 U	12.00 UJB	7.00 JB	26.00 UB	9.00 JB	11.00 UB	10.00 UB	8.00 UB
VINYL ACETATE	108-05-4	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
2-HEXANONE	591-78-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 U	5.00 U	5.00 U	3.00 J	5.00 U	2.00 J	6.00	2.00 J
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00 U	5.00 U	2.00 J	5.00 U	5.00 U	5.00	2.00 J
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	0.40 J	10.00 U	10.00 U	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	001	002 *	003*	004	005	006	007	008
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	150.00 UB	48.00 UB	10.00 U	10.00 U	10.00 U	230.00 UB	10.00 U	10.00 U
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	10.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	10.00 U	1.00 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	0.50 J
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	001	002*	003 *	004	005	006	007	008
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	009 *	010	011	012	013	014*	015 *	016*
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
BROMOFORM	75-25-2	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	24.00 UB	6.00 UJB	6.00 UJB	5.00 UJB	5.00 UJB	15.00 UJB	17.00 UJB	33.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
TETRACHLOROETHENE	127-18-4	ug/l	5.00 U	15.00	5.00	6.00	3.00 J	5.00 U	5.00 U	5.00 UJ
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	0.50 UJB
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	10.00	5.00 U	1.00 J	1.00 J	5.00 U	5.00 U	5.00 UJ
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 U	58.00	3.00 J	3.00 J	3.00 J	5.00 U	5.00 U	5.00 UJ
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
TRICHLOROETHENE	79-01-6	ug/l	5.00 U	55.00	7.00	6.00	3.00 J	5.00 U	5.00 U	5.00 UJ
ACETONE	67-64-1	ug/l	10.00 UJB	14.00 UJB	14.00 UJB	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	14.00 UJB
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
2-BUTANONE	78-93-3	ug/l	9.00 BJ	10.00 UJB	10.00 UJB	9.00 UJB	8.00 UJB	9.00 UJB	8.00 UJB	11.00 UJB
VINYL ACETATE	108-05-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
2-HEXANONE	591-78-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
TOTAL XYLENES	1330-20-7	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 U	6.00	3.00 J	2.00 J	3.00 J	5.00 U	5.00 U	5.00 UJ
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00 U	5.00 U	1.00 J	5.00 U	5.00 U	5.00 U	5.00 UJ
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	1.00 U	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	009 *	010	011	012	013	014*	015 *	016 *
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	400.00 UB	73.00 UB	50.00 UJB	410.00 UJB	10.00 UJB	10.00 U	89.00	10.00 U
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	74.00	10.00 U	10.00 U	10.00 U
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	0.40 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	0.70 J	1.00 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	11.00 UJB	10.00 U	10.00 U	5.00 J	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	009 *	010	011	012	013	014*	015 *	016*
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 U	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 UJ
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 UJ
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	--	--	--	20.00 N	26.00 N	--	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
BETA-BHC	319-85-7	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
DELTA-BHC	319-86-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
4,4-DDE	72-55-9	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
HEPTACHLOR	76-44-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
ENDOSULFAN I	959-98-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
ENDOSULFAN II	33213-65-9	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
DIELDRIN	60-57-1	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
ENDRIN	72-20-8	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
4,4-DDD	72-54-8	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
4,4-DDT	50-29-3	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
TOXAPHENE	8001-35-2	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 UJ
METHOXYCHLOR	72-43-5	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
ENDRIN KETONE	53494-70-5	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 UJ
CHLORDANE	57-74-9	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
ALDRIN	309-00-2	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ
PCB-1242	53469-21-9	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
PCB-1254	11097-69-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ
PCB-1221	11104-28-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
PCB-1232	11141-16-5	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
PCB-1248	12672-29-6	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
PCB-1260	11096-82-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ
PCB-1016	12674-11-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ
METALS										
FLUORIDE	FLR	mg/l	0.10 U	0.60	0.34	0.33	0.32	0.10 U	0.10 U	0.10 U
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
ARSENIC	7440-38-2	mg/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
CADMIUM	7440-43-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHROMIUM	7440-47-3	ug/l	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U
COPPER	7440-50-8	ug/l	22.00 U	22.00 U	22.00 U	22.00 U	22.00 U	22.00 U	22.00 U	22.00 U
LEAD	7439-92-1	ug/l	4.00 UJ	6.60 J	4.00 UJ	4.00 UJ	4.00 UJ	4.00 UJ	4.00 UJ	4.00 UJ
MERCURY	7439-97-6	mg/l	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
NICKEL	7440-02-0	ug/l	21.00	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
SELENIUM	7782-49-2	mg/l	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ
SILVER	7440-22-4	ug/l	21.00 J	10.00 J	6.00 UJ	6.00 UJ	6.00 UJ	11.00 J	12.00 J	6.00 UJ
THALLIUM	7440-28-0	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	009*	010	011	012	013	014*	015*	016 *
METALS Cont'd										
ZINC	7440-66-6	ug/l	26.00	32.00	53.00	65.00	69.00	58.00	26.00	34.00
ALUMINUM	7429-90-5	ug/l	193.00	186.00	102.00	118.00	117.00	138.00	135.00	117.00
BARIUM	7440-39-3	ug/l	80.00 U	90.00	80.00 U	80.00 U	105.00	80.00 U	80.00 U	80.00 U
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
MANGANESE	7439-96-5	ug/l	13.00 U	13.00 U	13.00 U	13.00 U	13.00 U	13.00 U	13.00 U	13.00 U
IRON	7439-89-6	ug/l	66.00	205.00	49.00	38.00	52.00	207.00	54.00	35.00
CYANIDE	74-90-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
VANADIUM	7440-62-2	ug/l	20.00 U	21.00	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
SODIUM	7440-23-5	mg/l	4.02 U	150.00	87.30	83.10	113.00	4.81	4.02 U	4.02 U
TIN	7440-31-5	ug/l	17.00 U	17.00 U	17.00 U	17.00 U	170.00 U	17.00 U	17.00 U	27.00
CALCIUM	7440-70-2	mg/l	2.08	148.00	176.00	172.00	164.00	2.67	0.72	1.10
MAGNESIUM	7439-95-4	mg/l	0.24	22.90	22.80	22.20	21.40	0.29	0.22 U	0.22 U
POTASSIUM	7440-09-7	mg/l	0.50 UJ	7.64 J	6.90 J	6.36 J	7.84 J	0.50 UJ	0.50 UJ	0.50 UJ
ANIONS										
BORON	7440-42-8	ug/l	0.05 U	0.65	0.20	0.20	0.27	0.05 U	0.05 U	0.05 U
CHLORIDE	16887-00-6	mg/l	10.00	105.00	120.00	120.00	135.00	1.00 U	10.00	5.00
TOTAL PHOSPHATES	PHOS	ug/l	0.03 J	0.10 J	0.05 J	0.05 J	0.07 J	0.04 J	0.03 J	0.03 J
SULFATE	14808-79-8	mg/l	15.00	167.00	314.00	301.00	355.00	10.00 U	10.00 U	10.00 U
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	--	--	--	--	--	--	--	--
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	1.00 UJ	1.00 UJ	1.00 UJ	1.20 J	1.00 UJ	1.40 J	1.00 UJ	1.00 UJ
ORTHO-PHOSPHATE	OPH	mg/l	0.02 J	0.06 J	0.05 J	0.05 J	0.06 J	0.04 J	0.03 J	0.03 J
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	--	--	--	--	--	--	--
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	--	--	--	--	--
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	410.00 NB	--	1400.00 NB	--	--	750.00 N	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	009 *	010	011	012	013	014*	015 *	016*
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022*	023	024
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	12.00 U	12.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	6.00 U	6.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	27.00 U	27.00 U
CHLOROFORM	67-66-3	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	1.00 J
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	6.00 UJB	6.00 UJB	6.00 UJB	6.00 UJB	6.00 UJB	23.00 UJB	6.00 UJ	8.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	18.00 U	18.00 U
TETRACHLOROETHENE	127-18-4	ug/l	5.00 UJ	5.00 UJ	8.00 J	8.00	5.00	5.00 U	5.00 U	3.00 J
TOLUENE	108-88-3	ug/l	0.50 UJB	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 UJ	5.00 UJ	6.00 J	5.00	2.00	5.00 U	5.00 U	2.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 UJ	5.00 UJ	8.00 J	7.00	4.00 J	5.00 U	6.00 U	3.00 J
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	6.00 U	6.00 U
TRICHLOROETHENE	79-01-6	ug/l	3.00 J	3.00 J	10.00 J	12.00	5.00	5.00 U	5.00 U	5.00
ACETONE	67-64-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJB	14.00 UJB	14.00 UJB	2.00 UJ	8.00 UJB	10.00 UJB
CARBON DISULFIDE	75-15-0	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	11.00 UJB	11.00 UJB	18.00 UJB	11.00 UJB	11.00 UJB	11.00 UJB	3.00 UJB	25.00 UJ
VINYL ACETATE	108-05-4	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	5.00 U
2-HEXANONE	591-78-6	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	36.00 U	36.00 U
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	46.00 U	46.00 U
STYRENE	100-42-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	5.00 U	5.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 UJ	5.00 UJ	7.00 J	6.00	5.00	5.00 U	1.00 J	2.00 J
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 UJ	5.00 UJ	3.00 J	3.00 J	5.00 U	5.00 U	5.00 U	1.00 J
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 UJ	10.00 UJ	1.00 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U	3.50 U	10.00 U	10.00 U
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 UJ
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 UJ
PHENOL	108-95-2	ug/l	10.00 U	1.00 J	2.00 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022 *	023	024
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 U	10.00 U	10.00 U	2.00 UJB	4.00 UJB	2.00 UJB	10.00 UJ	10.00 UJ
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	18.00 UJ	18.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 U	20.00 U	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	2.00 UJB	2.00 UJB	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	10.00 U	10.00 U	10.00 U	2.00 UJB	2.00 UJB	2.00 UJB	2.00 J	10.00 UJ
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 UJ
4-CHLOROANILINE	106-47-8	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022 *	023	024
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 UJ
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 UJ	50.00 U	50.00 U	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 R
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	4.00 U	4.00 UJ	89.00 J	4.00 UJ	4.00 UJ	4.00 UJ	113.00 U	113.00 UJ
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	--	--	--	--	--	--	3.00 N	1.00 N
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.05 U	0.05 UJ	0.79 J	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
BETA-BHC	319-85-7	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
DELTA-BHC	319-86-8	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
4,4-DDE	72-55-9	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.01 U	0.01 U
HEPTACHLOR	76-44-8	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
ENDOSULFAN I	959-98-8	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01	0.01 U
ENDOSULFAN II	33213-65-9	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.03 U	0.03 U
DIELDRIN	60-57-1	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.01 U	0.01 U
ENDRIN	72-20-8	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.01 U	0.01 U
4,4-DDD	72-54-8	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.01 U	0.01 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.05 U	0.05 U
4,4-DDT	50-29-3	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.02 U	0.02 U
TOXAPHENE	8001-35-2	ug/l	3.00 U	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	0.50 U	0.50 U
METHOXYCHLOR	72-43-5	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.05 U	0.05 U
ENDRIN KETONE	53494-70-5	ug/l	0.10 U	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.10 UJ	0.05 U	0.05 U
CHLORDANE	57-74-9	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.25 U	0.25 U
ALDRIN	309-00-2	ug/l	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.01 U	0.01 U
PCB-1242	53469-21-9	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.15 U	0.15 U
PCB-1254	11097-69-1	ug/l	1.00 U	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	0.25 U	0.25 U
PCB-1221	11104-28-2	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.25 U	0.25 U
PCB-1232	11141-16-5	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.25 U	0.25 U
PCB-1248	12672-29-6	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.15 U	0.15 U
PCB-1260	11096-82-5	ug/l	1.00 U	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	0.25 U	0.25 U
PCB-1016	12674-11-2	ug/l	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.15 U	0.15 U
METALS										
FLUORIDE	FLR	mg/l	0.55	0.55	0.42	0.36	0.45	0.10 U	1.00	0.47
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
ARSENIC	7440-38-2	mg/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	8.00 U	8.00 U
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
CADMIUM	7440-43-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	4.00 U	4.00 U
CHROMIUM	7440-47-3	ug/l	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U	9.00 U	8.00 U	8.00 U
COPPER	7440-50-8	ug/l	22.00 U	22.00 U	22.00 U	22.00 U	41.00	22.00 U	16.00 U	16.00 U
LEAD	7439-92-1	ug/l	4.00 UJ	4.00 UJ	4.00 UJ	4.00 UJ	4.00 UJ	13.00 J	3.70	2.00 U
MERCURY	7439-97-6	mg/l	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.19 U	0.19 U
NICKEL	7440-02-0	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	34.00	20.00 U
SELENIUM	7782-49-2	mg/l	3.00 UJ	3.00 UJ	3.00 UJ	3.00 UJ	4.00	3.00 U	4.00 U	4.00 U
SILVER	7440-22-4	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	7.00 UJ	7.00 UJ
THALLIUM	7440-28-0	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022 *	023	024
METALS Cont'd										
ZINC	7440-66-6	ug/l	92.00	96.00	68.00	274.00	51.00	20.00	57.00	17.00 U
ALUMINUM	7429-90-5	ug/l	130.00	68.00 U	110.00	94.00	84.00	101.00	263.00	87.00 U
BARIUM	7440-39-3	ug/l	80.00 U	80.00 U	80.00 U	80.00 U	80.00 U	80.00 U	67.00 U	67.00 U
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
MANGANESE	7439-96-5	ug/l	13.00 U	13.00 U	13.00 U	13.00 U	691.00	13.00 U	14.00 U	14.00 U
IRON	7439-89-6	ug/l	42.00	39.00	67.00	79.00	85.00	46.00	33.00	29.00 U
CYANIDE	74-90-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
VANADIUM	7440-62-2	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	37.00	30.00 U
SODIUM	7440-23-5	mg/l	103.00	128.00	107.00	130.00	108.00	4.02 U	163.00	130.00
TIN	7440-31-5	ug/l	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	27.00 R	27.00 R
CALCIUM	7440-70-2	mg/l	126.00	126.00	126.00	154.00	126.00	1.81	159.00	178.00
MAGNESIUM	7439-95-4	mg/l	16.30	16.50	18.30	20.30	24.10	0.24	28.70	23.40
POTASSIUM	7440-09-7	mg/l	8.26 J	8.06 J	8.38 J	6.53 J	6.23 J	0.50 UJ	4.99	4.54
ANIONS										
BORON	7440-42-8	ug/l	0.26	0.26	0.28	0.28	0.35	0.05 U	0.44	0.26
CHLORIDE	16887-00-6	mg/l	90.00	95.00	95.00	110.00	80.00	10.00	100.00	125.00
TOTAL PHOSPHATES	PHOS	ug/l	0.14 J	0.14 J	0.06 J	0.13 J	0.17 J	0.11 J	0.07 J	0.15
SULFATE	14808-79-8	mg/l	307.00	305.00	278.00	277.00	186.00	10.00 U	353.00 J	318.00 J
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	--	--	--	--	--	--	10.00 J	13.00 J
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	2.00 J	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	1.00 UJ	0.05 U	0.50 U
ORTHO-PHOSPHATE	OPH	mg/l	0.06 J	0.05 J	0.06 J	0.04 J	0.05 J	0.02 J	0.03	0.01 J
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	--	--	--	--	--	15.00 NB	4.00 NB
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	7.00 NB	--	--	12.00 NB	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	--	--	--	--	--
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	4.00 NB
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--	--	--	6.00 NB	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	017	018	019	020	021	022 *	023	024
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 UJ	12.00 UJ	12.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U
CHLOROFORM	67-66-3	ug/l	5.00 U	1.00 J	1.00 J	5.00 U	5.00 U	2.00 J	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 U	6.00 U	6.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	5.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 J	11.00	11.00	1.00 J	1.00 J	15.00	2.00 J	3.00 J
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	4.00 J	4.00 J	2.00 J	5.00 U	6.00	9.00	1.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	6.00 U	9.00	9.00	2.00 J	6.00 U	11.00	6.00 U	6.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
TRICHLOROETHENE	79-01-6	ug/l	5.00 J	39.00	38.00	19.00	5.00	22.00	6.00	13.00
ACETONE	67-64-1	ug/l	11.00 UJB	8.00 UJB	8.00 UJB	11.00 UJB	8.00 UJB	10.00 UJB	10.00 UJB	10.00 UJB
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	3.00 UJB	3.00 UJB	10.00 UJB	3.00 UJB	3.00 UJB	24.00 JB	17.00 JB	33.00 JB
VINYL ACETATE	108-05-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ
2-HEXANONE	591-78-6	ug/l	36.00 U	36.00 U	36.00 U	36.00 U	36.00 U	36.00 UJ	36.00 UJ	36.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	46.00 U	46.00 U	46.00 U	46.00 U	46.00 U	46.00 UJ	46.00 UJ	46.00 UJ
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJB	5.00 UJB	5.00 UJB
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 UJ	5.00 J	5.00 J	5.00 UJ	5.00 UJ	8.00 J	14.00 J	5.00 UJ
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00	5.00	5.00 U	5.00 U	7.00	3.00 J	2.00 J
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 R	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 R	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	10.00 U	4.00 JN	10.00 U	10.00 U	5.00 J	10.00 R	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	18.00 U	18.00 U	18.00 UJ	18.00 UJ	18.00 U	18.00 UJ	18.00 UJ	18.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	3.00 UJB	2.00 UJB	10.00 U	2.00 UJB	3.00 UJB	2.00 JB	3.00 JB	2.00 JB
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
HEXACHLOROETHANE	67-72-1	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
PYRENE	129-00-0	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 R	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 R	10.00 UJ
BENZOIC ACID	65-85-0	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
4-CHLOROANILINE	106-47-8	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 UJ	50.00 U	50.00 UJ	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 R	50.00 U
UNKNOWN	UNK	ug/l	1.00 NB	3.00 N	2.00 NB	1.00 N	3.00 N	4.00 NB	5.00 N	6.00 NB
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
BETA-BHC	319-85-7	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DELTA-BHC	319-86-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDE	72-55-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR	76-44-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN I	959-98-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN II	33213-65-9	ug/l	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
DIELDRIN	60-57-1	ug/l	0.01 U	0.01 U	0.01 U	0.01	0.01 U	0.01 U	0.01 U	0.01 U
ENDRIN	72-20-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDD	72-54-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
4,4-DDT	50-29-3	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
TOXAPHENE	8001-35-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
METHOXYCHLOR	72-43-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
ENDRIN KETONE	53494-70-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
CHLORDANE	57-74-9	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
ALDRIN	309-00-2	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
PCB-1242	53469-21-9	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1254	11097-69-1	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1221	11104-28-2	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1232	11141-16-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1248	12672-29-6	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1260	11096-82-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1016	12674-11-2	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
METALS										
FLUORIDE	FLR	mg/l	0.64	0.50	0.50	0.66	0.51	0.45	0.63	0.47
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
ARSENIC	7440-38-2	mg/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
CADMIUM	7440-43-9	ug/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
CHROMIUM	7440-47-3	ug/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U
COPPER	7440-50-8	ug/l	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U
LEAD	7439-92-1	ug/l	2.00 U	2.80	3.40	2.00 U	4.10	4.20	2.00 U	2.00 U
MERCURY	7439-97-6	mg/l	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
NICKEL	7440-02-0	ug/l	20.00 U	24.00	20.00 U	20.00 U	20.00 U	33.00	27.00	20.00 U
SELENIUM	7782-49-2	mg/l	5.00	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
SILVER	7440-22-4	ug/l	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ
THALLIUM	7440-28-0	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
METALS Cont'd										
ZINC	7440-66-6	ug/l	43.00	68.00	43.00	48.00	38.00	38.00	25.00	43.00
ALUMINUM	7429-90-5	ug/l	138.00	217.00	221.00	87.00 U	87.00 U	264.00	226.00	221.00
BARIUM	7440-39-3	ug/l	100.00	143.00	87.00	67.00 U	116.00	74.00	67.00 U	79.00
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
MANGANESE	7439-96-5	ug/l	14.00 U	14.00 U	14.00 U	18.00	14.00 U	14.00 U	5420.00	18.00
IRON	7439-89-6	ug/l	29.00 U	29.00 U	58.00	29.00 U	29.00	31.00	742.00	59.00
CYANIDE	74-90-8	ug/l	10.00 UJ	44.00 J	10.00 J	10.00 UJ	10.00 UJ	31.00 J	10.00 UJ	10.00 UJ
VANADIUM	7440-62-2	ug/l	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	39.00	32.00	30.00 U
SODIUM	7440-23-5	mg/l	142.00	139.00	157.00	137.00	132.00	143.00	134.00	110.00
TIN	7440-31-5	ug/l	27.00 R	54.00 R	54.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R
CALCIUM	7440-70-2	mg/l	158.00	175.00	193.00	154.00	154.00	219.00	160.00	210.00
MAGNESIUM	7439-95-4	mg/l	22.00	21.50	23.90	20.00	18.50	24.70	24.10	23.10
POTASSIUM	7440-09-7	mg/l	7.44	4.64	5.25	6.97	5.34	4.76	5.68	5.03
ANIONS										
BORON	7440-42-8	ug/l	0.32	0.33	0.35	0.33	0.28	0.39	0.43	0.20
CHLORIDE	16887-00-6	mg/l	130.00	95.00	105.00	95.00	125.00	115.00	95.00	180.00
TOTAL PHOSPHATES	PHOS	ug/l	0.16 J	0.07 J	0.06 J	0.12 J	0.06 J	0.06 J	0.11 J	0.06 J
SULFATE	14808-79-8	mg/l	250.00	303.00 J	313.00 J	335.00 J	245.00	320.00 J	253.00	335.00 J
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	7.70 J	5.60 J	5.20 J	2.40 J	7.80 J	11.00 J	0.05 UJ	10.00 J
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
ORTHO-PHOSPHATE	OPH	mg/l	0.01 U	0.02	0.02	0.09	0.01 U	0.02	0.01 U	0.01
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	10.00 NB	9.00 NB	9.00 NB	10.00 NB	10.00 NB	7.00 NB	6.00 NB	6.00 NB
BENZENE,(1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE,TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	5.00 NB	--	--	5.00 NB	--	--	--
1-PROPENE,3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	--	--	7.00 N	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	2.00 NB	--	--	--	--	--	6.00 NB
CYCLOHEXANE,1,3-DICHLORO-,CIS-	24955-63-3	ug/l	7.00 NB	--	--	--	3.00 NB	15.00 NB	17.00 NB	20.00 NB
CYCLOHEXENE,1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	2.00 N
DISULFIDE,1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1-BROMO-2-CHLORO-,CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE,1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE,1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	2.00 NB	--	--	--	--	--
ETHANONE,1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	5.00 NB	3.00 NB	1.00 NB	--	7.00 NB	5.00 NB	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	2.00 NB	--	--
CYCLOHEXENE,3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	2.00 N	--	--
2-FURANMETHANOL,TETRAHYDRO-	97-99-4	ug/l	4.00 N	--	--	--	--	--	--	--
CYCLOHEXANE,1,4-DICHLORO-,CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	025	026	027	028	029	030	031	032
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	7.00 NB	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	9.00 NB	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040 *
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	1.00 UJB	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 UJB
BROMOFORM	75-25-2	ug/l	12.00 U	12.00 UJ	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	5.00 U	6.00 U	6.00 U	6.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	27.00 U	27.00 U	27.00 UJ	27.00 UJ	27.00 UJ	27.00 UJ	27.00 U	27.00 U
CHLOROFORM	67-66-3	ug/l	5.00 U	1.00 J	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 UJ
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	5.00 UJ	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	10.00 J	8.00
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	18.00 U	18.00 UJ	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	18.00 UJ
TETRACHLOROETHENE	127-18-4	ug/l	3.00 J	5.00	17.00	15.00	2.00 J	5.00 U	5.00 U	5.00 U
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	1.00 J	3.00 J	13.00	15.00	9.00	5.00 U	5.00 U	5.00 U
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	3.00 J	7.00	20.00	26.00	5.00	6.00 U	6.00 U	6.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
TRICHLOROETHENE	79-01-6	ug/l	6.00	8.00	23.00	91.00	48.00	5.00 U	5.00 U	5.00 U
ACETONE	67-64-1	ug/l	8.00 UJB	12.00 UJB	20.00 UJB	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJB	14.00 UJB
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	25.00 UJ	25.00 UJ	10.00 UJB	14.00 UJB	4.00 UJB	4.00 UJB	3.00 UJB	10.00 UJB
VINYL ACETATE	108-05-4	ug/l	5.00 U	10.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	10.00 U	5.00 UJ
2-HEXANONE	591-78-6	ug/l	36.00 U	36.00 UJ	10.00 U	36.00 UJ	36.00 UJ	36.00 UJ	36.00 U	36.00 U
4-METHYL-2-PENTANONE	108-10-1	ug/l	46.00 U	46.00 UJ	46.00 UJ	46.00 UJ	46.00 UJ	46.00 UJ	46.00 U	46.00 U
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	5.00 U	1.00 JB	12.00 UB	9.00 UJB	5.00 U	5.00 U	5.00 U	5.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 J	4.00 J	10.00 J	10.00 J	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 J	3.00 J	9.00 J	11.00	2.00 J	5.00 U	5.00 U	5.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	1.00 J	10.00 U	10.00 U	10.00 U	10.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 UJ
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 UJ	50.00 UJ	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ	50.00 UJ	50.00 UJ
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ	50.00 U	50.00 UJ
PHENOL	108-95-2	ug/l	10.00 U	10.00 U	10.00 U	2.00 J	10.00 R	10.00 UJ	10.00 U	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040 *
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 U	20.00 UJ	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	10.00 UJ	10.00 UJ	8.00 UJB	1.00 UJB	10.00 U	3.00 UJB	2.00 J	10.00 UJ
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	1.00 J	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 UJ	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 R	10.00 UJ	10.00 U	10.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
4-CHLOROANILINE	106-47-8	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 UJ
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040 *
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 UJ	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 R	50.00 R	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ	50.00 UJ	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 R	50.00 R	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ	50.00 UJ	50.00 R
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 UJ	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	3.00 NB	1.00 N	--	2.00 N	4.00 N	1.00 N	3.00 NB	5.00 N
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
BETA-BHC	319-85-7	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DELTA-BHC	319-86-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDE	72-55-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR	76-44-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN I	959-98-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN II	33213-65-9	ug/l	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
DIELDRIN	60-57-1	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.02 J	0.02 J	0.01 U	0.01 U
ENDRIN	72-20-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDD	72-54-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
4,4-DDT	50-29-3	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
TOXAPHENE	8001-35-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
METHOXYCHLOR	72-43-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
ENDRIN KETONE	53494-70-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
CHLORDANE	57-74-9	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
ALDRIN	309-00-2	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
PCB-1242	53469-21-9	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1254	11097-69-1	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1221	11104-28-2	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1232	11141-16-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1248	12672-29-6	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1260	11096-82-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1016	12674-11-2	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
METALS										
FLUORIDE	FLR	mg/l	0.51	0.47	0.51	0.55	0.74	0.49	0.10 U	0.10 U
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
ARSENIC	7440-38-2	mg/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
CADMIUM	7440-43-9	ug/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
CHROMIUM	7440-47-3	ug/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	16.00	8.00 U
COPPER	7440-50-8	ug/l	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	19.00	16.00 U
LEAD	7439-92-1	ug/l	2.00 U	2.00 U	3.50	2.00 U	2.00 U	2.00 U	2.00 UJ	2.00 U
MERCURY	7439-97-6	mg/l	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
NICKEL	7440-02-0	ug/l	20.00 U	20.00 U	28.00	38.00	20.00 U	20.00 U	20.00 U	20.00 U
SELENIUM	7782-49-2	mg/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
SILVER	7440-22-4	ug/l	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ
THALLIUM	7440-28-0	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040 *
METALS Cont'd										
ZINC	7440-66-6	ug/l	26.00	71.00	89.00	101.00	747.00	49.00	17.00 U	17.00 U
ALUMINUM	7429-90-5	ug/l	87.00 U	87.00 U	235.00	303.00	129.00	90.00	87.00 U	133.00
BARIUM	7440-39-3	ug/l	67.00 U	100.00	74.00	67.00 U	67.00 U	99.00	67.00 U	67.00 U
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
MANGANESE	7439-96-5	ug/l	14.00 U	14.00 U	14.00 U	14.00 U	1490.00	14.00 U	14.00 U	14.00 U
IRON	7439-89-6	ug/l	29.00 U	29.00 U	48.00	207.00	38.00	34.00	259.00	29.00 U
CYANIDE	74-90-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
VANADIUM	7440-62-2	ug/l	30.00 U	30.00 U	36.00	43.00	30.00 U	30.00 U	30.00 U	30.00 U
SODIUM	7440-23-5	mg/l	135.00	131.00	143.00	146.00	134.00	137.00	2.70 U	2.70 U
TIN	7440-31-5	ug/l	54.00 R	54.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R
CALCIUM	7440-70-2	mg/l	183.00	174.00	185.00	188.00	140.00	146.00	0.59 U	0.59 U
MAGNESIUM	7439-95-4	mg/l	23.70	22.50	23.40	23.70	21.50	20.00	0.23 U	0.23 U
POTASSIUM	7440-09-7	mg/l	4.57	4.93	5.20	6.40	6.74	6.81	0.50 U	0.50 U
ANIONS										
BORON	7440-42-8	ug/l	0.27	0.30 U	0.41	0.47	0.34	0.45	0.10 U	0.10 U
CHLORIDE	16887-00-6	mg/l	125.00	120.00	100.00	105.00	110.00	100.00	15.00	15.00
TOTAL PHOSPHATES	PHOS	ug/l	0.08 J	0.06 J	0.07 J	0.08 J	0.23 J	0.13 J	0.04 J	0.04 J
SULFATE	14808-79-8	mg/l	370.00 J	305.00 J	303.00 J	335.00 J	380.00 J	400.00 J	2.50	5.20
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	15.00 J	16.00 J	4.20 J	13.00 J	0.04 J	12.00 J	8.00 J	3.50 J
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
ORTHO-PHOSPHATE	OPH	mg/l	0.01 U	0.01	0.01 U	0.01 U	0.18	0.07	0.01 U	0.01 U
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	6.00 NB	9.00 NB	7.00 NB	6.00 NB	3.00 NB	10.00 NB	3.00 NB
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	5.00 N	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	12.00 N	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	54.00 NB	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	6.00 NB	9.00 NB	--	--	--
1-PROPENE,3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	10.00 N	--	3.00 N	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	4.00 NB	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	6.00 NB	--	8.00 NB	--	4.00 NB	--	--
CYCLOHEXANE,1,3-DICHLORO-,CIS-	24955-63-3	ug/l	--	--	4.00 NB	--	--	--	--	6.00 NB
CYCLOHEXENE,1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE,1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	3.00 NB	--	--	--	--	--	--
CYCLOHEXANE,1-BROMO-2-CHLORO-,CIS-	51422-75-4	ug/l	--	6.00 N	--	--	--	--	--	--
CYCLOPROPANE,1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	2.00 N	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	2.00 N	--	--	--	--
PROPANE,1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	4.00 N	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--	--	--	2.00 NB	--
ETHANONE,1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	1.00 N	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	2.00 NB	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE,3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL,TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,4-DICHLORO-,CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	033	034	035	036	037	038	039*	040 *
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	3.00 N	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	041*	042 *	043*	044 *	045	046	047	048
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	1.00 UJB	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	12.00 U	12.00 UJ	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	3.00 J	6.00 U	6.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	27.00 U	27.00 U	27.00 UJ	27.00 UJ	27.00 UJ	27.00 UJ	27.00 UJ	27.00 UJ
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	8.00	8.00	7.00	7.00	6.00 U	6.00 U	6.00 U	6.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	18.00 UJ	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U	18.00 U
TETRACHLOROETHENE	127-18-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00	2.00 J	3.00 J	5.00
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00	1.00 J	5.00 U	10.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	5.00 J	3.00 J	3.00 J	6.00
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
TRICHLOROETHENE	79-01-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	4.00 J	2.00 J	6.00	84.00
ACETONE	67-64-1	ug/l	18.00 UJB	10.00 UJB	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	9.00 UJB	24.00 JB	4.00 UJB	18.00 UJB	14.00 UJB	10.00 UJB	6.00 UJB	5.00 UJB
VINYL ACETATE	108-05-4	ug/l	5.00 UJ	10.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
2-HEXANONE	591-78-6	ug/l	36.00 U	36.00 UJ	36.00 UJ	36.00 UJ	36.00 UJ	36.00 U	36.00 UJ	36.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	46.00 U	46.00 UJ	46.00 UJ	46.00 UJ	46.00 UJ	46.00 U	46.00 UJ	46.00 UJ
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	5.00 U	5.00 UJB	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00	1.00 J	3.00 J	3.00 J
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 UJ	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	3.00 J	5.00 U	5.00 U	4.00 J
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 R	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 R	50.00 U	50.00 R	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 UJ	50.00 U	50.00 UJ	50.00 U	50.00 R	50.00 U	50.00 R	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	7.00 N	10.00 U	5.00 JN	10.00 R	10.00 U	10.00 R	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	041*	042 *	043*	044 *	045	046	047	048
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 UJ	10.00 U	10.00 UJ	3.00 UJB	10.00 U	10.00 UJ	10.00 U	10.00 UJ
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	18.00 UJ	18.00 UJ	18.00 U	18.00 UJ	18.00 U	18.00 UJ	18.00 U	18.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 U	20.00 UJ	20.00 U	20.00 UJ	20.00 U
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	10.00 UJ	3.00 JB	10.00 U	14.00 UJB	3.00 UJB	2.00 UJB	12.00 UJB	2.00 UJB
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 U	10.00 R	10.00 U	10.00 R	10.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
4-CHLOROANILINE	106-47-8	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 UJ	10.00 U
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	041 *	042*	043 *	044*	045	046	047	048
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 U	50.00 UJ	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 R	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 R	50.00 UJ	50.00 UJ	50.00 U	50.00 UJ	50.00 U	50.00 UJ	50.00 U
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 R	50.00 UJ	50.00 UJ	50.00 U	50.00 UJ	50.00 U	50.00 UJ	50.00 U
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 R	50.00 UJ	50.00 R	50.00 UJ
UNKNOWN	UNK	ug/l	1.00 N	6.00 NB	3.00 NB	9.00 N	3.00 N	8.00 N	5.00 N	42.00 N
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
BETA-BHC	319-85-7	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DELTA-BHC	319-86-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDE	72-55-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR	76-44-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN I	959-98-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN II	33213-65-9	ug/l	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
DIELDRIN	60-57-1	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDRIN	72-20-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4,4-DDD	72-54-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
4,4-DDT	50-29-3	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
TOXAPHENE	8001-35-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
METHOXYCHLOR	72-43-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
ENDRIN KETONE	53494-70-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
CHLORDANE	57-74-9	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
ALDRIN	309-00-2	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
PCB-1242	53469-21-9	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1254	11097-69-1	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1221	11104-28-2	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1232	11141-16-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1248	12672-29-6	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
PCB-1260	11096-82-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
PCB-1016	12674-11-2	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
METALS										
FLUORIDE	FLR	mg/l	0.10 U	0.10 U	0.10 U	0.10 U	0.75	0.61	0.68	0.49
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
ARSENIC	7440-38-2	mg/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
CADMIUM	7440-43-9	ug/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
CHROMIUM	7440-47-3	ug/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U
COPPER	7440-50-8	ug/l	16.00 U	16.00 U	16.00 U	16.00 U	16.00 U	18.00	16.00 U	16.00 U
LEAD	7439-92-1	ug/l	2.00 U	7.30	2.30 J	2.00 UJ	2.00 UJ	3.00 J	2.00 UJ	2.00 UJ
MERCURY	7439-97-6	mg/l	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
NICKEL	7440-02-0	ug/l	21.00	22.00	20.00 U	20.00 U	20.00 U	20.00 U	31.00	31.00
SELENIUM	7782-49-2	mg/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
SILVER	7440-22-4	ug/l	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ
THALLIUM	7440-28-0	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	041*	042 *	043*	044 *	045	046	047	048
METALS Cont'd										
ZINC	7440-66-6	ug/l	17.00 U	17.00 U	17.00 U	17.00 U	41.00	32.00	235.00	53.00
ALUMINUM	7429-90-5	ug/l	193.00	248.00	87.00 U	238.00	113.00	207.00	188.00	217.00
BARIUM	7440-39-3	ug/l	67.00 U	67.00 U	67.00 U	67.00 U	67.00 U	67.00 U	71.00	90.00
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
MANGANESE	7439-96-5	ug/l	14.00 U	14.00 U	14.00 U	14.00 U	1360.00	14.00 U	2320.00	27.00
IRON	7439-89-6	ug/l	29.00 U	241.00	230.00	232.00	378.00	29.00 U	29.00 U	29.00 U
CYANIDE	74-90-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
VANADIUM	7440-62-2	ug/l	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U
SODIUM	7440-23-5	mg/l	2.70 U	2.70 U	2.70 U	2.70 U	118.00	115.00	108.00	117.00
TIN	7440-31-5	ug/l	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R	27.00 R
CALCIUM	7440-70-2	mg/l	0.59 U	1.65	0.59 U	0.59 U	114.00	173.00	131.00	179.00
MAGNESIUM	7439-95-4	mg/l	0.23 U	0.28	0.23 U	0.23 U	22.30	24.40	27.00	21.10
POTASSIUM	7440-09-7	mg/l	0.50 U	0.50 U	0.50 U	0.50 U	3.82	4.40	4.64	3.88
ANIONS										
BORON	7440-42-8	ug/l	0.10 U	0.10 U	0.10 U	0.10 U	0.25	0.61	0.43	0.31
CHLORIDE	16887-00-6	mg/l	1.00 U	5.00	10.00	5.00	90.00	105.00	80.00	110.00
TOTAL PHOSPHATES	PHOS	ug/l	0.06 J	0.04 J	0.04 R	0.04 R	0.11 R	0.10 R	0.08 R	0.08 R
SULFATE	14808-79-8	mg/l	5.00	1.80	1.00	1.00	270.00	270.00	235.00	380.00 J
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	0.05 J	0.05 UJ	0.05 UJ	0.18 J	9.60 J	7.50 J	6.00 J	7.00 J
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
ORTHO-PHOSPHATE	OPH	mg/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01	0.01	0.01	0.03
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	5.00 NB	6.00 NB	3.00 NB	--	--	--	--	--
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	4.00 N	--	5.00 NB	--	4.00 N	--	--	12.00 N
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	8.00 N	--	--	--	3.00 N	--	2.00 N	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	5.00 NB	--	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	9.00 NB	--	--	--	--	--	2.00 N	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	15.00 N	--	--	--	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	3.00 N	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	041*	042 *	043*	044 *	045	046	047	048
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	110.00 N	--	23.00 N	--	65.00 N
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	2.00 N	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	18.00 NB	--	--	--	--	--	2.00 NB
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	3.00 N	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	31.00 N	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	8.00 N	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	1.00 N	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	4.00 N	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	1.00 N	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	3.00 N	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	3.00 N	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	3.00 N	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	2.00 N	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	3.00 NB	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	45.00 N	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	049	050 *	051	052	053	054 *	055	056
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	1.00 J	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	5.00 UJ	5.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	11.00	6.00 U	5.00 U	5.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	27.00 UJ	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	1.00 J	3.00 J	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	23.00 U	23.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	6.00 U	8.00 UJB	6.00 U	6.00 U	6.00 U	8.00 UJB	2.00 UJB	3.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	18.00 U	18.00 U	5.00 U	18.00 UJ	18.00 U	18.00 U	5.00 UJ	5.00 UJ
TETRACHLOROETHENE	127-18-4	ug/l	6.00	5.00 U	9.00	5.00	2.00 J	5.00 U	3.00 J	1.00 J
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	10.00	5.00 U	12.00	2.00 J	5.00 U	5.00 U	2.00 J	2.00 J
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 J	6.00 U	10.00	4.00 J	6.00 U	6.00 U	3.00 J	5.00
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	5.00 U	5.00 U
TRICHLOROETHENE	79-01-6	ug/l	86.00	5.00 U	88.00	7.00	1.00 J	5.00 U	7.00	34.00
ACETONE	67-64-1	ug/l	10.00 UJ	10.00 UJB	10.00 UJB	28.00 UJB	10.00 UJB	10.00 UJ	10.00 UJ	3.00 UJB
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	7.00 UJB	4.00 UJB	10.00 UJB	4.00 UJB	22.00 B	25.00 U	17.00 UJB	28.00 UJB
VINYL ACETATE	108-05-4	ug/l	5.00 UJ	10.00 U	10.00 UJ	5.00 UJ	5.00 UJ	10.00 UJ	10.00 R	10.00 R
2-HEXANONE	591-78-6	ug/l	36.00 UJ	36.00 UJ	36.00 UJ	36.00 UJ	36.00 UJ	36.00 UJ	10.00 UJ	10.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	46.00 UJ	46.00 U	46.00 U	46.00 U	46.00 U	46.00 U	10.00 UJ	10.00 UJ
STYRENE	100-42-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
TOTAL XYLENES	1330-20-7	ug/l	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHANE	75-34-3	ug/l	3.00 J	5.00 UJ	4.00 J	3.00 J	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	4.00 J	5.00 U	5.00	1.00 J	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	23.00 U	23.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	--	--
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	6.00 J	10.00 U	3.00 JN	2.00 JN	10.00 U	10.00 U	2.00 UJB
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	049	050 *	051	052	053	054 *	055	056
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	10.00 U	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	11.00 U	11.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 UJ	10.00 U	10.00 U	11.00	10.00 U	10.00 UJ	7.00 J	2.00 J
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	18.00 UJ	10.00 UJ	10.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	2.00 UJB	10.00 U	1.00 U	10.00 U	10.00 U	4.00 UJB	20.00 U	20.00 U
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	12,00 U	12.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	15.00 UJ	15.00 UJ
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	12.00 U	12.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	10.00 U	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	12.00 U	12.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U.	10.00 U
PYRENE	129-00-0	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	12.00 U	12.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	15.00 U	15.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 R	10.00 R
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	049	050 *	051	052	053	054*	055	056
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 U	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 U	50.00 R	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 U	50.00 R	50.00 R	50.00 R	50.00 R	50.00 U	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	113.00 U	--	--
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 UJ	50.00 R	50.00 R	50.00 R	50.00 R	50.00 UJ	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	16.00 N	2.00 N	6.00 N	4.00 N	--	68.00 NB	--	--
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	2.00 U	2.00 U
BETA-BHC	319-85-7	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	1.00 U	1.00 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
DELTA-BHC	319-86-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
4,4-DDE	72-55-9	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.30 U	0.30 U
HEPTACHLOR	76-44-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
ENDOSULFAN I	959-98-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
ENDOSULFAN II	33213-65-9	ug/l	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	1.00 U	1.00 U
DIELDRIN	60-57-1	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01	0.01 U	0.30 U	0.30 U
ENDRIN	72-20-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.40 U	0.40 U
4,4-DDD	72-54-8	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	1.00 U	1.00 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	3.00 U	3.00 U
4,4-DDT	50-29-3	ug/l	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	5.00 U	5.00 U
TOXAPHENE	8001-35-2	ug/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	170.00 U	170.00 U
METHOXYCHLOR	72-43-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	6.00 U	6.00 U
ENDRIN KETONE	53494-70-5	ug/l	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	2.00 U	2.00 U
CHLORDANE	57-74-9	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	123.00 U	123.00 U
ALDRIN	309-00-2	ug/l	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.20 U	0.20 U
PCB-1242	53469-21-9	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	17.00 U	17.00 U
PCB-1254	11097-69-1	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	87.00 U	87.00 U
PCB-1221	11104-28-2	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	62.00 U	62.00 U
PCB-1232	11141-16-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	69.00 U	69.00 U
PCB-1248	12672-29-6	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	54.00 U	54.00 U
PCB-1260	11096-82-5	ug/l	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	30.00 U	30.00 U
PCB-1016	12674-11-2	ug/l	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	84.00 U	84.00 U
METALS										
FLUORIDE	FLR	mg/l	0.48	0.10 U	0.50	0.40	0.60	0.10 U	--	--
ANTIMONY	7440-36-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	--	--
ARSENIC	7440-38-2	mg/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	--	--
BERYLLIUM	7440-41-7	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	--	--
CADMIUM	7440-43-9	ug/l	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	--	--
CHROMIUM	7440-47-3	ug/l	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	8.00 U	--	--
COPPER	7440-50-8	ug/l	17.00	16.00 U	16.00 U	16.00 U	17.00	21.00	--	--
LEAD	7439-92-1	ug/l	2.00 UJ	5.10	4.80	4.70	4.20	4.80	--	--
MERCURY	7439-97-6	mg/l	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	--	--
NICKEL	7440-02-0	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	--	--
SELENIUM	7782-49-2	mg/l	4.00 U	4.00 UJ	4.00 UJ	4.00 UJ	4.50 J	4.00 UJ	--	--
SILVER	7440-22-4	ug/l	9.40 J	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	7.00 UJ	--	--
THALLIUM	7440-28-0	ug/l	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	6.00 UJ	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	049	050 *	051	052	053	054 *	055	056
METALS Cont'd										
ZINC	7440-66-6	ug/l	17.00 U	24.00	303.00	70.00	31.00	21.00	--	--
ALUMINUM	7429-90-5	ug/l	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	100.00	--	--
BARIUM	7440-39-3	ug/l	69.00	67.00 U	67.00 U	67.00 U	67.00 U	67.00 U	--	--
COBALT	7440-48-4	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	--	--
MANGANESE	7439-96-5	ug/l	14.00 U	14.00 U	14.00 U	68.00	14.00 U	14.00 U	--	--
IRON	7439-89-6	ug/l	29.00 U	46.00	53.00	242.00	76.00	316.00	--	--
CYANIDE	74-90-8	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	--	--
VANADIUM	7440-62-2	ug/l	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	--	--
SODIUM	7440-23-5	mg/l	104.00	2.70 UJ	106.00 J	111.00 J	99.60 J	2.70 J	--	--
TIN	7440-31-5	ug/l	27.00 R	27.00 U	27.00 U	27.00 U	27.00 U	27.00 U	--	--
CALCIUM	7440-70-2	mg/l	157.00	1.10	162.30	164.00	142.00	1.22	--	--
MAGNESIUM	7439-95-4	mg/l	19.30	0.23 U	20.20	22.60	20.40	0.23 U	--	--
POTASSIUM	7440-09-7	mg/l	4.08	0.50 UJ	4.10 J	4.83 J	4.22 J	0.50 UJ	--	--
ANIONS										
BORON	7440-42-8	ug/l	0.24	0.10 U	0.27	0.23	0.46	0.10 U	--	--
CHLORIDE	16887-00-6	mg/l	115.00	5.00	110.00	130.00	105.00	15.00	--	--
TOTAL PHOSPHATES	PHOS	ug/l	0.07 R	0.03	0.06	0.18	0.07	0.05	--	--
SULFATE	14808-79-8	mg/l	400.00 J	5.00	285.00	335.00	188.00	7.50	--	--
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	6.00 J	0.05 U	5.60	6.80	12.00	0.05 U	--	--
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	--	--
ORTHO-PHOSPHATE	OPH	mg/l	0.03	0.01 U	0.02	0.01 U	0.03	0.01 U	--	--
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	6.00 NB	5.00 N	5.00 NB	5.00 NB	39.00 NB	--	--
BENZENE,(1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	2.00 N	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	25.00 NB	30.00 NB	30.00 NB	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	3.00 NB	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	4.00 NB	5.00 NB	9.00 NB	4.00 NB	--	--	--
1-PROPENE,3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	4.00 N	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	2.00 NB	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,3-DICHLORO-,CIS-	24955-63-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE,1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE,1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1-BROMO-2-CHLORO-,CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE,1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE,1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	2.00 N	--	--	2.00 NB	--	--	--
ETHANONE,1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	2.00 NB	--	--	--
CYCLOHEXENE,3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL,TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,4-DICHLORO-,CIS-	16749-11-4	ug/l	2.00 N	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	4.00 N	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	049	050*	051	052	053	054*	055	056
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	3.00 N	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	26.00 NB	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	3.00 NB	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	4.00 N	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	6.00 N	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	2.00 N	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	1.00 NB	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	37.00 NB	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	3.00 N	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	CUNITS	057*	058	059	060	061*	062	063	064
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 UJ	5.00 U	5.00 UJ	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	2.00 UJB	2.00 UJB	2.00 UJB	2.00 UJB	2.00 UJB	2.00 UJB	2.00 UJ	3.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U
TETRACHLOROETHENE	127-18-4	ug/l	5.00 U	12.00	11.00	5.00	5.00 U	3.00 J	1.00 J	1.00 J
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	4.00 J	4.00 J	12.00	5.00 U	5.00	14.00	13.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 U	9.00	8.00	6.00	5.00 U	4.00 J	4.00 J	4.00 J
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 U	5.00 UJ	5.00 U	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U
TRICHLOROETHENE	79-01-6	ug/l	5.00 U	33.00	15.00	53.00	5.00 U	38.00	120.00	120.00
ACETONE	67-64-1	ug/l	10.00 UJ	6.00 UJB	6.00 UJB	4.00 UJB	5.00 UJB	10.00 UJ	10.00 UJ	10.00 UJ
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ
2-BUTANONE	78-93-3	ug/l	19.00 UJB	17.00 UJB	16.00 UJB	27.00 UJB	27.00 UJB	10.00 UJ	10.00 UJ	10.00 UJ
VINYL ACETATE	108-05-4	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
2-HEXANONE	591-78-6	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
STYRENE	100-42-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 UJ	6.00 J	6.00 J	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00	4.00 J	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	--	--	--	--	--	--	--	--
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 U	50.00 U	50.00 R
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 U	50.00 U	50.00 R
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 U	50.00 U	50.00 R
PHENOL	108-95-2	ug/l	10.00 U	3.00 UJB	5.00 UJB	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	057*	058	059	060	061*	062	063	064
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 U	2.00 J	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ	20.00 UJ
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
2,4-DINITROTOLUENE	121-14-2	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 R	10.00 U	10.00 U	10.00 U	10.00 R
4-METHYLPHENOL	106-44-5	ug/l	15.00 U	15.00 U	15.00 U	10.00 R	15.00 U	15.00 U	15.00 U	10.00 R
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	057 *	058	059	060	061 *	062	063	064
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 UJ	50.00 U	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 R	50.00 U	50.00 U	50.00 U	50.00 R
3-NITROANILINE	99-09-2	ug/l	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 R	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 R
UNKNOWN	UNK	ug/l	--	10.00 NJ	--	20.00 NJ	--	--	--	10.00 NJ
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
BETA-BHC	319-85-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
DELTA-BHC	319-86-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
4,4-DDE	72-55-9	ug/l	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
HEPTACHLOR	76-44-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN I	959-98-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN II	33213-65-9	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIELDRIN	60-57-1	ug/l	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
ENDRIN	72-20-8	ug/l	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
4,4-DDD	72-54-8	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
4,4-DDT	50-29-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOXAPHENE	8001-35-2	ug/l	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U
METHOXYCHLOR	72-43-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
ENDRIN KETONE	53494-70-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
CHLORDANE	57-74-9	ug/l	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U
ALDRIN	309-00-2	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PCB-1242	53469-21-9	ug/l	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U
PCB-1254	11097-69-1	ug/l	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U
PCB-1221	11104-28-2	ug/l	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U
PCB-1232	11141-16-5	ug/l	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U
PCB-1248	12672-29-6	ug/l	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U
PCB-1260	11096-82-5	ug/l	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U
PCB-1016	12674-11-2	ug/l	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U
METALS										
FLUORIDE	FLR	mg/l	--	--	--	--	--	--	--	--
ANTIMONY	7440-36-0	ug/l	--	--	--	--	--	--	--	--
ARSENIC	7440-38-2	mg/l	--	--	--	--	--	--	--	--
BERYLLIUM	7440-41-7	ug/l	--	--	--	--	--	--	--	--
CADMIUM	7440-43-9	ug/l	--	--	--	--	--	--	--	--
CHROMIUM	7440-47-3	ug/l	--	--	--	--	--	--	--	--
COPPER	7440-50-8	ug/l	--	--	--	--	--	--	--	--
LEAD	7439-92-1	ug/l	--	--	--	--	--	--	--	--
MERCURY	7439-97-6	mg/l	--	--	--	--	--	--	--	--
NICKEL	7440-02-0	ug/l	--	--	--	--	--	--	--	--
SELENIUM	7782-49-2	mg/l	--	--	--	--	--	--	--	--
SILVER	7440-22-4	ug/l	--	--	--	--	--	--	--	--
THALLIUM	7440-28-0	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	057*	058	059	060	061*	062	063	064
METALS Cont'd										
ZINC	7440-66-6	ug/l	--	--	--	--	--	--	--	--
ALUMINUM	7429-90-5	ug/l	--	--	--	--	--	--	--	--
BARIUM	7440-39-3	ug/l	--	--	--	--	--	--	--	--
COBALT	7440-48-4	ug/l	--	--	--	--	--	--	--	--
MANGANESE	7439-96-5	ug/l	--	--	--	--	--	--	--	--
IRON	7439-89-6	ug/l	--	--	--	--	--	--	--	--
CYANIDE	74-90-8	ug/l	--	--	--	--	--	--	--	--
VANADIUM	7440-62-2	ug/l	--	--	--	--	--	--	--	--
SODIUM	7440-23-5	mg/l	--	--	--	--	--	--	--	--
TIN	7440-31-5	ug/l	--	--	--	--	--	--	--	--
CALCIUM	7440-70-2	mg/l	--	--	--	--	--	--	--	--
MAGNESIUM	7439-95-4	mg/l	--	--	--	--	--	--	--	--
POTASSIUM	7440-09-7	mg/l	--	--	--	--	--	--	--	--
ANIONS										
BORON	7440-42-8	ug/l	--	--	--	--	--	--	--	--
CHLORIDE	16887-00-6	mg/l	--	--	--	--	--	--	--	--
TOTAL PHOSPHATES	PHOS	ug/l	--	--	--	--	--	--	--	--
SULFATE	14808-79-8	mg/l	--	--	--	--	--	--	--	--
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	--	--	--	--	--	--	--	--
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	--	--	--	--	--	--	--	--
ORTHO-PHOSPHATE	OPH	mg/l	--	--	--	--	--	--	--	--
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	--	--	--	--	--	--	--
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	--	--	--	--	--
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	057*	058	059	060	061*	062	063	064
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	065*	066	067	068	069	070*	071	072
VOLATILE ORGANICS										
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 UJ	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	2.00 UJB	2.00 UJB	1.00 UJB	2.00 UJB	1.00 UJB	2.00 UJB	1.00 UJB	1.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 UJ	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
TETRACHLOROETHENE	127-18-4	ug/l	5.00 U	1.00 J	2.00 J	2.00 J	3.00 J	5.00 U	3.00 J	7.00
TOLUENE	108-88-3	ug/l	5.00 U	2.00 J	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00 U	2.00 J	5.00 U	1.00 J	2.00 J	5.00 U	5.00 U	5.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00 U	5.00 UJ	5.00 UJ	3.00 J	4.00 J	5.00 U	2.00 J	6.00
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TRICHLOROETHENE	79-01-6	ug/l	5.00 U	23.00	8.00	3.00 J	4.00 J	5.00 U	4.00 J	56.00
ACETONE	67-64-1	ug/l	5.00 UJB	10.00 UJ	10.00 UJ	4.00 UJB	2.00 UJB	3.00 UJB	3.00 UJB	10.00 UJ
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 UJ	5.00 UJ	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	5.00 UJB	10.00 UJ	10.00 UJ	22.00 UJB	20.00 UJB	13.00 UJ	12.00 UJB	3.00 UJB
VINYL ACETATE	108-05-4	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
2-HEXANONE	591-78-6	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
STYRENE	100-42-5	ug/l	5.00 UJ	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
TOTAL XYLENES	1330-20-7	ug/l	5.00 UJ	5.00 U	5.00 U	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHANE	75-34-3	ug/l	5.00 U	5.00 U	5.00 U	3.00 J	6.00	5.00 U	5.00 UJ	3.00 J
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	3.00 J
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U	23.00 U
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	--	--	--	--	--	--	--	--
BASE/NEUTRAL/ACID EXTRACTABLE										
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
PHENOL	108-95-2	ug/l	10.00 U	5.00 UJB	10.00 U	13.00 UJB	7.00 UJB	3.00 UJB	4.00 UJB	4.00 UJB
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	065*	066	067	068	069	070*	071	072
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
BENZIDINE	92-87-5	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U	11.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 UJ	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	5.00 J	10.00 U
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 UJ	10.00 U	10.00 U	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 R	20.00 UJ	20.00 R	20.00 R	20.00 R	20.00 R	20.00 R	20.00 R
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U	20.00 U
2,4-DINITROTOLUENE	121-14-2	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U	12.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	15.00 U	15.00 U	15.00 U	15.00 U	15.00 U	15.00 U	15.00 U	15.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R	10.00 R
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	065 *	066	067	068	069	070 *	071	072
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd										
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 UJ	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 R	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	8.00 NJB	9.00 NJB	--	--	--	9.00 NJB
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	--	--	20.00 NJ	--	10.00 NJ	--	--	9.00 NJ
PESTICIDES										
ALPHA-BHC	319-84-6	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
BETA-BHC	319-85-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
DELTA-BHC	319-86-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
4,4-DDE	72-55-9	ug/l	0.30 U	0.02 J	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
HEPTACHLOR	76-44-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN I	959-98-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN II	33213-65-9	ug/l	1.00 U	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIELDRIN	60-57-1	ug/l	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
ENDRIN	72-20-8	ug/l	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
4,4-DDD	72-54-8	ug/l	1.00 U	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U
4,4-DDT	50-29-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
TOXAPHENE	8001-35-2	ug/l	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U	170.00 U
METHOXYCHLOR	72-43-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U	6.00 U
ENDRIN KETONE	53494-70-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
CHLORDANE	57-74-9	ug/l	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U	123.00 U
ALDRIN	309-00-2	ug/l	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PCB-1242	53469-21-9	ug/l	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U	17.00 U
PCB-1254	11097-69-1	ug/l	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U	87.00 U
PCB-1221	11104-28-2	ug/l	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U	62.00 U
PCB-1232	11141-16-5	ug/l	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U	69.00 U
PCB-1248	12672-29-6	ug/l	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U	54.00 U
PCB-1260	11096-82-5	ug/l	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U	30.00 U
PCB-1016	12674-11-2	ug/l	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U	84.00 U
METALS										
FLUORIDE	FLR	mg/l	--	--	--	--	--	--	--	--
ANTIMONY	7440-36-0	ug/l	--	--	--	--	--	--	--	--
ARSENIC	7440-38-2	mg/l	--	--	--	--	--	--	--	--
BERYLLIUM	7440-41-7	ug/l	--	--	--	--	--	--	--	--
CADMIUM	7440-43-9	ug/l	--	--	--	--	--	--	--	--
CHROMIUM	7440-47-3	ug/l	--	--	--	--	--	--	--	--
COPPER	7440-50-8	ug/l	--	--	--	--	--	--	--	--
LEAD	7439-92-1	ug/l	--	--	--	--	--	--	--	--
MERCURY	7439-97-6	mg/l	--	--	--	--	--	--	--	--
NICKEL	7440-02-0	ug/l	--	--	--	--	--	--	--	--
SELENIUM	7782-49-2	mg/l	--	--	--	--	--	--	--	--
SILVER	7440-22-4	ug/l	--	--	--	--	--	--	--	--
THALLIUM	7440-28-0	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	065 *	066	067	068	069	070*	071	072
METALS Cont'd										
ZINC	7440-66-6	ug/l	--	--	--	--	--	--	--	--
ALUMINUM	7429-90-5	ug/l	--	--	--	--	--	--	--	--
BARIUM	7440-39-3	ug/l	--	--	--	--	--	--	--	--
COBALT	7440-48-4	ug/l	--	--	--	--	--	--	--	--
MANGANESE	7439-96-5	ug/l	--	--	--	--	--	--	--	--
IRON	7439-89-6	ug/l	--	--	--	--	--	--	--	--
CYANIDE	74-90-8	ug/l	--	--	--	--	--	--	--	--
VANADIUM	7440-62-2	ug/l	--	--	--	--	--	--	--	--
SODIUM	7440-23-5	mg/l	--	--	--	--	--	--	--	--
TIN	7440-31-5	ug/l	--	--	--	--	--	--	--	--
CALCIUM	7440-70-2	mg/l	--	--	--	--	--	--	--	--
MAGNESIUM	7439-95-4	mg/l	--	--	--	--	--	--	--	--
POTASSIUM	7440-09-7	mg/l	--	--	--	--	--	--	--	--
ANIONS										
BORON	7440-42-8	ug/l	--	--	--	--	--	--	--	--
CHLORIDE	16887-00-6	mg/l	--	--	--	--	--	--	--	--
TOTAL PHOSPHATES	PHOS	ug/l	--	--	--	--	--	--	--	--
SULFATE	14808-79-8	mg/l	--	--	--	--	--	--	--	--
NITRATE-N	NTA	mg/l	--	--	--	--	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	--	--	--	--	--	--	--	--
BICARBONATE	BICARB	ug/l	--	--	--	--	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--	--	--	--	--
SULFIDE	SLF	mg/l	--	--	--	--	--	--	--	--
ORTHO-PHOSPHATE	OPH	mg/l	--	--	--	--	--	--	--	--
TENTITIVELY IDENTIFIED COMPOUNDS										
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	--	--	--	--	--	--	--
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	--	--	--	--	--
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	--	--	--	--	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	065 *	066	067	068	069	070 *	071	072
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd										
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.

Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.

RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter

ug/l = micrograms/liter

mg/l = milligrams/liter

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	073	074 *	075*	076
VOLATILE ORGANICS						
BENZENE	71-43-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
BROMOFORM	75-25-2	ug/l	5.00 U	5.00 U	5.00 U	5.00 UJ
CARBON TETRACHLORIDE	56-23-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 UJ
CHLOROBENZENE	108-90-7	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	5.00 U	5.00 U	5.00 U	5.00 UJ
CHLOROETHANE	75-00-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R
CHLOROFORM	67-66-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 UJ
1,2-DICHLOROPROPANE	78-87-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
ETHYLBENZENE	100-41-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	23.00 U	23.00 U	23.00 U	23.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	2.00 UJB	2.00 UJB	23.00 UJB	3.00 UJB
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U
TETRACHLOROETHENE	127-18-4	ug/l	16.00	5.00 U	5.00 U	21.00
TOLUENE	108-88-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	13.00	5.00 U	5.00 U	16.00
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	17.00	5.00 U	5.00 U	25.00 J
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
TRICHLOROETHENE	79-01-6	ug/l	16.00	5.00 U	5.00 U	110.00
ACETONE	67-64-1	ug/l	10.00 UJ	2.00 UJB	10.00 UJ	10.00 UJ
CARBON DISULFIDE	75-15-0	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
2-BUTANONE	78-93-3	ug/l	14.00 UJB	7.00 UJB	10.00 UJ	17.00 UJB
VINYL ACETATE	108-05-4	ug/l	10.00 R	10.00 R	10.00 R	10.00 R
2-HEXANONE	591-78-6	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
4-METHYL-2-PENTANONE	108-10-1	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 UJ
STYRENE	100-42-5	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U
TOTAL XYLENES	1330-20-7	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	10.00	5.00 U	5.00 U	11.00
1,2-DICHLOROETHANE	107-06-2	ug/l	5.00 UJ	5.00 UJ	5.00 UJ	5.00 UJ
1,1-DICHLOROETHENE	75-35-4	ug/l	7.00	5.00 U	5.00 U	11.00
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
VINYL CHLORIDE	75-01-4	ug/l	1.00 J	23.00 U	23.00 U	2.00 J
DIISOPROPYLMETHYLPHOSPHATE	DIMP	ug/l	--	--	--	--
BASE/NEUTRAL/ACID EXTRACTABLE						
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DICHLOROPHENOL	120-83-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
2-NITROPHENOL	88-75-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROPHENOL	100-02-7	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
PENTACHLOROPHENOL	87-86-5	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
PHENOL	108-95-2	ug/l	3.00 UJB	4.00 UJB	6.00 UJB	10.00 U
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHENE	83-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
ACENAPHTHYLENE	208-96-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
ANTHRACENE	120-12-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	073	074 *	075 *	076
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd						
BENZIDINE	92-87-5	ug/l	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(A)PYRENE	50-32-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(B)FLUORANTHENE	205-99-2	ug/l	11.00 U	11.00 U	11.00 U	11.00 U
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 UJ
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	2.00 J	3.00 J	10.00 U	3.00 J
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	10.00 UJ	10.00 UJ	10.00 UJ	10.00 U
2-CHLORONAPHTHALENE	91-58-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
CHRYSENE	218-01-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
1,2-DICHLOROBENZENE	95-50-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
1,3-DICHLOROBENZENE	541-73-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
1,4-DICHLOROBENZENE	106-46-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	20.00 R	20.00 R	20.00 R	20.00 R
DIETHYL PHTHALATE	84-66-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
DIMETHYL PHTHALATE	131-11-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	20.00 U	20.00 U	20.00 U	20.00 U
2,4-DINITROTOLUENE	121-14-2	ug/l	12.00 U	12.00 U	12.00 U	12.00 U
2,6-DINITROTOLUENE	606-20-2	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
FLUORANTHENE	206-44-0	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
FLUORENE	86-73-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBENZENE	118-74-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROBUTADIENE	87-68-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
HEXACHLOROCYCLOPENTADIENE	77-47-4	ug/l	15.00 UJ	15.00 UJ	15.00 UJ	15.00 UJ
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
ISOPHORONE	78-59-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
NAPHTHALENE	91-20-3	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
NITROBENZENE	98-95-3	ug/l	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIMETHYLAMINE	62-75-9	ug/l	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	12.00 U	12.00 U	12.00 U	12.00 U
N-NITROSODIPHENYLAMINE	86-30-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
PHENANTHRENE	85-01-8	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
PYRENE	129-00-0	ug/l	12.00 U	12.00 U	12.00 U	12.00 U
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
ANILINE	62-53-3	ug/l	--	--	--	--
BENZYL ALCOHOL	100-51-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
2-METHYLPHENOL	95-48-7	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
4-METHYLPHENOL	106-44-5	ug/l	15.00 U	15.00 U	15.00 U	15.00 U
BENZOIC ACID	65-85-0	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
4-CHLOROANILINE	106-47-8	ug/l	10.00 R	10.00 R	10.00 R	10.00 R
2-METHYLNAPHTHALENE	91-57-6	ug/l	10.00 U	10.00 U	10.00 U	10.00 U

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	073	074 *	075 *	076
BASE/NEUTRAL/ACID EXTRACTABLE Cont'd						
2-NITROANILINE	88-74-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
2,4,5-TRICHLOROPHENOL	95-95-4	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
3-NITROANILINE	99-09-2	ug/l	50.00 R	50.00 R	50.00 R	50.00 R
DIBENZOFURAN	132-64-9	ug/l	10.00 U	10.00 U	10.00 U	10.00 U
4-NITROANILINE	100-01-6	ug/l	50.00 UJ	50.00 UJ	50.00 UJ	50.00 UJ
BUTYLATED HYDROXYTOLUENE (BHT)	128-37-0	ug/l	--	--	8.00 NJB	8.00 NJB
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--
1-HEXANOL, 2-ETHER	104767	ug/l	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	50.00 U	50.00 U	50.00 U	50.00 U
UNKNOWN	UNK	ug/l	20.00 NJ	--	--	20.00 NJ
PESTICIDES						
ALPHA-BHC	319-84-6	ug/l	2.00 U	2.00 U	2.00 U	2.00 U
BETA-BHC	319-85-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U
GAMMA-BHC (LINDANE)	58-89-9	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
DELTA-BHC	319-86-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
4,4-DDE	72-55-9	ug/l	0.30 U	0.30 U	0.30 U	0.30 U
HEPTACHLOR	76-44-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN I	959-98-8	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
ENDOSULFAN II	33213-65-9	ug/l	1.00 U	1.00 U	1.00 U	1.00 U
DIELDRIN	60-57-1	ug/l	0.30 U	0.30 U	0.30 U	0.30 U
ENDRIN	72-20-8	ug/l	0.40 U	0.40 U	0.40 U	0.40 U
4,4-DDD	72-54-8	ug/l	1.00 U	1.00 U	1.00 U	1.00 U
ENDOSULFAN SULFATE	1031-07-8	ug/l	3.00 U	3.00 U	3.00 U	3.00 U
4,4-DDT	50-29-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U
TOXAPHENE	8001-35-2	ug/l	170.00 U	170.00 U	170.00 U	170.00 U
METHOXYCHLOR	72-43-5	ug/l	6.00 U	6.00 U	6.00 U	6.00 U
ENDRIN KETONE	53494-70-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U
CHLORDANE	57-74-9	ug/l	123.00 U	123.00 U	123.00 U	123.00 U
ALDRIN	309-00-2	ug/l	0.20 U	0.20 U	0.20 U	0.20 U
PCB-1242	53469-21-9	ug/l	17.00 U	17.00 U	17.00 U	17.00 U
PCB-1254	11097-69-1	ug/l	87.00 U	87.00 U	87.00 U	87.00 U
PCB-1221	11104-28-2	ug/l	62.00 U	62.00 U	62.00 U	62.00 U
PCB-1232	11141-16-5	ug/l	69.00 U	69.00 U	69.00 U	69.00 U
PCB-1248	12672-29-6	ug/l	54.00 U	54.00 U	54.00 U	54.00 U
PCB-1260	11096-82-5	ug/l	30.00 U	30.00 U	30.00 U	30.00 U
PCB-1016	12674-11-2	ug/l	84.00 U	84.00 U	84.00 U	84.00 U
METALS						
FLUORIDE	FLR	mg/l	--	--	--	--
ANTIMONY	7440-36-0	ug/l	--	--	--	--
ARSENIC	7440-38-2	mg/l	--	--	--	--
BERYLLIUM	7440-41-7	ug/l	--	--	--	--
CADMIUM	7440-43-9	ug/l	--	--	--	--
CHROMIUM	7440-47-3	ug/l	--	--	--	--
COPPER	7440-50-8	ug/l	--	--	--	--
LEAD	7439-92-1	ug/l	--	--	--	--
MERCURY	7439-97-6	mg/l	--	--	--	--
NICKEL	7440-02-0	ug/l	--	--	--	--
SELENIUM	7782-49-2	mg/l	--	--	--	--
SILVER	7440-22-4	ug/l	--	--	--	--
THALLIUM	7440-28-0	ug/l	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	073	074*	075 *	076
METALS Cont'd						
ZINC	7440-66-6	ug/l	--	--	--	--
ALUMINUM	7429-90-5	ug/l	--	--	--	--
BARIUM	7440-39-3	ug/l	--	--	--	--
COBALT	7440-48-4	ug/l	--	--	--	--
MANGANESE	7439-96-5	ug/l	--	--	--	--
IRON	7439-89-6	ug/l	--	--	--	--
CYANIDE	74-90-8	ug/l	--	--	--	--
VANADIUM	7440-62-2	ug/l	--	--	--	--
SODIUM	7440-23-5	mg/l	--	--	--	--
TIN	7440-31-5	ug/l	--	--	--	--
CALCIUM	7440-70-2	mg/l	--	--	--	--
MAGNESIUM	7439-95-4	mg/l	--	--	--	--
POTASSIUM	7440-09-7	mg/l	--	--	--	--
ANIONS						
BORON	7440-42-8	ug/l	--	--	--	--
CHLORIDE	16887-00-6	mg/l	--	--	--	--
TOTAL PHOSPHATES	PHOS	ug/l	--	--	--	--
SULFATE	14808-79-8	mg/l	--	--	--	--
NITRATE-N	NTA	mg/l	--	--	--	--
NITRATE/NITRITE	14797-BOTH	mg/l	--	--	--	--
BICARBONATE	BICARB	ug/l	--	--	--	--
CARBONATE	CARB	ug/l	--	--	--	--
SULFIDE	SLF	mg/l	--	--	--	--
ORTHO-PHOSPHATE	OPH	mg/l	--	--	--	--
TENTITIVELY IDENTIFIED COMPOUNDS						
CYCLOTRISILOXANE, HEXAMETHYL	541-05-9	ug/l	--	--	--	--
BENZENE, (1,1-DIMETHYLETHYL)	98-06-6	ug/l	--	--	--	--
1,4-DIOXANE	123-91-1	ug/l	--	--	--	--
METHANE, TRICHLOROFLUORO-	75-69-4	ug/l	--	--	--	--
2-PROPENYL ESTER OF BUTANOIC ACID	2051-78-7	ug/l	--	--	--	--
1,3,5-CYCLOHEPTATRIENE	544-25-2	ug/l	--	--	--	--
2(3H)-FURANONE, DIHYDRO-	96-48-0	ug/l	--	--	--	--
1-PROPENE, 3,3,3-TRICHLORO-	2233-00-3	ug/l	--	--	--	--
CYCLOHEXENE, 4-CHLORO-	930-65-4	ug/l	--	--	--	--
CYCLOHEXENE, 3-CHLORO-	2441-97-6	ug/l	--	--	--	--
CYCLOHEXANE, 1,3-DICHLORO-, CIS-	24955-63-3	ug/l	--	--	--	--
CYCLOHEXENE, 1-IODO-	17497-53-9	ug/l	--	--	--	--
DISULFIDE, 1,1-DIMETHYLETHYLMETHYL	35166-82-6	ug/l	--	--	--	--
CYCLOHEXANE, 1-BROMO-2-CHLORO-, CIS-	51422-75-4	ug/l	--	--	--	--
CYCLOPROPANE, 1-CHLORO-2-ETHENYL-1-MET	62337-93-3	ug/l	--	--	--	--
2-METHYL-PENTANE	107-83-5	ug/l	--	--	--	--
PROPANE, 1,3-DIMETHOXY-2-(METHOXYMETHY	15476-20-7	ug/l	--	--	--	--
BI-2-CYCLOHEXEN-1-YL	1541-20-4	ug/l	--	--	--	--
ETHANONE, 1-(2-THIENYL)-	88-15-3	ug/l	--	--	--	--
TRANS-2-CHLORO-CYCLOHEXANOL	6628-80-4	ug/l	--	--	--	--
3-METHOXY-5-METHYL-2-HEXANONE	56667-04-0	ug/l	--	--	--	--
CYCLOHEXENE, 3-BROMO-	1521-51-3	ug/l	--	--	--	--
2-FURANMETHANOL, TETRAHYDRO-	97-99-4	ug/l	--	--	--	--
CYCLOHEXANE, 1,4-DICHLORO-, CIS-	16749-11-4	ug/l	--	--	--	--
M.M.E.CYCLOHEXANEDIOLE	33669-76-0	ug/l	--	--	--	--
HEXANEDIOIC ACID, DIOCTYL ESTER	123-79-5	ug/l	--	--	--	--

APPENDIX A-1
EPA RI/FS STUDY SUMMARY RESULTS

COMPOUND NAME	CAS #	UNITS	073	074*	075*	076
TENTITIVELY IDENTIFIED COMPOUNDS Cont'd						
2-PENTENE,5-BROMO-2,3-DIMETHYL	56312-52-8	ug/l	--	--	--	--
CYCLOHEXANOL,4-CHLORO-,TRANS-	29538-77-0	ug/l	--	--	--	--
2-FURANOL,TETRAHYDRO-2-METHYL-	7326-46-7	ug/l	--	--	--	--
1-PROPENE,1,1,2-TRICHLORO-	21400-25-9	ug/l	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,TRANS	822-86-6	ug/l	--	--	--	--
CYCLOHEXANE,NITRO-	1122-60-7	ug/l	--	--	--	--
2-PIPERIDINONE	675-20-7	ug/l	--	--	--	--
FURAN,2,5-DIETHYLTETRAHYDRO-	41239-48-9	ug/l	--	--	--	--
CYCLOHEXANE,1,2-DICHLORO-,CIS	10498-35-8	ug/l	--	--	--	--
2-PROPENAL,3-(DIMETHYLAMINO)-3-(METHY	49582-51-6	ug/l	--	--	--	--
4-METHYL-THIAZOLE	693-95-8	ug/l	--	--	--	--
CYCLOHEXANOL,2-BROMO-,CIS	16536-57-5	ug/l	--	--	--	--
HEXANE,3,3-DIMETHYL-	563-16-6	ug/l	--	--	--	--
3,4-HEXANEDIONE,2,2,5-TRIMETHYL	20633-03-8	ug/l	--	--	--	--
BENEZENEACETICACID,1,1-DIMETHYLETHYLEIS	16537-09-0	ug/l	--	--	--	--
3-HEXANONE,2,4-DIMETHYL-	18641-70-8	ug/l	--	--	--	--
OXIRANE,2,2-DIMETHYL-	558-30-5	ug/l	--	--	--	--
CYCLOHEXANE,AZIDO-	19573-22-9	ug/l	--	--	--	--
PIPERIDINONE	27154-43-4	ug/l	--	--	--	--
1H-1,2,4-TRIAZOL-3-AMINE	61-82-5	ug/l	--	--	--	--
1-PROPANOL,3-METHOXY-2,2-BIS(METHOXYM	20637-36-9	ug/l	--	--	--	--
CYCLOPENTANECARBOXYLICACID,3-METHLEN	37575-80-7	ug/l	--	--	--	--
OXIRANE,PROPYL-	1003-14-1	ug/l	--	--	--	--
BENZENE,METHYL-	108-88-3	ug/l	--	--	--	--
OCTODIANE-4,5-DIAL	4486-59321	ug/l	--	--	--	--
3-METHYL 2-BUTENAL	107-86-8	ug/l	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Number = abbreviated identification. Full EPA sample number is 198-DW-XXX-001, with XXX being sample number given above. Samples with asterisk are blanks for QA/QC purposes.

