Final
Remedial Action Plan

T H Agriculture & Nutrition, L.L.C.
Eastern Fresno County, California

K/J 844083.75
June 1999

Kennedy/Jenks Consultants

FINAL REMEDIAL ACTION PLAN

T H AGRICULTURE & NUTRITION, L.L.C.

EASTERN FRESNO COUNTY, CALIFORNIA

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LIST OF ACRONYMS

ACRONYMN	TITLE
ADWL	Acceptable Drinking Water Level
AL	Action Level
ARARs	Applicable or Relevant and Appropriate Requirements
APCD	San Joaquin Valley Unified Air Pollution Control District, Fresno Zone
APN	Assessor's Parcel Number
bgs	Below Ground Surface
BHC	Benzene hexachloride (γ-BHC is Lindane)
CCR	California Code of Regulations
CDFA	California Department of Food and Agriculture
CDI	Chronic Daily Intake
CEQA	California Environmental Quality Act
CERCLA	Federal Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CPH	Chlorophenoxy Herbicide
CSF	Cancer Slope Factor
CWA	Clean Water Act
DBCP	Dibromochloropropane
1,2-DCA	1,2-dichloroethane
DDD	Dichlorodiphenyldichloroethane
DDE	p,p'-dichlorodiphenylethane
DDT	Dichlorodiphenyltrichloroethane
DEF	s,s,s-tributylphosphorotrithioate
DHS	Former California Department of Health Services (now DTSC)
DOT	Department of Transportation (Federal)
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control (formerly DHS)
DWSP	THAN's Domestic Well Sampling Program
EDB	Ethylene dibromide
EPA	U.S. Environmental Protection Agency

LIST OF ACRONYMS (cont'd)

ACRONYMN	TITLE
FCHD	Fresno County Health Department
Fed.Reg.	Federal Register
FMFCD	Fresno Metropolitan Flood Control District
FRG	Final Remediation Goal
FS	Feasibility Study
GAC	Granular Activated Carbon
gpm	Gallons Per Minute
H&SC	Health & Safety Code
HI	Hazard Index
HRA	Health Risk Assessment
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
MW	Monitoring Well
NBAR	Non-Binding Preliminary Allocation of Responsibility
NCP	National Contingency Plan
NPL	National Priorities List
OCL	Organochlorine
OSHA	California or Federal Occupational Safety & Health Administration
O&M	Operations and Maintenance
OM&M	Operations, Maintenance & Monitoring
PRG	Preliminary Remedial Goal
PRP	Potentially Responsible Party
QAPP	Quality Assurance Project Plan
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RAOs	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Federal Resource Conservation and Recovery Act (laws affecting the management of hazardous and non-hazardous waste)
RfC	Reference Concentration

LIST OF ACRONYMS (cont'd)

ACRONYMN	TITLE
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board, Central Valley Region
SDWA	Safe Drinking Water Act
SVE	Soil Vapor Extraction
SWRCB	State Water Resources Control Board
TBC	To Be Considered (Criteria)
TCP	1,2,3-Trichloropropane
TDS	Total Dissolved Solids
THAN	T H Agriculture & Nutrition, L.L.C.
TLV	Threshold Limit Value
UCL	Upper Confidence Limit
USGS	U.S. Geologic Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1 INTRODUCTION

1.1 Purpose

This Final Remedial Action Plan (RAP) is prepared for the T H Agriculture & Nutrition, L.L.C. (THAN) site located at 7183 East McKinley Avenue in Eastern Fresno County (the Site). This report was prepared pursuant to California Health and Safety Code §25356.1 and the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 as amended (the Order). The Order was issued by the California Department of Health Services (DHS), now called the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) to THAN and other respondents. The other respondents included Geigy Company, Inc. (now Novartis Crop Protection, Inc.) and Olin Mathieson Chemical Corporation (now Olin Corporation). Novartis Crop Protection Inc. and Olin Corporation have participated in the review of this document and have financially contributed to the investigation and remediation of the Site. This report was also prepared in accordance with DTSC guidance (DTSC 1987b), and other applicable state and federal statutes, regulations, and guidance.

The purpose of the Final RAP is to compile and summarize Site data obtained during the Remedial Investigation (RI) and the Feasibility Study (FS) in order to identify, and subsequently design, plan, and implement a final remedial action for the Site. The Final RAP includes a summary of Site conditions and Site history, as well as the findings of the RI which evaluated impacts to environmental media, primarily soils and groundwater. Also included is a summary of the FS development and evaluation of several remedial action alternatives. Finally, the Final RAP includes the selection and description of the preferred remedial action alternative. The public and other interested parties were provided an opportunity to be involved in the remedial action decision making process for the Site during the RAP approval process.

1.2 Site Identification

The Site consists of a 5-acre parcel located at 7183 East McKinley Avenue in Fresno County, about three miles northeast of Fresno, California as shown on Figure 1-1. The Site is the former location of an agricultural chemical formulation, packaging, and warehousing plant. THAN, and prior owners of the Site, including Novartis Crop Protection, Inc. and Olin Corporation, formulated agricultural chemicals at the Site. The terms "onsite," "nearsite" and "offsite" are defined as follows: Onsite refers to the fenced, 5-acre parcel known as "the Site"; nearsite refers to contiguous properties, including the adjacent 20-acre orchard property owned by THAN; and offsite refers to anywhere else.

1.3 Agency Interaction Overview

THAN has performed its investigative and remedial activities at and around the Site under the direction of several regulatory agencies, including the Fresno County Health Department, California Regional Water Quality Control Board, Central Valley Region (RWQCB), the California DTSC, and Region IX of the United States Environmental Protection Agency (EPA).

A Cleanup and Abatement Order, issued by RWQCB on 3 February 1984 and amended on 21 March 1984 (1984 RWQCB Order), directed THAN and other respondents, among other things, to: (1) identify and excavate landfilled wastes, certain structures, and certain soils containing pesticide residues in certain areas of the Site, and (2) evaluate groundwater conditions resulting from former Site activities.

In early 1984, DTSC began to take a more active role in oversight of Site investigation and remediation activities. On 28 May 1985, DTSC issued a Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 84/85-001 (1985 DTSC Order) to THAN and certain other prior owner/operators of the Site. The 1985 DTSC Order included requirements for THAN and other respondents to implement a domestic well sampling program, provide alternate drinking water to those households with domestic water wells where samples of groundwater contained chemicals known to be associated with the Site in excess of certain regulatory limits, and prepare a remedial investigation/feasibility study (RI/FS) report. On 17 July 1985, RWQCB issued a new Cleanup and Abatement Order (1985 RWQCB Order) to THAN and other respondents containing requirements consistent with those set forth in the DTSC Order.

On 23 January 1987, DTSC issued a new Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 (1987 DTSC Order) to THAN and other respondents, which superseded all previous DTSC orders. The 1987 DTSC Order included requirements for THAN and other respondents to: (1) revise the existing domestic well sampling program, (2) develop and submit a RI/FS work plan pursuant to EPA guidelines, and (3) implement a phased groundwater investigation program to characterize offsite migration of chemicals in groundwater from the Site. DTSC issued amendments to the 1987 DTSC Order on 8 May 1987 and 5 January 1991 to incorporate technical changes relating to the groundwater investigation and to modify domestic well sampling programs. As discussed in Section 1.1, the 1987 DTSC Order, as amended, is hereinafter referred to as the Order.

On 29 June 1988, RWQCB rescinded its 1985 Order based on its determination that the orders issued by DTSC satisfied RWQCB's concerns regarding the protection of water quality and that THAN was completing the requirements of DTSC's orders within the specified time-frames.

In accordance with Section V.D.9 of the 1987 DTSC Order, THAN submitted a Phase I Workplan for groundwater investigation to the DTSC on 9 March 1987. In accordance with Section V.D.1 of the 1987 DTSC Order, THAN submitted a draft RI/FS Workplan for the Site on 7 May 1987. The Phase I Workplan for groundwater investigation was approved by the DTSC in Amendments to the 1987 DTSC Order issued on 8 May 1987. The Phase I groundwater investigation was performed during the Summer of 1987, and a report of the investigation, dated 18 November 1987, was submitted to the DTSC (JHK 1987). THAN submitted a revised RI/FS Workplan to DTSC on 18 March 1988. The Phase II/III groundwater investigation was performed in the spring of 1990, and the summary report was submitted to DTSC in January 1991.

As specified in Section V.E.3 of the Order, the Remedial Investigation Summary (RI) report and Feasibility Study (FS) report were prepared in accordance with the National Contingency Plan (40 CFR Part 300 *et seq*) and EPA guidance documents for conducting an RI/FS (EPA 1989a). DTSC notified THAN on 9 January 1992 that sufficient data existed to prepare the draft RI report. The draft RI report and the draft Multipathway Health

Risk Assessment (HRA) report were submitted on 31 March 1992 and the draft FS report was submitted on 5 June 1992. The RI, HRA, and FS draft reports were prepared in accordance with the Order and RI/FS Workplan. THAN received comments from DTSC, the RWQCB, and the EPA on the draft RI and FS reports on 19 December 1992. Comments from DTSC and the EPA on the draft HRA report were received by THAN on 18 August 1992. Revised draft RI and FS documents were submitted on 31 January 1993. The HRA response to comments was submitted on 2 February 1993. DTSC conditionally approved the draft RI report on 27 April 1993 and the draft FS report on 23 June 1993. The final RI report was submitted on 28 May 1993. The final FS report was submitted on 30 June 1993. The final draft HRA report was submitted on 29 July 1993. In its letter of 6 August 1993, DTSC confirmed final approval of the final RI/FS reports. The final HRA report was submitted to the agencies on 31 January 1996.

In its letter of 6 August 1993, DTSC also notified THAN to prepare the draft RAP/Proposed Plan in accordance with Section V.H.1 of the Order. The preliminary draft RAP was submitted to the agencies on 22 March 1994. DTSC provided comments on the draft RAP on 7 October 1994. THAN submitted responses to DTSC comments on 14 November 1994. On 31 March 1995, DTSC transmitted to THAN November 1994 memoranda providing comments on the draft RAP. In March 1997, DTSC provided additional comments on the draft RAP, provided THAN with a list of Proposed Final Remediation Goals (PFRGs) and provided THAN with an opportunity to prepare a Technical and Economic Feasibility Evaluation (TEFE). On 30 April 1997, THAN transmitted a TEFE to DTSC. DTSC provided comments on the TEFE and revised the PFRGs on 3 October 1997. The revised TEFE is included as Appendix B in this report. In a letter dated 10 March 1998 to THAN, DTSC requested finalization of the draft RAP. The final Draft RAP was submitted on 3 May 1999. Following the public meeting and the public comment period, DTSC approved the Final RAP on 30 June 1999.

Other reports submitted to DTSC since completion of the RI report include: a 23 February 1994 report on the results of shallow soil sampling conducted in December 1993 (Appendix A), a 16 September 1996 report documenting the operations of the Soil Vapor Extraction (SVE) systems and recommending their closure (K/J 1996), and a 5 November 1997 report documenting the removal action for drainage system H (Chaney 1997). Numerous tables and figures are included in the Final RAP from the RI report, the FS report, and the HRA. Many of these tables and figures from previously submitted documents have not been updated for the Final RAP on the basis of more recent reports.

1.4 Scope of the RAP

The Final RAP follows the format guidelines provided by DTSC (DTSC 1987b). Because the Site is listed on the federal National Priorities List (NPL), this Final RAP is also intended to satisfy the elements for a Proposed Plan as set forth in the National Contingency Plan, 40 Code of Federal Regulations Section 300.430 (f)(2) and EPA guidance (EPA 1989a). Table 1-1 identifies the various elements of the Proposed Plan and where those elements are addressed in the Final RAP.

This section describes the scope of the Final RAP. Section 2 of the Final RAP consists of an executive summary of the Site history, the investigative history, description of the preferred remedial action alternative, and the preliminary allocation of financial responsibility. Section 3 is a detailed description of Site characteristics, including the Site history and physical attributes. Section 4 is a summary of the remedial investigation activities. The summary of the RI includes the results of field activities performed to characterize the Site, and available information regarding conditions in soil, surface water, groundwater and air on and near the Site. Tables providing information included in the RI report are presented in Section 4. This section also describes chemical fate and transport of chemicals known to be associated with the Site in environmental media. Section 5 is a summary of the potential risks to human health and the environment posed by conditions at the Site. Section 6 presents an evaluation of the potential effects of chemicals at the Site on present, future, and probable beneficial uses of resources. Section 7 summarizes the feasibility study process, and discusses the remedial action alternatives that were considered, as well as the preferred remedial action alternative.