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

UNITS

ng/l = nano grams/liter
ug/l = micrograms/liter
mg/l = milligrams/liter

APPENDIX A-2
SUMMARY OF HITS FOR
TENTATIVELY IDENTIFIED UNKNOWN ORGANIC COMPOUNDS

SAMPLE NO.	SERIES	CAS #	UNITS	RESULT	QUALIFIER	SCAN NO.
198DW012001	BNA	UNK	ug/l	20.00	N	32.40
198DW012001	BNA	UNK	ug/l	36.00	N	34.17
198DW013001	BNA	UNK	ug/l	26.00	N	29.09
198DW023001	BNA	UNK	ug/l	3.00	N	281.00
198DW023001	BNA	UNK	ug/l	1.00	N	417.00
198DW023001	BNA	UNK	ug/l	3.00	NB	795.00
198DW024001	BNA	UNK	ug/l	1.00	N	524.00
198DW024001	BNA	UNK	ug/l	5.00	NB	795.00
198DW025001	BNA	UNK	ug/l	1.00	NB	286.00
198DW026001	BNA	UNK	ug/l	3.00	N	577.00
198DW027001	BNA	UNK	ug/l	2.00	NB	285.00
198DW028001	BNA	UNK	ug/l	1.00	N	279.00
198DW028001	BNA	UNK	ug/l	1.00	NB	396.00
198DW029001	BNA	UNK	ug/l	3.00	N	577.00
198DW030001	BNA	UNK	ug/l	4.00	NB	234.00
198DW030001	BNA	UNK	ug/l	2.00	NB	282.00
198DW031001	BNA	UNK	ug/l	5.00	N	286.00
198DW031001	BNA	UNK	ug/l	2.00	NB	413.00
198DW031001	BNA	UNK	ug/l	3.00	N	576.00
198DW032001	BNA	UNK	ug/l	6.00	NB	233.00
198DW032001	BNA	UNK	ug/l	2.00	NB	413.00
198DW033001	BNA	UNK	ug/l	3.00	NB	795.00
198DW034001	BNA	UNK	ug/l	1.00	N	281.00
198DW034001	BNA	UNK	ug/l	1.00	NB	794.00
198DW036001	BNA	UNK	ug/l	2.00	N	418.00
198DW037001	BNA	UNK	ug/l	4.00	N	333.00
198DW037001	BNA	UNK	ug/l	2.00	NB	525.00
198DW037001	BNA	UNK	ug/l	7.00	N	713.00
198DW038001	BNA	UNK	ug/l	1.00	N	284.00
198DW039001	BNA	UNK	ug/l	3.00	NB	289.00
198DW040001	BNA	UNK	ug/l	5.00	N	795.00
198DW041001	BNA	UNK	ug/l	1.00	N	412.00
198DW041001	BNA	UNK	ug/l	11.00	N.	795.00
198DW042001	BNA	UNK	ug/l	6.00	NB	234.00
198DW042001	BNA	UNK	ug/l	2.00	NB	281.00
198DW042001	BNA	UNK	ug/l	6.00	NB	400.00
198DW043001	BNA	UNK	ug/l	3.00	NB	234.00
198DW043001	BNA	UNK	ug/l	8.00	N	357.00
198DW044001	BNA	UNK	ug/l	9.00	N	343.00
198DW044001	BNA	UNK	ug/l	6.00	NB	837.00
198DW044001	BNA	UNK	ug/l	10.00	N	2019.00
198DW045001	BNA	UNK	ug/l	3.00	N	287.00
198DW045001	BNA	UNK	ug/l	3.00	N	576.00
198DW046001	BNA	UNK	ug/l	8.00	N	400.00
198DW046001	BNA	UNK	ug/l	4.00	N	339.00
198DW046001	BNA	UNK	ug/l	4.00	N	2026.00
198DW046001	BNA	UNK	ug/l	12.00	N	389.00
198DW046001	BNA	UNK	ug/l	17.00	N	540.00
198DW046001	BNA	UNK	ug/l	9.00	N	545.00

APPENDIX A-2
SUMMARY OF HITS FOR
TENTATIVELY IDENTIFIED UNKNOWN ORGANIC COMPOUNDS

SAMPLE NO.	SERIES	CAS #	UNITS	RESULT	QUALIFIER	SCAN NO.
198DW047001	BNA	UNK	ug/l	5.00	N	575.00
198DW048001	BNA	UNK	ug/l	42.00	N	232.00
198DW048001	BNA	UNK	ug/l	6.00	N	342.00
198DW048001	BNA	UNK	ug/l	2.00	N	836.00
198DW048001	BNA	UNK	ug/l	11.00	N	2017.00
198DW049001	BNA	UNK	ug/l	16.00	N	221.00
198DW049001	BNA	UNK	ug/l	22.00	N	231.00
198DW049001	BNA	UNK	ug/l	15.00	N	254.00
198DW049001	BNA	UNK	ug/l	4.00	N	343.00
198DW049001	BNA	UNK	ug/l	11.00	N	403.00
198DW049001	BNA	UNK	ug/l	6.00	N	732.00
198DW049001	BNA	UNK	ug/l	5.00	N	837.00
198DW049001	BNA	UNK	ug/l	5.00	N	2022.00
198DW050001	BNA	UNK	ug/l	2.00	N	525.00
198DW050001	BNA	UNK	ug/l	2.00	N	253.00
198DW050001	BNA	UNK	ug/l	1.00	NB	336.00
198DW051001	BNA	UNK	ug/l	6.00	N	711.00
198DW051001	BNA	UNK	ug/l	3.00	N	457.00
198DW052001	BNA	UNK	ug/l	4.00	N	713.00
198DW054001	BNA	UNK	ug/l	68.00	NB	222.00
198DW054001	BNA	UNK	ug/l	37.00	N	233.00
198DW054001	BNA	UNK	ug/l	18.00	N	2024.00
198DW058001	BNA	UNK	ug/l	10.00	NJ	1891.00
198DW060001	BNA	UNK	ug/l	20.00	NJ	880.00
198DW064001	BNA	UNK	ug/l	10.00	NJ	871.00
198DW067001	BNA	UNK	ug/l	20.00	NJ	721.00
198DW067001	BNA	UNK	ug/l	20.00	NJ	1067.00
198DW069001	BNA	UNK	ug/l	10.00	NJ	722.00
198DW072001	BNA	UNK	ug/l	9.00	NJ	723.00
198DW073001	BNA	UNK	ug/l	20.00	NJ	722.00
198DW073001	BNA	UNK	ug/l	10.00	NJ	1072.00
198DW076001	BNA	UNK	ug/l	20.00	NJ	719.00
198DW076001	BNA	UNK	ug/l	10.00	NJ	1065.00
198DW076001	BNA	UNK	ug/l	10.00	NJ	1654.00

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-1 11/4/85	MW-1 12/5/85	MW-1 1/3/86	MW-1 2/13/86	MW-1 3/6/86	MW-1 5/2/86	MW-2 11/4/85	MW-2 12/5/85
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	2.00	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U	11.00	1.00 U	--	1.00 U	1.00 U	1.00 U	5.00
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	3.00	4.00	--	1.00 U	3.00	3.00	3.00
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	--	2.00 U	2.00	2.00 U	6.00
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	4.00	5.00	5.00	--	1.00 U	5.00	47.00	50.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	1.00 U	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	5.00 U	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	5.00 U	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	5.00 U	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	10.00 U	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	5.00 U	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	10.00 U	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	50.00 U	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	10.00 U	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	5.00 U	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	5.00 U	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	10.00 U	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	5.00 U	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	10.00 U	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	10.00 U	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	10.00 U	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	1.00 U	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-1 11/4/85	MW-1 12/5/85	MW-1 1/3/86	MW-1 2/13/86	MW-1 3/6/86	MW-1 5/2/86	MW-2 11/4/85	MW-2 12/5/85
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	5.00 U	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	50.00 U	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	5.00 U	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	5.00 U	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	5.00 U	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	1.00 U	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	5.00 U	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	10.00 U	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	10.00 U	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	10.00 U	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	5.00 U	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	5.00 U	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	5.00 U	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	5.00 U	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	5.00 U	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	10.00 U	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	13.00	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	5.00 U	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	60.00 U	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	19.00	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	1.00 U	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	10.00 U	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	5.00 U	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	5.00 U	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	1.00 U	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	10.00 U	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	5.00 U	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	1.00 U	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	5.00 U	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	1.00 U	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	5.00 U	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	25.00 U	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	10.00 U	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	10.00 U	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	10.00 U	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	50.00 U	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	25.00 U	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	50.00 U	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	5.00 U	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	10.00 U	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	50.00 U	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	25.00 U	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	25.00 U	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-1 11/4/85	MW-1 12/5/85	MW-1 1/3/86	MW-1 2/13/86	MW-1 3/6/86	MW-1 5/2/86	MW-2 11/4/85	MW-2 12/5/85
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	5.00 U	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	5.00 U	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	25.00 U	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	100.00 U	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	50.00 U	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	50.00 U	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	25.00 U	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	25.00 U	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	25.00 U	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	50.00 U	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-2A 12/5/85	MW-2 1/3/86	MW-2 2/13/86	MW-2 3/6/86	MW-2 5/2/86	MW-3 11/4/85	MW-3 12/5/85	MW-3 1/3/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	--	2.00	2.00	1.00 U	1.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	--	1.00 U	2.00	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	--	1.00 U	2.00	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	5.00	1.00 U	--	1.00 U	1.00 U	1.00 U	5.00	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	--	3.00	3.00	2.00	1.00 U	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	5.00	2.00 U	--	6.00	7.00	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	--	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	45.00	43.00	--	61.00	49.00	3.00	2.00	2.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	--	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLORDBENZENE	120-82-1	ug/l	--	--	1.00 U	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	5.00 U	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	5.00 U	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	5.00 U	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	10.00 U	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	5.00 U	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	10.00 U	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	50.00 U	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	10.00 U	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	5.00 U	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	5.00 U	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	10.00 U	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	10.00 U	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	10.00 U	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	10.00 U	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	1.00 U	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-2A 12/5/85	MW-2 1/3/86	MW-2 2/13/86	MW-2 3/6/86	MW-2 5/2/86	MW-3 11/4/85	MW-3 12/5/85	MW-3 1/3/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	5.00 U	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	50.00 U	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	5.00 U	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	5.00 U	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	5.00 U	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	1.00 U	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	5.00 U	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	10.00 U	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	10.00 U	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	10.00 U	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	5.00 U	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	5.00 U	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	5.00 U	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	5.00 U	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	5.00 U	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	10.00 U	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	10.00 U	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	10.00 U	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	5.00 U	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	0.06 U	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	5.00 U	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	1.00 U	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	10.00 U	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	5.00 U	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	5.00 U	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	1.00 U	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	10.00 U	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	5.00 U	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	1.00 U	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	5.00 U	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	1.00 U	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	5.00 U	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	25.00 U	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	10.00 U	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	10.00 U	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	10.00 U	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	50.00 U	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	25.00 U	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	50.00 U	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	5.00 U	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	10.00 U	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	50.00 U	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	25.00 U	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	25.00 U	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-2 12/5/85	MW-2 1/3/86	MW-2 2/13/86	MW-2 3/6/86	MW-2 5/2/86	MW-3 11/4/85	MW-3 12/5/85	MW-3 1/3/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	5.00 U	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	5.00 U	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	25.00 U	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	100.00 U	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	50.00 U	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	50.00 U	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	25.00 U	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	25.00 U	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	25.00 U	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	50.00 U	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.
ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-3 2/13/86	MW-3 3/6/86	MW-4 11/4/85	MW-4 12/6/86	MW-4 1/3/86	MW-4 2/13/86	MW-4 3/6/86	MW-5 11/4/85
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U	1.00 U	1.00 U	6.00	1.00 U	1.00 U	1.00 U	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	3.00	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	2.00	1.00 U	1.00 U	1.00 U	1.00 U	4.00	1.00 U	44.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	1.00 U	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	5.00 U	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	5.00 U	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	5.00 U	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	10.00 U	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	5.00 U	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	10.00 U	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	50.00 U	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	10.00 U	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	5.00 U	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	5.00 U	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	10.00 U	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	5.00 U	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	10.00 U	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	10.00 U	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	10.00 U	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	1.00 U	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-3 2/13/86	MW-3 3/6/86	MW-4 11/4/85	MW-4 12/6/86	MW-4 1/3/86	MW-4 2/13/86	MW-4 3/6/86	MW-5 11/4/85
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	5.00 U	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	50.00 U	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	5.00 U	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	5.00 U	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	5.00 U	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	1.00 U	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	5.00 U	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	10.00 U	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	10.00 U	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	10.00 U	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	5.00 U	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	5.00 U	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	5.00 U	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	5.00 U	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	5.00 U	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	10.00 U	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	10.00 U	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	10.00 U	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	5.00 U	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	5.00 U	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	1.00 U	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	10.00 U	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	5.00 U	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	5.00 U	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	1.00 U	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	10.00 U	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	5.00 U	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	1.00 U	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	5.00 U	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	1.00 U	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	5.00 U	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	25.00 U	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	10.00 U	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	10.00 U	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	10.00 U	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	50.00 U	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	25.00 U	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	50.00 U	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	5.00 U	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	10.00 U	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	50.00 U	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	25.00 U	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	25.00 U	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-3 2/13/86	MW-3 3/6/86	MW-4 11/4/85	MW-4 12/6/86	MW-4 1/3/86	MW-4 2/13/86	MW-4 3/6/86	MW-5 11/4/85
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	5.00 U	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	5.00 U	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	25.00 U	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	100.00 U	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	50.00 U	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	50.00 U	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	25.00 U	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	25.00 U	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	25.00 U	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	50.00 U	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.
ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-5 12/6/85	MW-5 1/3/86	MW-5 2/12/86	MW-5 3/6/86	MW-5 5/2/86	MW-6 11/4/85	MW-6 12/6/85	MW-6 1/3/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	2.00	1.00 U	2.00	3.00	2.00	1.00 U	1.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	4.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	3.00	4.00	1.00 U
TOLUENE	108-88-3	ug/l	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	3.00	2.00 U	5.00	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	40.00	44.00	51.00	69.00	57.00	7.00	5.00	6.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-5 12/6/85	MW-5 1/3/86	MW-5 2/12/86	MW-5 3/6/86	MW-5 5/2/86	MW-6 11/4/85	MW-6 12/6/85	MW-6 1/3/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-5 12/6/85	MW-5 1/3/86	MW-5 2/12/86	MW-5 3/6/86	MW-5 5/2/86	MW-6 11/4/85	MW-6 12/6/85	MW-6 1/3/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-6 2/12/86	MW-6 3/6/86	MW-8 11/4/85	MW-8 12/6/85	MW-8 1/3/86	MW-8 2/13/86	MW-8 3/6/86	MW-9 11/4/85
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	21.00
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	3.00	1.00 U	1.00 U	14.00	1.00 U	1.00 U	1.00 U	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	7.00	15.00	6.00	8.00	9.00	12.00	16.00	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	10.00	31.00	7.00	6.00	5.00	5.00	1.00 U	1.00 U
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-6 2/12/86	MW-6 3/6/86	MW-8 11/4/85	MW-8 12/6/85	MW-8 1/3/86	MW-8 2/13/86	MW-8 3/6/86	MW-9 11/4/85
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-6 2/12/86	MW-6 3/6/86	MW-8 11/4/85	MW-8 12/6/85	MW-8 1/3/86	MW-8 2/13/86	MW-8 3/6/86	MW-9 11/4/85
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-9 12/6/85	MW-9 1/3/86	MW-9 2/12/86	MW-9 3/6/86	MW-11 11/4/85	MW-11 12/5/85	MW-11 1/3/86	MW-11 2/12/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	2.00	2.00	1.00 U	1.00 U	1.00 U	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	6.00	1.00 U	1.00 U	1.00 U	1.00 U	12.00	1.00 U	--
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	3.00	1.00 U	1.00 U	2.00
TOLUENE	108-88-3	ug/l	1.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	--
TRICHLOROETHENE	79-01-6	ug/l	20.00	20.00	18.00	26.00	9.00	8.00	7.00	--
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	--
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-9 12/6/85	MW-9 1/3/86	MW-9 2/12/86	MW-9 3/6/86	MW-11 11/4/85	MW-11 12/5/85	MW-11 1/3/86	MW-11 2/12/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-9 12/6/85	MW-9 1/3/86	MW-9 2/12/86	MW-9 3/6/86	MW-11 11/4/85	MW-11 12/5/85	MW-11 1/3/86	MW-11 2/12/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-11 3/6/86	MW-11 5/2/86	DW-2 11/5/85	DW-2 12/5/85	DW-2 1/3/86	DW-2 2/12/86	DW-2 3/6/86	DW-3 11/5/85
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	7.00	5.00	6.00	3.00	3.00	5.00
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	6.00	4.00	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U	2.00	1.00 U	9.00	1.00 U	3.00	1.00 U	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	3.00	11.00	7.00	5.00	4.00	1.00 U	8.00
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLORDETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	3.00
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	7.00	7.00	19.00	31.00	40.00	29.00	36.00	46.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	MW-11 3/6/86	MW-11 5/2/86	DW-2 11/5/85	DW-2 12/5/85	DW-2 1/3/86	DW-2 2/12/86	DW-2 3/6/86	DW-3 11/5/85
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-3 12/5/85	DW-3 1/3/86	DW-3 2/12/86	DW-3 3/6/86	DW-5 11/5/85	DW-5 12/5/85	DW-5 1/3/86	DW-5 2/12/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	4.00	6.00	3.00	4.00	1.00 U	1.00 U	1.00 U	1.00
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	14.00	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	9.00	1.00 U	1.00 U	1.00 U	1.00 U	7.00	1.00 U	3.00
TETRACHLOROETHENE	127-18-4	ug/l	5.00	4.00	5.00	5.00	4.00	3.00	1.00 U	3.00
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	39.00	40.00	40.00	47.00	11.00	6.00	7.00	7.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-3 12/5/85	DW-3 1/3/86	DW-3 2/12/86	DW-3 3/6/86	DW-5 11/5/85	DW-5 12/5/85	DW-5 1/3/86	DW-5 2/12/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-3 12/5/85	DW-3 1/3/86	DW-3 2/12/86	DW-3 3/6/86	DW-5 11/5/85	DW-5 12/5/85	DW-5 1/3/86	DW-5 2/12/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-5 3/6/86	DW-8 2/12/86	DW-9 2/13/86	DW-12 2/13/86	DW-14 11/5/85	DW-15 11/5/85	DW-15 12/5/85	DW-15 1/3/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00	1.00 U	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	3.00	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	5.00	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	2.00	2.00	1.00 U	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	7.00	1.00 U	1.00 U	3.00	8.00	2.00	1.00 U	1.00 U
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-5 3/6/86	DW-8 2/12/86	DW-9 2/13/86	DW-12 2/13/86	DW-14 11/5/85	DW-15 11/5/85	DW-15 12/5/85	DW-15 1/3/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLORDBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-5 3/6/86	DW-8 2/12/86	DW-9 2/13/86	DW-12 2/13/86	DW-14 11/5/85	DW-15 11/5/85	DW-15 12/5/85	DW-15 1/3/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	0.20	0.20 U	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	0.10	0.10 U	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	1.00	1.00 U	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	2.00 U	2.00	2.00 U	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.
ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-15 2/12/86	DW-15 3/6/86	DW-16 11/5/85	DW-16 1/3/86	DW-16 2/12/86	DW-16 3/6/86	DW-17 11/5/85	DW-17 12/5/85
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00	2.00	5.00	4.00	5.00	5.00	4.00	3.00
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	2.00	1.00 U	1.00 U	1.00 U	4.00	6.00	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	4.00	1.00 U	1.00 U	1.00 U	4.00	1.00 U	1.00 U	4.00
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	8.00	5.00	5.00	1.00 U	1.00	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	2.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	1.00 U	1.00 U	15.00	13.00	14.00	11.00	10.00	8.00
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-15 2/12/86	DW-15 3/6/86	DW-16 11/5/85	DW-16 1/3/86	DW-16 2/12/86	DW-16 3/6/86	DW-17 11/5/85	DW-17 12/5/85
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-15 2/12/86	DW-15 3/6/86	DW-16 11/5/85	DW-16 1/3/86	DW-16 2/12/86	DW-16 3/6/86	DW-17 11/5/85	DW-17 12/5/85
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-17 1/3/86	DW-17 2/12/86	DW-17 3/6/86	DW-17 5/2/86	DW-18 11/5/85	DW-18 12/5/85	DW-18 1/3/86	DW-18 2/12/86
VOA SERIES										
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	5.00	3.00	5.00	3.00	1.00	1.00 U	3.00	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BENZENE	71-43-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U	3.00	1.00 U	4.00	1.00 U	11.00	1.00 U	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U	1.00 U	1.00 U	2.00	1.00	1.00 U	1.00 U	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	8.00	9.00	9.00	12.00	1.00 U	2.00	2.00	1.00 U
VINYL CHLORIDE	75-01-4	ug/l	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
BNA SERIES										
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	51-28-5	ug/l	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	95-57-8	ug/l	--	--	--	--	--	--	--	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--	--	--	--	--	--	--	--
2-NITROPHENOL	88-75-5	ug/l	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--	--	--	--	--	--	--	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--	--	--	--	--	--	--	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-17 1/3/86	DW-17 2/12/86	DW-17 3/6/86	DW-17 5/2/86	DW-18 11/5/85	DW-18 12/5/85	DW-18 1/3/86	DW-18 2/12/86
BNA SERIES Cont'd										
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--	--	--	--	--	--	--	--
4-NITROPHENOL	100-02-7	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHENE	83-32-9	ug/l	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	ug/l	--	--	--	--	--	--	--	--
ANTHRACENE	120-12-7	ug/l	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	50-32-8	ug/l	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--	--	--	--	--	--	--	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--	--	--	--	--	--	--	--
CHRYSENE	218-01-9	ug/l	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--	--	--	--	--	--	--	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--	--	--	--	--	--	--	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	84-66-2	ug/l	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--	--	--	--	--	--	--	--
FLUORANTHENE	206-44-0	ug/l	--	--	--	--	--	--	--	--
FLUORENE	86-73-7	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	118-74-1	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	67-72-1	ug/l	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--	--	--	--	--	--	--	--
ISOPHORONE	78-59-1	ug/l	--	--	--	--	--	--	--	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	ug/l	--	--	--	--	--	--	--	--
NITROBENZENE	98-95-3	ug/l	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	87-86-5	ug/l	--	--	--	--	--	--	--	--
PHENANTHRENE	85-01-8	ug/l	--	--	--	--	--	--	--	--
PHENOL	108-95-2	ug/l	--	--	--	--	--	--	--	--
PYRENE	129-00-0	ug/l	--	--	--	--	--	--	--	--
PESTICIDES										
4,4-DDD	72-54-8	ug/l	--	--	--	--	--	--	--	--
4,4-DDE	72-55-9	ug/l	--	--	--	--	--	--	--	--
4,4-DDT	50-29-3	ug/l	--	--	--	--	--	--	--	--
ALDRIN	309-00-2	ug/l	--	--	--	--	--	--	--	--
BETA-BHC	319-85-7	ug/l	--	--	--	--	--	--	--	--
CHLORDANE	57-74-9	ug/l	--	--	--	--	--	--	--	--
DELTA-BHC	319-86-8	ug/l	--	--	--	--	--	--	--	--
DIELDRIN	60-57-1	ug/l	--	--	--	--	--	--	--	--

Appendix A.3
SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-17 1/3/86	DW-17 2/12/86	DW-17 3/6/86	DW-17 5/2/86	DW-18 11/5/85	DW-18 12/5/85	DW-18 1/3/86	DW-18 2/12/86
PESTICIDES Cont'd										
ENDOSULFAN SULFATE	1031-07-8	ug/l	--	--	--	--	--	--	--	--
ENDRIN	72-20-8	ug/l	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR	76-44-8	ug/l	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--	--	--	--	--	--	--	--
METHOXYCHLOR	72-43-5	ug/l	--	--	--	--	--	--	--	--
PCB-1016	12674-11-2	ug/l	--	--	--	--	--	--	--	--
PCB-1221	11104-28-2	ug/l	--	--	--	--	--	--	--	--
PCB-1232	11141-16-5	ug/l	--	--	--	--	--	--	--	--
PCB-1248	12672-29-6	ug/l	--	--	--	--	--	--	--	--
PCB-1254	11097-69-1	ug/l	--	--	--	--	--	--	--	--
PCB-1260	11096-82-5	ug/l	--	--	--	--	--	--	--	--
TOXAPHENE	8001-35-2	ug/l	--	--	--	--	--	--	--	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.
Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

ug/l = micrograms/liter

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-18 3/6/86
VOA SERIES			
1,1,1-TRICHLOROETHANE	71-55-6	ug/l	1.00 U
1,1,2,2-TETRACHLOROETHANE	79-34-5	ug/l	1.00 U
1,1,2-TRICHLOROETHANE	79-00-5	ug/l	1.00 U
1,1-DICHLOROETHANE	75-34-3	ug/l	1.00 U
1,1-DICHLOROETHENE	75-35-4	ug/l	1.00 U
1,2-DICHLOROETHANE	107-06-2	ug/l	1.00 U
1,2-DICHLOROPROPANE	78-87-5	ug/l	1.00 U
2-CHLOROETHYLVINYLETHER	110-75-8	ug/l	5.00 U
BENZENE	71-43-2	ug/l	1.00 U
BROMODICHLOROMETHANE	75-27-4	ug/l	1.00 U
BROMOFORM	75-25-2	ug/l	1.00 U
BROMOMETHANE (METHYL BROMIDE)	74-83-9	ug/l	5.00 U
CARBON TETRACHLORIDE	56-23-5	ug/l	1.00 U
CHLOROBENZENE	108-90-7	ug/l	1.00 U
CHLOROETHANE	75-00-3	ug/l	5.00 U
CHLOROFORM	67-66-3	ug/l	1.00 U
CHLOROMETHANE (METHYL CHLORIDE)	74-87-3	ug/l	5.00 U
CIS-1,3-DICHLOROPROPENE	10061-01-5	ug/l	1.00 U
DIBROMOCHLOROMETHANE	124-48-1	ug/l	1.00 U
ETHYLBENZENE	100-41-4	ug/l	1.00 U
METHYLENE CHLORIDE (DICHLOROMETHANE)	75-09-2	ug/l	1.00 U
TETRACHLOROETHENE	127-18-4	ug/l	1.00 U
TOLUENE	108-88-3	ug/l	1.00 U
TRANS-1,2-DICHLOROETHENE	156-60-5	ug/l	2.00 U
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ug/l	1.00 U
TRICHLOROETHENE	79-01-6	ug/l	2.00 U
VINYL CHLORIDE	75-01-4	ug/l	5.00 U
BNA SERIES			
1,2,4-TRICHLOROBENZENE	120-82-1	ug/l	--
1,2-DICHLOROBENZENE	95-50-1	ug/l	--
1,3-DICHLOROBENZENE	541-73-1	ug/l	--
1,4-DICHLOROBENZENE	106-46-7	ug/l	--
2,4,6-TRICHLOROPHENOL	88-06-2	ug/l	--
2,4-DICHLOROPHENOL	120-83-2	ug/l	--
2,4-DIMETHYLPHENOL	105-67-9	ug/l	--
2,4-DINITROPHENOL	51-28-5	ug/l	--
2,4-DINITROTOLUENE	121-14-2	ug/l	--
2,6-DINITROTOLUENE	606-20-2	ug/l	--
2-CHLORONAPHTHALENE	91-58-7	ug/l	--
2-CHLOROPHENOL	95-57-8	ug/l	--
2-METHYL-4,6-DINITROPHENOL	534-52-1	ug/l	--
2-NITROPHENOL	88-75-5	ug/l	--
3,3-DICHLOROBENZIDINE	91-94-1	ug/l	--
4-BROMOPHENYLPHENYL ETHER	101-55-3	ug/l	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ug/l	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-18 3/6/86
BNA SERIES Cont'd			
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	ug/l	--
4-NITROPHENOL	100-02-7	ug/l	--
ACENAPHTHENE	83-32-9	ug/l	--
ACENAPHTHYLENE	208-96-8	ug/l	--
ANTHRACENE	120-12-7	ug/l	--
BENZO(A)ANTHRACENE	56-55-3	ug/l	--
BENZO(A)PYRENE	50-32-8	ug/l	--
BENZO(B)FLUORANTHENE	205-99-2	ug/l	--
BENZO(G,H,I)PERYLENE	191-24-2	ug/l	--
BENZO(K)FLUORANTHENE	207-08-9	ug/l	--
BIS(2-CHLOROETHOXY) METHANE	111-91-1	ug/l	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ug/l	--
BIS(2-CHLOROISOPROPYL) ETHER	39638-32-9	ug/l	--
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	ug/l	--
BUTYLBENZYLPHTHALATE	85-68-7	ug/l	--
CHRYSENE	218-01-9	ug/l	--
DI-N-BUTYL PHTHALATE	84-74-2	ug/l	--
DI-N-OCTYL PHTHALATE	117-84-0	ug/l	--
DIBENZO(A,H)ANTHRACENE	53-70-3	ug/l	--
DIBROMOCHLOROPROPANE	96-12-18	ng/l	--
DIETHYL PHTHALATE	84-66-2	ug/l	--
DIMETHYL PHTHALATE	131-11-3	ug/l	--
FLUORANTHENE	206-44-0	ug/l	--
FLUORENE	86-73-7	ug/l	--
HEXACHLOROBENZENE	118-74-1	ug/l	--
HEXACHLOROBUTADIENE	87-68-3	ug/l	--
HEXACHLOROETHANE	67-72-1	ug/l	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ug/l	--
ISOPHORONE	78-59-1	ug/l	--
N-NITROSODI-N-PROPYLAMINE	621-64-7	ug/l	--
NAPHTHALENE	91-20-3	ug/l	--
NITROBENZENE	98-95-3	ug/l	--
PENTACHLOROPHENOL	87-86-5	ug/l	--
PHENANTHRENE	85-01-8	ug/l	--
PHENOL	108-95-2	ug/l	--
PYRENE	129-00-0	ug/l	--
PESTICIDES			
4,4-DDD	72-54-8	ug/l	--
4,4-DDE	72-55-9	ug/l	--
4,4-DDT	50-29-3	ug/l	--
ALDRIN	309-00-2	ug/l	--
BETA-BHC	319-85-7	ug/l	--
CHLORDANE	57-74-9	ug/l	--
DELTA-BHC	319-86-8	ug/l	--
DIELDRIN	60-57-1	ug/l	--

Appendix A.3

SACWSD MUNICIPAL WELL AND MONITORING WELL ANALYTICAL RESULTS

COMPOUND NAME	CAS #	UNITS	DW-18 3/6/86
PESTICIDES Cont'd			
ENDOSULFAN SULFATE	1031-07-8	ug/l	--
ENDRIN	72-20-8	ug/l	--
GAMMA-BHC (LINDANE)	58-89-9	ug/l	--
HEPTACHLOR	76-44-8	ug/l	--
HEPTACHLOR EPOXIDE	1024-57-3	ug/l	--
METHOXYCHLOR	72-43-5	ug/l	--
PCB-1016	12674-11-2	ug/l	--
PCB-1221	11104-28-2	ug/l	--
PCB-1232	11141-16-5	ug/l	--
PCB-1248	12672-29-6	ug/l	--
PCB-1254	11097-69-1	ug/l	--
PCB-1260	11096-82-5	ug/l	--
TOXAPHENE	8001-35-2	ug/l	--

NOTES

Compound Name = commonly used compound terminology.
Sample Name = commonly used well name. Refer to Figure 3-1 for well locations.

Sample Date = sample date
Units: ng/l = nano grams/liter

CAS # = standardize compound definition in Chemical Abstracts.
RESULT = reported in units given. Letter(s) correspond to data qualifiers which are defined in Table 4-1.

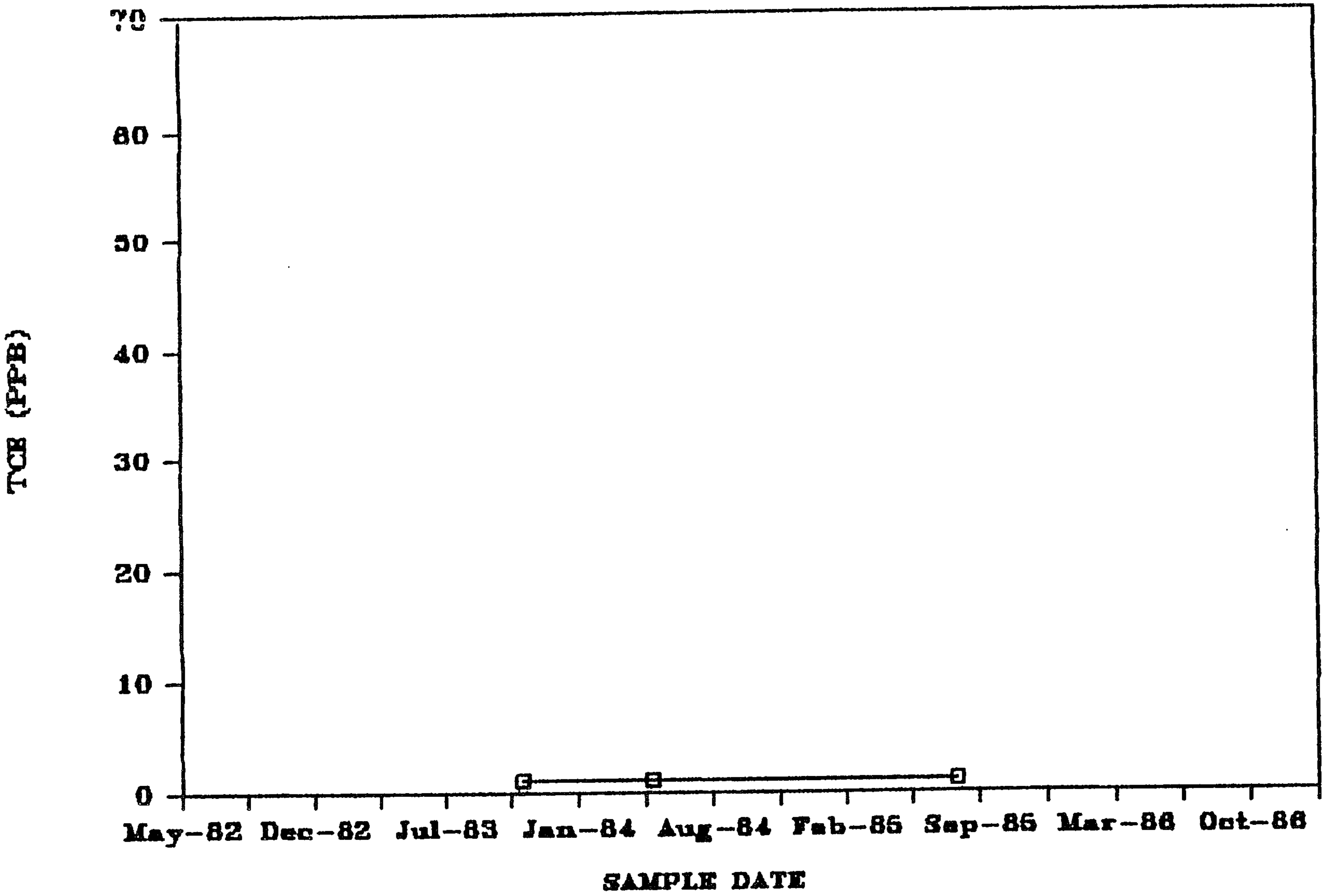
ug/l = micrograms/liter

APPENDIX B

Time Trend Plots for SACWSD Municipal and Monitory Wells

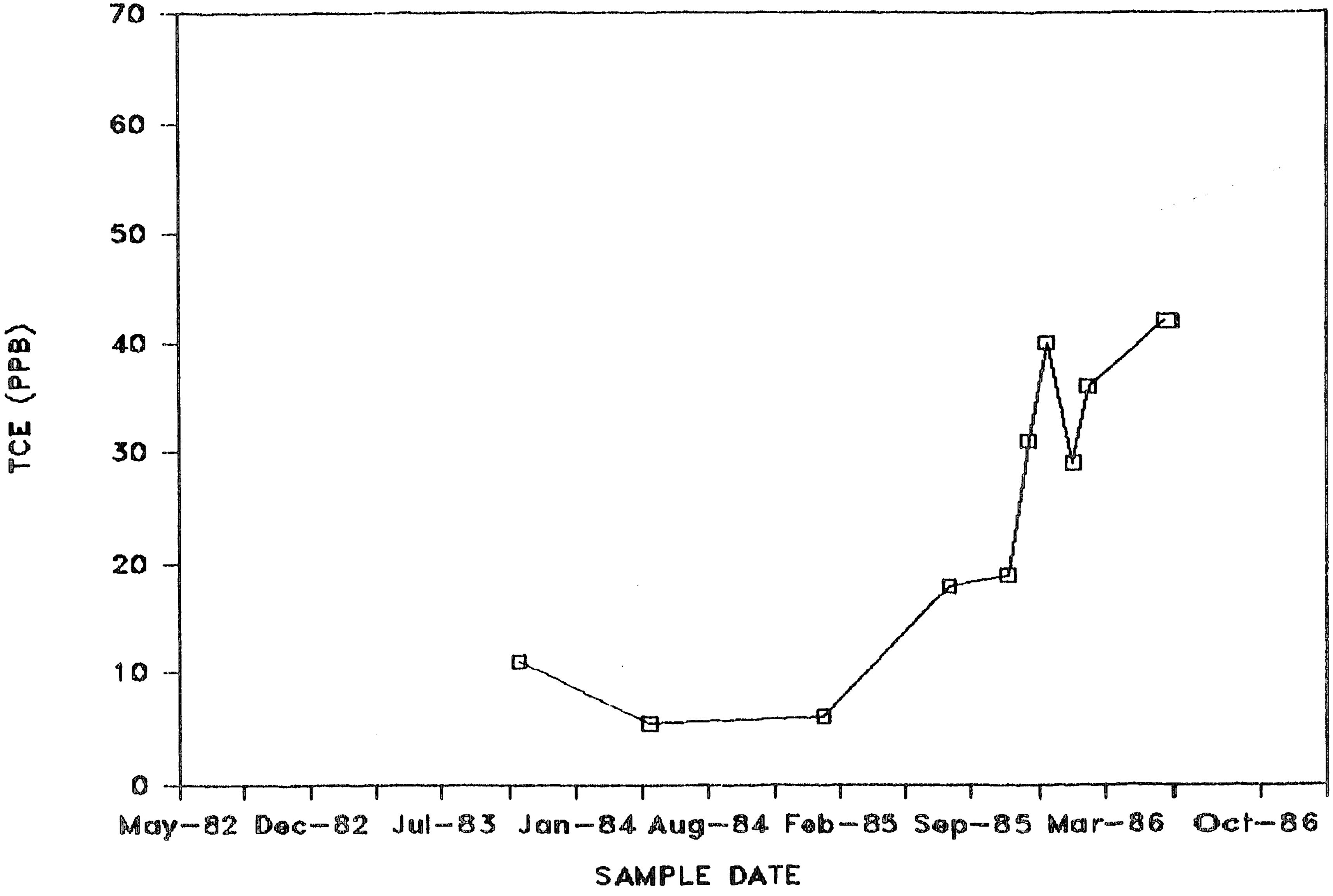
SAC-1

TCE CONCENTRATION



SAC-2

TCE CONCENTRATION



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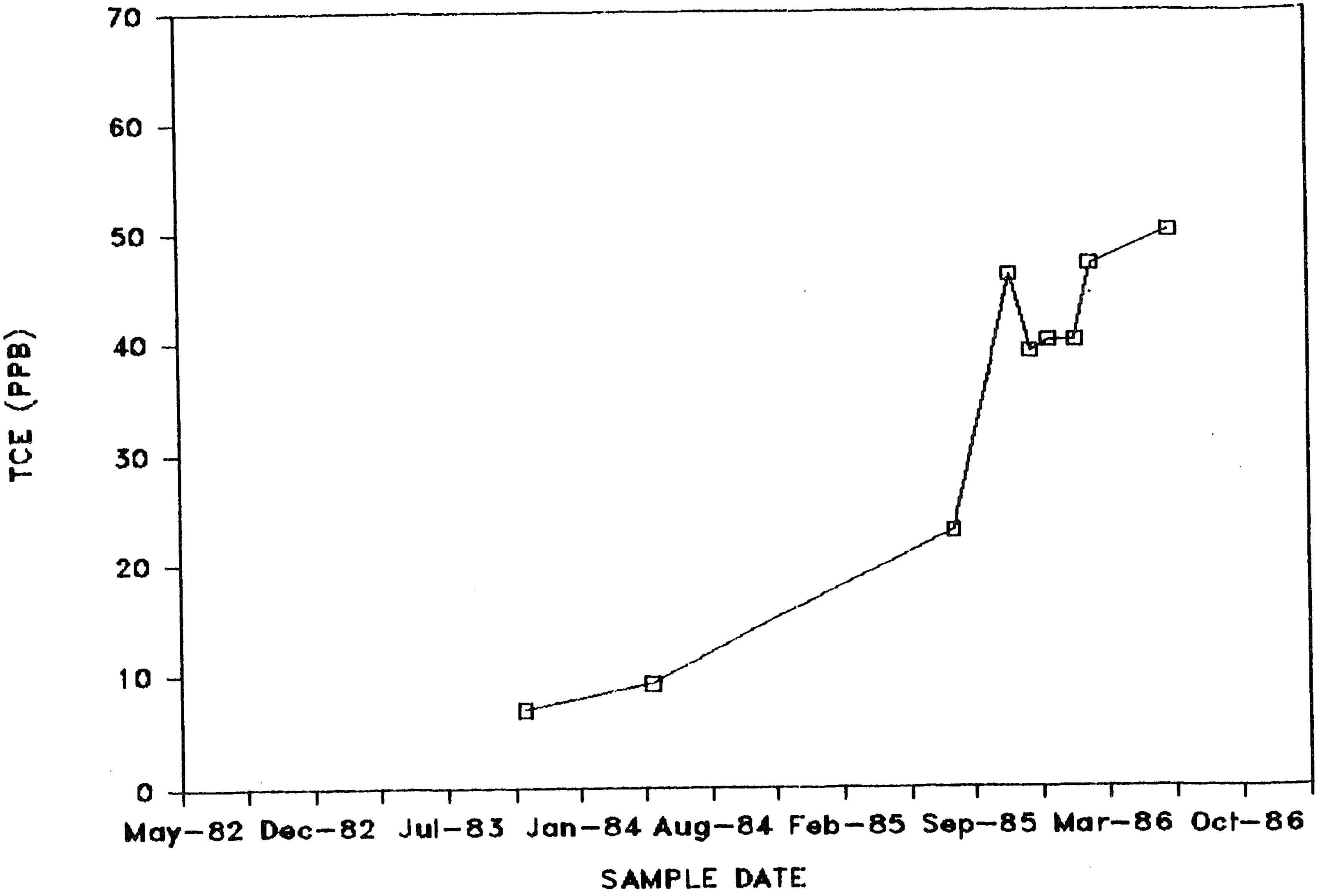

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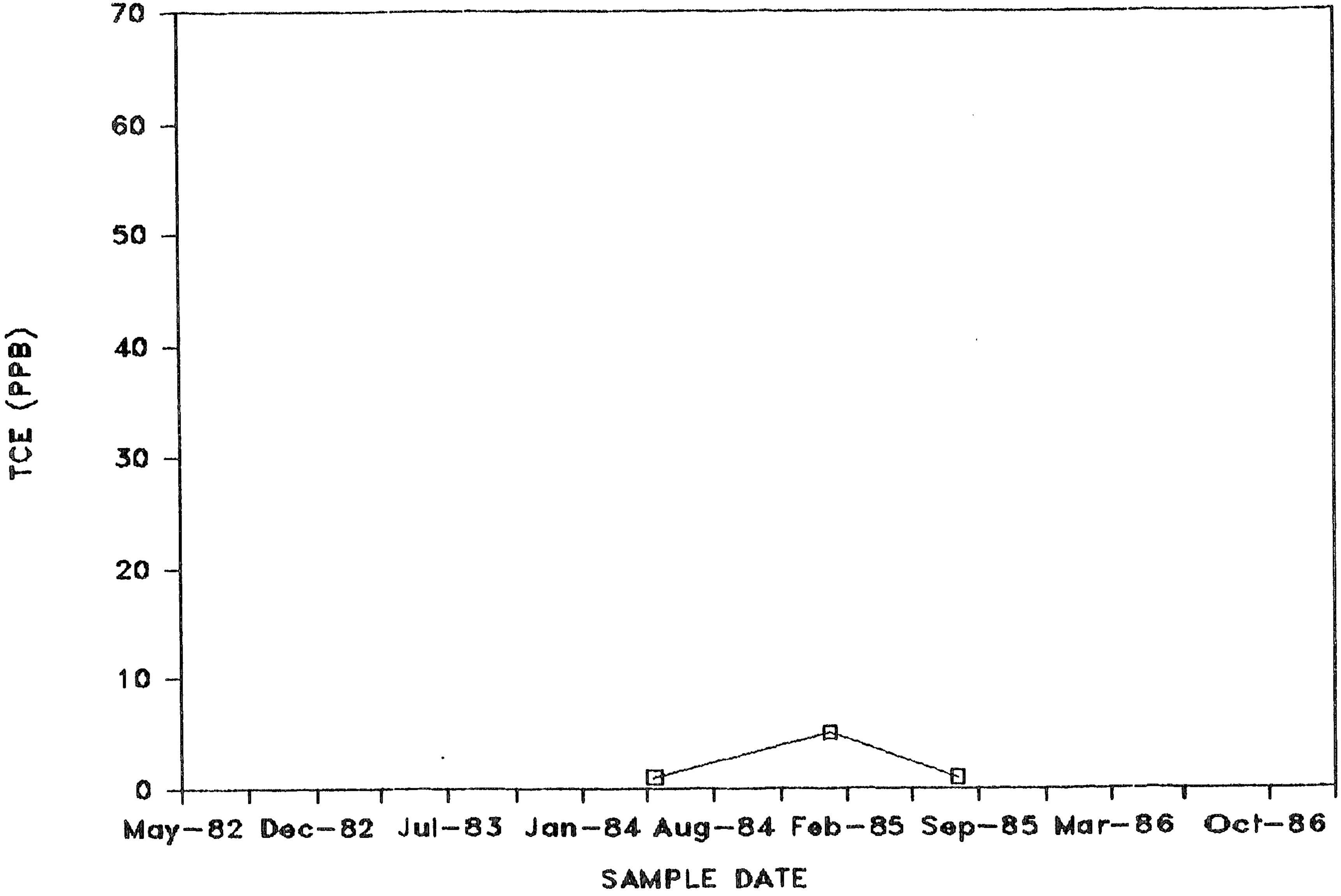

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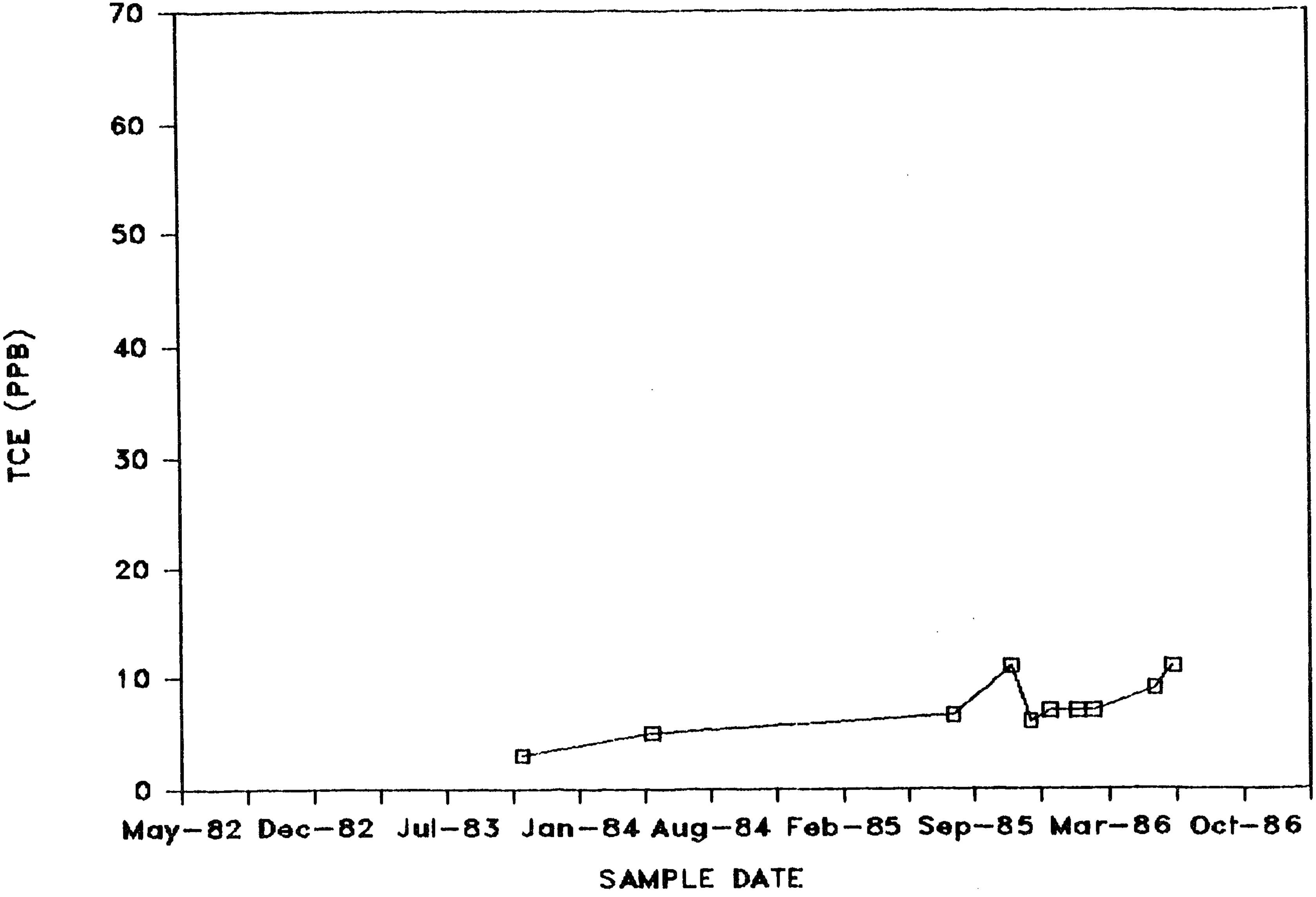

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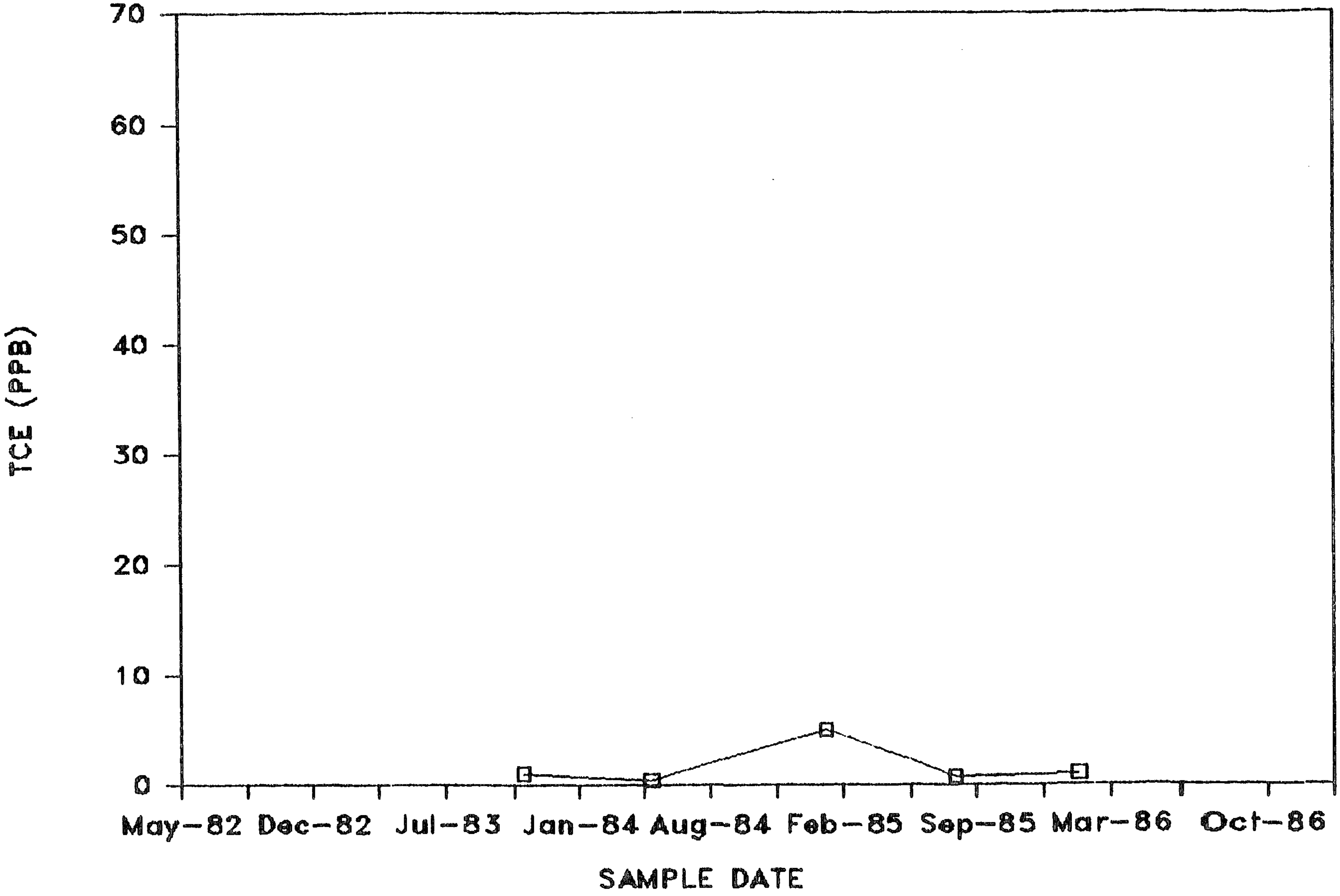

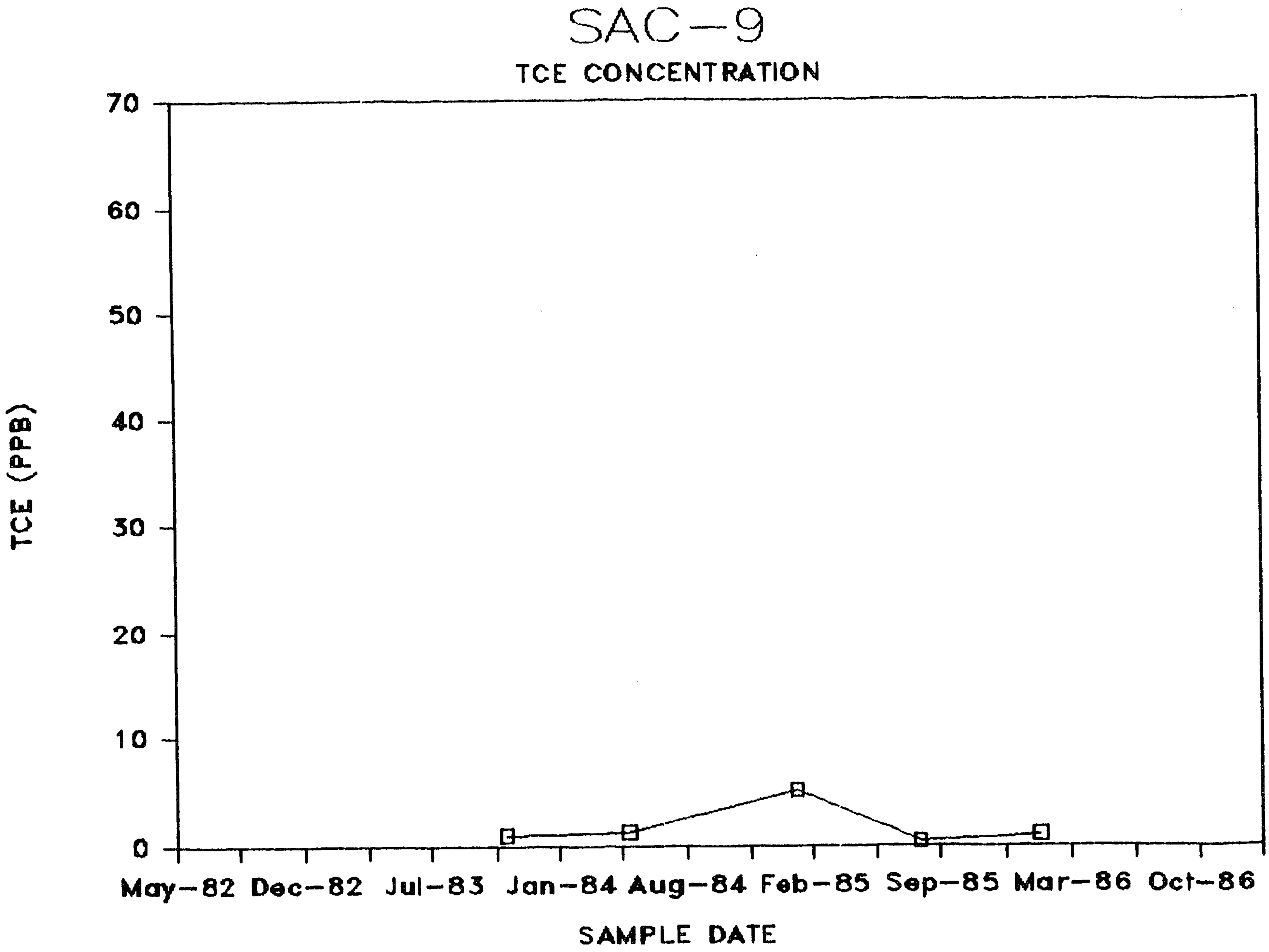
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TCE CONCENTRATION
TCE (PPB)
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60
50
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30
20
10
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May-82
Dec-82
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Jan-84
Aug-84
Feb-85
Sep-85
Mar-86
Oct-86
SAMPLE DATE

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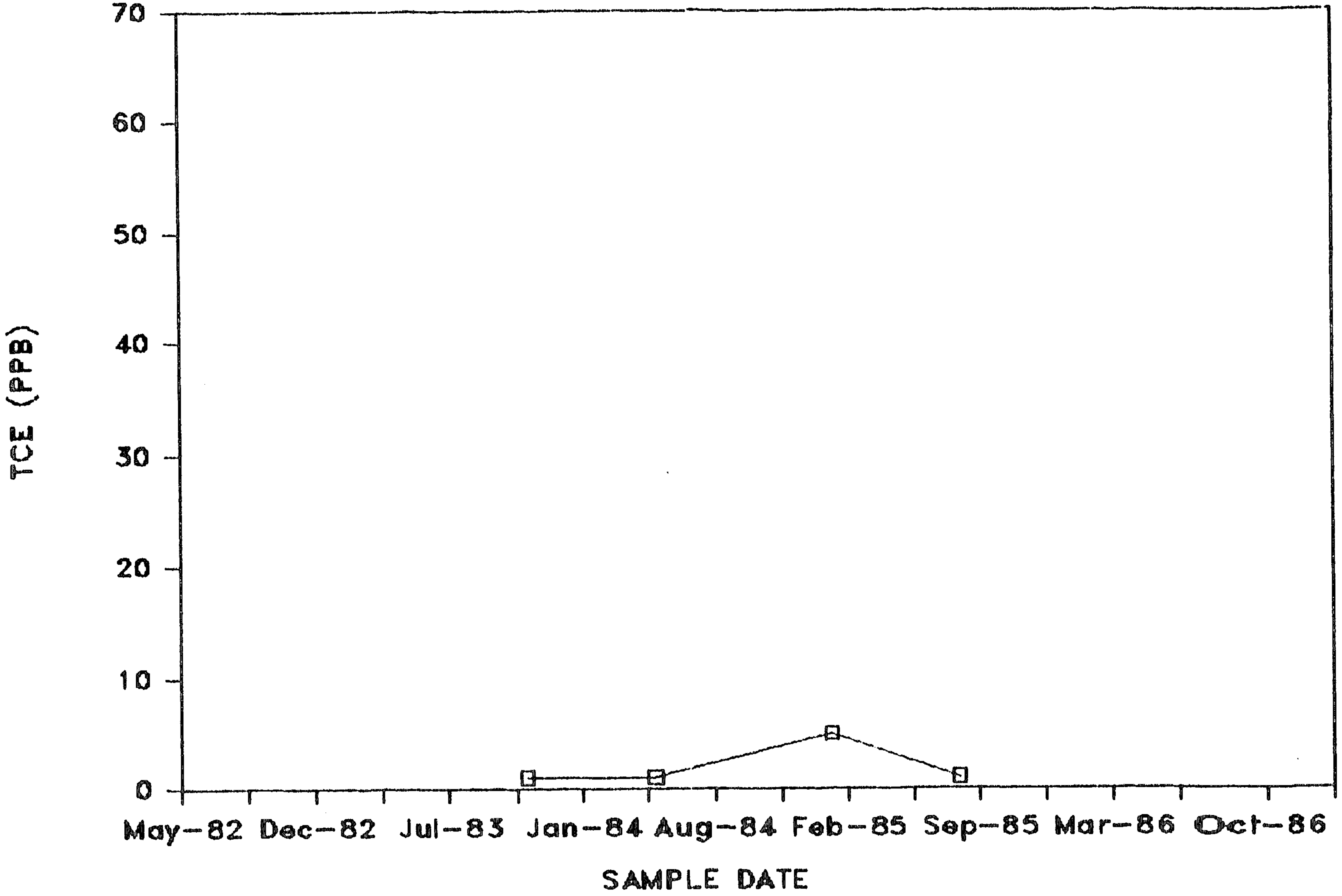

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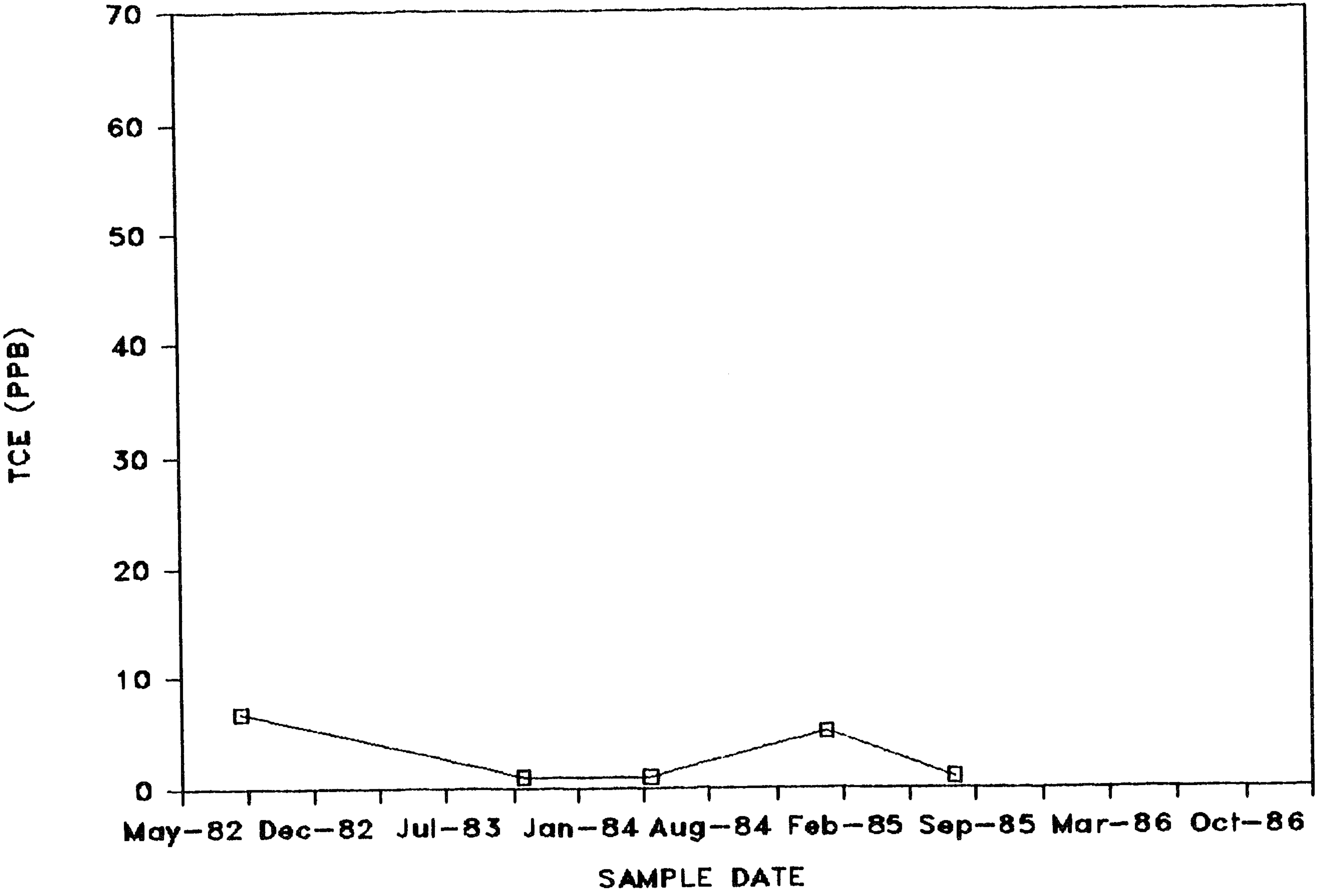

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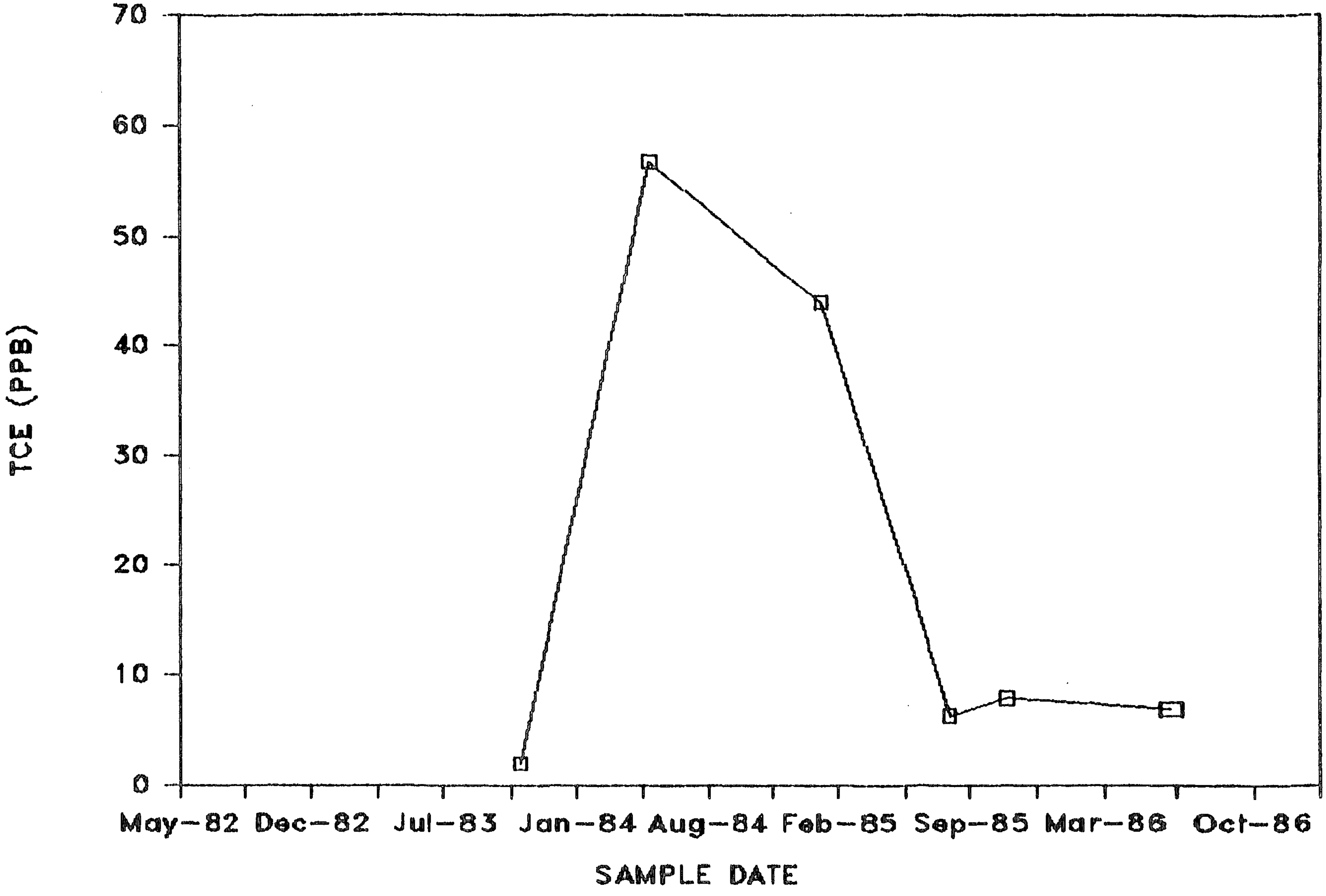

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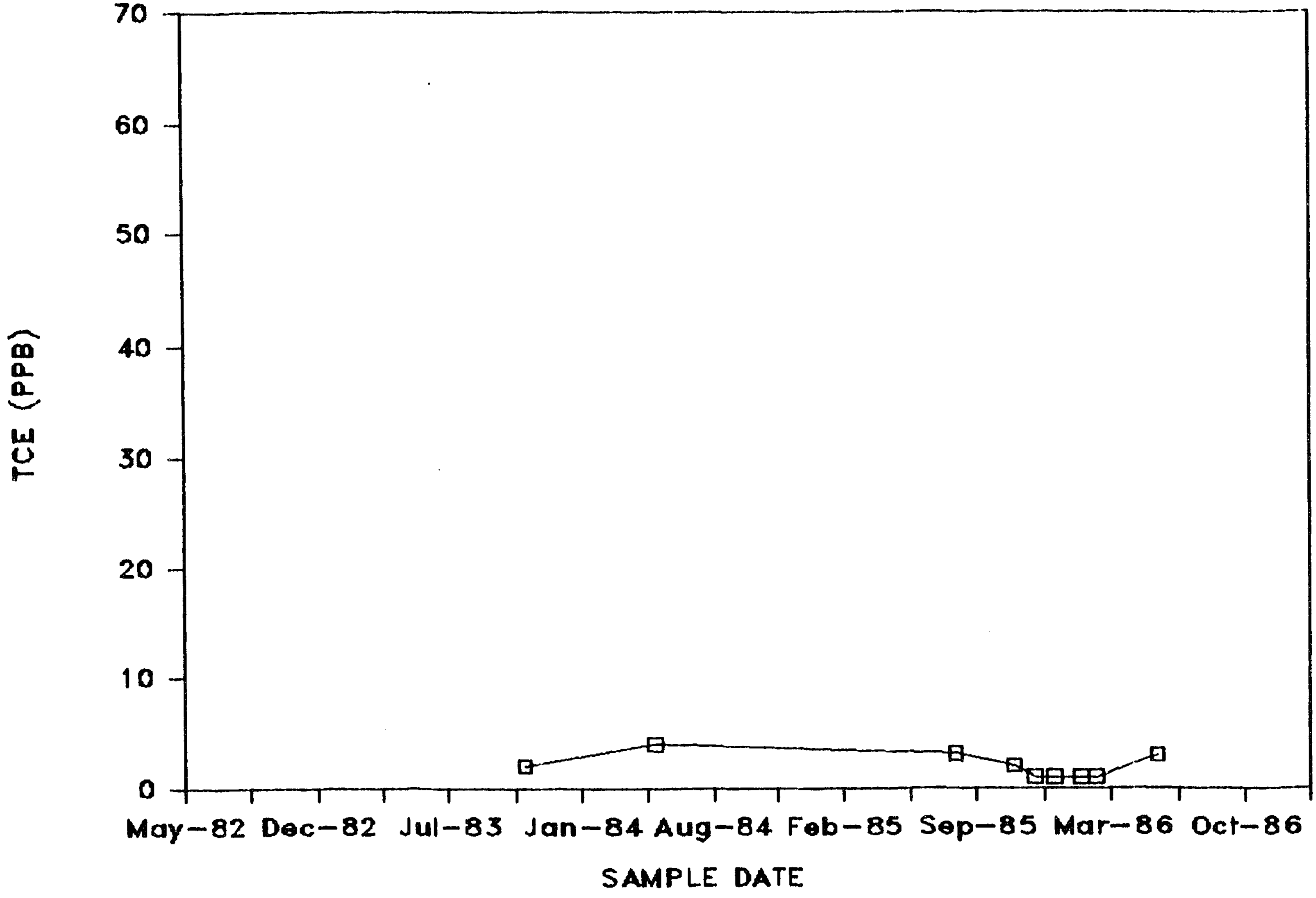

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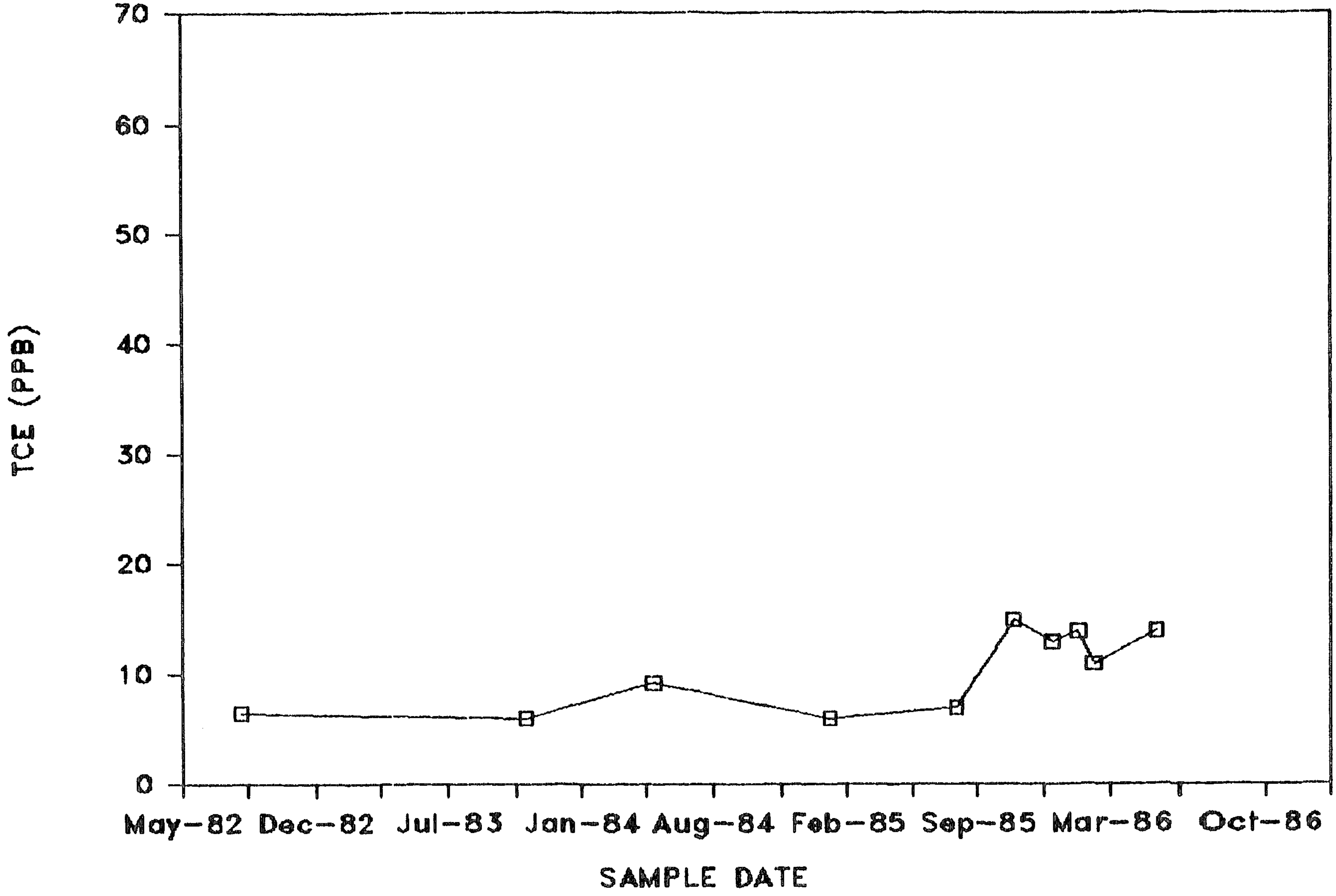

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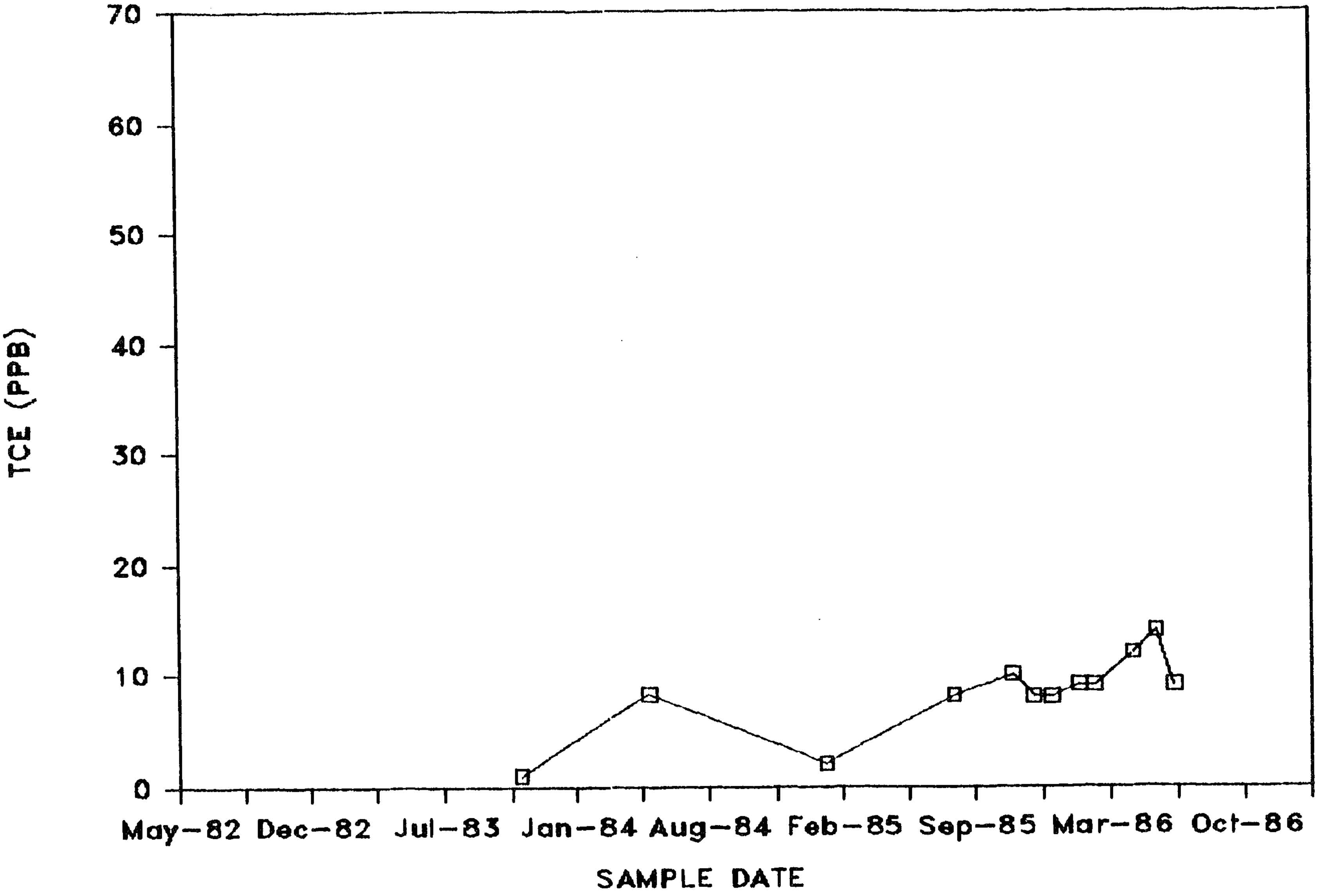

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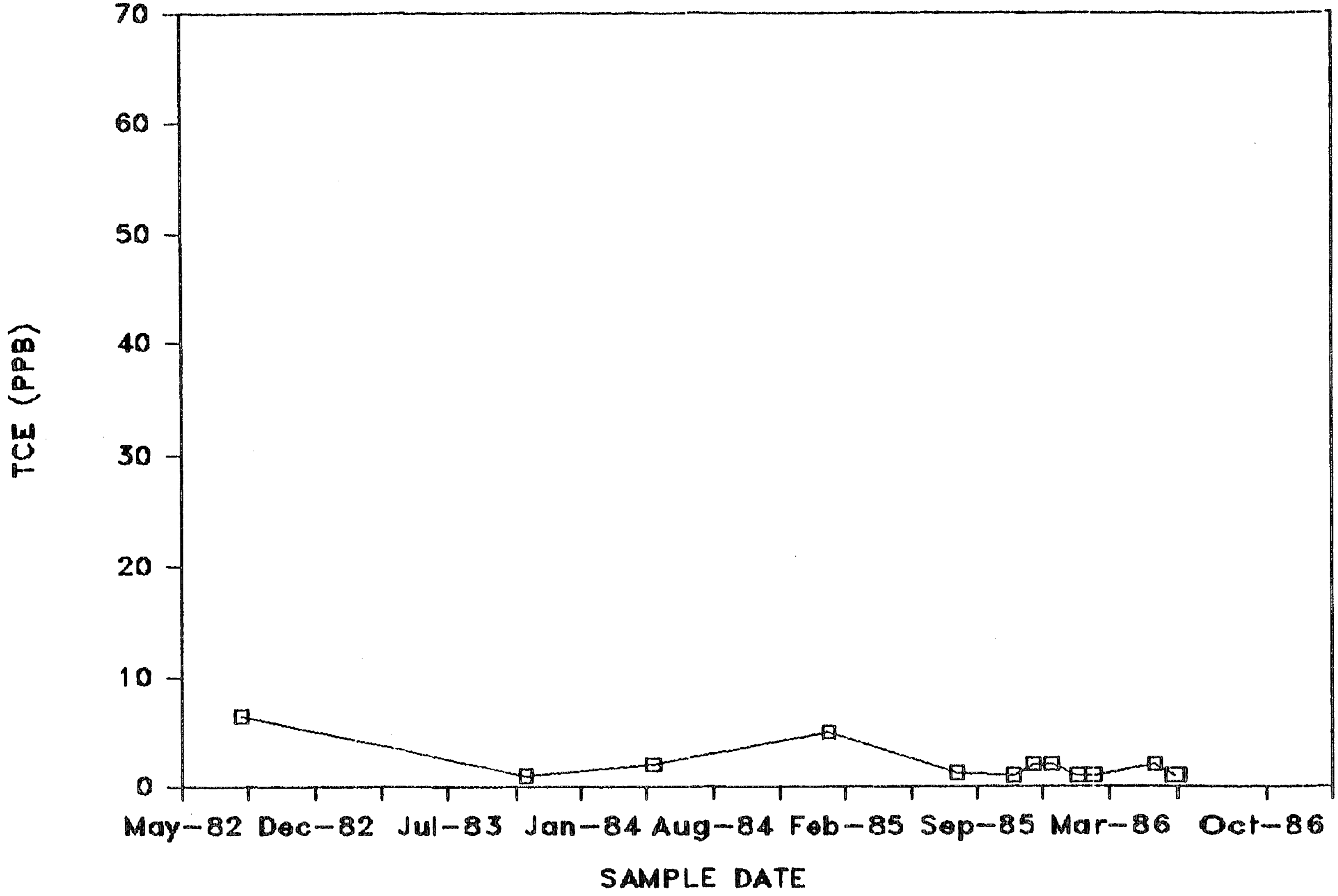