Section 8 provides the proposed preliminary schedule for implementation of the proposed preferred remedial action alternative. Section 9 presents DTSC's non-binding preliminary allocation of financial responsibility for the Site. Section 10 summarizes the ongoing operation and maintenance requirements associated with the preferred remedial action alternative. Section 11 lists references used in developing the Final RAP.

Five appendices are included in the RAP. Appendix A presents the analytical results of shallow soil samples collected along East McKinley Avenue immediately north of the Site. Appendix B presents the TEFE. Appendix C presents DTSC's Statement of Reasons and their non-binding allocation of responsibility. Appendix D is the Administrative Record List. Appendix E provides DTSC's responses to public comments on the draft RAP, and the transcript from the public meeting.

2 EXECUTIVE SUMMARY

2.1 Consistency with State and Federal Requirements

This Final Remedial Action Plan (RAP) is prepared for the T H Agriculture & Nutrition, L.L.C. (THAN) site located at 7183 East McKinley Avenue in Eastern Fresno County (the Site). This report was prepared pursuant to California Health and Safety Code §25356.1 and the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 as amended (the Order) issued by the California Department of Health Services (DHS), now called the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) to THAN and other respondents. The other respondents included Geigy Company, Inc. (now Novartis Crop Protection, Inc.) and Olin Mathieson Chemical Corporation (now Olin Corporation). Novartis Crop Protection Inc. and Olin Corporation have participated in the review of this document and have financially contributed to the investigation and remediation of the Site. The report is prepared in accordance with DTSC guidance (DTSC 1987b).

In addition, the Final RAP is consistent with the Hazardous Substance Account Act (Chapter 6.8 of the California Health and Safety Code), the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the federal Superfund Amendments and Reauthorization Act of 1986 (SARA), the National Contingency Plan, 40 Code of Federal Regulations Section 300.430, and United States Environmental Protection Agency Guidance.

2.2 Summary of Site Information

2.2.1 Site History and Interim Remedial Measures

The Site consists of a 5-acre parcel located at 7183 East McKinley Avenue in Fresno County, about three miles northeast of Fresno, California. THAN and prior owners of the Site, including the Geigy Company, Inc. (now Novartis Crop Protection, Inc.) and Olin Mathieson Chemical Corporation (now Olin Corporation), formulated agricultural chemicals at the Site.

Little is known about the physical plant or the operations onsite prior to 1950. Between 1950 and 1981, the Site was utilized by several owners for the formulation, packaging, and warehousing of agricultural chemicals (*i.e.*, pesticides). Chemicals handled at the Site included agricultural chemicals, various raw materials used in agricultural chemical formulation, quality assurance laboratory chemicals, and solvents. In addition, certain chemicals were consigned or purchased and warehoused at the Site solely for resale. THAN discontinued operations at the Site in 1981.

Interim remedial activities completed for the Site have included soil excavation, structures demolition, soil vapor extraction, and the provision of alternate drinking water supplies to nearby residents. More than 24,000 cubic yards of chemically-affected soil were excavated, transported, and disposed of offsite during excavations conducted in 1984 (approximately 14,000 cubic yards) and 1989 (approximately 10,000 cubic yards). In conjunction with the soil excavation in 1984, a concrete sump, tanks, a concrete pad, and a metal frame shed were dismantled and disposed of offsite at a permitted landfill facility. In 1989, five structures, a 10,000-gallon storage tank, and a concrete slab were demolished and approximately 5,100 tons of chemically-affected building debris and the storage tank were disposed of offsite at a permitted landfill facility. In 1992, an underground storage tank containing boiler fuel oil was excavated and removed from the Site. Two soil vapor extraction systems were installed to remove volatile and semi-volatile organic compounds from unsaturated zone soils at two locations of the Site. The systems operated successfully, and were taken out of service in 1993 because the remedial action objectives had been achieved.

Since 1985, THAN has provided bottled water or replacement carbon filters as needed to residents downgradient (southwest) of the Site whose domestic wells yielded samples containing concentrations of chemicals known to be associated with the Site. An extension of the City of Fresno water distribution system funded by THAN was designed and constructed from 1988 to 1990. Every household included in THAN's domestic well sampling program has been offered a connection to the Fresno domestic water supply system at THAN's expense.

2.2.2 Investigation Results

Since the Spring of 1981, THAN has performed extensive remedial investigation (RI) activities at the Site to evaluate the extent to which chemicals handled in past operations may have affected soil, groundwater, and air at or near the Site. The results of these investigations and response actions have been documented in the Remedial Investigation report (K/J 1993). More than 1,400 soil samples and 1,800 groundwater samples have been collected and chemically analyzed. Soil samples were analyzed for up to 215 organic chemicals including organophosphate, organochlorine and other pesticides (including DBCP and ethylene dibromide [EDB]), 13 priority pollutant metals, and other selected inorganic chemicals. A total of 87 chemicals were detected in the soil samples collected. Groundwater samples collected from monitoring, domestic, and irrigation wells at or near the Site were analyzed for up to 196 chemicals. A total of 80 organic and inorganic chemicals were detected in the collected groundwater samples.

Based on these results, onsite soil and groundwater at or near the Site have been identified as media of potential public health or environmental concern.

2.2.2.1 Soil

Several onsite chemical source areas were identified including the former landfill area, the former railroad loading dock, the former south loading dock, certain former subsurface drainage systems, and the former solvent storage area. Based upon frequency of detection and published health-based criteria, the chemicals of concern remaining in onsite soils include: organochlorine pesticides (DDT, DDD, DDE, Dieldrin, Lindane, and Toxaphene), volatile organic compounds (VOCs) (chloroform, xylenes, and ethylbenzene), and the nematocide DBCP. The greatest number of chemicals remaining were detected in soil samples collected from depths of 1 to 12 feet.

2.2.2.2 Groundwater

Based on their frequency of detection and published health-based criteria, the chemicals of concern detected in samples of onsite and offsite groundwater include 1,2-DCA, carbon tetrachloride, chloroform, Dieldrin, DBCP and 1,2,3-trichloropropane (1,2,3-TCP). Lindane, alpha-BHC, and delta-BHC have historically been detected. Historically, the highest chemical concentrations in groundwater have been detected in samples from the A zone. Due to the significant drop in water levels since 1987, the A zone is currently not completely saturated. Because of varying water levels in the A zone, only a few monitoring wells have sufficient water to be sampled regularly.

In the Fresno area, DBCP has been detected at elevated concentrations in groundwater as a result of its regional application to crops. DBCP was present at levels higher than those detected regionally in some groundwater samples collected prior to 1987 from shallow, A-zone monitoring wells onsite. Maximum concentrations of DBCP detected in groundwater samples from onsite B-zone and all offsite monitoring wells are well within the range and not significantly different from the range of regional DBCP concentrations reported in the literature and measured during the RI.

A recent study of regional groundwater has provided indications that 1,2,3-TCP is also a regional pollutant similar to DBCP. Additional sampling conducted in accordance with the current groundwater monitoring program, or a revised monitoring program, will generate additional information regarding the nature and extent of 1,2,3-TCP in groundwater. This information will be evaluated on an on-going basis and appropriate actions will be taken if it is determined that the Site is a significant source of 1,2,3-TCP in groundwater.

2.2.3 Summary of Risk Assessment

A multipathway health risk assessment (HRA) was performed to evaluate the potential public health and ecological risks, if any, posed by chemicals of concern in groundwater and onsite soils. Given that significant remedial activities have already been completed by THAN at the site, the HRA considered potential risks to public health and the environment assuming that no further action is taken. The major steps of the HRA included selection of chemicals of concern, evaluation of potential exposure pathways, and risk characterization. The conclusion of the HRA was that under certain current and future exposure scenarios, the calculated risk from exposure to soil and groundwater was outside of the risk range generally considered acceptable.

Assuming a normal distribution of chemicals (as recommended by U.S. EPA and the State of California), the lifetime incremental cancer risks calculated in the HRA for potential exposure to chemicals associated with the Site in soils and groundwater sometimes exceed the 10^{-4} to 10^{-6} range considered acceptable under the NCP. Under current exposure scenarios, the highest calculated risk for exposure to soil was 2×10^{-3} for onsite workers, and under future scenarios, the highest calculated risk was 4×10^{-3} for a hypothetical onsite adult resident. No adverse noncancer health effects are expected for soil exposure under the current and future exposure scenarios for offsite populations, as indicated by calculated hazard index (HI) values less than 1. Under current and future land-use scenarios, the HI values calculated for all onsite populations exceeded 1. The chemicals contributing to the HI values above 1 were DDT (and its degradation products), Dieldrin, and arsenic.

For use of groundwater as drinking water, bathing water, or swimming pool water, the highest calculated risks were for drinking water use. Under current land-use scenarios, the maximum calculated risks ranged from 2×10^{-5} to 2×10^{-4} for an offsite resident child and adult, respectively. Under the future land-use scenarios, the maximum calculated risks were 3×10^{-5} for an offsite resident child and 1×10^{-3} for an onsite resident adult. DBCP accounted for over 50 percent of the calculated risk, and Dieldrin accounted for over 10 percent. The maximum calculated HI values for groundwater use were 1 for current exposure scenarios, and greater than 1 for various future land-use scenarios.

Information developed in the HRA was one of the elements used in developing Final Remediation Goals (FRGs) for groundwater and onsite soils.

2.3 Remedial Action Alternatives Evaluated

The HRA report, together with applicable or relevant and appropriate requirements (ARARs), were utilized in the Feasibility Study (FS) to develop Remedial Action Objectives (RAOs). The FS identified and screened prospective remedial technologies, and then assembled appropriate technologies into comprehensive remedial action alternatives. Detailed and comparative evaluations of the remedial action alternatives were conducted using evaluation criteria established by EPA. Eleven alternatives, including the no further action alternative were evaluated in the FS. A twelfth alternative was developed with the concurrence of the DTSC, following the results of a Technical and Economic Feasibility Evaluation.

2.3.1 Preferred Remedial Action Alternative

Alternative 12 was selected as the preferred remedial action alternative for the Site based on key performance objectives identified by DTSC in a letter to THAN dated 6 August 1993. These performance objectives are based on , and in some instances are refinements of, the remedial action objectives identified and used in the FS. The components of the preferred remedial action alternative are presented below:

- Soil Component
  - Soil vapor extraction (completed)
  - Design and construction of asphaltic and composite cap to minimize contact with residual chemicals in soil, and minimize movement of chemicals from soil to other media (groundwater and air)
  - Land use restrictions (*e.g.*, no residential use or use by sensitive populations)
  - Access controls (maintain existing fencing and signs)
- Groundwater Component - Onsite/Nearsite
  - Long-term groundwater monitoring of monitoring wells and domestic wells, as necessary
  - Monitored natural attenuation of low chemical concentrations in groundwater
  - Contingency plan for action (*e.g.*, groundwater extraction and/or treatment, if necessary) if groundwater monitoring results for the A-zone (if groundwater is

encountered) or the B-zone show that chemical levels are confirmed to exceed FRGs

- Groundwater Component - Offsite
  - Groundwater containment at the compliance point if chemicals strictly known to be associated with the Site are confirmed at concentrations exceeding FRGs
  - Groundwater containment (at the compliance point) if warranted based on an evaluation of concentrations and trends of chemicals strictly known to be associated with the Site
  - Long-term groundwater monitoring of monitoring wells and domestic wells, as necessary
  - Monitored natural attenuation of low chemical concentrations in groundwater
- Further Engineering/Administrative/Institutional Controls
  - Continued provision (and expansion, as appropriate) of alternate water supply by connections to public water supply system, point-of-use treatment, or bottled water
  - Financial assurances to ensure long-term maintenance and operation of remedial actions
  - A review within five years and every five years thereafter to confirm that the remedy remains effective in protecting human health and the environment

2.3.1.1 Soil Component

The preferred alternative includes the design, construction, and maintenance of an asphaltic and composite cap to cover the 5-acre Site. The cap will include existing asphalt-paved areas. The remaining areas to be capped will be covered with a composite cap consisting of one or more of the following: clay, soil, synthetic materials, gravel, or vegetation. The cap will be constructed to further minimize, if not eliminate, the migration of chemicals from onsite soils to other media, such as groundwater and air. The cap will be designed to reduce exposure to those areas containing chemically-affected soils which produce an excess lifetime incremental cancer risk of greater than 10^{-6}, or a hazard index of greater than 1 for non-carcinogens, based on an industrial exposure scenario.