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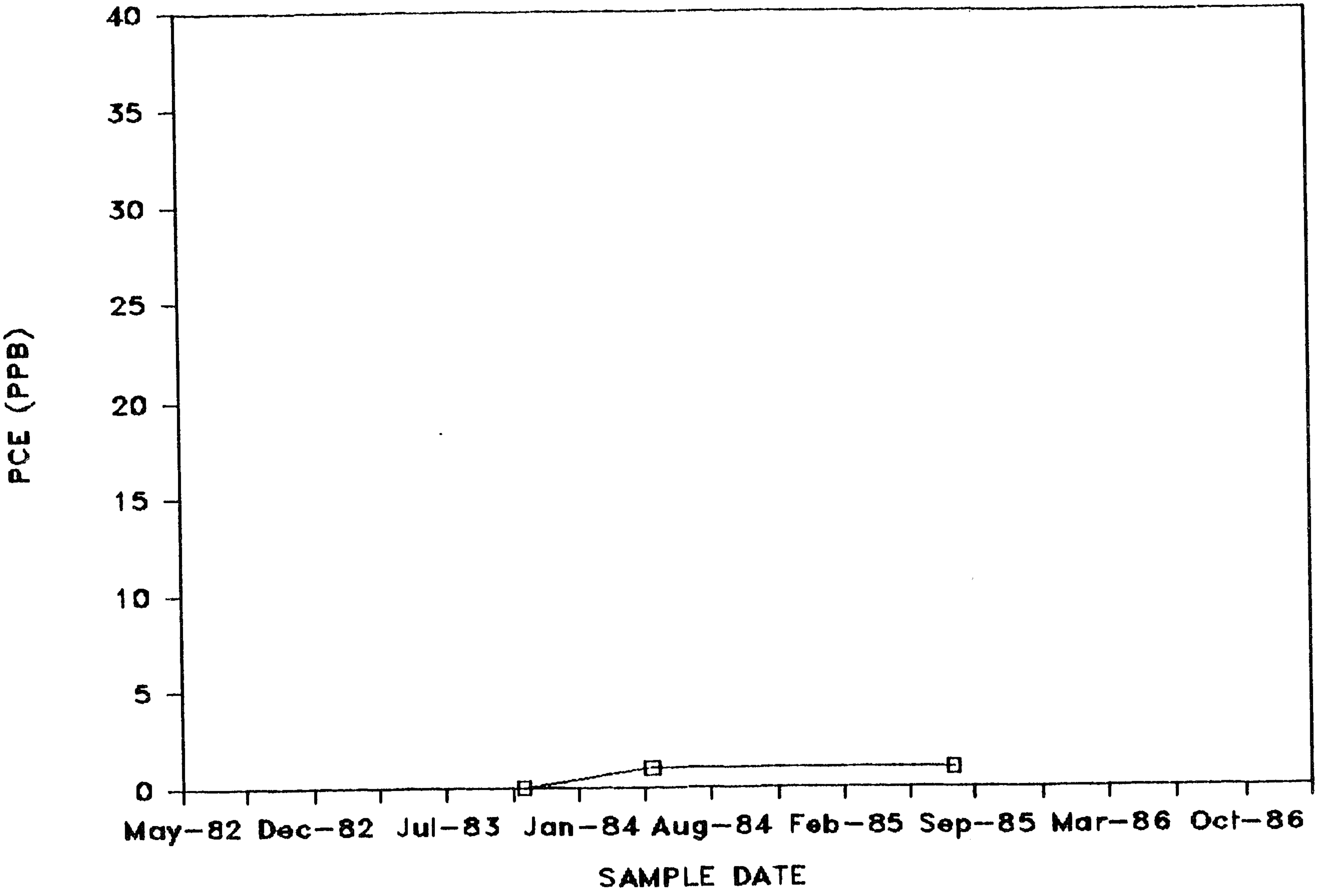

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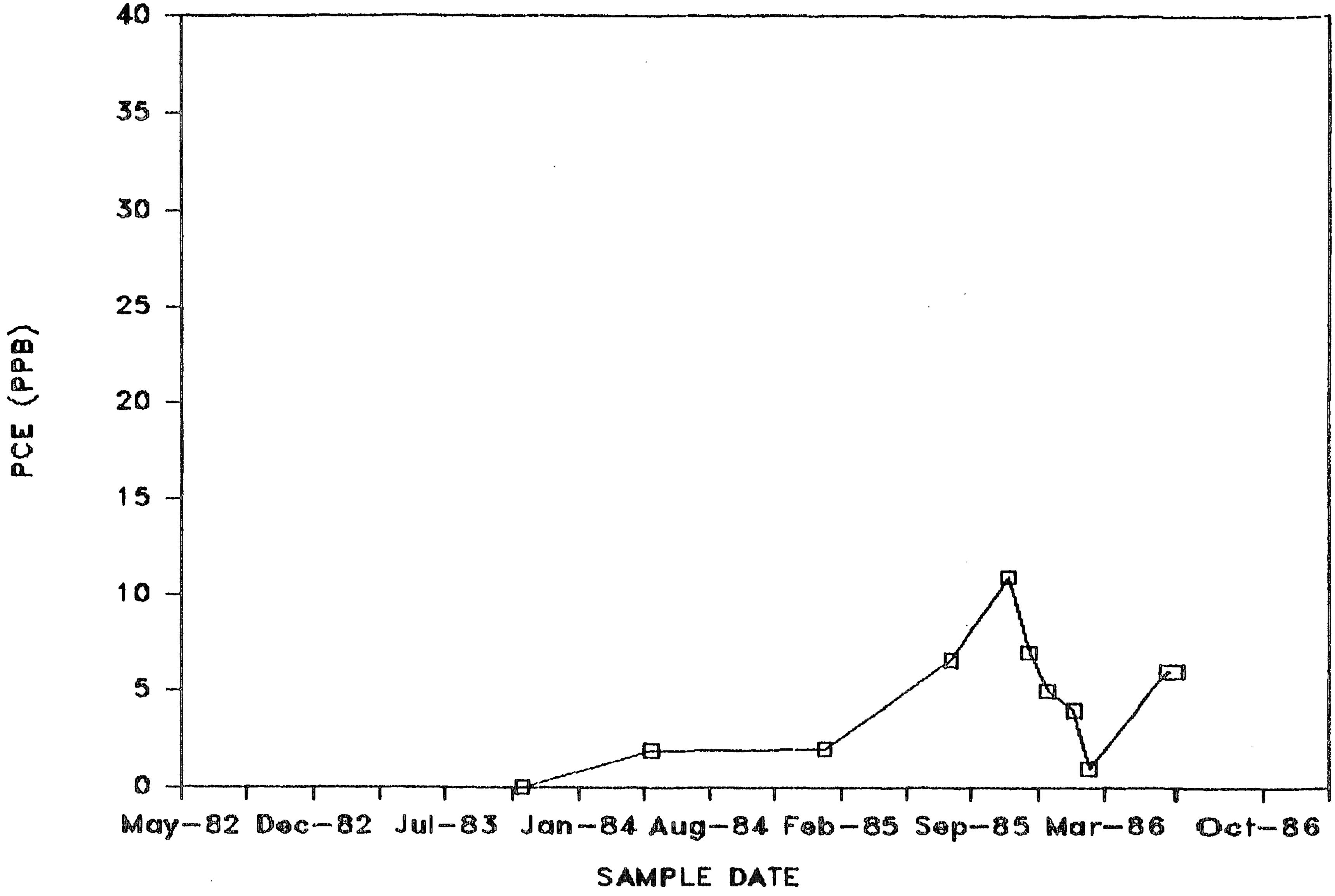

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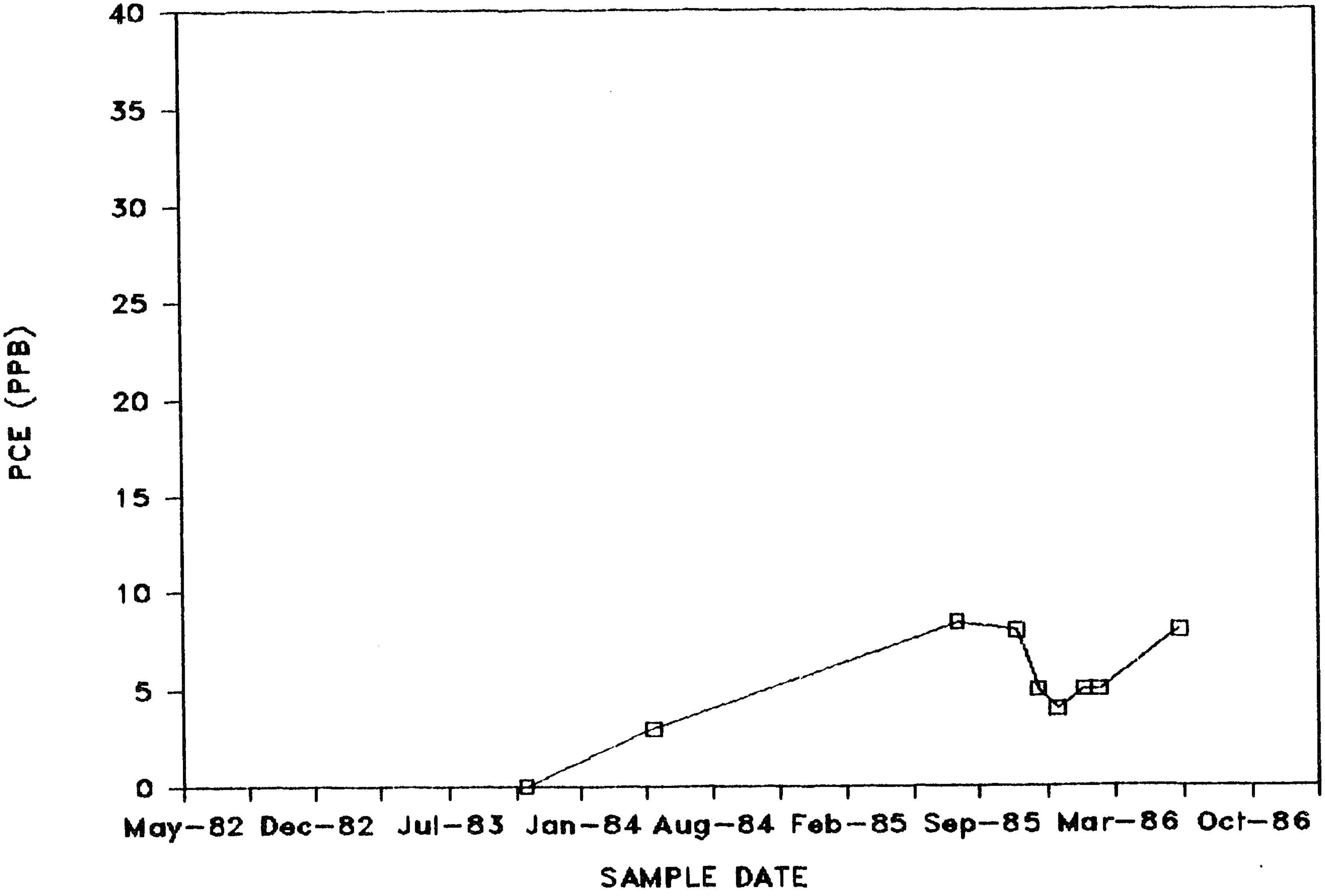

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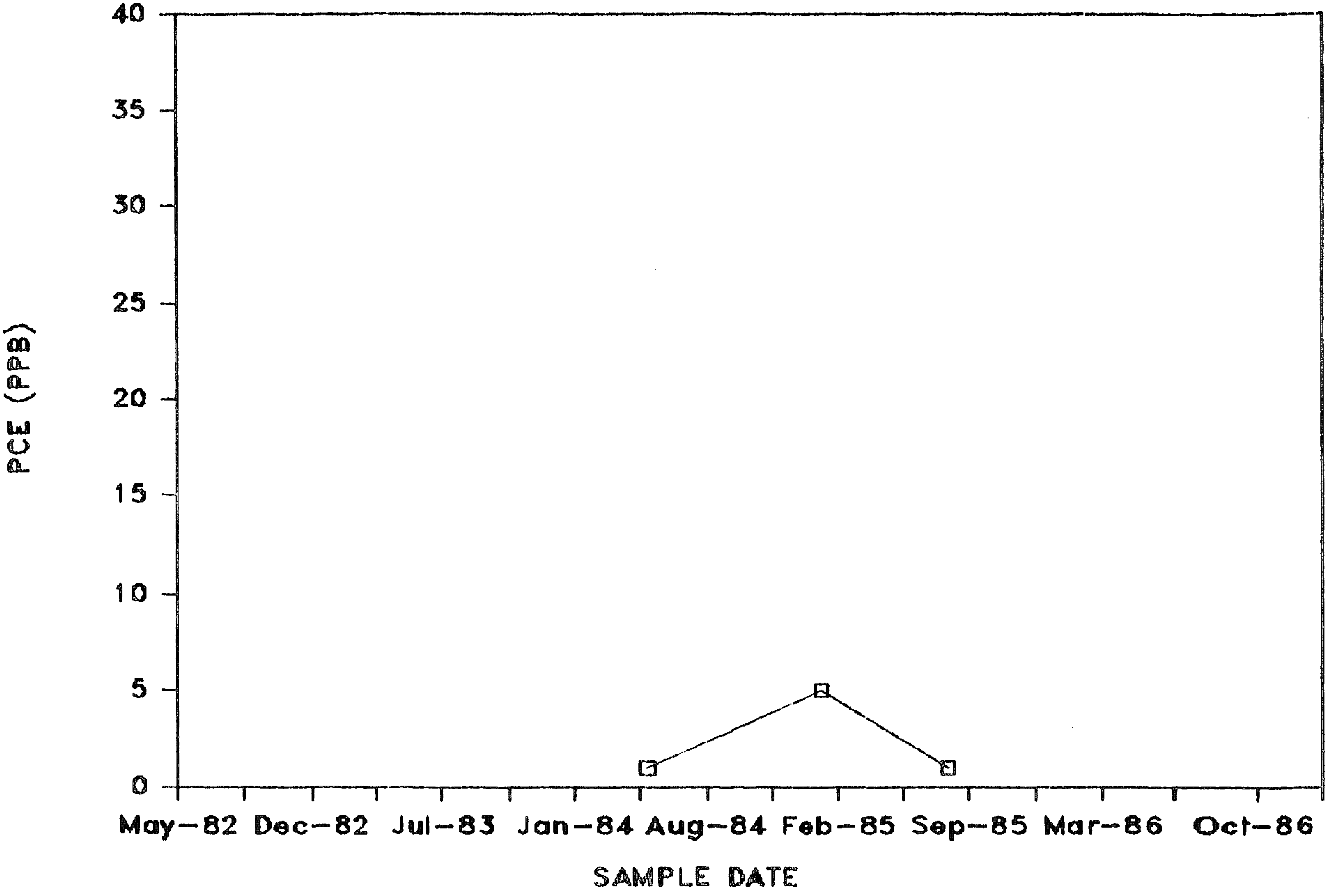

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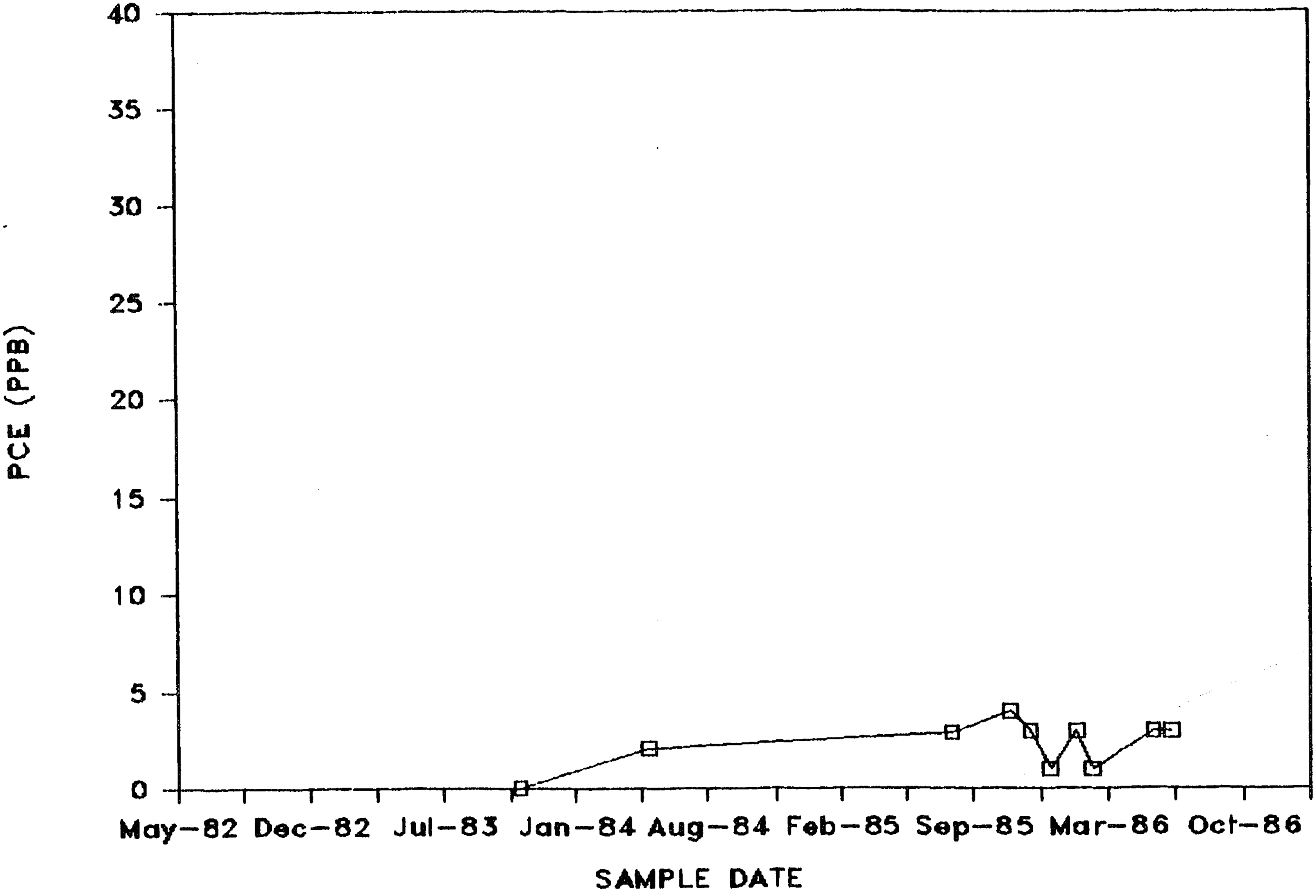

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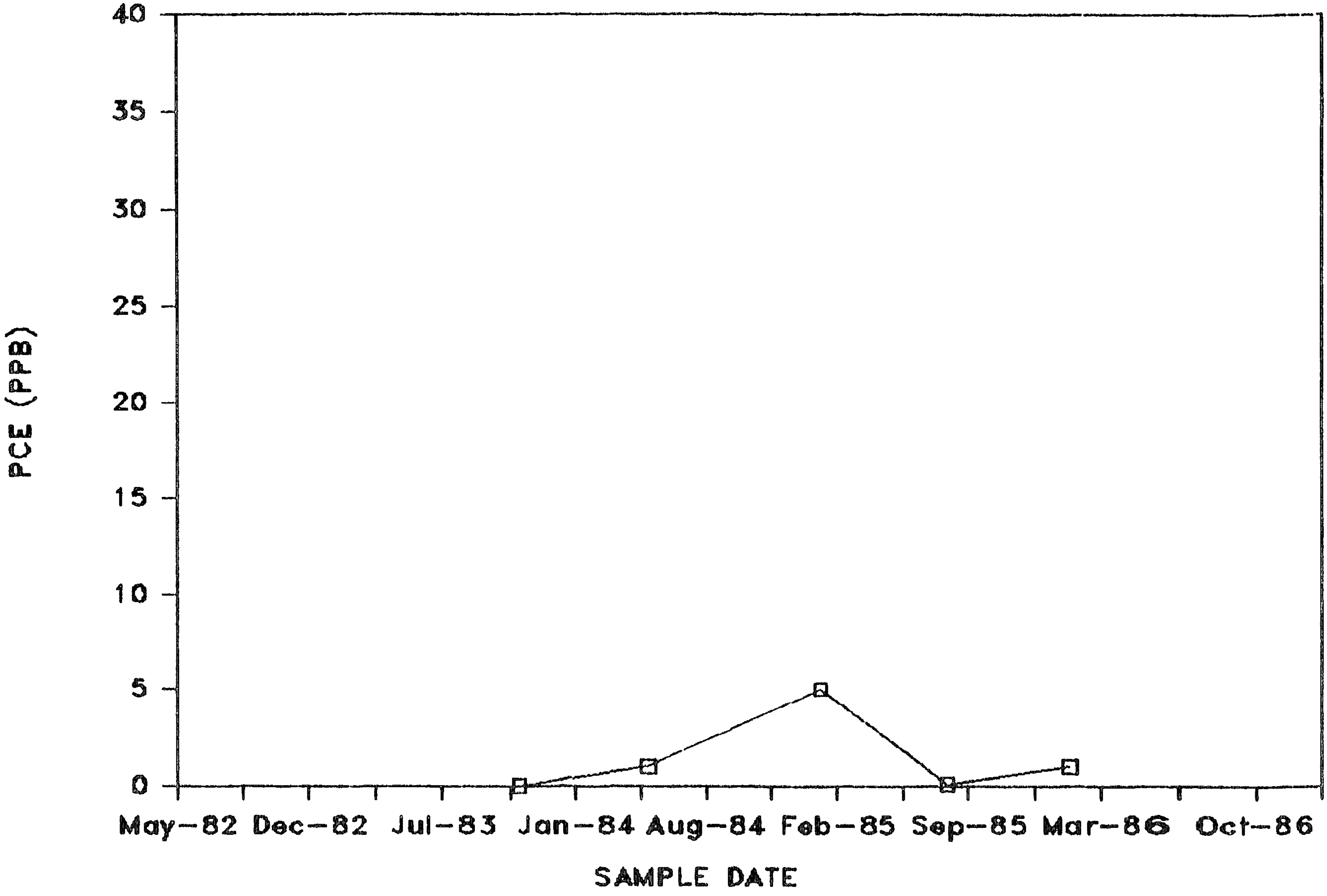

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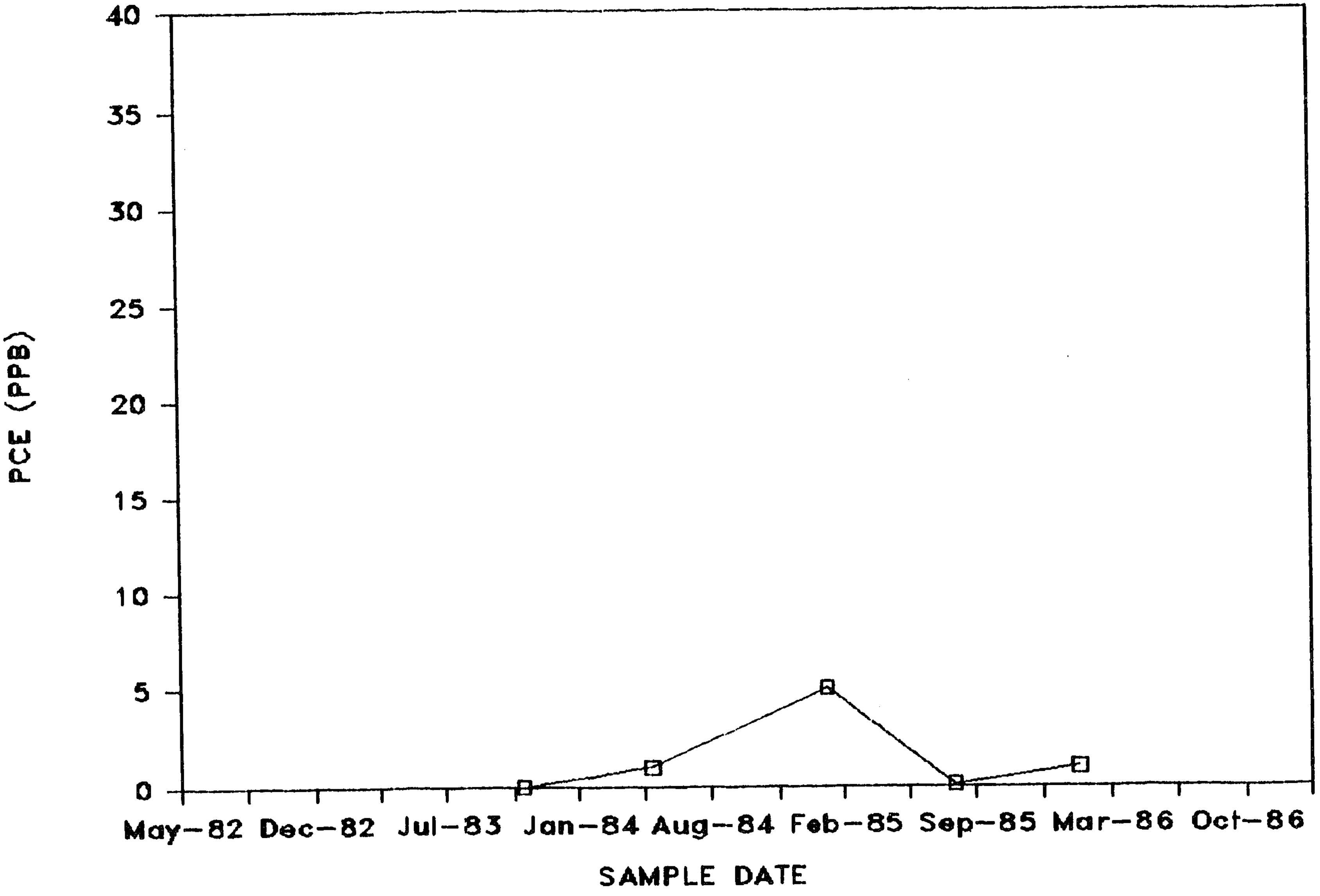

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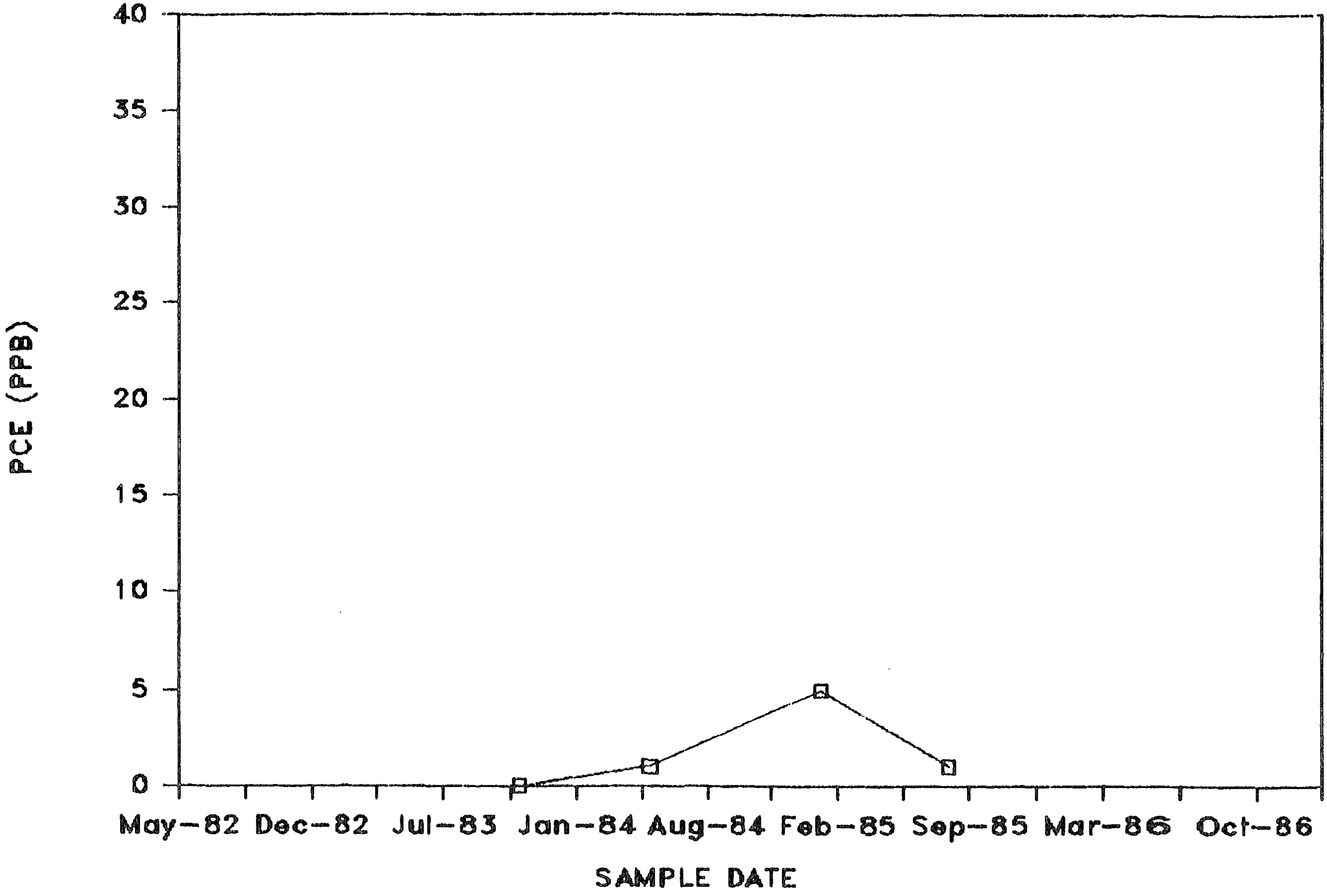

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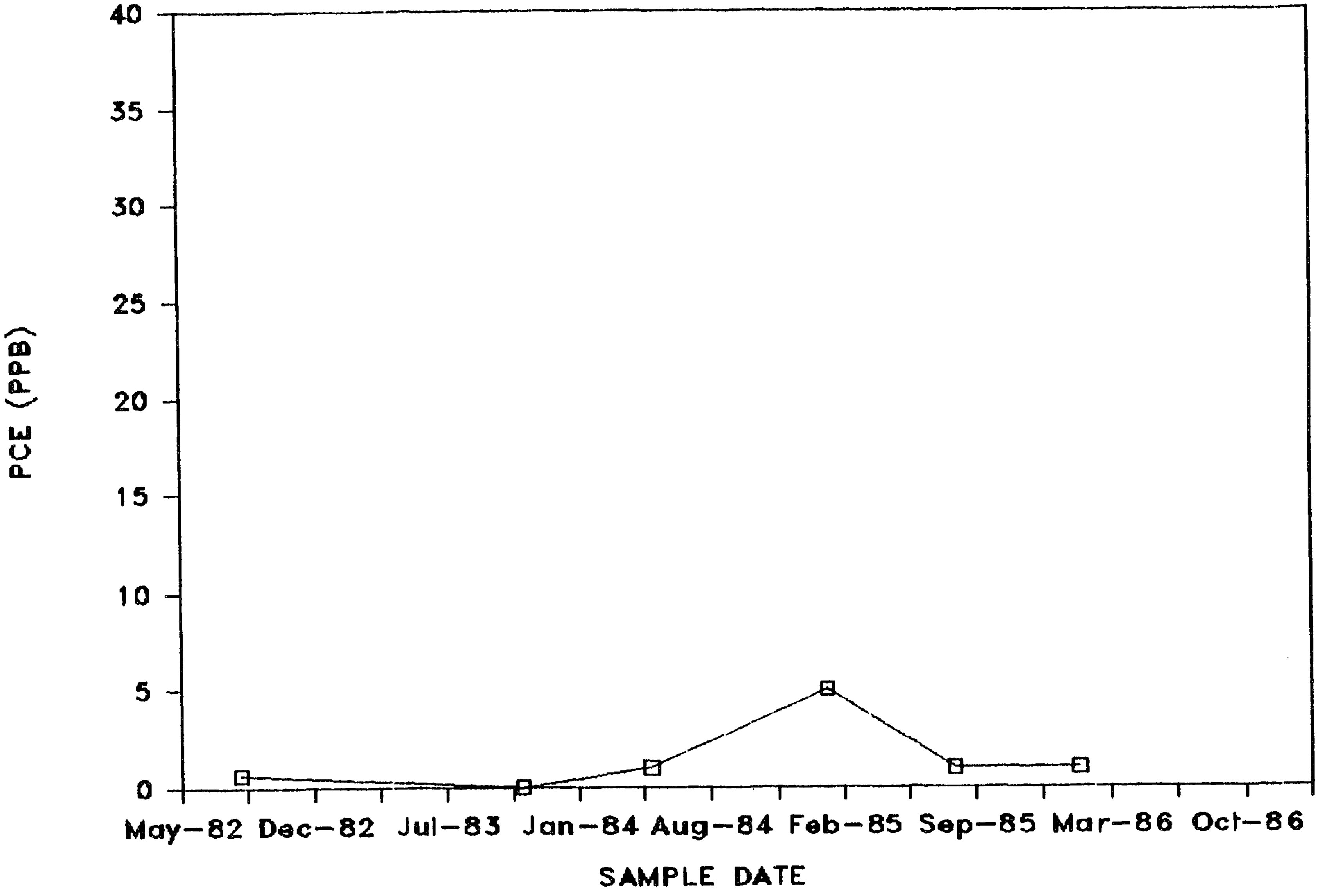

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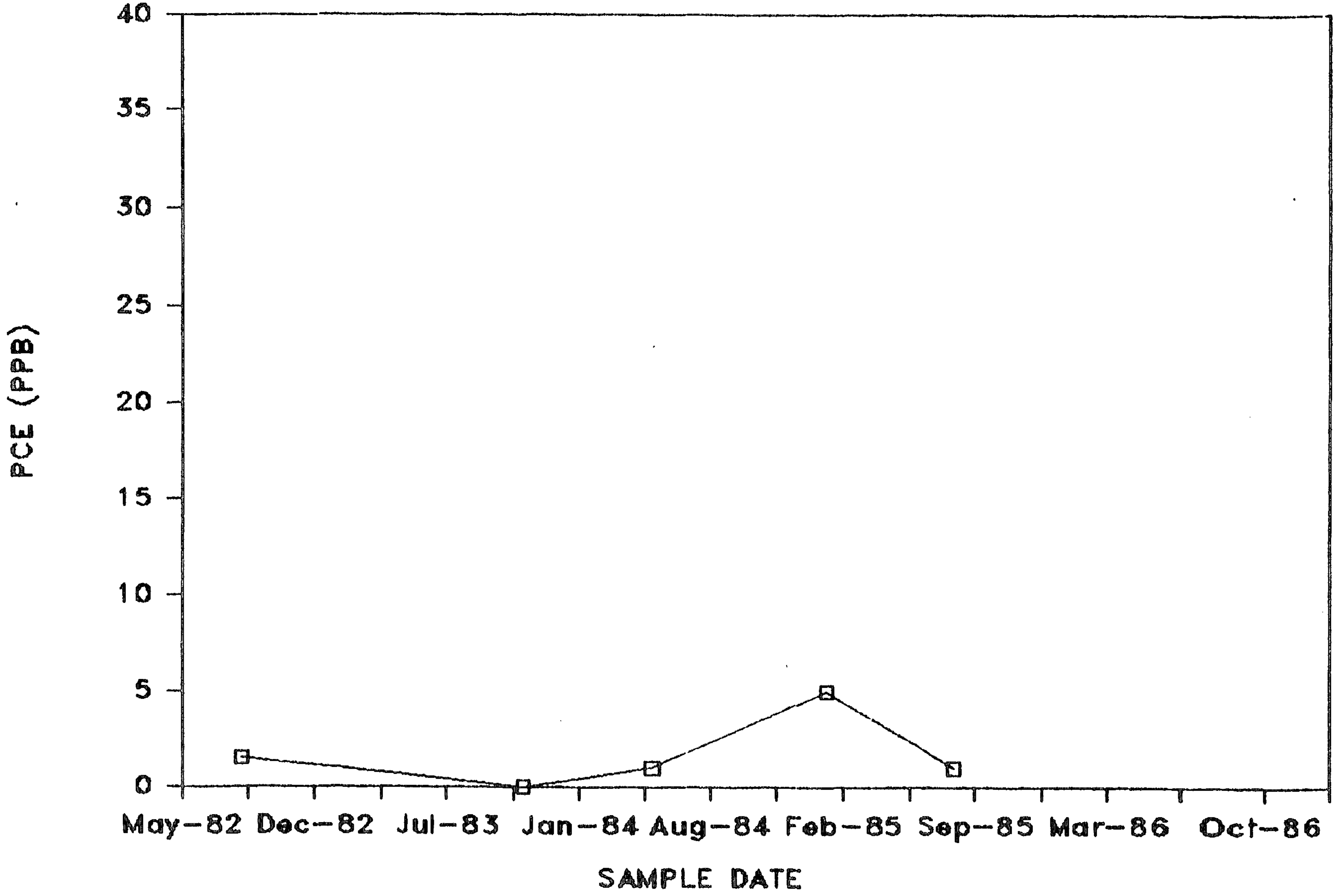

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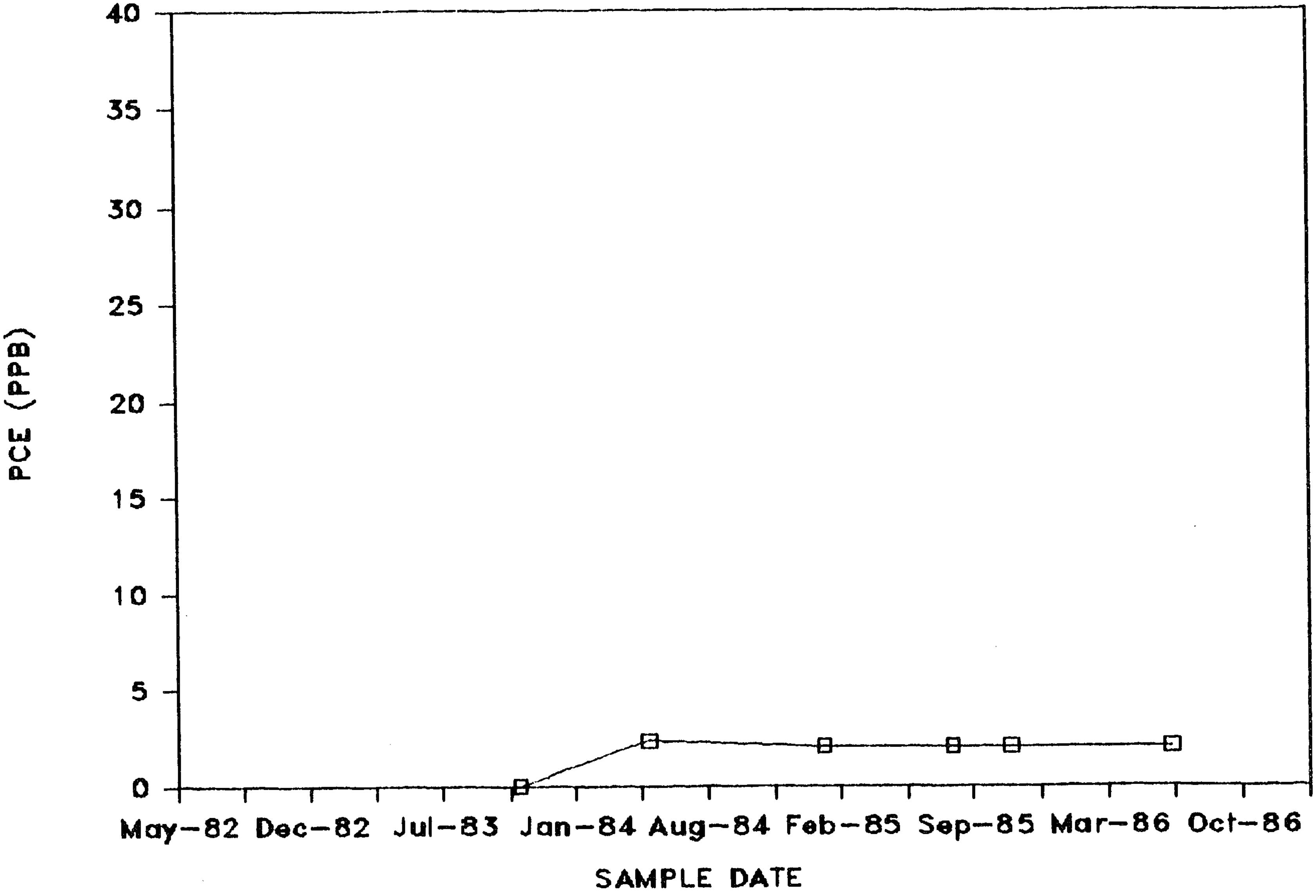

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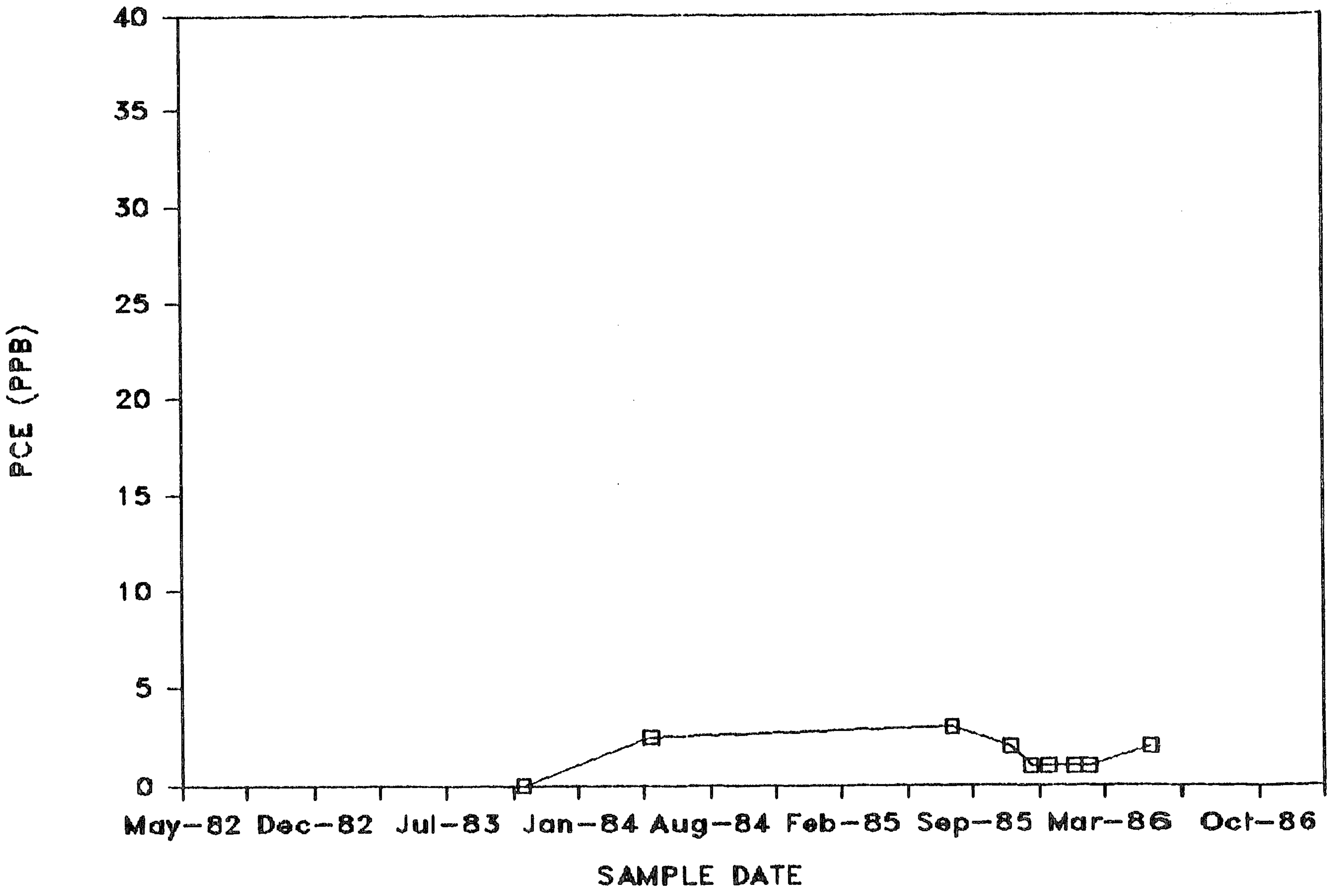

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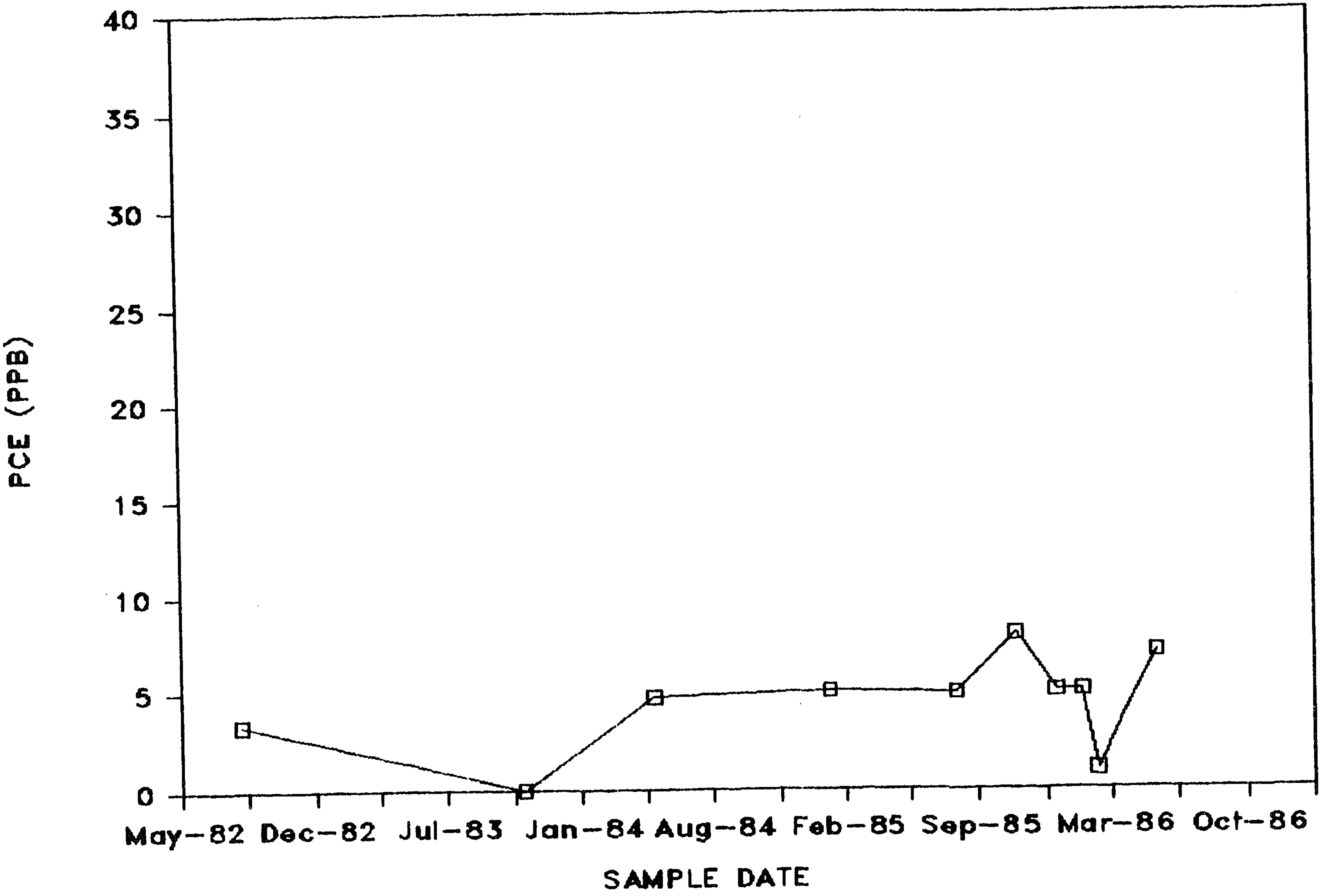

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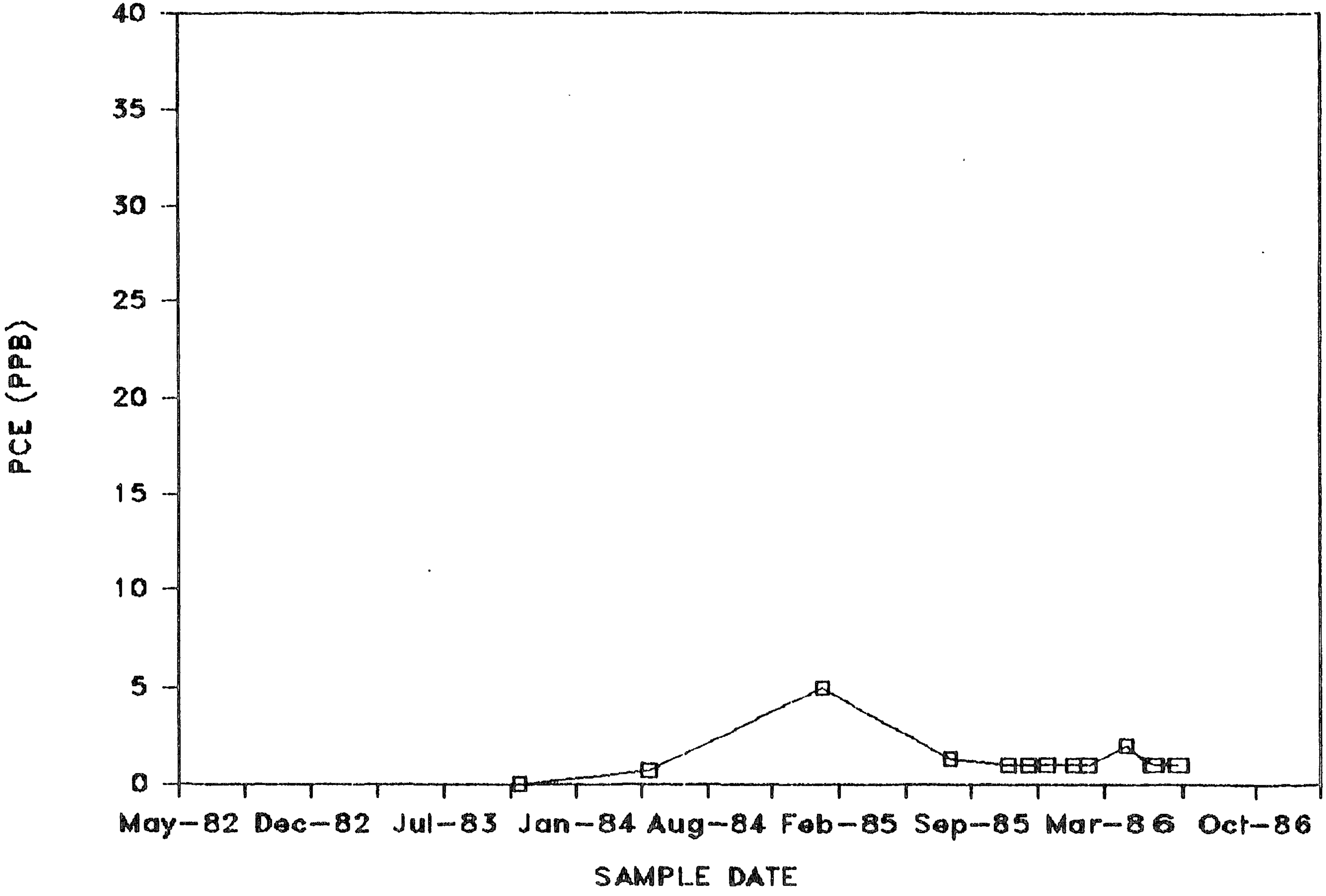

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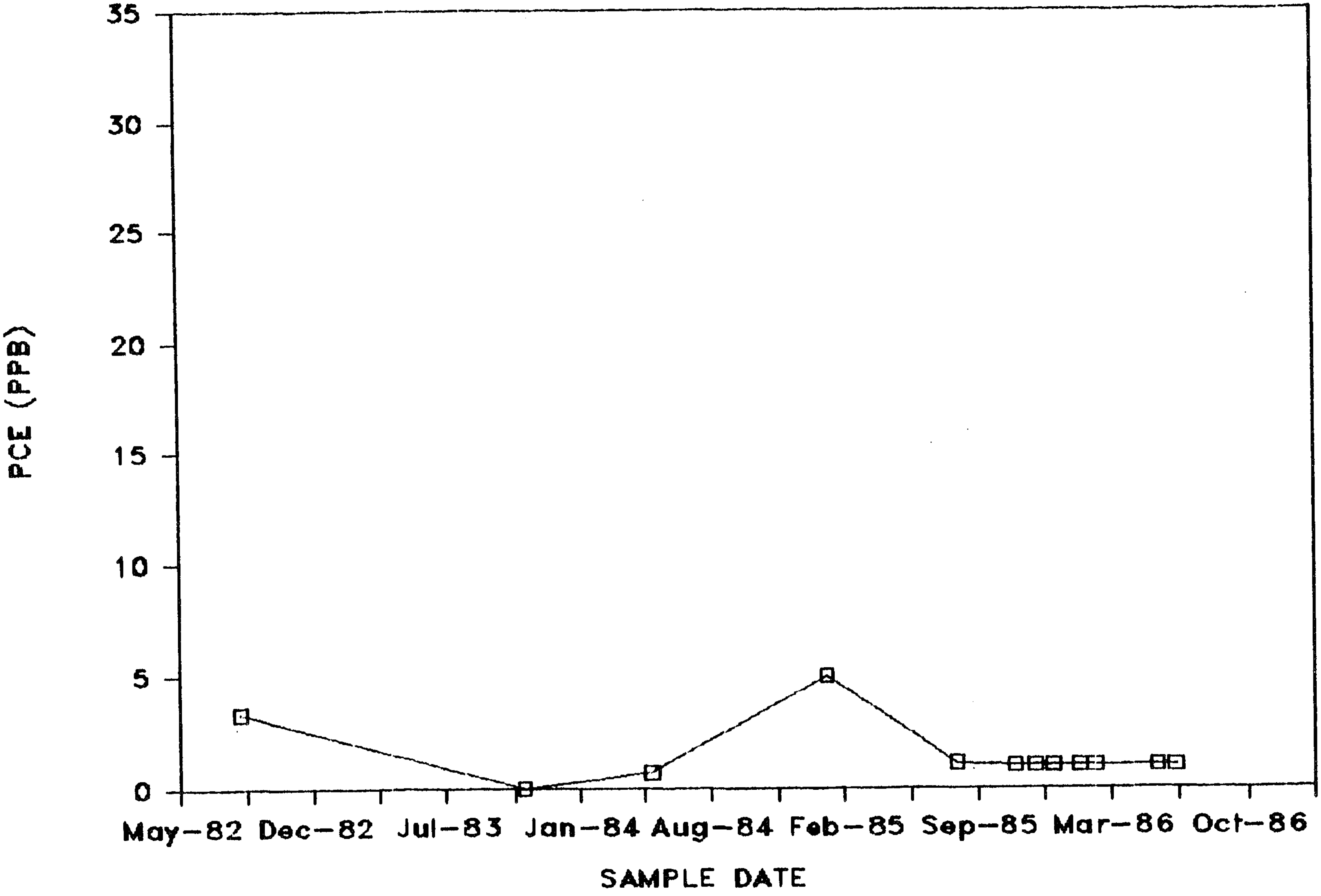
PCE CONCENTRATION



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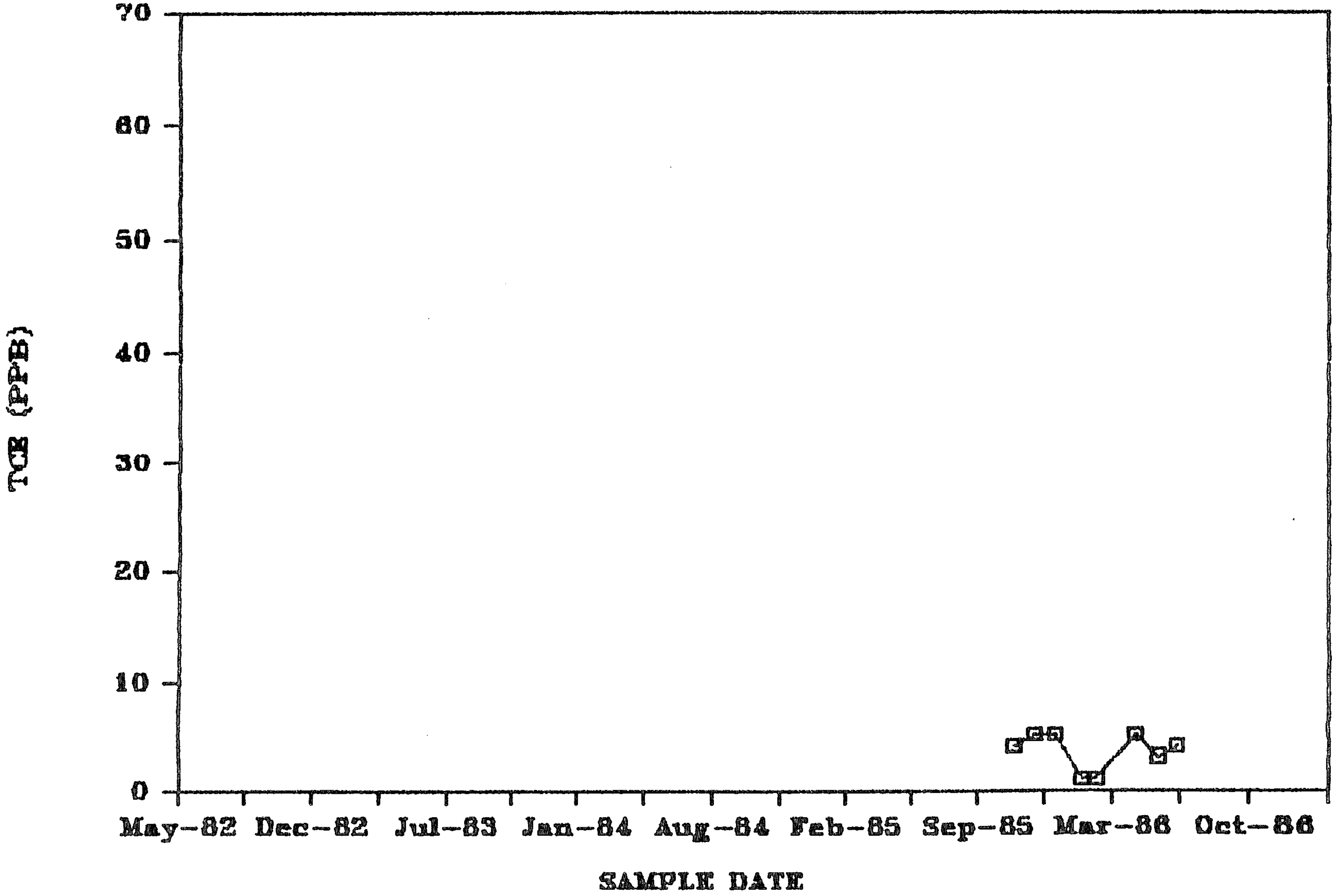

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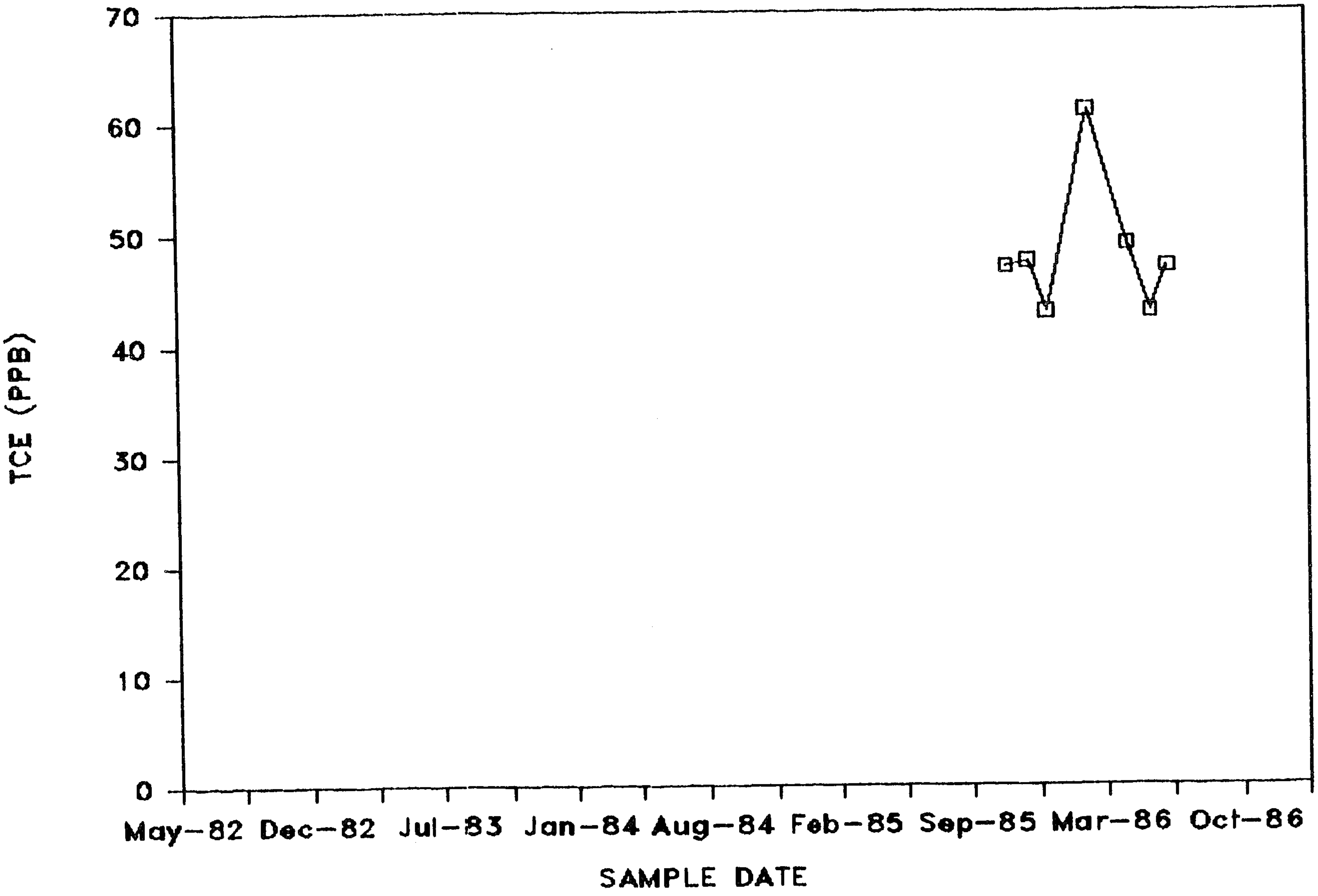

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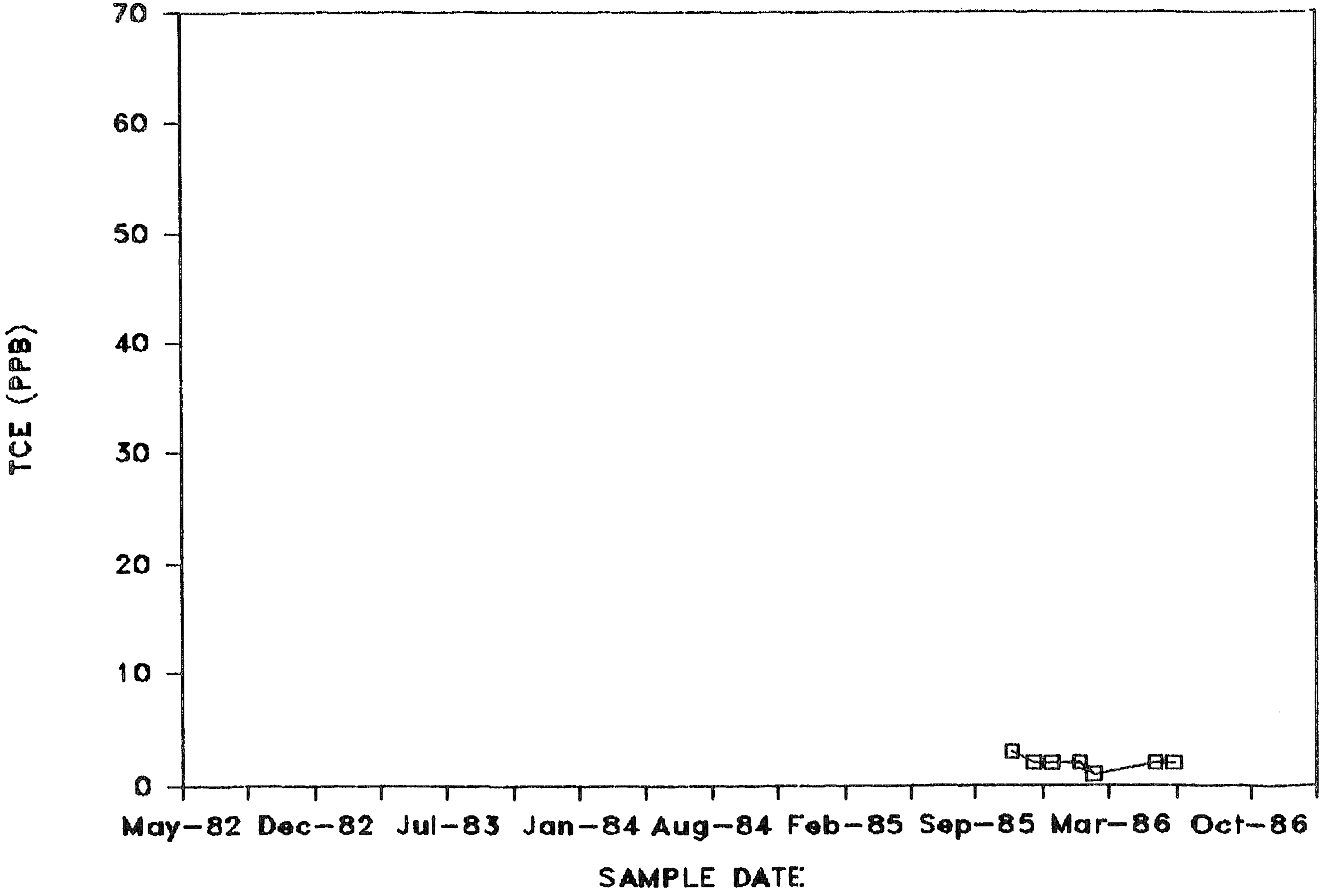

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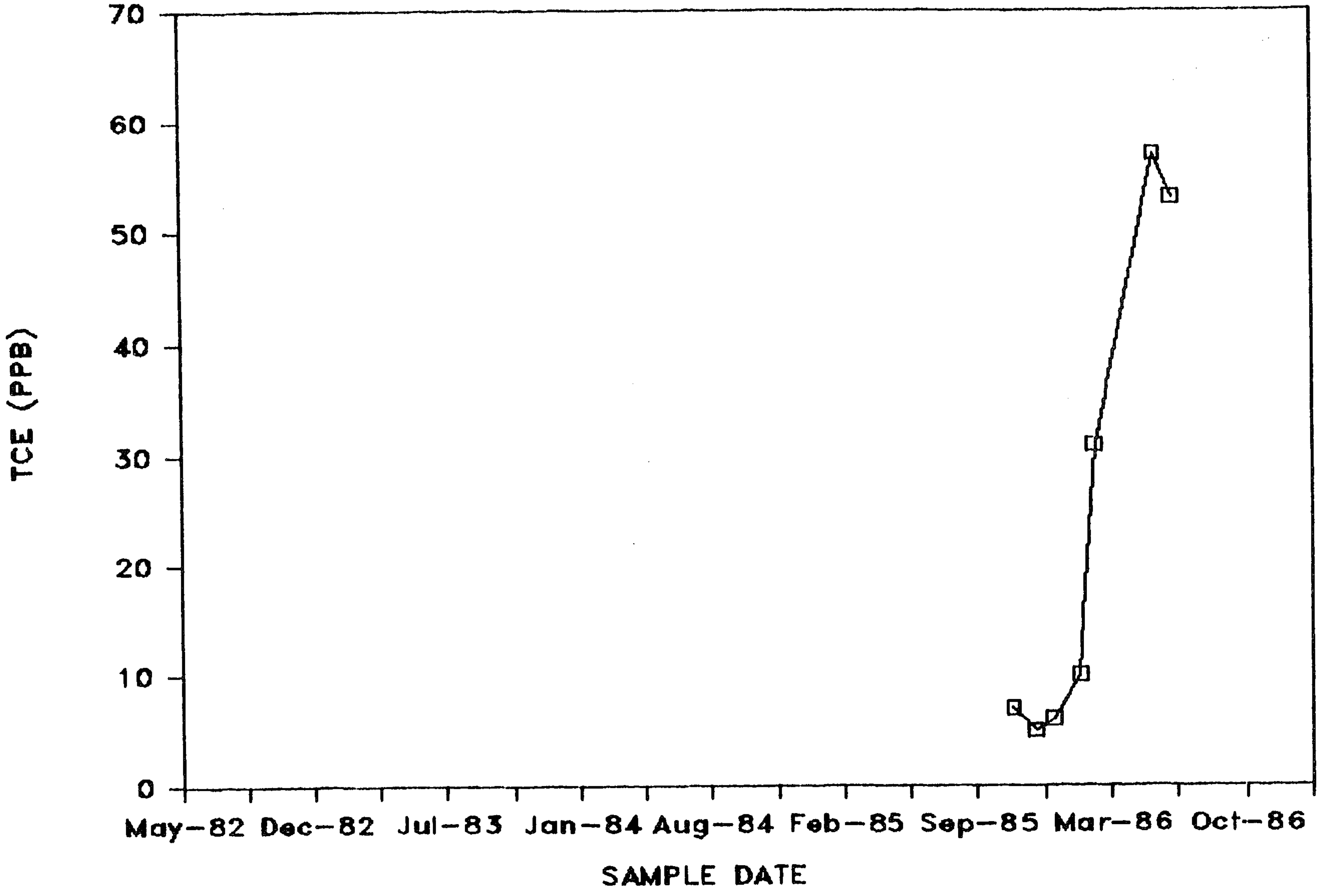

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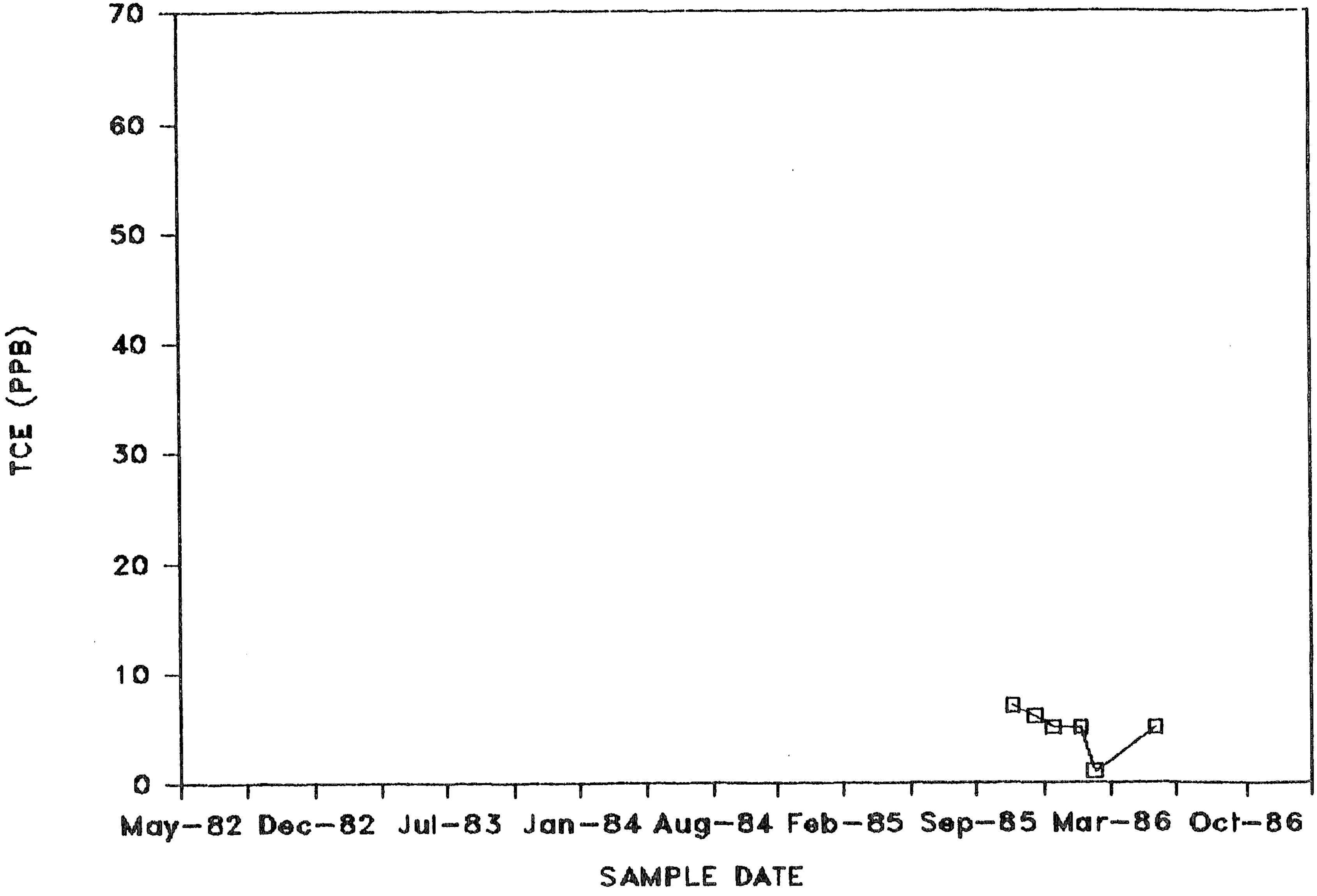

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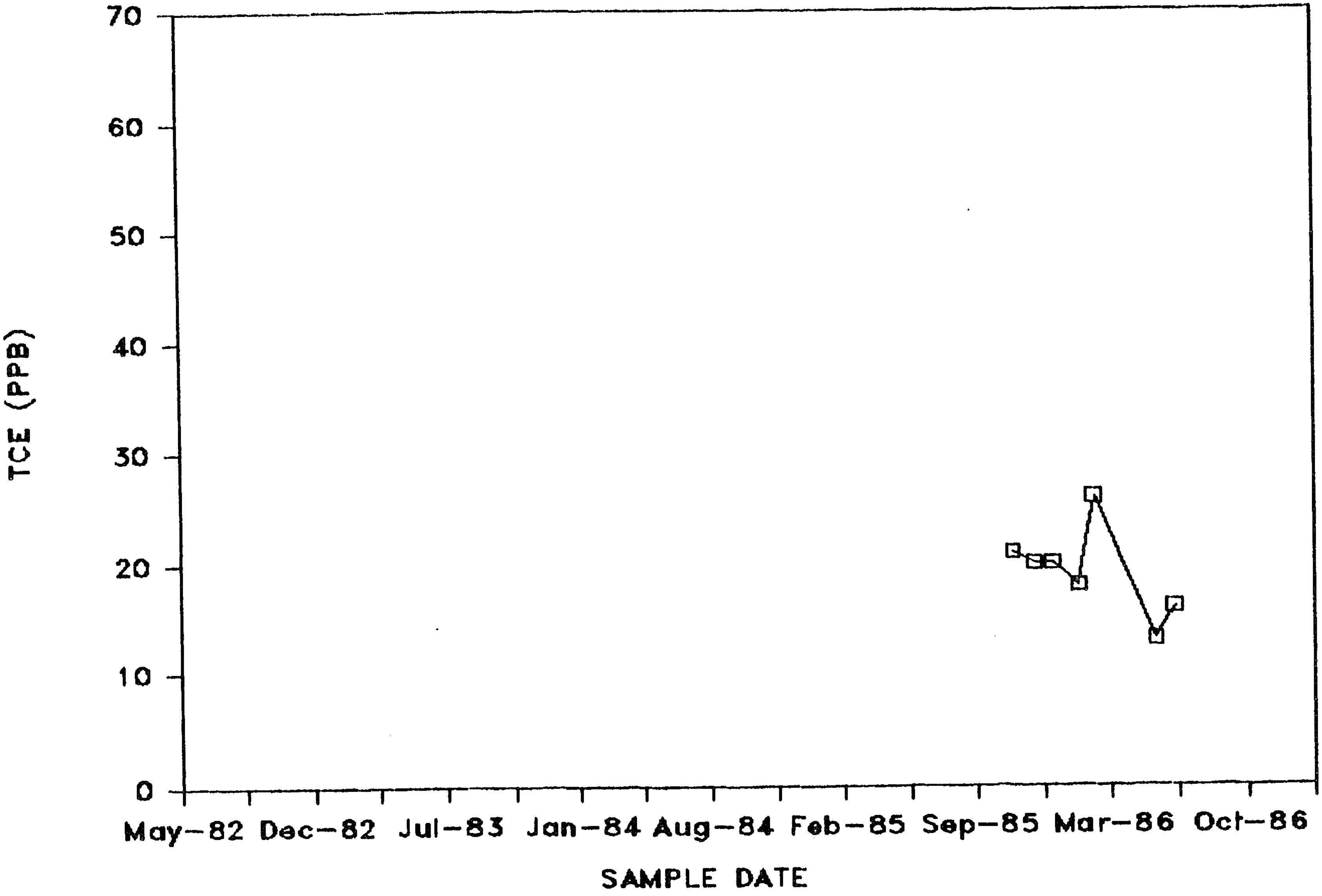

MW — 11

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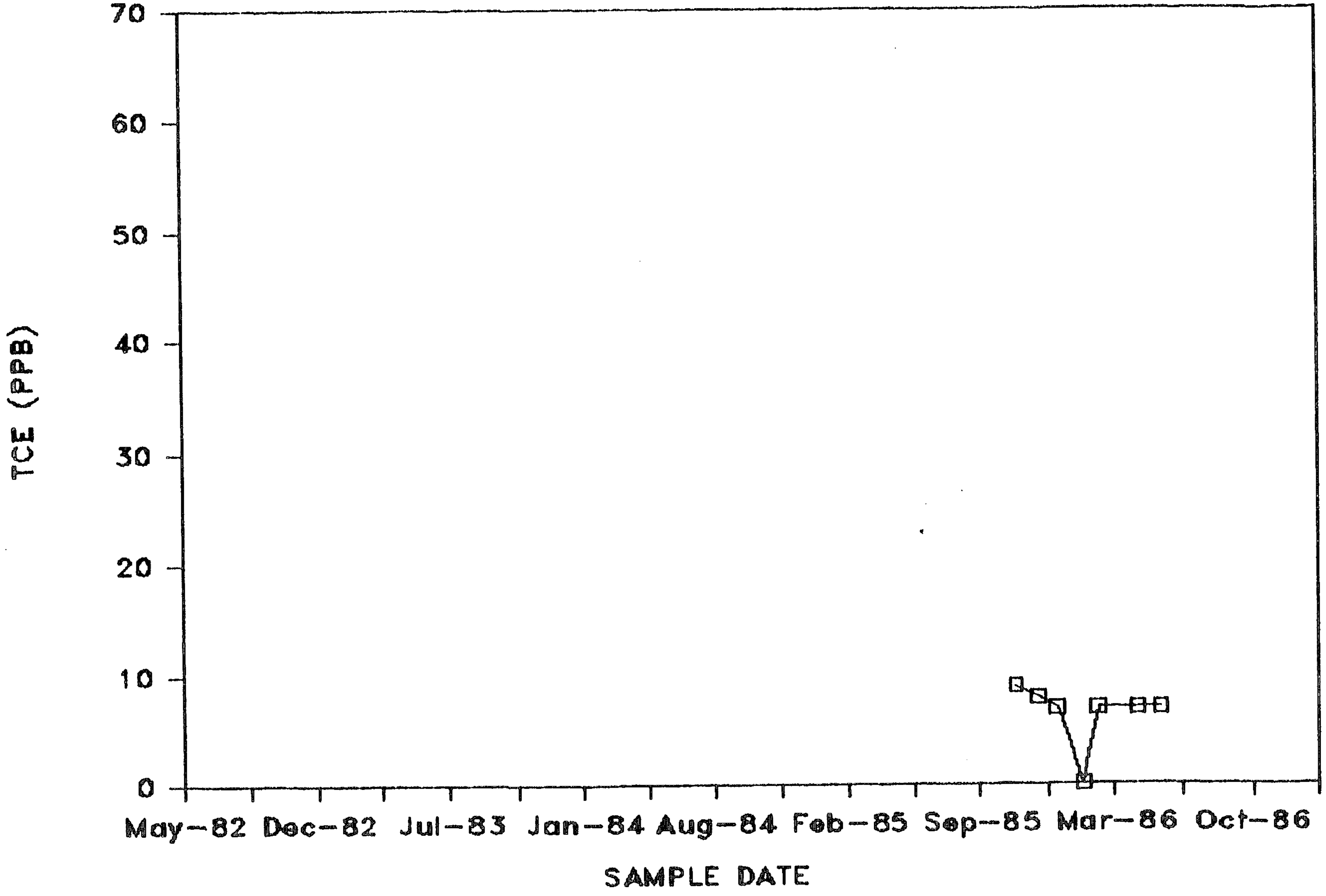