The alternative will also include appropriate land use restrictions and access controls (maintaining existing fencing and signs) to prevent future residential use of the Site and to maintain the integrity of the cap. Appropriate financial assurance will be provided by THAN to assure design, construction, and long-term maintenance of the soil component of the final remedy.

2.3.1.2 Groundwater Component

Groundwater monitoring has been performed since the early investigations of the Site, and long-term groundwater monitoring will continue to be an important feature of the groundwater component of the remedy. If the A-zone resaturates, monitoring of the A-zone will also be included in the monitoring program.

The TEFE report (Appendix B) documented the time and expense required to accelerate the attainment of FRGs in groundwater. In addition, the beneficial use of groundwater will not be altered following remediation of chemicals associated with the Site because of the regional presence of DBCP (and in some areas, nitrate and arsenic) in excess of drinking water standards. Also, 1,2,3-TCP has been detected in regional groundwater samples and may be regulated in the future. Finally, active groundwater remediation results in only minor reductions in the time required for remediation compared with natural groundwater flow and natural attenuation of chemical concentrations. The negligible health benefits, lack of change in beneficial use, and the time required for remediation do not justify the costs of active remediation. Nevertheless, containment of groundwater is a component of the remedy if warranted by groundwater conditions (as discussed below). Monitored natural attenuation is also a component of the remedial action alternative for groundwater.

Appropriate financial assurance will be provided by THAN to assure design, construction, and long-term maintenance of the groundwater component of the final remedy.

Some components of the alternative will differ between onsite/nearsite groundwater and offsite groundwater. The particular aspects of the remedy for onsite/nearsite and offsite groundwater are discussed separately below.

- Onsite/Nearsite Groundwater

  Existing A-zone monitoring wells onsite and nearsite will be monitored on a regular basis for the presence of groundwater. If groundwater is encountered, water samples will be collected and analyzed as part of the groundwater monitoring program. If the groundwater monitoring results for either the A-zone (if groundwater is encountered) or the B-zone indicate that concentrations of chemicals known to be associated with the Site in onsite/nearsite groundwater samples exceed chemical-specific FRGs for those chemicals, then a special confirmation sampling round will be conducted during the quarter following the initial detection of elevated chemical levels. If the special quarterly sampling event confirms the presence of elevated chemical levels, then a contingency plan will be developed and submitted to the DTSC for approval.

  The contingency plan will be implemented if elevated concentrations (exceeding the FRG) are found in the next semi-annual sampling event, making three consecutive sampling events where concentrations exceeded the FRG. With the special confirmation quarterly sampling event, the initial and two confirmation sampling results will be available within approximately six months.

  DBCP is a regional pollutant in addition to being a chemical associated with the Site. In either the A-zone (if resaturated) or the B-zone, if DBCP is detected and the concentrations are found to be elevated above background, a FRG for DBCP will be established by DTSC based on an evaluation of background groundwater quality conditions. Based on the presence of 1,2,3-TCP in groundwater from areas clearly unaffected by Site activities, the initial indications are that 1,2,3-TCP is similar to DBCP in being a regional groundwater pollutant. If the regional presence of 1,2,3-TCP in groundwater is confirmed, 1,2,3-TCP will be evaluated in the same manner as DBCP.

- Offsite Groundwater

  Selected offsite monitoring wells and domestic wells will continue to be monitored for the presence of chemicals known to be associated with the Site. Data obtained from the groundwater monitoring program will be used to evaluate the effectiveness of the remedy in reducing chemicals known to be associated with the Site in excess of chemical-specific FRGs.

  The compliance point will be in the vicinity of the monitoring well MW-184 cluster. Containment of groundwater (consisting of groundwater extraction followed by infiltration/injection) will be implemented if chemicals strictly known to be associated with the Site are confirmed at concentrations exceeding FRGs. Groundwater will also be contained in the vicinity of the monitoring well MW-184 cluster if warranted based on an evaluation at other wells of concentrations and trends of chemicals strictly known to be associated with the Site. Consideration will be given to the concentration of chemicals, and whether concentrations appear to be increasing based on a trend analysis. If containment is warranted, it will consist of groundwater extraction followed by infiltration/injection.

  In addition to the routine groundwater monitoring, additional parameters will be analyzed to evaluate the effectiveness of monitored natural attenuation. This information will be used to determine the effectiveness of monitored natural attenuation if concentrations in groundwater remain low.

2.3.1.3 Further Engineering/Administrative/Institutional Controls

THAN identified a small number of developed (non-agricultural) parcels in the downgradient vicinity of the Site that may not be currently served by a regulated, multi-connection water purveyor. DTSC has expressed concern that residents in these areas may have their water supply affected by potential migration of Site-related chemicals, and that these residents should be afforded the same level of protection as other area residents. THAN agrees to provide water supply connections to these residents in the downgradient vicinity of the Site, as appropriate. This action meets the goal of protecting human health, even if the risk is hypothetical at this time.

Also, a wellhead protection program will be evaluated for implementation should chemicals known to be associated with the Site be detected above FRGs in municipal supply well PS-102.

In compliance with the NCP, within five years after the initiation of the remedial action, a review will be made of the remedy to confirm that the remedy remains effective in protecting human health and the environment. If the review finds that the remedy is not effective, then the review will include recommendations to ensure that the remedy becomes effective, identify milestones toward achieving protectiveness, and provide a schedule for THAN to accomplish the necessary tasks.

2.3.2 Remedial Alternatives Not Selected

This section describes those alternatives that were considered during the FS and rejected.

2.3.2.1 Alternative 1: No Further Action

This alternative involves no further action beyond those remedial measures that have previously been implemented or completed at the Site, and the existing extension of the City Water System. Under this alternative, any ongoing remedial measures such as groundwater monitoring would be discontinued.

2.3.2.2 Alternative 2: Limited Action

This alternative continues the existing institutional controls (fencing of the Site and provision of alternate water supplies), access restrictions to the Site and monitoring of groundwater. This alternative also included a one-year air monitoring program and evaluation of the effectiveness of the existing soil vapor extraction (SVE) systems. However, the SVE systems are no longer operating because the remedial objectives of the SVE systems were achieved. The SVE systems remain in place while THAN awaits approval from DTSC on permanent closure of the SVE systems.

2.3.2.3 Alternative 3: Limited Action and Institutional Controls

In addition to the measures provided under Alternative 2, this alternative would include deed restrictions on the Site, Fresno County regional groundwater use restrictions, and a wellhead treatment protection program.

2.3.2.4 Alternative 4: Soil Capping

This alternative includes the installation of an asphaltic and composite cap in conjunction with drainage controls. Existing asphalt-covered areas at the Site would be reconditioned and maintained. The remainder of the affected areas would be covered with a composite cap consisting of one or more layers of compacted clay, soil, synthetic materials, gravel, and vegetation. This alternative would also include a deed restriction and other elements of Alternative 3.

2.3.2.5 Alternative 5: *In situ* Soil Treatment

Under this alternative, onsite shallow chemically-affected soils (1-12 feet) would be stabilized or solidified in place and covered with topsoil and vegetative cover. This alternative would also include the deed restriction, groundwater use restrictions, wellhead protection program, alternate water supply, and groundwater monitoring.

2.3.2.6 Alternative 6: *Ex situ* Soil Treatment

This alternative would involve excavation of onsite chemically-affected soils, onsite thermal desorption, and replacement of the soils. Dust control measures and emission controls would be utilized during soil excavation and treatment. The treated soils would be placed in the excavation and covered with topsoil and vegetative cover. This alternative would include groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

2.3.2.7 Alternative 7: Soil Capping and Contingent Onsite and Nearsite Groundwater Extraction

In addition to the measures associated with Alternative 4 (Soil Capping), this alternative includes contingent onsite and nearsite groundwater extraction and treatment followed by discharge or reuse of the treated groundwater. This alternative would also include deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

2.3.2.8 Alternative 8: Soil Capping and Offsite Groundwater Extraction

In addition to the measures associated with Alternative 4 (Soil Capping), this alternative would include: 1) the offsite extraction of groundwater containing chemicals known to be associated with the Site at concentrations in excess of FRGs, 2) treatment of the extracted groundwater, and 3) discharge or reuse of the extracted groundwater. This alternative would also include deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

2.3.2.9 Alternative 9: Soil Capping and Contingent Onsite, Nearsite and Offsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 4 (Soil Capping), contingent onsite and nearsite groundwater extraction/treatment/discharge (an element of Alternative 7), and offsite groundwater extraction/treatment/discharge (an element of Alternative 8). This alternative would also include deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

2.3.2.10 Alternative 10: *In situ* Soil Treatment and Offsite Groundwater Extraction

This alternative includes the measures presented for Alternative 5 (*in situ* Soil Treatment), and the offsite groundwater extraction/treatment/discharge measures presented for Alternative 8. This alternative would also include deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

2.3.2.11 Alternative 11: *Ex situ* Soil Treatment and Offsite Groundwater Extraction

This alternative includes the measures presented for Alternative 6 (*ex situ* Soil Treatment), and the offsite groundwater extraction/treatment/discharge measures presented for Alternative 8. This alternative would also include groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring.

3 DETAILED DESCRIPTION OF SITE CHARACTERISTICS

3.1 Site History

3.1.1 Site Location

The Site consists of a 5-acre parcel located at 7183 East McKinley Avenue in Fresno County, about three miles northeast of Fresno, California. The location of the Site is shown on a 7.5 minute series USGS topographic map, revised 1981 (Figure 1-1). In addition to the Site, THAN currently owns an adjacent 20-acre orchard parcel that borders on the south, east, and west sides of the Site. The Site is located in Section 35, Township 13 South, Range 21 East of the Mount Diablo Base and Meridian, Fresno County, California. The Site and the surrounding parcel are located by the Fresno County Assessor in Book 310, page 6, Parcels 4 and 5, which correspond to Assessor's Parcel Numbers (APN) 310-06-04 (the Site) and 310-06-05 (the surrounding parcel). Figure 3-1 presents the assessor's parcel map for the Site.

The Site is the former location of an agricultural chemical formulation, packaging, and warehousing plant. THAN, and prior owners of the Site, including the Geigy Company, Inc. (now Novartis Crop Protection, Inc.) and Olin Mathieson Chemical Corporation (now Olin Corporation), formulated agricultural chemicals at the Site. Properties surrounding THAN's 25 acres of land consist of farms, orchards, and low-density residential developments.

3.1.2 Nature of Business

Little is known about the physical plant or the operations onsite prior to 1950. The Site was initially leased from Anthony Joseph by the Geigy Company, Inc. in December 1950 and then purchased in 1951. Agricultural chemical formulation activities at the Site are not known to predate the Geigy Company, Inc. operations. Between 1950 and 1981 the Site was utilized by several owners for the formulation, packaging, and warehousing of a variety of agricultural chemicals.

3.1.3 Length of Operation

Between 1950 and 1981, the Site was owned and operated by several companies. From about December 1950 until December 1955, the Site was owned and/or operated by Geigy Company, Inc. Geigy Chemical Corporation, Ciba-Geigy Corporation, and Novartis Crop Protection, Inc. are successor companies to Geigy Company, Inc. From 1955 until 1959, the Site was owned and operated by Olin Corporation, a Virginia corporation (Olin). Olin was formerly known as Olin Mathieson Chemical Corporation. From 1959 until present, the Site has been owned or operated by T H Agriculture & Nutrition Company, Inc., (now T H Agriculture & Nutrition, L.L.C.) a Delaware corporation (THAN) and related companies. THAN discontinued operations at the Site in 1981.

3.1.4 Types of Chemicals at the Site

Chemicals handled at the Site by the Site's owners/operators included agricultural chemicals (*i.e.*, pesticides), various raw materials used in agricultural chemical formulation, quality assurance laboratory chemicals, and solvents. In addition, certain chemicals were consigned or purchased and warehoused at the Site solely for resale.

An inventory of the chemical substances known to have been handled by THAN at the Site was presented in the RI report (K/J 1993, Appendix C). Some or all of the chemicals handled by THAN may have been handled at the Site by the other owners/operators of the Site. A list of trade names for materials and products handled at the Site was developed based on a review of THAN's available records. The chemical composition of the trade name materials and products, particularly for the active pesticide ingredients, was determined based upon a literature review and interviews with former plant personnel. The list of chemicals incorporates generic and chemical names to describe trade name chemicals.