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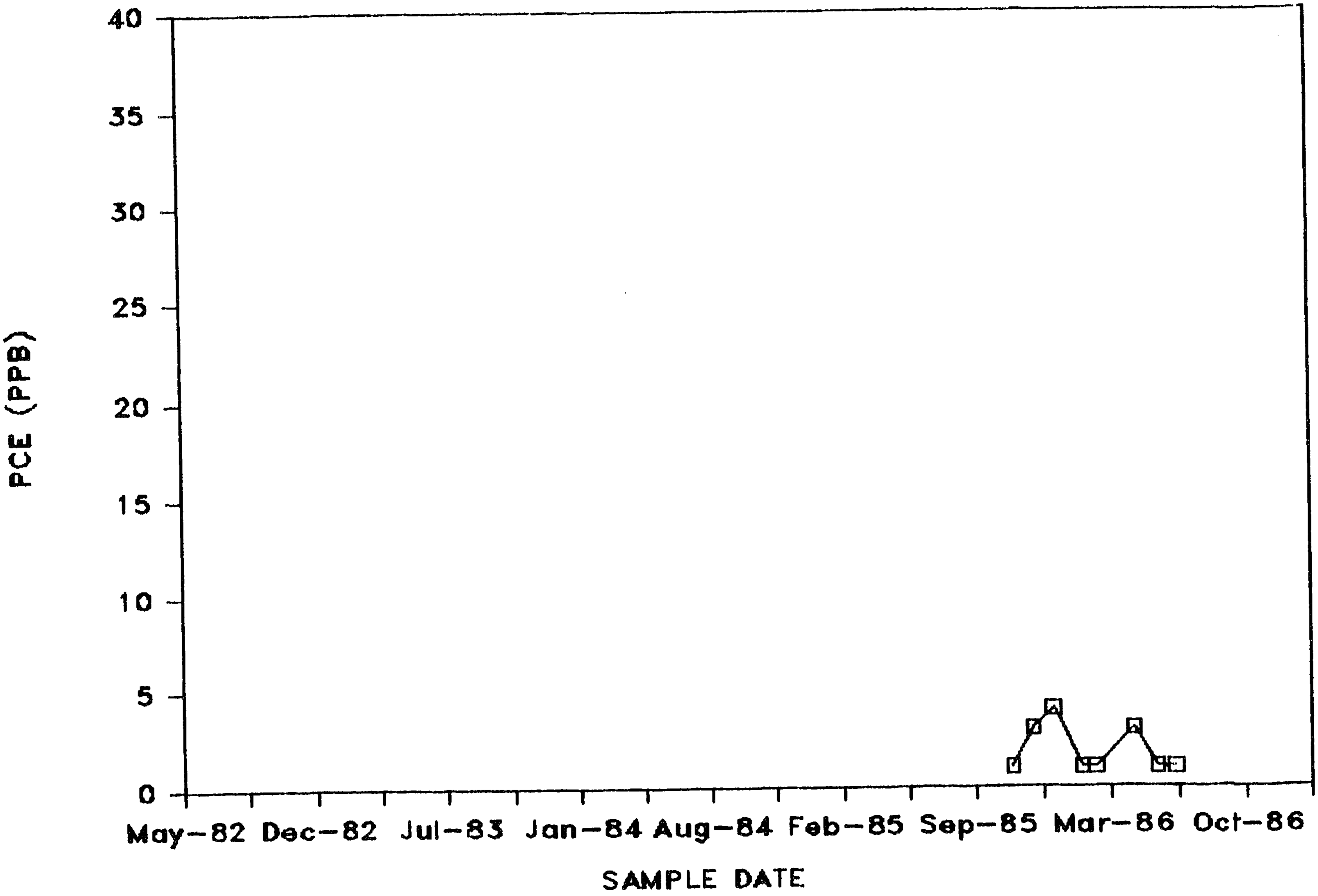

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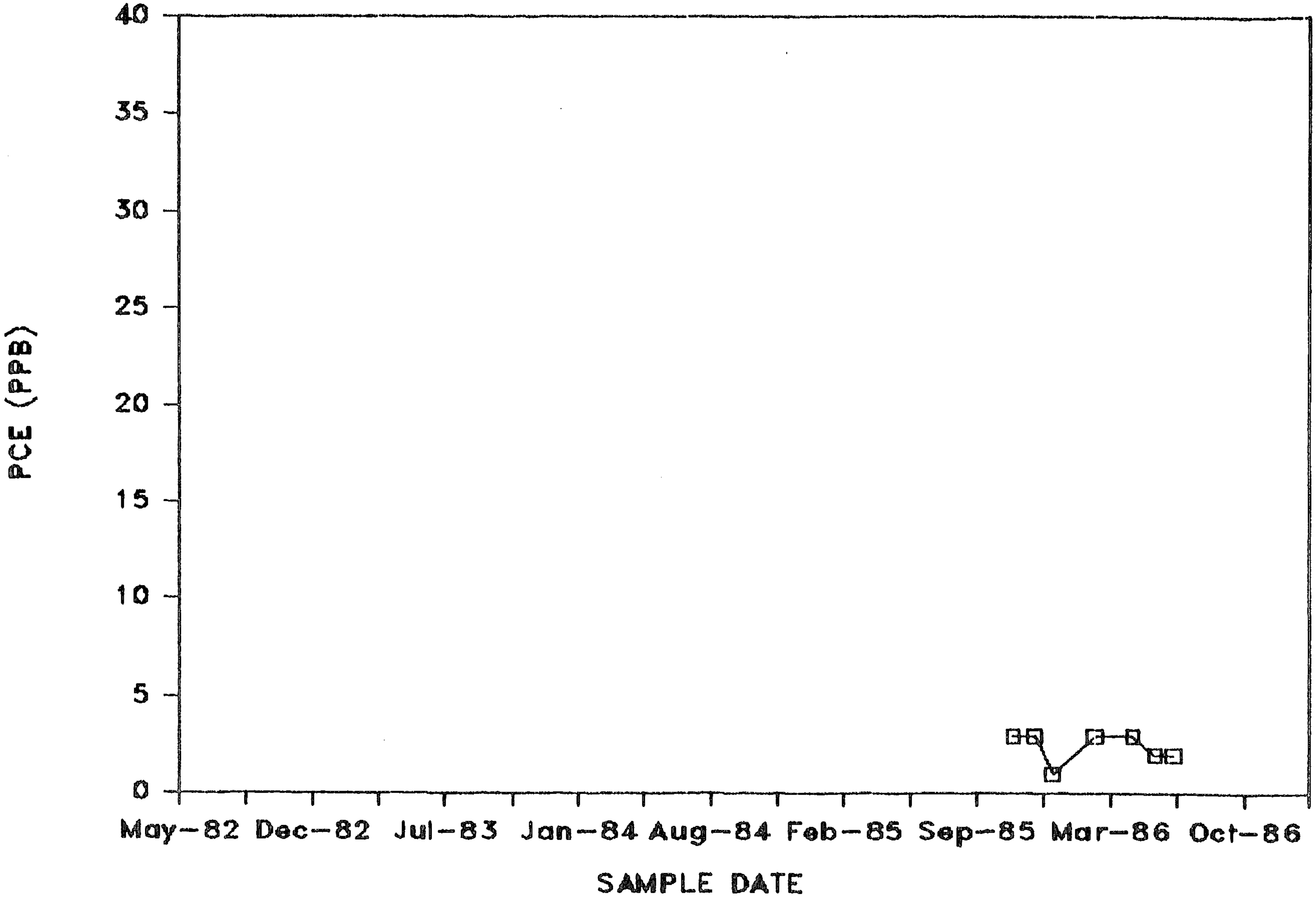

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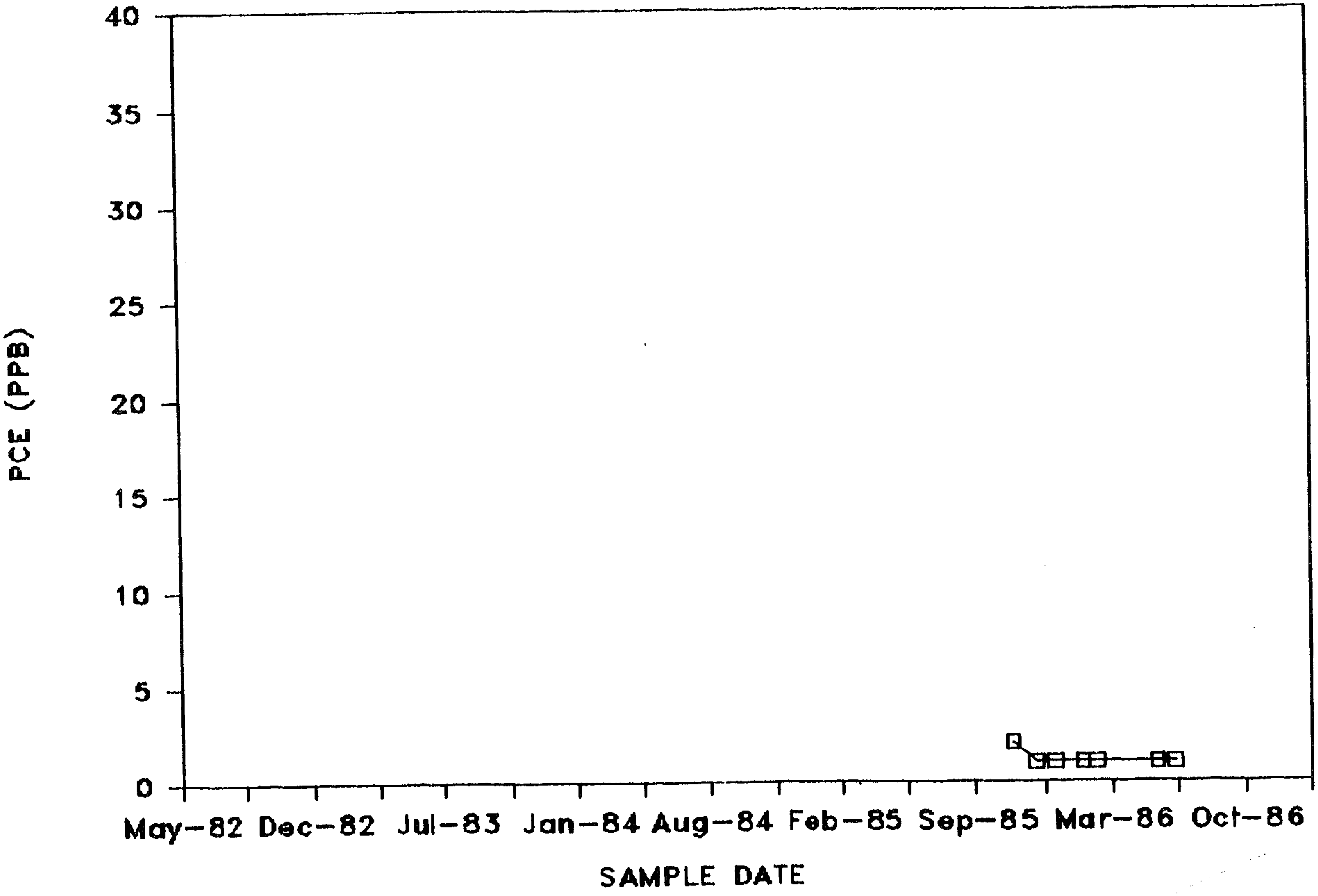

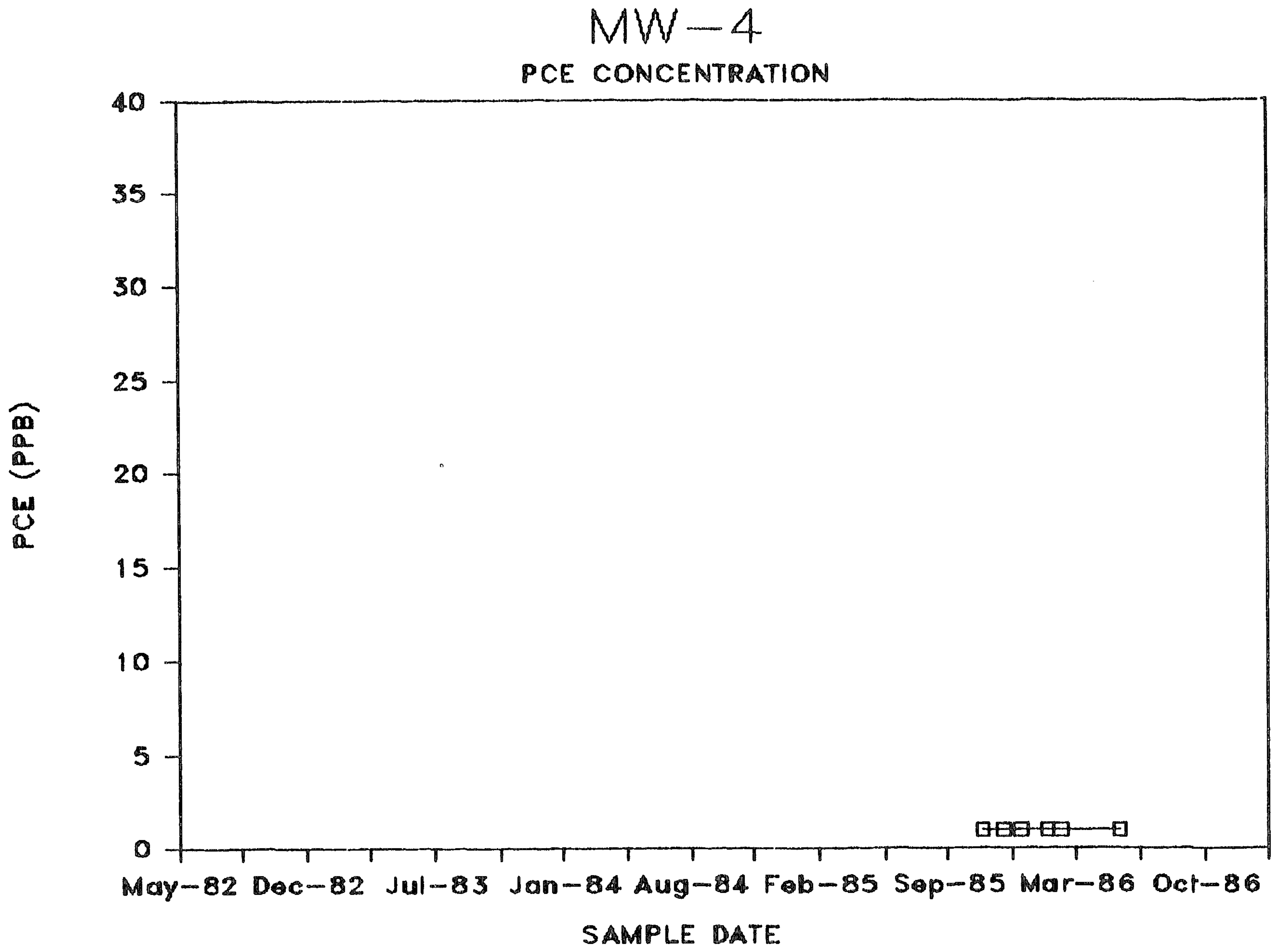
MW—4
PCE CONCENTRATION
PCE (PPB)
40
35
30
25
20
15
10
5
0
May—82
Dec—82
Jul—83
Jan—84
Aug—84
Feb—85
Sep—85
Mar—86
Oct—86
SAMPLE DATE

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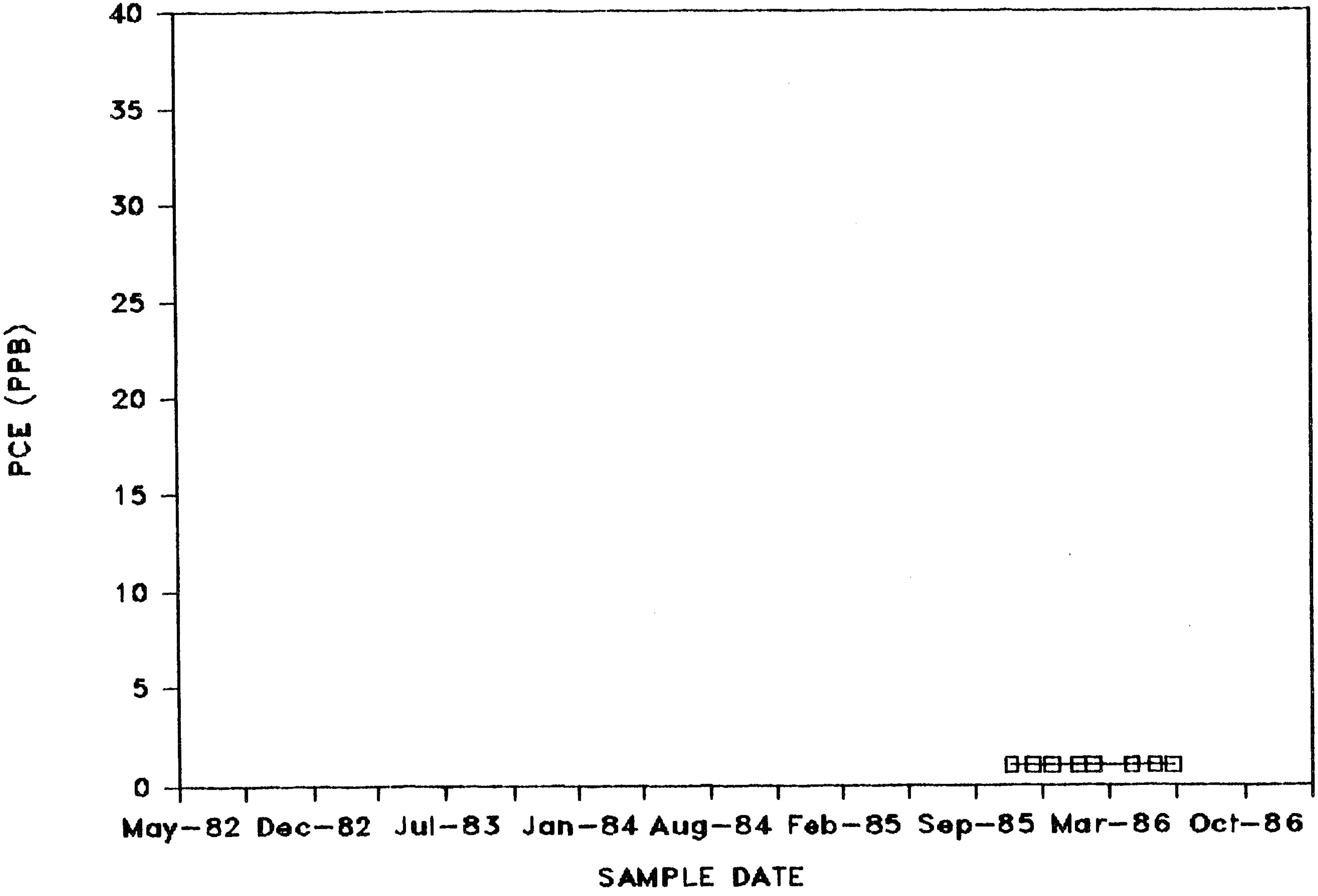
PCE CONCENTRATION



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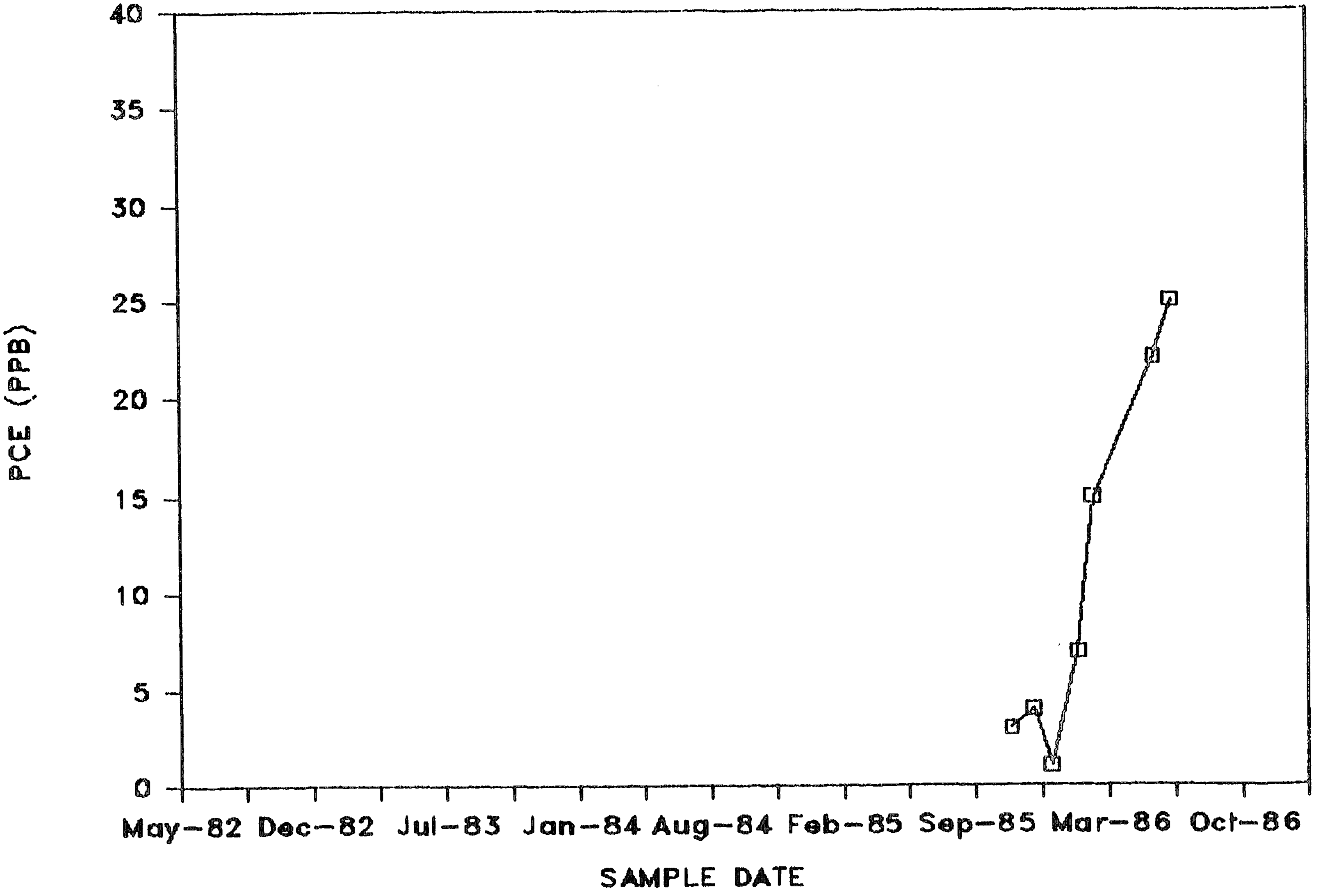
PCE CONCENTRATION



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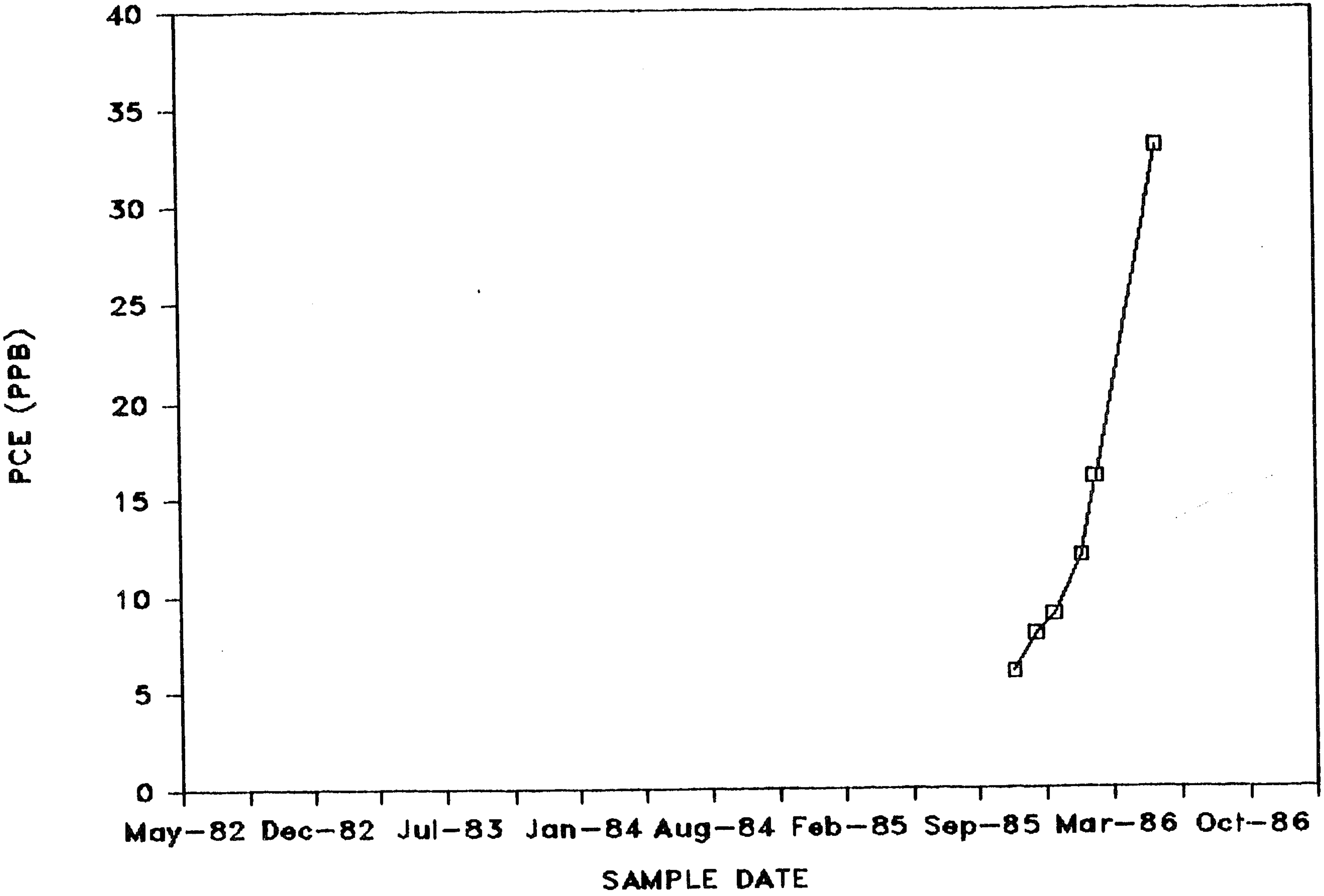

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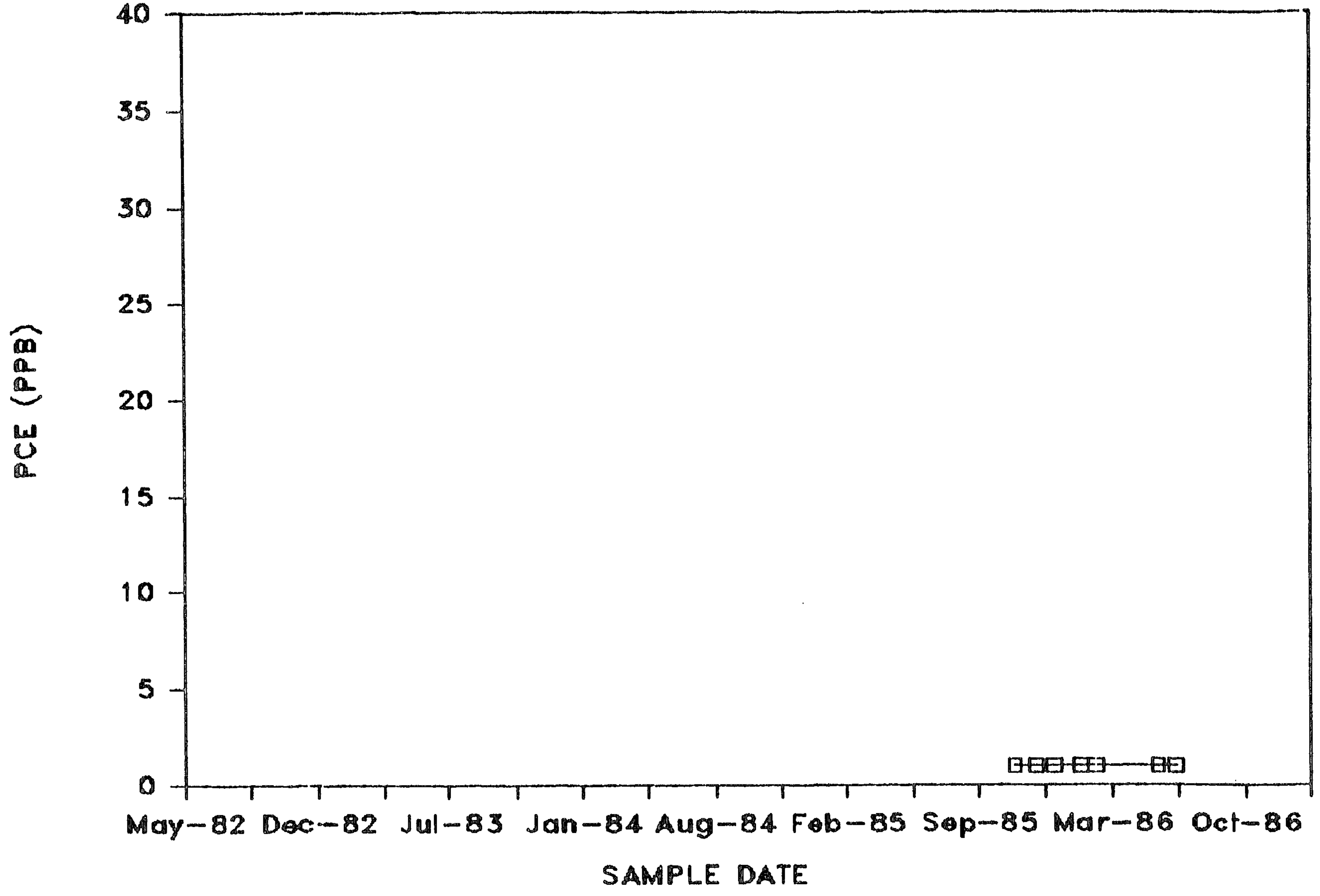

MW-11

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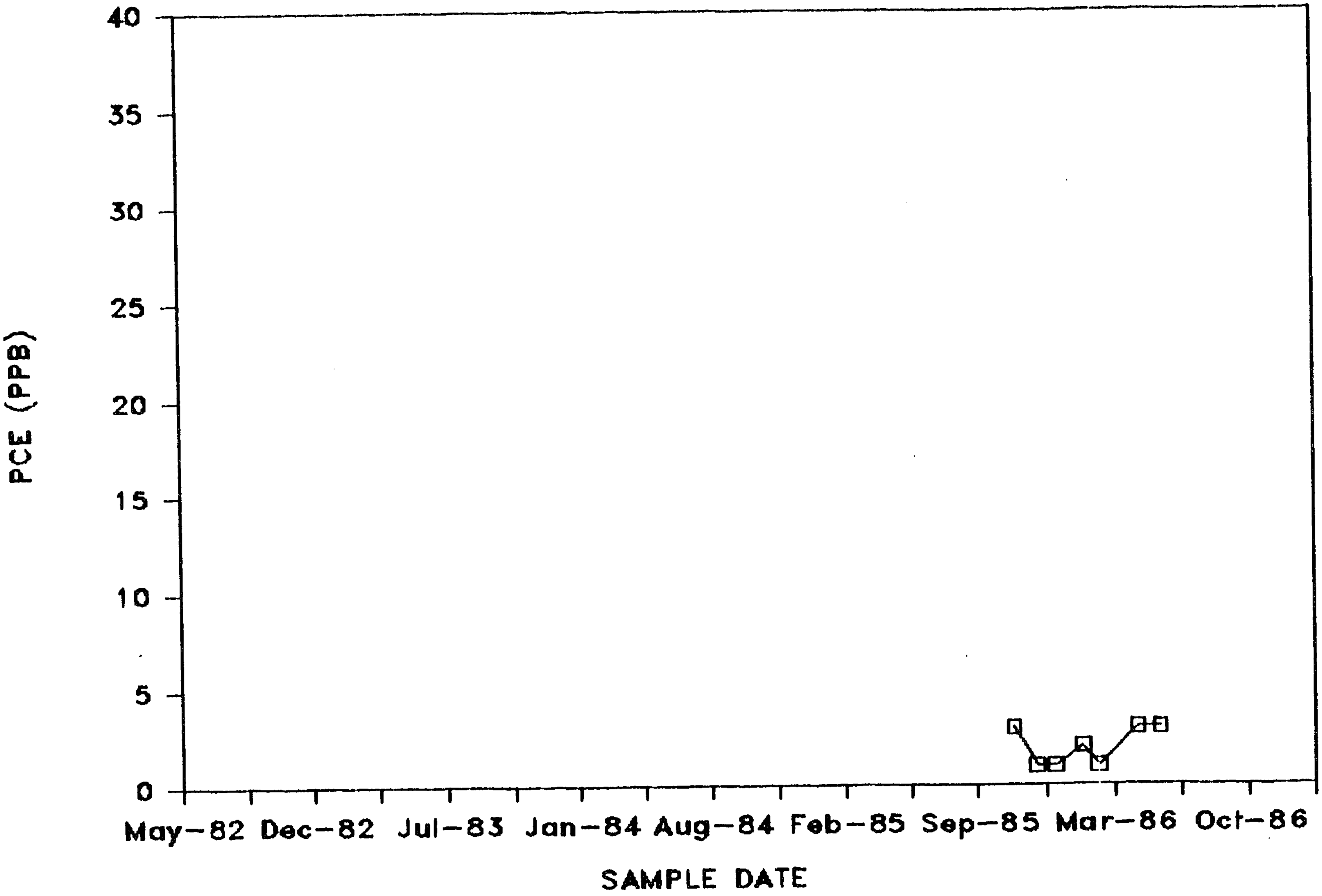

APPENDIX C

Summary of Shower Room Air Model

APPENDIX C

SUMMARY OF SHOWER ROOM AIR MODEL[1]

The shower room air model is used to estimate the potential inhalation exposure to volatile organic compounds (VOC) while showering. The chemical-specific model approach estimates volatilization based upon a specific set of chemical and physical parameters. A kinetic, time-dependent algorithm is used to estimate air concentrations in the shower. Portions of this work have previously been published (EA 1985).

Estimation of VOC concentration in the shower room air is based upon Liss and Slater's (1974) adaptation of the two-film gas-liquid mass transfer theory. Andelman (1985) found Liss and Slater's approach to be consistent with experimental results. The volatilization rate of a VOC across the surface of a hypothetical shower droplet is estimated, and then the subsequent VOC concentration in the air after an estimated drop time is predicted. It is also assumed that the VOC released into the shower stall air is completely mixed and that there is no buildup of VOC at the air-water interface, i.e., VOCs instantaneously achieve a steady-state level in which the rate of input into the air equals the rate of output from the shower room. While air exchange rate is not directly taken into account in the shower inhalation subroutine, this approach presumes that the air is exchanging at a rate sufficient to maintain steady-state conditions in the shower room. The model subroutine does not estimate the contribution to the air concentration associated with continued volatilization from water as it runs over the showering individual and drains from the shower stall.

The subroutine used to estimate inhalation exposures while showering is based upon the assumption that mass-transfer is the rate-limiting step. The overall

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[1] This summary is an excerpt from Foster, S.A., and Chrostowski, P.C., 1986. Integrated household exposure model for use of tap water contaminated with volatile organic chemicals. Presented at the 79th Air Pollution Control Association Annual Meeting, Minneapolis, Minnesota. Paper 86-12.3. June 1986.

mass-transfer coefficient (K_L) for each VOC of interest is estimated according to the following equation (Lyman et al. 1982):

$$K_L = \left(\frac{1}{k_1} + \frac{RT}{Hk_g}\right)^{-1}$$

where

K_L = overall mass transfer coefficient (cm/hr)

H = Henry's Law Constant (atm-m^3/mole-K)

RT = 2.4×10^{-2} atm-m^3/mole (gas constant of 8.2×10^{-5} atm-m^3/mole-K times absolute temperature of 293 K)

k_g = gas-phase mass-transfer coefficient (cm/hour)

k_1 = liquid-phase mass-transfer coefficient (cm/hour).

Empirical values of K_L, k_1, and k_g are situation specific. Typical values of k_1 (20 cm/hour) and k_g (3,000 cm/hour), which have been measured for CO_2 and H_2O, respectively, may be used to estimate these parameters for other compounds (e.g., VOCs) according to the equations below (Liss and Slater 1974).

$$k_g\ (VOC) = k_g\ (H_2O)\ {\frac{18}{MW_{VOC}}}^{0.5}$$

$$k_1\ (VOC) = k_1\ (CO_2)\ {\frac{44}{MW_{VOC}}}^{0.5}$$

The value for K_L is adjusted to the shower water temperature (T_S) according to the semi-empirical equation (O'Connor and Dobbins 1956) developed to estimate the effect of temperature on oxygen mass-transfer rate:

$$K_L'(T_S) = K_L\ {\frac{t_1 u_s}{T_s u_1}}^{-0.5}$$

where

T_1 = calibration water temperature of k_1 (K)

T_s = shower water temperature (K)

u_1 = water viscosity at T_1 (cp)

u_s = water viscosity at T_s (cp).

Volatilization is a first-order process, which may be described by the differential equation

$$-\frac{dC_{sw}}{dt} = K'_L aC$$

or, after substituting values for time and droplet geometry, the integral equation

$$C_{sw} = C_o e^{-K'_L t/600d}$$

where

C_o = tap water concentration (ug/liter)

C_{sw} = shower droplet concentration after time t (ug/liter)

a = specific interfacial area (cm^{-1})

d = shower droplet diamter (cm)

t = shower droplet drop time (sec).

The value 600d equals 6/3600d, in which 6/d is the specific interfacial area for a hypothetical shower droplet of diameter d and 3,600 is the factor used to convert K'_L from cm/hr to cm/sec. A large interfacial area for the hypothetical shower droplet would encourage rapid VOC volatilization into the shower stall air. The term $K'_L/600d$ combines both the rate of transfer and the available interface area across which volatilization occurs.

The concentration leaving the shower droplet (C_d) is obtained by the mass balance

$$C_d = C_o\ (1-e^{-K'_L t/600d}),$$

and the VOC concentration in the shower stall air (C_a) is estimated by the equation

$$C_a = \frac{C_d \ (SW)}{AV_s}$$

where

C_a = air concentration (ug/liter)

SW = volume of water used while showering (liters)

AV_s = shower stall air volume (liters).

Based upon the theoretical approach outlined above, daily inhalation exposure (E_{is}) for an individual while showering is estimated by the equation

$$E_{is} = C_a \ (VR_s)(AFH)(D_s)$$

where

E_{is} = inhalation exposure while showering (ug/day)

AFH = pulmonary absorption factor

VR_s = ventilation rate while showering (liters/min)

D_s = shower duration (minutes).

TABLE C-1

INPUT PARAMETERS FOR SHOWER EXPOSURE MODEL

Parameter	Units or Value	Description and Source
H	atm-m^3/mol-^{o}K	Henry's Law Constant: 9.10×10^{-3} (trichloroethylene) 6.56×10^{-2} (1,2-dichloroethylene) 2.59×10^{-2} (tetrachloroethylene) 1.44×10^{-2} (1,1,1-trichloroethane) 4.31×10^{-3} (1,1-dichloroethane) 3.40×10^{-2} (1,1-dichloroethylene)
MW	g/mole	Molecular weight: 131.50 (trichloroethylene) 96.95 (1,2-dichloroethylene) 165.83 (tetrachloroethylene) 133.41 (1,1,1-trichloroethane) 98.96 (1,1-dichloroethane) 96.95 (1,1-dichloroethylene)
$k_1(CO_2)$	cm/hr	Liquid-phase mass transfer coefficient for CO_2: 20 cm/hr
k_g (H_2O)	cm/hr	Gas-phase mass transfer coefficient for H_2O: 2,000 cm/hr
AFH	—	Pulmonary absorption factor: 0.75
C_o	ug/l	Tap water concentration
T_1	^{o}K	Calibration water temperature: 293^{o}K
T_s	^{o}K	Shower water temperature: 318^{o}K (estimated range: 300^{o}-320^{o}K)
u_1	centipoise (cp)	Water viscosity at T_1: 1.002 cp
u_s	centipoise (cp)	Water viscosity at T_s: 0.596 cp
t	sec	Shower droplet drop time: 2 sec (value varies)[a]
d	cm	Shower droplet diameter: 0.2 cm (value varies and is not well characterized)
SW	liters	Volume of water used while showering: 100 l (reported range: 40-400)[b,c]

TABLE C-1 (Continued)

Parameter	Units or Value	Description and Source
AV_S	liters	Air volume of shower stall: 2.94×10^3 l (estimated value; 1.27×10^3 l, minimum)
VR_S	l/min	Ventilation rate while showering: 15 l/min Reported values[d]: 2-28 (adult male) 4-29 (adult female) 5-35 (10-year-old male) 5-32 (6-year-old female)
D_S	min	Shower duration: 10 min (estimated range: 2-20)

[a] Andelman (1985) uses a droplet velocity of 1.0 m/sec.

[b] Shehata, A.T. A Multi-Route Exposure Assessment to Chemically-Contaminated Drinking Water and Health Significance with Emphasis on Gasoline. Prepared for Maine Department of Environmental Protection. Bureau of Health. Maine Department of Human Services. January 1985.

[c] Metcalf and Eddy, Inc. Wastewater Engineering: Treatment, Disposal, Reuse. 2nd ed. McGraw Hill, Inc. 1979.

[d] U.S. Environmental Protection Agency. Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessements. Office of Health and Environmental Assessment. Final Report. OHEA-E-161. March 1985.

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APPENDIX D

Toxicity Profiles

BENZENE

ABSORPTION, DISTRIBUTION, METABOLISM, EXCRETION

Benzene is readily absorbed into the body via ingestion and inhalation (EPA 1985b). Dermal absorption is somewhat slower (EPA 1985b). It is stored in the bone marrow, liver, and body fat (EPA 1985a). Elimination is by exhalation of unchanged benzene through the lungs or by metabolism in the liver to urinary metabolites (EPA 1985b). Conjugated phenolic metabolites of benzene (e.g., phenol, catechol, hydroquinone) appear in the urine mainly as etheral sulphates and glucuronides (IARC 1982).