Pesticide formulations generally contain an active ingredient and various carriers, such as solvents, oils, surfactants, and inert ingredients such as clays. The active ingredient is the pesticide itself, such as dichlorodiphenyltrichloroethane (DDT). The term "pesticide" includes those chemicals used as herbicides, fungicides, rodenticides, defoliants, and insecticides. Pesticides handled at the Site and detected in soil and/or groundwater included organochlorine pesticides, (*e.g.*, DDT, DDE, DDD, Toxaphene, Chlordane, Benzene Hexachloride isomers [BHC], and Dieldrin); organophosphates (*e.g.*, Diphenamid, Malathion, Trifluralin, Guthion); chlorophenoxy herbicides and miscellaneous pesticides.

Solvents were used in product formulation and for laboratory purposes. Other chemicals included non-active ingredient chemicals used in pesticide formulation such as surfactants; pigments or dyes; diluents; chemicals sold for other agricultural needs such as nutrients, fertilizer ingredients, and chelating agents; and chemicals used at the Site to maintain operations, such as cleaning agents and laboratory chemicals which were not solvents (K/J 1993).

3.1.5 Waste Handling Activities and Potential Release of Chemicals

In addition to the agricultural chemicals handled, formulated, packaged, and warehoused at the Site, various wastes produced during operation of the facility were historically handled onsite. Prior to 1965, empty agricultural chemical containers, clean-out clays and other plant wastes were disposed in an onsite landfill. Both the areal and vertical extent of the landfill have been investigated. Chemically-affected landfill soils and materials were excavated and disposed of offsite at a permitted landfill facility as part of various response actions conducted at the Site in 1984.

Other onsite waste-handling activities included temporary storage of wastewater in a concrete sump and tank prior to offsite disposal, and discharge of wastewater to several onsite drainage systems consisting of dry wells, cisterns, septic tanks, and leach lines. These drainage systems have been investigated and are described in the RI report (K/J 1993). With the exception of drainage system F, chemically-affected soils, piping, and other structures from the known drainage systems were excavated and disposed of offsite at a permitted landfill facility as part of various response actions conducted at the Site between 1984 and 1989 (see Section 3.1.8). Drainage system F which is located on the west side of the Site, continues to service the restrooms located in the Site office. A Site map, Figure 3-2, shows the location of existing and demolished structures, the location of the former drainage systems and other features, and the location of excavated areas.

An additional drainage system was identified at the Site in 1994 (drainage system H). Elevated concentrations of agricultural chemicals were detected in soil and sediment samples collected within and underlying the portion of drainage system H investigated by Boring DLH-7. Drainage system H, and soil and sediments impacted within and below drainage system H were removed from the Site during the week of 4 May to 10 May 1997. The removal action is described in the 4 November 1997 Removal Action Report by Chaney, Walton and McCall (Chaney 1997). Drainage system H was located south of drainage system G and north of the former tool shed.

In addition to waste handling activities, other chemicals may have reached soil during railroad and truck loading operations, and from possible leaks or spills during the loading, storage, and transfer of chemicals used onsite.

3.1.6 Site Investigations

Since the Spring of 1981, extensive RI activities have been performed by THAN under the direction of the Fresno County Health Department, the RWQCB, DTSC, and Region IX of EPA. THAN has conducted investigations to characterize the soil and the groundwater underlying the Site and vicinity to provide information for conducting remedial activities. THAN also has performed various response actions and interim response actions at the Site, including the demolition of several Site structures that were affected by chemicals associated with past operations and the excavation of more than 24,000 cubic yards of chemically-affected soil. These activities are summarized in the RI report (K/J 1993). THAN's various RI and response actions are documented in the Information Repository established by THAN at the Fresno County Public Library, Sunnyside Branch. A timeline of RI related activities is presented in Table 3-1. The chronological discussion below is intended as a brief overview.

In 1981, THAN began investigatory activities with a soil and groundwater sampling program. Seventeen soil borings were drilled and sampled, primarily in the southeast quadrant of the Site, in the area of the former landfill. Six shallow onsite monitoring wells were installed, with five located around the Site perimeter and one centrally located. The initial sampling included the new monitoring wells, three existing onsite wells and four offsite domestic wells. To provide additional information, three offsite intermediate depth borings were drilled in 1982.

In 1983, an additional twenty-six soil borings were drilled and sampled to further evaluate Site conditions in preparation for interim remedial activities. Four shallow monitoring wells were installed offsite. Groundwater monitoring well sampling and analysis was performed quarterly until June 1996. Since June 1996 groundwater monitoring is performed semiannually.

In 1984, investigatory activities were performed prior to and in conjunction with excavation and other interim remedial activities described in Section 3.1.8. Over eighty borings were drilled and sampled and four additional shallow monitoring wells were installed and sampled. Soil samples were collected throughout the Site, along the perimeter and at depths up to 50 feet. The unpaved areas of the Site were divided into 25-foot grid areas from which surface soil samples were collected. Air monitoring before and during the excavation activities was performed.

During 1985, a program was undertaken to evaluate existing onsite drainage systems. Research indicated that several systems were still in place. Samples were collected of sludge and soil from these systems. Additional soil borings were drilled and samples collected. One shallow monitoring well was installed in 1985.

In accordance with the 1987 DTSC Order, THAN submitted a Phase I Workplan for groundwater investigation. The Phase I investigation, which included the installation and sampling of six monitoring well clusters screened in the shallow (A-zone), intermediate (B-zone), and deep (C-zone) water bearing zones, was completed in 1987. The draft Remedial Investigation/Feasibility Study (RI/FS) Workplan was submitted to DTSC in 1987 in accordance with Section V.D.1 of the Order.

Additional groundwater investigation was performed in 1988, including the installation of an onsite intermediate zone monitoring well. The RI/FS Workplan was approved by DTSC in 1988. In 1988, THAN submitted a plan to DTSC for demolition and removal of several remaining Site structures. Preliminary investigations were performed to prepare for interim remedial activities in 1989. Investigations included onsite air monitoring and sampling of onsite building materials.

In 1989, soil investigation focused on support for excavation activities described in Section 3.1.8 below. Twenty-eight borings, located both onsite and in the orchard, were drilled and sampled. Additional sampling was performed to evaluate the feasibility of soil vapor extraction as a remedial option. The investigation included thirteen cone penetrometer borings, the collection of forty-three soil gas samples, and the installation of nine vapor extraction wells.

The Phase II/III groundwater investigation was completed in 1990. Four monitoring well clusters (MW 181-184) were installed offsite and completed in the A, B, C and D water-bearing zones. Three additional monitoring wells were installed offsite and sampled in the B and C zone (MW 185-B0, 186-B0 and 155-C1). Six vapor extraction wells were also installed onsite and sampled.

Twelve soil borings were drilled and sampled and three additional soil vapor extraction wells were added in 1991.

The Remedial Investigation Summary Report provides detailed information regarding Site investigations (K/J 1993).

Twelve shallow soil samples from six sampling locations were collected by DTSC and split with THAN for analysis on 8 December 1993 (Appendix A).

Soil samples and sediment samples were collected from the vicinity of drainage system H during April 1994. Confirmation soil samples were collected in May 1997 after removal of drainage system H and impacted soils in the vicinity of drainage system H (Chaney 1997).

Confirmation soil sampling was performed in the Former Solvent Storage Area to confirm the effectiveness of the SVE system in remediating vadose zone soils in this area. The confirmation sampling was performed in November 1995 (K/J 1996).

3.1.7 Summary of Previous Studies

THAN has performed studies and documented activities in accordance with the requirements of administrative orders issued by the RWQCB and the DTSC. Table 3-2 lists key documents submitted to the RWQCB and DTSC. Several documents listed in Table 3-2 are primarily planning documents, others summarized Site activities, and other documents evaluated the feasibility or risks of future activities or existing conditions. Planning documents such as the RI/FS Workplan (K/J 1988a), the Quality Assurance Project Plan (QAPP) (K/J 1988b), the Sampling and Analysis Plan (K/J 1987), and the Structures Demolition Plan (K/J 1988c) provided information regarding THAN's approach and plans for Site activities. Upon completion of activities, THAN provided documentation and analysis of results in reports such as Status Reports - THAN Remedial Program (JHK 1984), the Phase I Ground Water Assessment (JHK 1987), quarterly groundwater monitoring reports, and THAN's Remedial Investigation Summary Report (K/J 1993). The analysis of risks potentially posed by Site conditions was developed in the draft THAN Health Risk Assessment (ENVIRON 1993). The evaluation of feasible alternatives to achieve remedial action objectives was provided in THAN's Feasibility Study (SEACOR 1993a).

The draft RI report and the draft HRA were submitted in March 1992 and the preliminary draft Feasibility Study was submitted in June 1992, in accordance with Section V.D.3 of the Order. DTSC conditionally approved the draft RI report on 27 April 1993 and the draft FS report on 23 June 1993. The final RI report was submitted on 28 May 1993. The final FS report was submitted on 30 June 1993. The final draft HRA report was submitted on 30 July 1993. In its letter of 6 August 1993, DTSC confirmed final approval of the final RI/FS reports. A report on the results of shallow soil sampling was submitted to the DTSC on 23 February 1994 and is included as Appendix A of this report.

The Preliminary Draft Remedial Action Plan was submitted on 22 March 1994 (K/J 1994). The final HRA was submitted in January 1996 (ENVIRON 1996). A report documenting the removal action for drainage system H was submitted to the DTSC on 5 November 1997 (Chaney 1997). The Technical and Economic Feasibility Evaluation (TEFE), incorporating comments from DTSC's letter dated 3 October 1997, was submitted on 2 July 1998 and is included as Appendix B of this report.

3.1.8 Interim Remedial Activities

Interim remedial activities completed for the Site have included soil excavation, structures demolition, soil vapor extraction, and provision of alternate drinking water supplies to nearby residents.

3.1.8.1 Soil Excavation

Two phases of soil excavation have been conducted at the Site. In the summer of 1984, approximately 14,000 cubic yards of chemically-affected soil and debris were removed from the former landfill area that was historically used for disposal of wastes. Also, the laboratory cisterns (former Drainage System A) and surrounding chemically-affected soils were excavated. In early 1989, in conjunction with demolition and removal of structures at the Site, approximately 10,000 cubic yards of chemically-affected soil were excavated in the former solvent storage area, the former railroad loading dock area, several known drainage systems and in the area around the former Dinoseb and Guthion tanks. The excavated soil and debris were disposed of offsite at a permitted landfill facility.

More than 24,000 cubic yards of chemically-affected soil were excavated, transported, and disposed of offsite during these two interim remedial activities. The location and areal extent of the soil excavations implemented at the Site are shown on Figure 3-2. These excavations are described in detail in the RI report (K/J 1993).

3.1.8.2 Structures Demolition and Removal

In conjunction with the soil excavation in the former landfill area in 1984, the nearby concrete sump, tanks, and concrete pad in the solvent storage area, the metal frame shed and the Dinoseb and Guthion tanks were dismantled and disposed of offsite at a permitted landfill facility.

Between January and April 1989, five structures were demolished at the Site, including the two-story brick building and the one-story wood frame building which housed the laboratory. The demolition debris was disposed of offsite at a permitted landfill facility. The structures were demolished based on the concentrations of organochlorine pesticides and other chemicals found in samples of the building materials as a result of past operations at the Site. The demolition was carried out in accordance with the methods described in the DTSC-approved Structures Demolition Plan (K/J 1988c). In conjunction with the building demolition, a 10,000-gallon storage tank in the vicinity of the metal warehouse and a concrete slab in the former Solvent Storage Area were also demolished. Approximately 5,100 tons of chemically affected building debris and the storage tank were disposed of offsite at a permitted landfill facility. The locations of buildings and former structures onsite are shown on Figure 3-2.

In 1992, an underground storage tank (UST) was identified south and east of the pump house. The steel UST was 5 feet long, 2.9 feet in diameter and contained approximately 75 gallons of boiler fuel oil. The location of the former UST is shown on Figure 3-2. The UST was removed in May 1992 in accordance with Fresno County and DTSC regulations.

In 1994, a drainage system (drainage system H) was identified south of drainage system G and north of the former tool shed. Drainage system H and soils impacted by drainage system H were removed from the site in May 1997. The removal activity is described in the 1997 "Report of Removal Action Drainage System H" (Chaney 1997).

3.1.8.3 Soil Vapor Extraction

Two soil vapor extraction (SVE) study systems were installed at the Site. One SVE system was installed in 1988 to evaluate the feasibility of removing chloroform and other volatile or semi-volatile compounds present from unsaturated zone soils in the former laboratory area. Another SVE system was installed in 1990 to evaluate the feasibility of removing xylenes and ethylbenzene from unsaturated zone soils in the former solvent storage area (K/J 1993). It is estimated that through System shut down in July 1993, more than 11,700 pounds of xylene and ethylbenzene, and more than 15,800 pounds of total non-methane hydrocarbons were removed during the operation of the system.

The SVE systems are no longer in operation. The systems were operated successfully, and the remedial action objectives for chemicals in soil were achieved. A soil vapor extraction report, recommending permanent closure of the SVE systems, was submitted to DTSC on 16 September 1996 (K/J 1996). The report documented results of soil sampling activities in the vicinity of the SVE systems, summarized historical operation of the systems, and included recommendations for closure of the systems. The SVE systems remain in place, but not in operation as THAN awaits written approval from DTSC.

3.1.8.4 Alternate Water Supplies

Since 1985, THAN has provided bottled water or replacement carbon filters as needed to residents downgradient (southwest) of the Site whose domestic wells yielded samples containing concentrations of chemicals known to be associated with the Site that exceeded Acceptable Drinking Water Levels (ADWLs). Beginning in 1987 and in accordance with the Order, THAN proposed to provide bottled water to all households included in its Domestic Well Sampling Program (DWSP) as well as to the Temperance Kutner Elementary School. A well would become a DWSP well upon the detection and confirmation of a chemical known to be associated with the Site other than DBCP in samples of groundwater collected from that well. In 1987, THAN also proposed to fund the extension of the existing municipal water distribution system to the Temperance Kutner Elementary School and all households included in the DWSP.

On 1 March 1988, pending written acceptance of THAN's proposal to extend the drinking water supply and issuance of amendments to the Order, THAN offered bottled water or replacement carbon filters, as needed, to households included in its DWSP regardless of sample results. On 12 March 1988, an authorized bottled water distributor initiated delivery of bottled water to the eligible households at THAN's expense.

The extension of the City water distribution system ("City Water System") funded by THAN was designed and constructed from 1988 to 1990. The City of Fresno now owns and operates the system. Every household included in THAN's DWSP has been offered a connection to the Fresno domestic water supply system at THAN's expense. One household included in the DWSP is not currently connected to the City Water System (K/J 1993).

3.2 Physical Description of the Site

3.2.1 Topography

The Site is flat and is situated on a gently southwestward-sloping area of low relief, located in eastern Fresno county. Figure 1-1 is a topographic map of the Site vicinity. This figure shows that less than a five-foot variation in height occurs in the immediate Site vicinity.

Drainage of the Site is controlled by Site features. During and after the 1989 response actions, grading modifications were made to provide runoff control. Currently surface water from paved areas is directed to a collection area. The paved area east of the office branches into a partially paved driveway that connects the main entrance to the east entrance. The paved area is bermed on the southeast side, just east of the metal warehouse, to collect surface water flows from the northeastern portion of the Site. Collected rainwater which does not evaporate is used onsite for irrigation. No surface runoff from the Site has been observed during RI activities over the past 10 years. Figure 3-3 shows the existing site structures and paved areas.

3.2.2 Areal Extent of Chemicals

Since the spring of 1981, THAN has performed extensive RI activities at the Site to evaluate the extent to which chemicals handled in past operations may have affected soil, groundwater, and air at or near the Site. The results of these investigations and response actions have been documented in the RI report (K/J 1993). More than 1,400 soil samples and 1,800 groundwater samples were collected and analyzed during THAN's RI. Figure 3-4 provides a visual overview of onsite sampling activity during the RI by presenting the locations of borings, soil samples collected, and monitoring and soil vapor extraction wells.

Since completion of the RI in 1993, additional sampling activities have been performed. Twelve shallow soil samples from 6 sampling locations were collected by DTSC and split for analysis with THAN on 8 December 1993 (Appendix A). Soil samples and sediment samples were collected from the vicinity of drainage system H during April 1994. Confirmation soil samples were collected during May 1997 after the removal of drainage system H and associated chemically impacted soils in the vicinity (Chaney 1997). Confirmation soil sampling was performed in the Former Solvent Storage Area to confirm the effectiveness of the SVE system in remediating vadose zone soils in this area. The confirmation sampling was performed in November 1995 (K/J 1996). Groundwater monitoring was continued on a quarterly basis until June 1996. Since June 1996, groundwater monitoring is conducted on a semiannual basis.

Soil samples were analyzed for up to 215 organic chemicals including organophosphate, organochlorine, and other pesticides (including DBCP and ethylene dibromide [EDB]), 13 priority pollutant metals, and other selected inorganic chemicals. A total of 87 chemicals were detected in all of the soil samples collected and analyzed. Groundwater samples collected from monitoring, domestic, and irrigation wells at or near the Site were analyzed for up to 196 chemicals. Figure 3-5 shows the locations of onsite monitoring and irrigation wells and Figure 3-6 shows the locations of offsite monitoring and domestic wells.

Eighty organic and inorganic chemicals were detected in the collected groundwater samples. A list of the chemicals detected in soil remaining onsite and groundwater samples collected is presented in Table 3-3 and 3-4 respectively. This Final RAP addresses the soils remaining onsite, which are characterized as "post-excavation" data.

Seventy-seven chemicals were detected in samples of soil remaining onsite. For information on chemical detections in samples of soil which have been excavated and removed from the Site, refer to the RI report (K/J 1993).

The areal extent of remaining onsite soils containing chemicals in excess of certain assumed preliminary remedial goals was estimated in the FS for purposes of evaluating the soil component of the remedial alternatives. Onsite soils affected by agricultural chemicals are most prevalent at depths of 12 feet or less (K/J 1993). Information presented in the RI indicates that chemical impact to offsite soils is minimal (K/J 1993). Further discussion is provided in Section 4.1.

In order to conceptually design and then evaluate groundwater control, treatment, and discharge remedial action components, the area, volume, and average concentration of chemically-affected groundwater were estimated. Figure 3-7 shows the approximate areal extent of groundwater affected by chemicals known to be associated with the Site. The area and volume of chemically-affected groundwater was estimated based on the use of FRGs for 1,2-DCA, Dieldrin, carbon tetrachloride and chloroform. Excluding DBCP and 1,2,3-TCP these chemicals represent the areal extent of chemicals known to be associated with the Site in groundwater as of December 1997. Figure 3-7 also shows the area of affected groundwater used in the TEFE.

3.2.3 Current Site Description

A Site plan identifying the current and former locations of various onsite structures is shown on Figure 3-2. Three structures remain onsite: the small office building, the one-story metal warehouse, and the pump house. There is a paved area east of the office which branches into a partially paved driveway that connects the main entrance to the east entrance. Figure 3-3 shows the existing Site structures and paved areas during the RI. Current uses of the Site are limited to office use on an occasional basis in support of response activities.

3.2.4 Description of Outlying Area

The Site lies on the eastern edge of the San Joaquin Valley, about ten miles from the westernmost foothills of the Sierra Nevada in eastern Fresno County. For the RI report, an assessment of the population and land use in the vicinity of the Site was completed. The area of the assessment was a six-mile by six-mile square with the Site at its center. The streets denoting the boundary of this square are Shaw (North), California (South), McCall (East), and Peach (West).

The land use within the six-square mile area is primarily of three types: low density residential, light industrial, and agricultural. In the western portion of the demographic area there is scattered light industry interspersed with the predominantly low-density residential areas. Additionally, the Fresno Air Terminal is located within the western portion of the area reviewed. The central region of the demographic area is mostly low density residential. The remaining eastern portion of the demographic area is a mixture of low density residential and land used for agriculture (K/J 1993).

Several irrigation canals criss-cross the area and several stormwater detention basins are also distributed throughout the study area. Regional storm runoff and subsurface drainage generally flow westward and are conveyed through canals, ditches, and channelized creek beds operated and maintained by the Fresno Irrigation District and the Fresno Metropolitan Flood Control District (K/J 1993). There are no surface water bodies such as rivers or lakes in the immediate Site vicinity. Redbank Creek is over 1,200 feet north and west of the Site. Mill Ditch, which flows into Redbank Creek north of the Site, is over 500 feet northeast of the Site where it passes closest to the Site (Figure 3-6).

In the immediate Site vicinity, land to the north and east of the Site is used largely for agricultural purposes. Land to the south and west of the Site has been developed for large-lot residential use, although some of this land remains committed to agricultural production.

3.2.5 Demography

Using 1990 census tract information obtained from The County of Fresno Development Department, it was estimated that the population within the six-square mile area was 41,012. Future plans for this area include continued development of land towards urban densities comparable to the Fresno metropolitan area (K/J 1993).

3.2.6 Location to Biological Receptors

The Site is located in an area developed for commercial, residential, agricultural and industrial use. The nearest residence to the Site is located approximately 500 feet to the west. The THAN orchard property extends approximately 360 feet to the west, 1,110 feet to the east and 150 feet to the south. No residences are present on the THAN orchard property. The City of Fresno has targeted the area in the vicinity of the Site for increased growth and development. Immediately north of the Site is East McKinley Avenue. Land use north of East McKinley Avenue is agricultural.

The Site is not known to serve as habitat for endangered or threatened plant or animal species.

3.2.7 Site Climatology

The climate of the Fresno area can be characterized by hot, humid summers and mild, foggy winters. The average summer temperature is usually 90°F or higher with the average winter temperature about 45°F. The annual average temperature is 62°F. Typically, there are no days during winter when frost is observed. The rainy season occurs generally between October and April. The rainfall averages 10.52 inches per year.

During spring and summer months, the wind direction is northwesterly. During fall and winter months, calm, non-windy conditions predominate. The calm conditions contribute to the presence of tule fog and smog during winter (K/J 1993).

3.2.8 Nearby Wells

Domestic wells in the area have been identified as part of THAN's DWSP. Figure 3-6 shows the locations of offsite monitoring and domestic wells which have been sampled by THAN as part of the groundwater monitoring program. Table 3-6 lists the address and number of domestic wells sampled as part of the DWSP.

The nearest public supply well to the Site, PS 102, is located 1/4-mile south of Belmont Avenue and 75 feet west of Fowler Street. This is approximately 2,800 feet south-southwest from monitoring well cluster 184, the farthest downgradient extent of organic chemicals known to be associated with the Site (excluding DBCP).

In accordance with City of Fresno Water Division and California Department of Health Services requirements, samples of groundwater from PS-102 are regularly collected and analyzed for the possible presence of chemicals known to be associated with the Site.

During the RI, with the exception of DBCP, no such chemicals have been detected. Furthermore, PS-102 is screened below 250 feet, ninety feet below the known vertical extent of Site chemicals in groundwater. A review of the driller's log indicates that a 40-foot clay layer of low permeability separates these water-bearing zones (K/J 1993).

3.2.9 Assessor's Map

A map showing the area surrounding the Site is provided as Figure 1-1. The assessor's parcel map is included as Figure 3-1. The associated ownership and property descriptions for the Site and the adjacent area are described in Section 3.1.

4 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

4.1 Geological Investigation of the Site

4.1.1 Regional and Local Geologic Conditions

The Site is within the eastern portion of the San Joaquin Valley, about ten miles from the westernmost foothills of the Sierra Nevada Mountains. The San Joaquin Valley is a geomorphic province consisting predominantly of alluvial fans and plains, lacustrine and marsh deposits, flood basin deposits and sand dunes. The Fresno region of the San Joaquin Valley is underlain by a basement complex of metamorphic and igneous rocks. Consolidated marine and continental sedimentary rocks of Cretaceous and Tertiary age consisting mainly of sandstone, siltstone and shale overlie the basement complex. The most important water-bearing geologic unit for water supply is the older alluvium, which consists of layers and lenses of variable-sized sediments. The Site is situated atop Quaternary older alluvium (K/J 1993).

4.1.2 Surface and Subsurface Soil Conditions

This section describes the surface and subsurface conditions at and in the vicinity of the Site. Geological investigations have produced lithologic logs, downhole geophysical logs, cone penetrometer test logs, a shallow seismic refraction survey, grain-size distribution analyses and other site-specific analyses.