HEALTH EFFECTS

ACUTE CHRONIC EFFECTS

The oral LD_{50} values of reagent-grade benzene in male Sprague-Dawley rats are reported to range from 0.93 g/kg bw to 4.9 g/kg bw (IARC 1982). An oral LD_{50} of 5.6 g/kg bw was reported in male Wistar rats (IARC 1982).

The toxic effects of benzene vapors in humans and other animals include central nervous system effects, hematological effects, and effects on the immune system.

In humans, acute exposures to high levels of benzene vapors (20,000 ppm) produce central nervous system effects that include dizziness, giddiness, exhilaration, nausea, vomiting, headache, drowsiness, staggering, loss of balance, narcosis, coma, and death (NAS 1976). Death is usually the result of respiratory or cardiac failure (NAS 1976). In experimental animals, acute exposures to high (unspecified) concentrations of benzene vapors cause depression of the central nervous system (EPA 1985b).

Chronic human exposure to benzene vapors (exposure concentrations unspecified) can cause a continuum of changes in the circulatory formed blood elements and bone marrow precursors (EPA 1985b). Leucopenia, thrombocytopenia, anemia, or combinations of these may occur (IARC 1982). At early stages of such blood dyscrasias, these effects appear to be reversible (IARC 1982). Exposure for longer periods of time may lead to pancytopenia, which results from bone marrow toxicity and is considered to be an irreversible stage of the disease (IARC 1982).

Leucopenia is the most commonly observed effect of chronic benzene intoxication (exposure concentrations unspecified) in laboratory animals (EPA 1985b). Longer exposure periods may lead to pancytopenia and bone marrow depression (EPA 1985b).

Immune system depression by benzene is well known. Depression of serum antibodies (IgG and IgA) in benzene workers (exposure concentrations unspecified) has been reported (EPA 1985a). In addition, it has been demonstrated that administration of benzene to mice in vivo inhibits the function of B- and T-lymphocytes in vitro (IARC 1982). These observations, as well as the well-known ability of benzene to depress leucocytes, may explain why benzene-exposed individuals readily succumb to infection and the terminal event in severe benzene toxicity is often overwhelming infection (IARC 1982).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Inhalation experiments conducted in rats, mice, guinea pigs, and rabbits suggest that benzene (exposure concentrations unspecified) is not teratogenic at doses that are fetotoxic and embryolethal (IARC 1982). It is a potent inhibitor of growth in utero (EPA 1985a).

Animal experiments in rats, guinea pigs, and rabbits suggest that exposures (concentrations unspecified) to benzene vapors may damage the testis (IARC 1982).

MUTAGENICITY

Benzene does not induce gene mutations in bacterial systems (IARC 1982). It has not been found to be a point mutagen in mammalian cells; however, benzene did induce cytogenetic abnormalities in mammalian cells in vitro (chromosomal aberrations and sister chromatid exchanges) (IARC 1982). Several studies demonstrated that benzene exposure of experimental animals in vivo leads to the induction of chromosomal aberrations in bone marrow cells (IARC 1982). There is a clear correlation between exposure (concentration unspecified) to benzene and the appearance of chromosomal aberrations in the bone marrow and in peripheral lymphocytes of individuals exposed to high levels of benzene (more than 100 ppm) (IARC 1982).

CARCINOGENICITY

Many case studies have described a causal relationship between exposure to benzene (concentrations unspecified) by inhalation (either alone or in combination with other chemicals) and leukemia in humans (IARC 1982). Most cases were acute myelogenous leukemia, although some were monocytic, erythroblastic, or lymphocytic (IARC 1982). A series of epidemiological studies, both cohort and case-control, showed statistically significant associations between leukemia and occupational exposure (concentration unspecified) to benzene (EPA 1984a). These results have been replicated in a number of countries and in different industries (IARC 1982).

Benzene has produced both solid tumors and leukemias in Sprague-Dawley rats (EPA 1984a). In these experiments, rats were administered benzene by gavage at doses of 50 or 250 mg/kg, 4 to 5 days a week for 52 weeks and observed for lifetime.

STANDARDS AND CRITERIA

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans (EPA 1984b), benzene has been classified by EPA (1984a) in Group A--Human Carcinogen. This category indicates that there is sufficient evidence from epidemiologic studies to support a causal association between an agent and cancer (EPA 1984b).

The EPA's Carcinogen Assessment Group (CAG) has calculated inhalation and oral carcinogenicity potency factors for benzene. Both were derived from human epidemiology studies in which significantly increased incidences of leukemia were observed for workers exposed to benzene principally by inhalation (EPA 1984a). The inhalation potency is 2.6×10^{-2} $(mg/kg/day)^{-1}$ and the oral potency is 5.2×10^{-2} $(mg/kg/day)^{-1}$ (EPA 1984a). The concentration in drinking water corresponding to a 10^{-6} excess lifetime cancer risk is 0.7 ug/liter.

EPA (1985c) promulgated a final drinking water recommended maximum contaminant level (RMCL) of zero because benzene is a human carcinogen. A drinking water maximum contaminant level (MCL) of 5 ug/liter has been proposed (EPA 1985d).

The EPA Office of Drinking Water developed a 10-day health advisory (HA) of 233 ug/liter for children (EPA 1985a). The HA was based on an inhalation study in which 103 mg/m^3 caused depressed white blood cell counts within 2 weeks. A dose of 96 mg/m^3 had no effect after 2 weeks (EPA 1985a). Health advisories for longer exposure periods were not developed because of the potent carcinogenic effects of benzene (EPA 1985a).

SUMMARY OF BENZENE CRITERIA

(1)	Final RMCL	0
(2)	Proposed MCL	5 ug/liter
(3)	Ten-day HA (child)	233 ug/liter
(4)	EPA Classification for Evidence of Carcinogenicity	Group A
	Oral carcinogenicity potency (q_1*)	5.2×10^{-2} (mg/kg/day)$^{-1}$
	Inhalation carcinogenicity potency (q_1*)	2.6×10^{-2} (mg/kg/day)$^{-1}$
	Drinking water concentration corresponding to 10^{-6} excess lifetime cancer risk	0.7 ug/liter

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1,1-DICHLOROETHANE

Description of Health Effects

Limited information is available concerning the effects of 1,1-dichloroethane (1,1-DCA). The extent or rate of absorption of 1,1-DCA has not been determined, but based on its chemical properties rapid gastrointestinal absorption and moderate absorption from inhalation are expected (1984).

1,1-DCA is probably less toxic than the 1,2-isomer (EPA 1980). At one time, the compound was used as an anesthetic, but it induced cardiac arrhythmias and use was discontinued. It is probable that human exposure to sufficiently high levels of 1,1-DCA would cause central nervous system depression and respiratory tract and skin irritation, since many of the chlorinated aliphatics cause these effects (Parker at al. 1979). However, no dose-response data concerning these effects are available. Renal damage was observed in cats exposed by inhalation in a subchronic study (Hoffman et al. 1971). Inhalation exposure of pregnant rats to high doses of 1,1-DCA (6,000 ppm) retarded fetal development (Schwetz et al. 1974).

A carcinogenicity bioassay of 1,1-DCA was limited by poor survival of both treatment and control groups, and the physical conditions of the treated animals was markedly stressed. A dose-related increase in the number of tumors was not observed by the Fisher exact test, but the data suggest that the compound may have carcinogenic properties (NCI 1978 as cited in USEPA 1984).

Standards and Criteria

Applying the criteria for evaluating the weight of evidence for carcinogenicity proposed by the Carcinogen Assessment Group, 1,1-DCA is most appropriately classified as a Group D, not classified, chemical (USEPA 1984).

EPA derived health-based criteria for subchronic and chronic exposure to 1,1-dichlorethane in its Health Effects Assessment for this compound (EPA

1984). The oral subchronic acceptable intake (AIS) and chronic acceptable intake (AIC) were calculated from a study by Hoffman et al. (1971). Cats exposed to 500 ppm 1,1-DCA for 26 weeks had no observed effects, but cats exposed to 500 ppm for 13 weeks and then 1,000 ppm for an additional 13 weeks suffered renal damage. The other mammalian species tested (rats, rabbits, and guinea pigs) had no observed adverse effects. The oral AIS is 1.2 mg/kg/day. The oral AIC of 0.12 mg/kg/day was derived from the AIS by applying an additional safety factor of 10 to compensate for less than lifetime exposure in the animal study (USEPA 1984).

The inhalation AIS of 1.38 mg/kg/day and the AIC of 0.14 mg/kg/day were also derived from the Hoffman et al. (1971) study (USEPA 1984).

1,1-Dichloroethane Criteria

(1)	USEPA Classification for Evidence of Carcinogenicity	Group D, Not classified
(2)	EPA Health Effects Assessment (HEA)	
	Oral AIS	1.2 mg/kg/day
	Oral AIC	0.12 mg/kg/day
	Inhalation AIS	1.38 mg/kg/day
	Inhalation AIC	0.14 mg/kg/day

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1,1-DICHLOROETHYLENE

Description of Health Effects

Several comprehensive reviews of the toxicology and potential health effects of 1,1-dichloroethylene have been prepared. The following summary is based primarily on information presented in three EPA documents. These include "Ambient Water Quality Criteria for Dichloroethylene" (EPA 1980), "Drinking Water Criteria Document for Dichloroethylenes" (EPA 1984), and "Health Assessment Document for Vinylidene Chloride" (EPA 1985a).

1,1-Dichloroethylene is a central nervous system depressant and has been used as an anesthetic. Chronic low-level exposure to this substance may result in neurotoxicity, nephrotoxicity, hepatotoxicity, and cardiac arrhythmia. Inhalation or oral exposure of rats and rabbits has produced fetotoxicity and minor skeletal abnormalities, but at doses associated with some degree of maternal toxicity.

1,1-Dichloroethylene has been found to be a point mutagen in bacterial systems with metabolic activation, but dominant lethal studies in rats and mice were negative. The evidence for the potential of 1,1-dichloroethylene to act as a human germ-cell mutagen is currently regarded by EOA (1985a) as limited. Although this designation indicates that there are insufficient data to classify this evidence as sufficient or suggestive of potential germ-cell mutagenicity, the available data also do not permit classification of 1,1-dichloroethylene as a non-germ cell mutagen.

A number of laboratory studies have investigated the carcinogenic potential of 1,1-dichloroethylene. A significantly increased incidence of renal adenocarcinomas was observed in male mice treated by inhalation with 1,1-dichloroethylene in a study by Maltoni et al. (1985); female mice in the same study showed an equivocal increase in mammary adenocarcinomas. Other studies with mice, rats and hamsters have not shown increased tumor incidences after exposure by the oral or inhalation routes.

The effects of 1,1-dichloroethylene on humans have not been studied in large enough populations to provide meaningful results (EPA 1980, 1985a).

Standards and Criteria

The EPA concluded that the evidence for carcinogenicity of 1,1-dichloroethylene is inadequate in humans and limited in experimental animals. Applying the criteria for evaluating the overall weight of evidence of carcinogenicity to humans proposed by the EPA, this compound is most appropriately classified in Group C, meaning that it is a possible human carcinogen. The EPA (1985a) reported carcinogenic potencies (q_1*) for exposure by ingestion and inhalation to 1,1-dichloroethylene in its Health Assessment Document for this compound.

The carcinogenic potency for exposure by ingestion was derived by estimating an upper-limit value from the negative data of a drinking water study by Quast et al. (1983) in Sprague-Dawley rats and a negative NTP (1982) gavage study in Fischer 344 rats and B6C3F1 mice. Quast et al. (1983) treated Sprague-Dawley rats with 50, 100, or 200 ppm 1,1-dichloroethylene in their drinking water for 2 years and observed only minimal hepatotoxicity. In the NTP bioassay (NTP 1982), no significant increases in tumor incidence were observed, but a maximum tolerated dose was apparently not achieved in the gavage treatment of F344 rats with 1 or 5 mg/kg and B6C3F1 mice with 2 or 10 mg/kg 5 times a week for 104 weeks. This approach assumes that a response occurs via ingestion, although there is no direct evidence that this is true. The highest upper-bound carcinogenic potency (q_1*) estimate using these data was 0.58 $(mg/kg/day)^{-1}$.

The carcinogenic potency for exposure by inhalation reported in the Health Assessment Document (EPA 1985a) is based on an inhalation study in mice by Maltoni et al. (1985). Swiss mice of both sexes were exposed to 0, 10, or 25 ppm (0, 40, or 100 mg/m^3) 1,1-dichloroethylene for 4 hours/day, 4 to 5 days/week for 52 weeks, and were observed for a total of 121 weeks. The most marked finding was the significantly increased incidence of renal adenocarcinomas in the high-dose male mice. Using data from this study, calculation of the cancer risk estimates by the multistage model yields an inhalation carcinogen potency of 1.16 $(mg/kg/day)^{-1}$.

Under the Safe Drinking Water Act, EPA has recently promulgated a final Recommended Maximum Contaminant Level (RMCL) and proposed a Maximum Contaminant Level (MCL) of 7 ug/liter for 1,1-dichloroethylene in drinking water (EPA 1985b). RMCLs are non-enforceable health goals that are to be set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. MCLs, which are enforceable standards when finalized, are EPA set as close as feasible to RMCLs after consideration of treatment and analytical technologies, costs, and other factors.

In setting the 7 ug/liter RMCL for 1,1-dichloroethylene, EPA determined that limited but insufficient evidence of carcinogenicity exists for this compound. Accordingly, it was classified in Regulatory Category II—equivocal evidence of carcinogenicity. RMCLs for Category II contaminants are set based on chronic toxicity data with an additional margin of safety or on lifetime risk calculations if chronic toxicity data are not available. For 1,1-dichloroethylene, EPA set the RMCL based on chronic toxicity data, primarily liver effects, obtained from the Quast et al. (1983) study in rats. An adjusted acceptable daily intake (AADI) of 350 ug/liter was derived from these data. By applying an extra safety factor of 10 to account for the possible carcinogenicity of this compound and assuming a 20% contribution to exposure from drinking water, the final RMCL of 7 ug/liter was determined (EPA 1984, EPA 1985b).

The EPA Office of Drinking Water developed one-day, longer-term, and lifetime health advisories (HAs) for 1,1-dichloroethylene (EPA 1985c). The one-day HA derived for a 10-kg child is 1,000 ug/liter. This HA was based on a study in which adult rats received single doses of 100, 300, or 500 mg/kg 1,1-dichloroethylene in corn oil. (Jenkins et al. 1972) A LOAEL of 100 mg/kg for liver enzyme changes was identified. The longer-term HA was based on a 90-day study in which rats received 0, 50, 100, or 200 ppm 1,1-dichloroethylene in their drinking water (Rampy et al. 1977). This study identified a NOAEL of 100 ppm (a decreased kidney:body weight ratio in males was observed at 50 ppm); increased cytoplasmic vacuolization of hepatocytes was observed in both sexes at 200 ppm. Based on the NOAEL of 100 ppm, a longer-term HA was derived for a 10-kg child consuming one liter of water per day and a 70-kg adult consuming 2 liters of water per day. These values are 1,000 ug/liter and 3,500 ug/liter, respectively. EPA noted that the longer-term HA of 1,000 ug/liter for a 10-kg child would also be appropriate for protection over a 10-day period.

A lifetime HA of 70 ug/liter was based on the Quast et al. (1983) study cited above. A LOAEL of 100 ppm was identified based upon a trend towards increased fatty deposition in the liver. A relative source contribution of 20% for drinking water was included in this value. A risk reference dose (RRfD) of 0.01 mg/kg/day was determined by EPA from data presented in this study. An RRfD is an estimate of daily exposure which appears to be without appreciable risk of deleterious non-carcinogenic effects over a lifetime of exposure. This value corresponds approximately to the oral reference dose (RfD) of 0.009 mg/kg/day (EPA 1986) also recommended by EPA and based on the Quast et al. (1983) study.

1,1-Dichloroethylene Criteria

(1)	EPA Drinking Water Health Advisories (HA)	
	One-day HA (child)	1000 ug/liter
	10-day HA (child)	1000 ug/liter
	Longer-term HA	
	Child	1000 ug/liter
	Adult	3500 ug/liter
	Lifetime HA	70 ug/liter
(2)	EPA Oral RfD	0.009 mg/kg/day
(3)	EPA Classification for Evidence of Carcinogenicity	Group C
	CAG Oral carcinogenic potency (q_1*)	0.58 $(mg/kg/day)^{-1}$
	CAG Inhalation carcinogenic potency (q_1*)	1.16 $(mg/kg/day)^{-1}$

	Drinking Water concentration corresponding to a 10^{-6} excess lifetime cancer risk	0.06 ug/liter
(4)	Final RMCL/Proposed MCL	7 ug/liter

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trans-1,2-DICHLOROETHYLENE

DESCRIPTION OF HEALTH EFFECTS

Information on the health effects of trans-1,2-dichloroethylene is limited. Freundt et al. (1977) exposed female rats by inhalation to 200 ppm trans-1,2-dichlorothylene for 8 hours per day, 5 days per week for 1, 2, 8, or 16 weeks and noted progressive damage to the lungs and progressive fatty degeneration of the liver. trans-1,2-Dichloroethylene was not mutagenic in the Ames assay and did not induce chromosomal aberrations in mouse bone marrow cells (Cerna and Kypenova 1977). Galli et al. (1982) reported that it was not mutagenic when tested in a diploid strain (D7) of *Saccharomyces cerevisiae* with and without S9. Finally, trans-1,2-dichloroethylene was not mutagenic in the *Escherichia coli* K12 assay system (Greim et al. 1975 as cited in EPA 1980).

EPA (1980) was unable to derive ambient water quality criteria for trans-1,2-dichloroethylene because of lack of data. There are still insufficient compound-specific data from which the potential chronic toxicity or carcinogenicity of this compound can be assessed. This compound has been classified in Group D (not classified due to inadequate animal evidence of carcinogenicity) according to EPA's Proposed Guidelines for Carcinogenic Risk Assessment, and currently is treated as a noncarcinogenic chemical (EPA 1985).

The EPA opinion concerning protection of human health from the toxic effects of trans-1,2-dichloroethylene in drinking water is summarized in recently proposed National Primary Drinking Water Regulations for Synthetic Organic Chemicals (EPA 1985). Because compound-specific information concerning toxicity of the 1,2-dichloroethylenes is not adequate, EPA has chosen to derive longer-term (1-12-year) and lifetime exposure criteria for both the cis- and trans- isomers from data on 1,1-dichloroethylene, a compound with similar structure (a geometric isomer of 1,2-dichloroethylene) and similar noncarcinogenic toxic end points. Derivation of these criteria are documented in detail in the Drinking Water Criteria Document for Dichloroethylenes (EPA 1984). Available information from shorter-term exposures to all three compounds also suggests that the noncarcinogenic toxicity induced by the

1,2-isomers is likely to be no more severe than that of 1,1-dichloroethylene. Accordingly, EPA derived longer-term draft health advisories for both cis- and trans-1,2-dichloroethylene of 1,000 and 3,500 ug/liter for children and adults, respectively, from data on 1,1-dichloroethylene.

EPA also derived an acceptable daily intake (ADI) for lifetime exposure based on the results of a 2-year chronic toxicity/oncogenicity study (Quast et al. 1983) in which rats received 0, 50, 100, or 200 mg/liter 1,1-dichloroethylene in drinking water. For the highest dose group, significant microscopic liver changes were seen in animals of both sexes, and minimal hepatocellular swelling and fatty changes were seen in female rats at all dose levels. At 100 ppm (10 mg/kg mean daily dose in males), a trend toward an increase in focal fatty changes in the liver was observed in males. No exposure-related changes were seen in males at the low dose. An ADI of 0.01 mg/kg/day for a 70-kg person was determined using a lowest-observed-adverse effect level (LOAEL) of 10 mg/kg/day and an uncertainty factor of 1,000, since a no-observed-adverse effect level (NOAEL) was not identified. The corresponding adjusted acceptable daily intake (AADI) for a 70-kg person drinking 2 liters of water per day is 350 ug/liter. EPA proposed an RMCL of 70 ug/liter for both cis- and trans-1,2-dichloroethylene based on the AADI of 350 ug/liter, assuming 20% of the exposure is via drinking water. Based on consideration of currently available data, EPA's proposed recommended guidelines for longer-term and lifetime exposure appear adequate for protection of the health of exposed individuals.

STANDARDS AND CRITERIA

(1)	EPA Classification for Evidence of carcinogenicity	Group D, not classified
(2)	EPA ADI	0.01 mg/kg/day
(3)	Proposed RMCL	70 ug/liter

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TETRACHLOROETHYLENE

DESCRIPTION OF HEALTH EFFECTS

Tetrachloroethylene is readily absorbed through the lungs (IARC 1979) and to some extent from the gastrointestinal tract (EPA 1985a,b). Tetrachloroethylene vapors and liquid can be absorbed through the skin (rate and extent unspecified) (EPA 1985a,b). Only small amounts of tetrachloroethylene (less than 4% of the absorbed dose) are metabolized in humans (IARC 1979). The metabolic pathways of tetrachloroethylene are saturable and may involve an epoxide intermediate (IARC 1979). Metabolic products include trichloroethanol, trichloroacetic acid, and unidentified chlorinated products (IARC 1979). Elimination of tetrachloroethylene has been reported to be primarily via the lungs (IARC 1979).

ACUTE/CHRONIC EFFECTS

Values for the oral LD_{50} of tetrachloroethylene in mice, as reported from three studies, are 6.4-8, 8.85, and 10.8 g/kg bw (IARC 1979). In rats the oral LD_{50} is 13 g/kg bw (IARC 1979). The inhalation LC_{50} in mice and rats with four-hour inhalation exposures has been reported to be 5,200 ppm (IARC 1979) and 4,000 ppm (EPA 1985a,b), respectively.

The principal toxic effects of tetrachloroethylene in humans and animals from both acute and longer-term exposures include central nervous system (CNS) depression and fatty infiltration of the liver and kidney with concomitant changes in serum enzyme activity levels indicative of tissue damage (EPA 1985a,b).

CENTRAL NERVOUS SYSTEM EFFECTS

Individuals exposed to concentrations of tetrachloroethylene ranging from 6,258 to 10,600 mg/m^3 experienced lassitude, mental fogginess, and exhilaration, progressing at the higher dose to signs of inebriation (EPA 1980). Signs of central nervous system depression and cholinergic stimulation were also observed at concentrations of 1,622 ppm of tetrachloroethylene in an animal study with rabbits, monkeys, rats, and guinea pigs (EPA 1980).

LIVER AND KIDNEY EFFECTS

Single oral gavage doses of 2,158 mg/kg tetrachloroethylene to rabbits resulted in an increase in serum lipoprotein levels and serum enzymes (alkaline phosphatase, SGOT, SGPT) which were indicative of liver damage (EPA 1985a,b). Increased total lipid and triglyceride levels were observed in mice exposed to 800 ppm tetrachloroethylene in air for 3 hours (EPA 1985a,b). A dose-related increase in fatty infiltration of the livers of mice was observed following four-hour inhalation exposures to 200 and 3,000 ppm (EPA 1985a,b).

Rats exposed to 1,600 ppm tetrachloroethylene for 7 hours per day, 5 days per week, 18 times over 25 days exhibited CNS depression and hepatic and renal hypertrophy. Rats exposed to 230 ppm and 470 ppm tetrachloroethylene, 8 hours a day, 5 days a week, over a period of 7 months, exhibited congestion and swelling of kidneys and liver, respectively (Carpenter 1973 as cited in EPA 1985a,b). Female Sprague-Dawley rats exposed to tetrachloroethylene in air 5 days a week for 12 months at concentrations of 300 or 600 ppm showed liver atrophy, and the high-dose females developed an increased incidence of fluid-filled cysts in the liver (EPA 1980).

Fatty infiltration in the livers of mice was observed following exposures to 200 ppm, 4 hours per day, 5 days per week for 8 months (EPA 1985a,b). A high incidence of toxic nephropathy was seen in mice and rats exposed orally to 500 mg/kg tetrachloroethylene for 78 weeks (NCI 1977).

In guinea pigs, a dose-dependent increase in liver weight and fatty infiltration of the liver was observed following exposure to 100, 200, or 400 ppm tetrachloroethylene for up to 169 exposures over 236 days (EPA 1985a,b).

Rabbits showed liver enzyme changes and renal function alterations following 200 to 300 ppm exposures, 4 hours per day, 5 days per week for 9 weeks (EPA 1985a,b).

Three of seven men occupationally exposed to tetrachloroethylene at concentrations of 1,890-2,600 mg/m^3 showed evidence of impaired liver function (EPA 1980).

TERATOGENICITY/REPRODUCTIVE EFFECTS

The offspring of female rats and mice exposed to tetrachloroethylene at 2,000 mg/m^3 for 7 hours daily on days 6-15 of gestation showed toxic effects, including a decrease in fetal body weight in mice and a small but significant increase in fetal resorption in rats (EPA 1985a,b). Mice also exhibited teratogenic effects, including subcutaneous edema and delayed ossification of skull bones and sternebrae (EPA 1985a,b).

MUTAGENICITY

The majority of mutagenicity studies, with a variety of test systems, revealed no evidence of mutagenic activity by tetrachloroethylene (EPA 1985a,b). Cerna and Kypenova (1977, abstract only) reported positive results in plate tests with S. typhimurium and in host-mediated assays (EPA 1985a,b).

CARCINOGENICITY

In a National Cancer Institute bioassay (1977), a high incidence of hepatocellular carcinomas was observed in both sexes of B6C3F$_1$ mice administered tetrachloroethylene in corn oil by gavage 5 days per week for 78 weeks. Time weighted average doses were 536 and 1,072 mg/kg bw/day in males and 386 and 772 mg/kg bw/day in females. No conclusion concerning the effects on Osborne-Mendel rats administered 471 to 949 mg/kg by gavage could be made because of high mortality rates and other technical flaws (NCI 1977).

In a recent draft (August (1985), NTP reported the results of inhalation studies concerning carcinogenicity of tetrachloroethylene. There was some evidence of carcinogenicity in F344/N rats (EPA 1985c). Clear evidence of carcinogenicity in B6C3F$_1$ mice of both sexes was observed (EPA 1985c). EPA is planning to reevaluate the carcinogenicity of tetrachloroethylene because of these results (EPA 1985c).

STANDARDS AND CRITERIA

Applying EPA's criteria for evaluating the overall weight of evidence of carcinogenicity to humans, tetrachloroethylene is most appropriately classified in Group B2, meaning it is a probable human carcinogen (EPA 1984).

In its health assessment document for tetrachloroethylene EPA (1985a) reported carcinogenic potencies (q_1*) for exposure to this compound by both ingestion and inhalation. Evaluation of the 1985 NTP data in a draft addendum of the health assessment document supported the quantitative results reported in the 1985 health assessment. The EPA Carcinogen Assessment Group (CAG) derived these values based on the results of the NCI (1977) bioassay for mice cited above. Groups of 50 male and 50 female $B6C3F_1$ mice received various levels of tetrachloroethylene in corn oil by gavage, 5 days per week, for 78 weeks. The time-weighted average doses for this study were 536 or 1,072 mg/kg/day for male mice, and 386 or 772 mg/kg/day for female mice. Control groups of 20 male and 20 female mice were also maintained. All surviving mice were killed at 90 weeks. Highly significant increases in the incidences of hepatocellular carcinomas were observed in treated mice. The incidences for these tumors were 2/20, 32/48, and 27/45 for the control, low-dose, and high-dose male mice, respectively, and 0/20, 19/48, and 19/45 for the control, low-dose, and high-dose female mice, respectively. The dose-response data for female mice were determined to be more reliable, and were therefore used to calculate a carcinogenic potency. Using the linearized multistage model and appropriate scaling factors, a carcinogenic potency of 5.1×10^{-2} $(mg/kg/day)^{-1}$ was derived. After adjusting for the amount of tetrachloroethylene metabolized after exposure to this compound in air, an inhalation potency factor of 1.7×10^{-3} $(mg/kg/day)^{-1}$ was calculated, also based on the hepatocellular carcinoma data for female mice. Based on the oral potency of 5.1×10^{-2} $(mg/kg/day)^{-1}$, the concentration in drinking water corresponding to a 10^{-6} excess lifetime cancer risk of 0.7 ug/liter.

The EPA Office of Drinking Water developed 10-day, longer-term, and lifetime health advisories (HAs) (EPA 1985d) for tetrachloroethylene. The 10-day HA derived for a 10-kg child is 34 mg/liter. The HA is based on the accumulated data on human inhalation exposure to tetrachloroethylene which indicates a LOAEL of 100 ppm for transient CNS depression. The longer-term HAs were based on an inhalation study in which rats of both sexes were exposed to 70, 230, or 470 ppm tetrachloroethylene, 8 hours/day, 5 days/week for 150 days (Carpenter 1937 as cited in EPA 1985d). This study identified a NOAEL of 70 ppm; at 230 ppm renal congestion and swelling were noted. Based on the NOAEL of 70 ppm a longer-term HA was derived for the 10-kg child consuming one liter of water per day and the 70-kg adult consuming 2 liters of water per day. These values are 1.94 mg/liter and 6.8 mg/liter, respectively.

The EPA (1985d) also derived a Drinking Water Equivalent Level (DWEL or life-time HA) for tetrachloroethylene because of its classification as a Group B2 carcinogen. A DWEL is defined as the medium-specific exposure which is interpreted to be protective for non-carcinogenic endpoints of toxicity over a lifetime of exposure. A DWEL of 680 ug/liter was determined for the 70 kg adult ingesting 2 liters of water per day. This value corresponds to an oral reference dose (RfD) of 0.02 mg/kg/day (EPA 1986) and is based on the NOAEL of 70 ppm established in the study by Carpenter (1937) cited above. The estimated excess cancer risks associated with lifetime exposure to drinking water containing tetrachloroethylene at 680 ug/liter is approximately 1×10^{-3}.

Tetrachloroethylene Criteria

(1)	EPA Drinking Water Health Advisories (HA)	
	Ten-Day HA (child)	34 mg/liter
	Longer-term HA	
	Child	1.94 mg/liter
	Adult	6.8 mg/liter
	Lifetime HA (DWEL)	680 ug/liter
(2)	EPA Oral RfD	0.02 mg/kg/day
(3)	EPA Classification for Evidence of Carcinogenicity	Group B2
	CAG Oral carcinogenic potency (q_1*)	5.1×10^{-2} (mg/kg/day)$^{-1}$
	CAG Inhalation carcinogenic potency (q_1*)	1.7×10^{-3} (mg/kg/day)$^{-1}$

	Drinking Water concentration corresponding to a 10^{-6} excess lifetime cancer risk	0.7 ug/liter
(4)	AWQC (concentration associated with a 10^{-6} lifetime cancer risk)	
	Ingestion of water and aquatic organisms	0.8 ug/liter
	Ingestion of water	0.9 ug/liter

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1,1,1-TRICHLOROETHANE

DESCRIPTION OF HEALTH EFFECTS

1,1,1-Trichloroethane (1,1,1-TCA) was retested for carcinogenicity because in a previous study by NCI (1977), early lethality precluded assessment of carcinogenicity. Preliminary results indicate that 1,1,1-TCA increased the incidence of combined hepatocellular carcinomas and adenomas in female mice when administered by gavage (NTP 1984). However, these results have been questioned, and the study is presently being audited. There is evidence that 1,1,1-trichloroethane is mutagenic in Salmonella typhimurium and causes transformation in cultured rat embryo cells (EPA 1980). Overall, these data suggest that the chemical may be carcinogenic. Currently, however, EPA classifies 1,1,1-trichloroethane in weight-of-evidence category D, meaning it is not classified as to its carcinogenicity because of inadequate animal evidence.

Other toxic effects of 1,1,1-TCA are seen only at concentrations well above those likely in an open environment. The most notable toxic effects of 1,1,1-trichloroethane in humans and animals are central nervous system depression, including anesthesia at very high concentrations and impairment of coordination, equilibrium, and judgment at lower concentrations (350 ppm and above); cardiovascular effects, including premature ventricular contractions, decreased blood pressure, and sensitization to epinephrine-induced arrhythmia; and adverse effects on the lungs, liver, and kidneys. Irritation of the skin and mucous membranes resulting from exposure to 1,1,1-trichloroethane has also been reported. The oral LD_{50} value of 1,1,1-trichloroethane in rats is about 11,000 mg/kg (EPA 1980, 1984).

Standards and Criteria

The EPA (1980) based its ambient water quality criterion (AWQC) for 1,1,1-trichloroethane on data on chronic oral toxicity in rats (NCI 1977). Based on these data and using a safety factor of 1,000, EPA estimated an acceptable daily intake for humans of 37.5 mg/day. The AWQC based on this value is 18.4 mg/liter. Excluding consumption of fish from contaminated water from the exposure, the recommended acceptable drinking water concentration is 19 mg/liter. EPA used the same approach in its Health Effects Assessment (HEA) for 1,1,1-trichloroethane (1984), and recommended a chronic allowable intake by ingestion of 0.54 mg/kg/day. Based on data on chronic toxicity in rats exposed to 1,1,1-trichloroethane by inhalation, the HEA recommended a chronic allowable intake for exposure by inhalation of 6.3 mg/kg/day. Based on results of a 90-day continuous inhalation study in guinea pigs, a subchronic allowable intake for inhalation of 11.0 mg/kg/day also was recommended in the HEA. HEAs summarize and evaluate information relevant to a preliminary interim assessment of adverse health effects associated with substances commonly found at Superfund sites. EPA (1985a) developed Health Advisories of 35,000 ug/liter and 125,000 ug/liter for children and adults, respectively, for longer-term exposure to 1,1,1-trichloroethane based on a subchronic oral toxicity study in rats. The guideline for a 10-kg child drinking 1 liter of water per day can be considered a conservative value for protection of the general population and would also probably protect most sensitive members of the population.

EPA (1985a) also developed a lifetime HA of 200 ug/liter for 1,1,1-trichloroethane. The advisory was based on a study by McNutt et al. (1975) that reported significant changes in the centrilobular hepatocytes of mice exposed at 1,000 ppm (5,460 mg/m^3) continuously for 14 weeks. Liver changes reported in mice at 250 ppm (1,365 mg/m^3) were not considered significant. A risk reference dose (RRfD) of 0.35 mg/kg/day was determined by EPA from data presented in this study. An RRfD is an estimate of daily exposure which appears to be without appreciable risk of deleterious non-carcinogenic effects over a lifetime of exposure. Using this value and assuming a relative source contribution from drinking water of 20%, the lifetime HA of 200 ug/liter was derived

Under the Safe Drinking Water Act, EPA recently promulgated a final Recommended Maximum Contaminant Level (RMCL) of 200 ug/liter and proposed a Maximum Contaminant Level (MCL) of 200 ug/liter for 1,1,1-trichloroethane in drinking water (EPA 1985b). RMCLs are non-enforceable health goals that are to be set at levels which would result in no known or anticipated adverse health effects with an adequate margin for safety. MCLs, which are enforceable standards when finalized, are set as close as feasible to RMCLs after consideration of treatment technologies, availability of analytical methods, costs, and other factors.

1,1,1-Trichloroethane Criteria

(1)	EPA Drinking Water Health Advisories (HA)	
	Longer-term HA	
	Child	35 mg/liter
	Adult	125 mg/liter
	Lifetime HA	200 ug/liter
(2)	EPA Oral RRfd	0.35 mg/kg/day
(3)	EPA Classification for Evidence of Carcinogenicity	D
(4)	Final RMCL/Proposed MCL	200 ug/liter

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DESCRIPTION OF HEALTH EFFECTS

ACUTE/CHRONIC EFFECTS

Trichloroethylene is a central nervous system depressant from acute and chronic exposure. High level exposure can result in death due to respiratory and cardiac failure. Trichloroethylene was once used as a general anesthetic, but its use was discontinued due to longer-term CNS effects. The longer-term effects may have been due to impurities introduced by soda lime used to remove carbon dioxide (EPA 1980).

The extent of trichloroethylene absorption after oral ingestion is virtually complete. With air exposure, absorption is proportional to concentration and duration of exposure. Trichloroethylene is eliminated by pulmonary excretion of the unchanged parent compound and by liver metabolism of urinary metabolites (EPA 1985a).

The hepatotoxic potential of trichloroethylene has been evaluated in human and animal studies. Animal studies have revealed transient increased liver weights, but relative liver weights decreased postexposure (Kjellstrand et al. 1983 as cited in EPA 1985a). Observations of liver or renal dysfunction in workers have been infrequent, and factors other than trichloroethylene probably were more causally related to the hepatorenal disturbances noted (EPA 1985a).

Industrial use of trichloroethylene is often associated with dermatological problems including reddening and skin burns on contact, and dermatitis resulting from vapors. These effects are usually the result of contact with concentrated solvent, however, and no effects have been reported from exposure to trichloroethylene in dilute, aqueous solutions (EPA 1985a).

CARCINOGENICITY

Studies investigating the carcinogenic potential of trichloroethylene have been conducted, and two of these studies revealed significant increases in the incidence of liver tumors among both sexes of B6C3F1 mice exposed by gavage (NCI 1976, NTP 1982 as cited in EPA 1985a).

There is disagreement in the scientific community about the relevance of mouse liver tumors as indicators of human cancer risk. Several strains of laboratory mice, including the B6C3F1 hybrid, appear to develop a high and variable proportion of liver tumors with or without exposure to chemicals. Certain scientists believe that the increased incidence of mouse liver tumors should be treated in the same manner as the increased incidence of tumors of other rodent organ sites, while others believe that mouse liver tumors are an experimental artifact which is not relevant to human hazard (EPA 1985b).

STANDARDS AND CRITERIA

EPA's Science Advisory Board examined the toxicology of trichloroethylene and its ranking under the IARC criteria. The majority of the Committee members felt that the compound should be classified in IARC Category 3 (compound cannot be classified as to its carcinogenicity in humans), while one member felt that IARC category 2B (probable human carcinogen) was more appropriate. The committee concluded that a definitive scientific opinion concerning the carcinogenicity of trichloroethylene could not be made at that time because interpretation of the significance of mouse hepatocellular carcinomas is uncertain and the animal evidence is limited (EPA 1985b).

EPA's Risk Assessment Forum classified trichloroethylene in Group B2—Probable Human Carcinogen (sufficient animal evidence of carcinogenicity and inadequate human evidence). The National Academy of Sciences has classified it as an animal carcinogen (EPA 1985b). Expressed in terms of relative potency, trichloroethylene ranks in the lowest quartile among the suspect or known human carcinogens evaluated by EPA's Carcinogen Assessment Group (EPA 1985a).

Because of its classification as a carcinogen, neither a subchronic acceptable intake nor a chronic acceptable intake for trichloroethylene was calculated by EPA in its Health Effects Assessment (HEA) for this compound (EPA 1984a). The Carcinogen Assessment Group derived carcinogenic potencies (q_1*) of 1.1×10^{-2} $(mg/kg/day)^{-1}$ for oral exposure and 4.6×10^{-3} $(mg/kg/day)^{-1}$ for inhalation exposure. These estimates are derived from the mouse liver tumor data in the NCI (1976) and NTP (1982) gavage studies (EPA 1984a).

Under the Safe Drinking Water Act, EPA recently promulgated a final recommended maximum contaminant level (RMCL) of zero and proposed a maximum contaminant level (MCL) of 5 ug/liter for trichloroethylene in drinking water (EPA 1985c). RMCLs are non-enforceable health goals that are set at levels which would result in no known or anticipated adverse health effects with an adequate margin of safety. RMCLs for compounds considered to be probable human carcinogens by EPA in the final rule were all set at zero. MCLs, which are enforceable standards when finalized, are set as close as feasible to RMCLs after consideration of treatment and analytical technologies, costs, and other factors.

The Office of Drinking Water (EPA 1984b) issued a draft lifetime health advisory or drinking water equivalent level (DWEL) for the noncarcinogenic effects of trichloroethylene. A DWEL is the medium-specific exposure which is interpreted to be protective for non-carcinogenic end-points of toxicity over a life-time of exposure. A relative source contribution factor was not included. The advisory of 260 ug/liter was based on a study by Kimmerle and Eben (1973) that reported increased liver weights when rats were administered 55 ppm trichloroethylene for 14 weeks. A risk reference dose (RRfD) of 0.00735 mg/kg/day was determined by EPA from data presented in this study. An RRfD is an estimate of daily exposure which appears to be without appreciable risk of deleterious non-carcinogenic effects over a lifetime of exposure.

Summary of Trichloroethylene Criteria

(1)	EPA Drinking Water Health Advisory (HA) Lifetime HA (DWEL)	260 ug/liter
(2)	EPA Oral RRfD	0.00735 mg/kg/day

(3)	EPA Classification for Evidence of Carcinogenicity	Group B2
	Oral carcinogenic potency (q_1*)	$1.1x10^{-2}$ $(mg/kg/day)^{-1}$
	Inhalation carcinogenic potency (q_1*)	$4.6x10^{-3}$ $(mg/kg/day)^{-1}$
	Drinking water concentration concentration corresponding to a 10^{-6} excess lifetime cancer risk	3.2 ug/liter
(4)	Proposed MCL	5 ug/liter

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