During the course of the RI, over 200 soil borings have been drilled at and near the Site to investigate surface and subsurface conditions from depths of one to two hundred and fifty feet. Surface and shallow subsurface soil samples from one to three feet deep were collected from grid areas in the unpaved areas of the Site. The lithology encountered during drilling consists of heterogeneous mixtures of sand, silt, gravel and occasional lenses of clay. Sandy silt comprises roughly 50 percent of the lithology encountered in the first 200 feet below ground surface. A loose silty sand layer is found at the ground surface and extends to depths between 4 to 9 feet across the Site and vicinity. This soil is coarse in texture and contains low percentages of clay and organic matter.

Lithologic logs for 202 borings of various depths dating from December 1982 to September 1991 are presented in Appendix K of the RI Report (K/J 1993). Electric (geophysical) and lithologic logs of the borings were used to construct two generalized geologic cross-sections presented in the RI Report (Figures 4-5 and 4-6 of the RI Report, K/J 1993). Domestic well logs reviewed during the RI indicate that the screened depths of domestic wells in the Site vicinity vary from about 96 to 170 feet.

4.1.2.1 Identification and Classification of Water Bearing Zones Near the Site

On the basis of Fresno Irrigation District records and information gathered during the RI, regional and local groundwater movement is from the northeast to the southwest. Water-producing zones of interest are present in the upper 200 feet of the alluvium (K/J 1993).

The lithology encountered during the RI consists of heterogeneous mixtures of sand, silt, gravel and occasional lenses of clay. Lithologic units of sand and gravel represent zones of high permeability and the most significant water-bearing zones. The water-bearing zones which have been sampled during the RI are identified as A, B, C, and D. Semi-confined permeable subunits encountered in each water-bearing zone are designated with numbers increasing with depth in a given zone (A1, B0, B1, B2, C0, C1, and D1). Subunits extend across the Site as interfingered layers of greater and lesser permeable materials, which may allow flow to occur between subunits within a water-bearing zone. Permeable water-bearing zones were encountered at the following depths:

1. In the A zone, clayey gravels and sands were encountered between depths of 15 and 45 feet below ground surface (bgs) in subunit A1. The A zone is currently not completely saturated but was historically saturated and became dry during the summer of 1987 due to climatic conditions.

2. In the B zone, silty sand and sand were encountered between depths of 58 and 78 feet bgs in subunit B0. Silty sand and sand were encountered between depths of 70 and 102 feet bgs in subunit B1. Silty sand and sand were encountered between depths of 99 and 115 feet bgs in subunit B2. The permeable subunits within the B zone are not continuous across the Site and are separated from one another by silt or clayey silt.

3. In the C zone, silty sand and sand were encountered between depths of 116 and 144 feet bgs in subunit C0. Silty sand, sand and silty gravel were encountered between depths of 140 and 184 feet bgs in the C1 subunit. The permeable C-zone layers are not continuous across the Site and are separated from one another by less permeable silt or clayey silt layers. The subunits within the C zone are separated from the B zone by approximately 20 feet of less permeable soils.

4. In the D zone, silty sand, sand and gravel were encountered between depths of 172 and 232 feet bgs in the D1 subunit. The permeable subunit of the D zone is separated from the C zone by approximately 15 feet of less permeable soils.

Subunits and water-bearing zones investigated during the RI appear to be in hydraulic communication, with preferential horizontal flow paths dominating groundwater movement (K/J 1993). Table 3-5 provides a list of monitored zones and associated wells.

4.1.2.2 Soil and Vadose Zone

The vadose zone is the zone of soil overlying a regional water table. The near-surface soils are characterized as excessively drained, rapidly permeable, having low water-holding capacity and susceptible to wind erosion. The soils are coarse textured and are composed of well-sorted sands overlying an unrelated older eroded alluvial deposit (K/J 1993).

In some locations beneath the surface layer, a dense, discontinuous hardpan layer has been encountered. Hardpan describes a semiconsolidated (compressed), uncemented soil layer. At the Site, the hardpan consists of silty soil. Where present, this hardpan layer occurs at an approximate depth of 4 feet in the northern and eastern part of the Site and dips to 9 feet in the southern and western part of the Site. The existence of shallow hardpan was established in a 1986 seismic refraction survey (RI Report, Appendix I, K/J 1993). Hardpan was confirmed in some locations, but the continuity of the hardpan could not be established. Hardpans at greater depths were not investigated in this survey.

The zone of currently unsaturated alluvial deposits extends from the surface to a depth of approximately 50 feet. The alluvium is composed of braided stream deposits and consists of angular to sub-rounded sand, occasional gravel, and cobbles interlayered with lenses of silt and some clay. The porosity of this unit varies between 30 and 40 percent (K/J 1993).

Deeper sediments encountered during the RI are generally similar to those near the ground surface with relatively sandy stream channel deposits interlayered with partially indurated fine-grained overbank deposits. Clay or silt layers at least 20 feet thick were encountered at the termination of the 250 foot deep borings.

4.1.3 Assessment of Chemical Impact to Offsite Soils

Soil sampling was performed to characterize the Site, identify source areas, and to guide response actions. As part of the Site characterization, offsite soil samples were collected along the Site perimeter and in the THAN orchard. The locations of onsite and nearsite borings from the RI are shown in Figures 4-1 and 4-2, respectively.

In December 1993, following completion of the RI Report, 12 nearsite soil samples were collected by DTSC from six locations along East McKinley Avenue north of the Site and split with THAN for analysis. At each location, 2 samples were collected at depths from 1 to 3 inches, and from 9 to 15 inches below ground surface (bgs). Chemicals reported as detected in the soils samples included DDT, DDE, dicofol, Dieldrin and toxaphene. A description of the sampling protocol and analytical results are presented in Appendix A.

Nearsite soil samples were collected and analyzed from the fenceline borings, 111 through 121, the orchard borings (OB-1 to OB-4), two samples from the railroad excavation outside the fence to the north, and two sample borings near the orchard's eastern perimeter, 197 and 198. Also, drill cutting samples were collected during the installation of nearsite monitoring wells and samples were collected by others on the property along Temperance and McKinley to the west of the Site. The majority of the above-referenced soil samples, including most offsite samples, have been analyzed for organochlorine and organophosphorus agricultural chemicals and DBCP. Additionally, many soil samples were analyzed for volatile and semi-volatile organic compounds, Dinoseb, and chlorophenoxy herbicides. Soil samples collected from Borings 197 and 198 were analyzed for priority pollutant metals, EDB and DBCP.

Table 4-1 is a summary of the analytical results for soil samples collected during the RI from borings located offsite. The data indicate that chemicals have been detected at concentrations less than 1 mg/kg in these soil samples, with the exception of one sample collected near the Railroad excavation. The chemicals detected are DDT and its breakdown products, Toxaphene, Dieldrin, and endosulfan and its breakdown products. With the exception of endosulfan, the concentrations of these chemicals detected in the nearsite samples are two orders of magnitude lower than the average concentrations of these chemicals detected in soil samples collected from a depth of 0 to 1 foot across the Site (Table 4-2) (K/J 1993). Offsite migration of chemicals from onsite soil, if any, does not appear to be significant.

4.1.4 Assessment of Chemical Impact to Onsite Soil

This section will discuss the distribution of chemicals in soil as indicated by the analysis of samples collected from the Site. As previously described, the Final RAP addresses the soils remaining onsite, as characterized by "post-excavation" data. For information on chemical detections in samples of soil which have been excavated and removed from the Site, the reader is referred to the RI Report (K/J 1993). Chemicals detected in samples of soils remaining onsite are presented in Table 3-3.

4.1.4.1 Remedial Investigation Results

Chemicals were detected in varying frequency and concentration in different areas of the Site. For the purposes of the RI Report, the Site was divided into six onsite or nearsite study areas, as shown in Figure 4-3, and identified as follows:

1. Study Area 1: Landfill Area
2. Study Area 2: Railroad Area
3. Study Area 3: Central Area
4. Study Area 4: Solvent Storage Area
5. Study Area 5: Drainage System A Area
6. Study Area 6: Other Remaining Areas

The six study areas identified above were used to facilitate discussion and statistical and graphical analysis. The boundaries of the study areas do not correspond to the boundaries of potential sources or areas that were excavated as part of response actions at the Site.

To support effective review and analysis of the large volume of data, those chemicals detected in soil and groundwater were classified into four groups based on health criteria and prevalence in environmental media. The groups were based on published health-based criteria (either carcinogenicity classification or chronic oral reference dose) and frequency of detection (either percentage of detection, based on the number of times a chemical was analyzed for regardless of concentration, or the number of detections). All detected chemicals were evaluated, without regard to concentration, as potential chemicals of concern. The chemicals of highest concern identified for soil in the RI Report were DDT, DDD, DDE, Dieldrin, Toxaphene, DBCP, chloroform, Lindane and the metals: arsenic, beryllium, and lead. This list was refined by the subsequent analysis in the HRA (Environ 1996).

The chemicals of concern remaining in onsite soils are classified in two groups: organochlorine pesticides (DDT, DDD, DDE, Dieldrin, Toxaphene and Lindane) and volatile organic compounds (VOCs) including DBCP (Dibromochloropropane) and chloroform. These chemicals are discussed below. The VOCs, xylene and ethyl benzene, are included in the discussions because of their significance in the Soil Vapor Extraction process.

Other chemical groups detected in soil samples include, with few exceptions, organophosphorus compounds, chlorophenoxy herbicides, halogenated alkanes, ketones, monocyclic aromatic compounds, metals and miscellaneous pesticides (including Dinoseb). Additional discussion and information regarding chemical detections in soil is presented in the RI Report (K/J 1993).

Statistical and graphical summary information is presented to show the concentration, frequency and location of the chemicals detected. Statistical analysis of chemicals detected in samples of soil remaining onsite is presented in Table 4-3. Samples of soil remaining onsite were divided into three vertical zones for purposes of site characterization: Zone 1 (0 to 1 foot), Zone 2 (1 to 12 feet), and Zone 3 (greater than 12 feet). Of the 994 samples collected from soil remaining onsite, 95 were collected from Zone 1; 523 from Zone 2; and 376 from Zone 3. Tables 4-2, 4-4 and 4-5 present the statistical calculations for each zone. These tables include only chemicals detected and confirmed. Concentration ranges for selected chemicals detected in samples of soil are shown in Table 4-6.

4.1.4.1.1 Organochlorine Pesticides

DDT and the other organochlorine pesticides are found throughout the vadose zone at depths ranging from 0 to 50 feet. The low sorption capacity of soil onsite, due to its low organic matter and low clay contents, and facilitated transport probably played a role in the vertical extent of these chemicals. Facilitated transport is a process by which a chemical in a soil-water system may be mobilized. Given that potential sources of chemicals have largely been remediated by the response actions performed, and given the length of time which has passed since these potential sources could last have received chemicals (a minimum of 15 to 20 years), it is unlikely that facilitated transport will account for any significant additional transport of the chemicals in remaining soils onsite or groundwater. Future downward vertical migration of chemicals present in surface soils is expected to be slow and limited due to the low rainfall and the presence of restricting, less permeable soil layers.

1. **DDT, DDE and DDD**. DDT and its breakdown products are the most frequently detected chemicals in samples of soil collected onsite. In samples of soil collected outside of known source areas (Area 6), the sum of DDT, DDE and DDD concentrations range mostly between 1 to 100 mg/Kg and are generally found at depths less than 5 feet.

   In Areas 1 through 5, over half of the detections of the sum of DDT, DDE and DDD concentrations in soil samples range from 0.1 mg/Kg to 100 mg/Kg. The maximum DDT detection in a sample of soil collected onsite was 4,500 mg/Kg. Most of the detections of the sum of DDT, DDE and DDD are in the former landfill area (Area 1), the former railroad loading dock area (Area 2) and in near surface soils. Below depths of 12 feet, the detections of the sum of DDT, DDE and DDD decrease significantly in both frequency and concentration. Figures 4-4 through 4-6 present this information graphically. These figures show the detections in the three depth zones, Zone 1 (0 to 1 foot), Zone 2 (1 to 12 feet), and Zone 3 (greater than 12 feet). DDT, DDE and DDD are expected to persist in Site soils for several years. Transport of DDT and its breakdown products from soil to groundwater is not expected to occur to a significant extent due to the relative immobility of these chemicals and the low rainfall (K/J 1993).

2. **Toxaphene**. Concentrations of Toxaphene detected in samples of soil remaining onsite range typically between 0.1 mg/Kg and 100 mg/Kg (Table 4-6). The maximum detection of Toxaphene in a sample of remaining soil onsite is

7,900 mg/kg. Figures 4-7 through 4-9 present the concentration distributions of Toxaphene for Zones 1 through 3, respectively. Toxaphene is expected to persist in soil with minimal migration to groundwater. Toxaphene has not been detected in groundwater to date (K/J 1993).

3. **Dieldrin**. As shown on Table 4-6, more than two thirds of the Dieldrin detected in samples of soil remaining onsite ranges between 0.01 and 1 mg/Kg. Figures 4-10 through 4-12 present the concentration distributions for Zones 1 through 3, respectively, for Dieldrin. Dieldrin remaining onsite is expected to persist and degrade very slowly. Dieldrin is classified as slightly mobile. Dieldrin has been detected in samples of groundwater collected downgradient of the former landfill and downgradient of Drainage System A. This apparent mobility may be the result of conditions which existed at the time of its release. Dieldrin is not expected to migrate significantly due to the soils' natural sorption characteristics and low rainfall (K/J 1993).

4. **Other Organochlorines**. Other organochlorines were detected in samples of soil collected onsite. The distribution of these chemicals is depicted in Figures 4-13 through 4-15 for Zones 1, 2, and 3. Detections of chemicals below 12 feet are few, and concentrations are below 10 mg/kg in all but two samples. The BHC isomers, including Lindane, are the most significant of the other organochlorine chemicals detected in terms of toxicity and frequency (K/J 1993).

4.1.4.1.2 Volatile Organic Compounds (VOCs)

Although a number of VOCs were detected at the Site, the VOCs detected most frequently in soil are limited to two categories: halogenated alkanes and aromatics hydrocarbons (primarily xylenes). Halogenated alkanes, notably DBCP and chloroform, were detected in samples of soil remaining at much lower concentrations than the organochlorines of concern. VOCs are found more frequently at depths greater than 12 feet due to their mobility. The potential sources of DBCP, chloroform and aromatic hydrocarbons to soil and groundwater onsite were removed more than 15 years ago when Site operations ceased. In addition, chemically-affected soils were removed as part of the interim remedial activities. Further movement of these chemicals from onsite soil to groundwater or air is unlikely to occur. DBCP and chloroform have been detected in groundwater onsite and offsite. Xylene has not been confirmed in samples of groundwater collected on or offsite (K/J 1993).

1. **DBCP**. Figures 4-16 through 4-18 show concentration distributions for Zones 1 through 3, respectively, for DBCP. Eighty-five percent of DBCP detections in samples of soil collected onsite ranged between 0.001 to 0.1 mg/Kg (Table 4-6) (K/J 1993).

2. **Chloroform**. Chloroform detections in samples of soil collected onsite range between 0.001 to 0.1 mg/Kg. Figures 4-19 and 4-20 present the concentration distributions for Zones 2 and 3, respectively (K/J 1993). Chloroform was not detected in Zone 1.

3. **Xylenes and Ethyl Benzene**. Xylenes and ethyl benzene concentrations in samples ranged broadly, with most detections of xylenes between 0.1 and 1,000 mg/Kg and most detections of ethyl benzene between 0.01 to 100 mg/Kg. Figures 4-21 through 4-23 present the past concentration distributions for Zones 1 through 3, respectively, for both xylene and ethyl benzene (K/J 1993). As discussed below in Section 4.1.4.2.1, operation of the soil vapor extraction system substantially reduced xylene and ethylbenzene concentrations in soil.

4.1.4.1.3 Other Chemicals

Organophosphorus compounds, miscellaneous pesticides and eight metals (including arsenic) were detected in samples of soil remaining onsite. These chemicals are indicated on the statistics presented in Tables 4-2 through 4-5 (K/J 1993). The concentrations of metals which have been detected onsite are consistent with naturally occurring concentrations of metals in the United States. Additionally, the metals are of low mobility or relatively immobile, and are expected to be persistent in soil (K/J 1993).

4.1.4.2 Recent Investigation Results

4.1.4.2.1 Soil Vapor Systems Closure Confirmation Soil Sampling

In November 1995, confirmation soil sampling was performed in the Former Solvent Storage Area to confirm the effectiveness of a SVE system in remediating vadose zone soils in this area. The SVE system operated from April 1991 to July 1993 when it was shut down. Four confirmation soil borings were installed adjacent to soil borings from previous investigations in the Former Solvent Storage Area. Soil samples from these previous borings had detections of xylenes in concentrations at or exceeding 1,000 mg/Kg. An additional soil boring was installed between two soil vapor extraction wells. Xylene and ethylbenzene were detected in confirmation soil samples collected from one (B-204) of the five borings installed. The maximum concentration of xylene detected was 0.27 mg/Kg and the maximum concentration of ethylbenzene detected was 0.05 mg/Kg. The results of the confirmation soil sampling are presented in a report submitted to the DTSC on 16 September 1996 (K/J 1996).

4.1.4.2.2 Drainage System H Removal

An additional drainage system was identified at the Site during 1994 (drainage system H). Soil boring DLH7 was installed on 15 April 1994 to assess the impact to soils in the vicinity of drainage system H. Elevated concentrations of agricultural chemicals were detected in soil or sediment samples collected from boring DLH7. Thirteen of those were detected at concentrations greater than the previous maxima for samples collected during the RI. Those samples for which new maxima were detected were from soil or sediment samples collected exclusively from the 5 or 7 foot depth in boring DLH7. In soil and sediment samples collected at the 8 and 10 foot depths from boring DLH7, the concentrations of all chemicals detected were well within the range of those measured in other soils remaining onsite which are subject to the final remedy. Drainage system H, and soil and sediments impacted within and below drainage system H were removed from the Site during the week of 4 May to 10 May 1997. Confirmation soil samples were collected during the removal action. The results of the April 1994 and May 1997 soil samples are described in the 4 November 1997 Removal Action Report by Chaney, Walton and McCall (Chaney 1997).

Drainage system H was located south of drainage system G and north of the former tool shed.

4.2 Hydrogeological Investigation

4.2.1 Groundwater Conditions

Groundwater levels show considerable annual variation at and near the Site. The depth to groundwater historically has ranged from 30 to 50 feet below ground surface. Due to local drought conditions in the past few years, groundwater levels are currently 50 feet below ground surface. Because of this change in groundwater depth since late 1987, water levels have fallen below the screened interval in the A-zone monitoring wells (K/J 1993).

Several hydrogeologic parameters, including transmissivity, hydraulic conductivity, and flow velocity were estimated in the RI Report. The average transmissivity (the ability of a water-bearing unit to conduct fluid) of the water-bearing layers or subunits evaluated during the RI was calculated to be from 0.005 to 0.010 feet^2/second. The saturated hydraulic conductivity of permeable layers in the area was estimated to be between 0.001 and 0.005 feet/second. The estimated range of groundwater flow velocity was calculated to be 0.2 to 0.4 feet/day downgradient of the Site. Hydraulic continuity along and between layers is primarily lateral, but some vertical leakage is evident. The direction of groundwater flow, which is measured at the time of quarterly sampling, has historically been to the southwest of the Site (K/J 1993).

4.2.2 Surface Water Conditions and Beneficial Uses

Surface water from regional storm runoff and subsurface drainage is conveyed westward and southwestward through ditches, canals, and modified creek beds operated and maintained by the Fresno Irrigation District and the Fresno Metropolitan Flood Control District. Drainage features within one mile of the Site include Mill Ditch (north of the Site), Redbank Creek (which joins Mill Ditch approximately 1/2 mile northeast of the Site), Temperance Ditch (an enclosed underground pipe just south of the Site), and the channelized bed of Fancher Creek (also located south of the Site) (see Figure 1-1).

The occurrence of surface water on the Site is transient and limited to rainfall events. During rainfall events, surface water from paved areas is directed to a collection area. The paved area east of the office branches into a partially paved driveway that connects the main entrance to the east entrance. The paved area is bermed on the southeast side, just east of the metal warehouse, to collect surface water flows from the northeastern portion of the Site. Collected rainwater which does not evaporate is used onsite for irrigation. Figure 3-3 shows the existing site structures and paved areas.

No surface runoff from the Site has been observed during RI activities and over the past five years. An extensive study of drainage at the Site was conducted in 1985. The study concluded that grading and drainage existing at that time effectively controlled surface water flows. No runoff was observed at that time. Subsequent grading modifications during and after the 1989 response actions provided further runoff control (K/J 1993).

Given the small volume of surface water which collects onsite only after rainfall events, beneficial uses of surface water other than Site irrigation have not been explored.

4.2.3 Subsurface Water Conditions and Beneficial Uses

Groundwater in the vicinity of the Site is designated by the EPA as a sole source drinking water aquifer (EPA 1993) and as suitable for municipal, domestic, agricultural and industrial water supply by the Regional Water Quality Control Board under the Water Quality Control Plan for the Tulare Lake Basin (SWRCB 1995). Although groundwater has been classified as a source of drinking water, the regional presence of DBCP in groundwater adversely impacts the quality of that drinking water source.

Groundwater in the Site vicinity has historically been used for domestic and municipal supplies. As discussed in Section 3.1.8.4, THAN has provided either connections to the City Water System or an alternate drinking water supply to those residents included in THAN's DWSP as established in the Order. It is THAN's understanding that domestic wells that are or were formerly included in the DWSP and affected by chemicals known to be associated with the Site, are used for nonpotable uses (*e.g.*, irrigation).

4.2.4 Chemical Impact Assessment

Groundwater investigations during the RI included the collection and laboratory analysis of groundwater samples from monitoring, domestic, and irrigation wells located onsite and offsite. Groundwater monitoring wells were installed and groundwater samples collected and analyzed during the RI to evaluate the nature and extent of chemicals in groundwater onsite and in the vicinity of the Site. In accordance with the Order, groundwater samples were also collected from domestic and irrigation wells and analyzed to determine whether chemicals associated with the Site were present in domestic water supplies at concentrations exceeding appropriate drinking water standards. Table 3-6 provides a list of domestic and agricultural wells sampled by THAN as of December 1997. Figures 3-5 and 3-6 show the location of onsite and offsite monitoring and domestic wells, respectively.

The potential presence of chemicals has been evaluated by laboratory analyses of groundwater samples collected during the RI and subsequent groundwater monitoring events. Table 3-4 lists the 80 organic and inorganic chemicals analyzed for and detected, at least once, in the groundwater samples collected during the RI from these wells. Table 4-7 presents statistics for the organic and inorganic chemicals detected in groundwater samples. The statistics include groundwater data collected from 1981 through September 1991 for nine chemicals and data from January 1987 through September 1991 for all other chemicals detected, except as footnoted. These statistics include maximum concentration detected, mean concentration, and frequency of detections. As shown in Table 4-7, DBCP has been detected in more groundwater samples than any other chemical. Statistical analyses performed for the draft RI Report submitted in March 1992 used data available from samples collected prior to September 1991. Updates to these data are provided in Tables 4-8 through 4-10, which provide historical maximum detected concentrations for onsite, offsite and domestic wells as well as maximum detections since October 1991. Table 4-13 presents the maximum detections in the last four rounds of groundwater monitoring (April 1996, June 1996, May 1997 and December 1997). These data are discussed below and additional information is available in THAN's quarterly and semi-annual groundwater monitoring reports.

The maximum organic chemical concentrations detected in samples from onsite wells and offsite monitoring wells during the RI are presented in Table 4-11 and Table 4-12, respectively. These concentrations and monitoring well locations are listed according to the water-bearing zone from which the sample was collected. If a chemical was detected in groundwater samples collected from both A-zone and B-zone monitoring wells, then the maximum concentration and the well where the sample was collected are listed for each water-bearing zone.

As with chemicals detected in soil, chemicals considered to be of most concern in groundwater were identified based on their frequency of detection and published health-based criteria. The chemicals of concern detected in samples of onsite and offsite groundwater include 1,2-DCA, chloroform, carbon tetrachloride, Dieldrin, DBCP, and 1,2,3-trichloropropane (1,2,3-TCP). Lindane, alpha-BHC and delta-BHC have historically been detected. Historically, the highest chemical concentrations in groundwater have been detected in samples from the A zone. Due to the significant drop in water levels since 1987, the A zone was not saturated. Consequently, the A zone could rarely be sampled since 1987. Since the end of the drought, selected A-zone wells have been sampled, however, no A-zone wells could be sampled in the December 1997 monitoring event. Eleven A-zone wells were dry and six A-zone wells had insufficient water for purging and sampling. A series of figures, 4-24 through 4-28, show the concentrations of chemicals in groundwater samples collected in June 1998 from onsite and offsite monitoring wells and domestic wells for water-bearing zones A through D, respectively (Chaney 1998b). Figure 3-7 shows the approximate extent of the chemicals known to be associated with the Site in excess of applicable FRGs. This figure reflects data collected through June 1998.

4.2.4.1 1,2-Dichloroethane (1,2-DCA) Detected in Groundwater

This section discusses 1,2-DCA detected first in onsite groundwater and then in offsite groundwater. The highest concentration of 1,2-DCA (183 μg/l) in groundwater samples collected during the RI was detected in a sample from onsite A-zone Monitoring Well 139 (14 July 1984 sample). Since October 1991 (the last RI groundwater monitoring event), 1,2-DCA was detected at a maximum concentration of 0.9 μg/l in a September 1992 sample from Monitoring Well 77A. (Table 4-8). 1,2-DCA has not been detected in samples collected from B-zone wells onsite. 1,2-DCA is not on the THAN site chemical inventory.

Historically, 1,2-DCA has been detected in groundwater samples collected from offsite A-zone wells at maximum concentrations less than 3.2 μg/l (Wells 30-A and 31-A). 1,2-DCA has been detected in groundwater samples collected from five offsite B-zone wells, one C-zone well, and twenty-one domestic wells at maximum concentrations of 2.2 μg/l (MW 183-B2, June 1991), 1.2 μg/l (MW 153-C1, April 1988), and 7.4 μg/l (Domestic Well 902, September 1984), respectively (Table 4-9, Table 4-10). 1,2-DCA has been detected farthest from the Site in a groundwater sample collected from Domestic Well 1001 (approximately 4,800 feet downgradient from the Site) where it was detected in the sample collected in December 1989 at 0.5 μg/l (K/J 1993).

Groundwater samples collected in the April 1996 through December 1997 groundwater sampling events have had detections in MW 182-B1 and nearby domestic wells (at a maximum 1,2-DCA concentration of 2.3 μg/l), consistent with the area in which 1,2-DCA has historically been detected. 1,2-DCA has not been detected in groundwater samples collected from any D-zone wells (Chaney 1998b).

As discussed in the RI, the rate of migration of 1,2-DCA is estimated to be similar to that of chloroform, which was estimated to be approximately 0.2 to 0.4 ft/day (70 to 140 ft/year) based on historical chloroform data. The similarity of mobility factors for 1,2-DCA and chloroform support the estimate of a similar migration rate for 1,2-DCA. The direction of migration for 1,2-DCA and all other chemicals is estimated to be to the southwest (K/J 1993).

4.2.4.2 Chloroform Detected in Groundwater

Chloroform has been detected in samples of groundwater collected from onsite and offsite monitoring and domestic wells. Historically, chloroform has been detected in samples from A-zone groundwater Monitoring Wells 2, 75, 77, 77-A1, 138, 139, 140, and 145. Since 1987, low water levels resulting from the drought have prevented the sampling of most of these wells. The maximum concentration of chloroform onsite was 20,000 µg/l, collected in Well 77 in October of 1984. Since October 1991, the maximum concentration of chloroform offsite (1.7 µg/l) was detected in a September 1992 sample from Well 77A (Table 4-8). Chloroform has been detected much less consistently in groundwater samples collected from the three onsite B-zone groundwater monitoring wells (K/J 1993) and has not been detected in the onsite B-zone wells since December 1989 (Table 4-13).

Chloroform has been detected in groundwater samples collected during the RI from offsite monitoring wells screened in the A, B, and C zones. Chloroform has also been detected in groundwater samples collected from domestic wells sampled as part of the THAN Domestic Well Sampling Program as defined in the Order. Chloroform has not been detected in groundwater samples collected in D-zone wells (K/J 1993).

The historical maximum concentration of chloroform detected in offsite A-zone wells was 3,700 µg/l from Well 31A in October of 1984 (Table 4-9). The historical maximum concentration of chloroform in the B zone was 160 µg/l in October 1990 in MW182-B1. The maximum concentration detected since October of 1991 was 89 µg/l also in MW182-B1. In the April 1996 to December 1997 sampling rounds, the concentrations of chloroform detected in Well MW182-B1were less than 10 µg/l (Table 4-13). In the C zone, the historical and recent maxima were also detected from the 182 well cluster (Table 4-9). Domestic Wells 906, 909, and 910, located near the 182 well cluster, have historically yielded samples with the highest chloroform concentrations when compared with results for groundwater samples taken from other domestic wells. The historical maximum detection in a domestic well was collected from Well 906 (190 µg/l in December 1984). Since October 1991, the maximum concentration of chloroform (100 µg/l) was detected in a June 1992 sample collected from Well 909 (Table 4-10). The maximum detection in the April 1996 through December 1997 groundwater sampling events was collected from Well 906 (36 µg/l) (Table 4-13).

Approximately 800 feet downgradient of the Site, chloroform is consistently detected in groundwater samples collected from the B1 subunit (Monitoring Well cluster 152) (K/J 1993). Samples with the highest chloroform concentrations (less than 10 µg/l, well below the FRG of 100 µg/l) continue to be collected from Well 182-B1, approximately 1,600 feet downgradient of the Site and located in the center of the area where chloroform historically has been detected in samples from domestic wells (Chaney 1998b, Table 4-13).

Chloroform has been detected in samples collected from the furthest downgradient Monitoring Well 184-C1 (approximately 6,600 feet downgradient of the Site) since its installation (June 1990). The maximum concentration of chloroform in samples collected from Well 184-C1 during the April 1996 to December 1997 sampling events was 11 µg/l. Chloroform has been detected at low levels in the samples from Monitoring Well 184-B1 beginning in March 1994. Chloroform has not been detected in samples from the D-zone monitoring wells.

As discussed in the RI, the rate of migration of chloroform is estimated to be approximately 0.2 to 0.4 ft/day (70 to 140 ft/year) based on historical chloroform detections. The direction of migration for chloroform and all other chemicals is estimated to be to the southwest (K/J 1993).

4.2.4.3 Dieldrin Detected in Groundwater

Dieldrin has been detected in groundwater samples collected from A-zone groundwater monitoring wells when the A zone was saturated, with the maximum concentration (12.8 µg/l) of Dieldrin detected from Well 6 in July 1984. Due to the drought, it was not possible to sample most A-zone wells since 1987. Since October 1991, the maximum concentration of Dieldrin detected was 0.35 µg/l in a June 1992 sample from Well 145. Dieldrin was detected in offsite A-zone Monitoring Well 29A at a concentration of 0.04 µg/l in the sample collected in May 1997 (Table 4-13).

Dieldrin has been detected in groundwater samples collected from onsite B-zone wells and onsite plant supply Well 904. The maximum concentration detected in an onsite B-zone well was 0.23 µg/l in December 1990. Dieldrin was detected in the onsite Domestic Well 905 at 0.18 µg/l in June 1993 (Table 4-8). Since October 1991, the maximum concentration in an onsite B-zone well was 0.21 µg/l in a December 1991 sample from Well 186-B0. Dieldrin was not detected in samples from onsite B-zone wells during the April 1996 through December 1997 sampling events.

Dieldrin has been detected in groundwater samples collected from offsite Monitoring Wells 31-B, 152-B1, 153-B1 and 182-B1. The historical maximum concentrations of Dieldrin detected in the offsite B-zone groundwater monitoring wells are from Well 153-B1 (Table 4-9). During the April 1996 to December 1997 sampling events, the maximum concentration of Dieldrin detected in a offsite B-zone well was 0.11 µg/l. Dieldrin has not been detected in any C- or D-zone wells.

Dieldrin has been detected in groundwater samples collected from offsite domestic wells. The maximum concentration of Dieldrin detected in a groundwater sample collected from a domestic well offsite was 0.38 µg/l from Well 902 in June 1988. Dieldrin was detected in groundwater samples collected from Domestic Well 977 in June 1985 at 0.1 µg/l and June 1988 at 0.18 µg/l. This is the farthest location from the Site from which a groundwater sample was collected which contained Dieldrin (approximately one mile downgradient) (K/J 1993).

The rate of migration of Dieldrin and other organochlorine pesticides is estimated to be slower than that of chloroform, 1,2-DCA, and other volatile organic compounds due to mobility factors (K/J 1993).

4.2.4.4 Dibromochloropropane (DBCP) Detected in Groundwater

DBCP has historically been detected in groundwater samples collected from onsite A-zone wells when the A zone was saturated. The maximum concentration of DBCP detected in any groundwater sample collected by THAN was 81.4 µg/l in a sample collected from onsite A-zone Well 77 A in July 1984. The maximum concentration of DBCP collected from an onsite well since October 1991 was 0.77 µg/l in a December 1992 sample from Well 77 A. (Table 4-8).

DBCP concentrations detected in A-zone groundwater samples collected nearsite on THAN property surrounding the Site ranged from less than 0.01 to 5.2 µg/l (K/J 1993). DBCP has been detected in onsite B-zone wells, with the maximum concentration detected in the April 1996 through December 1997 groundwater sampling events at 0.02 µg/l (Table 4-13).

The maximum concentration of DBCP detected in any sample of B-zone groundwater collected offsite during the RI was 7.1 µg/l collected from Well 30 B in July 1983 (Table 4-9). All of the 141 groundwater samples collected during the RI from monitoring wells screened in the C zone offsite during the RI detected DBCP. The maximum concentration of DBCP detected in C-zone groundwater collected offsite during the RI was 5.6 µg/l in a sample collected from Well 153-C1 in October 1990 (Table 4-9).

DBCP has been detected in 19 of the 26 samples analyzed for DBCP that were collected from offsite D-zone groundwater monitoring wells during the RI with a maximum concentration of 0.22 µg/l. DBCP is the only organic chemical that was detected in samples from offsite D-zone monitoring wells during the RI. Since the RI, 1,2,3-TCP has also been detected in samples from offsite D-zone monitoring wells. DBCP was detected at a maximum concentration of 0.7 µg/l from Monitoring Well 182-D1 in September 1993. DBCP was detected at concentrations ranging from 0.37 µg/l to 0.63 µg/l in offsite D-zone samples collected during the April 1996 to December 1997 sampling events (Table 4-13).

Between 1981 and September 1991, 1,087 groundwater samples were collected from domestic and irrigation wells and analyzed for DBCP. DBCP is the most frequently detected organic chemical in the samples of groundwater collected and analyzed from domestic and irrigation wells during the RI. The maximum concentration of DBCP detected in a groundwater sample collected offsite during the RI was 28.5 µg/l in a sample from domestic well number 939 collected on 26 June 1982 (Table 4-10). Since October of 1991, the maximum concentration of DBCP detected was 5.12 µg/l in a sample from domestic well 943 collected on 16 December 1991 (Table 4-10). DBCP was detected in concentrations ranging from 1.2 µg/l to 3.7 µg/l in domestic well samples collected during the April 1996 to December 1997 sampling events (Table 4-13).In the Fresno area, DBCP has been detected at elevated concentrations in groundwater as a result of its regional application to crops. DBCP was present at levels higher than those detected regionally in some samples collected prior to 1987 from shallow, onsite A-zone monitoring wells. Maximum concentrations of DBCP detected in groundwater samples from onsite B-zone and all offsite monitoring wells are well within the range and not significantly different from the range of regional DBCP concentrations reported in literature (see further discussion below) and measured during the RI.

The rate of migration of DBCP is estimated to be similar to that of chloroform, based on mobility factors (K/J 1993). The direction of migration is assumed to be in the same direction as for other chemicals known to be associated with the Site (*i.e.*, to the southwest). However, due to regional concentrations of DBCP detected in groundwater samples, the direction of migration cannot be determined solely from a review of the analytical data collected for DBCP during the RI.

4.2.4.5 Regional Use and Extent of DBCP in Groundwater

Several studies have been made on the occurrence and distribution of DBCP in groundwater in California and Fresno County.

California Department of Food and Agriculture (CDFA) reported that DBCP was detected at concentrations of less than 1 mg/Kg in agricultural soils to which DBCP had been applied in Southeastern Fresno County (K/J 1993). DBCP was detected in samples from 1,280 of the 3,016 wells sampled by the CDFA in the Fresno, Merced and Modesto areas between 1975 and 1988 (K/J 1993). Detected concentrations of DBCP in those wells ranged from 0.1 to 10.5 µg/l (K/J 1993).

A 1984 State Water Resources Control Board (SWRCB) study documented the occurrence of DBCP in groundwater state-wide. Local and state well sampling programs reported that approximately 41 percent of all well water tested in Fresno County in 1984 contained DBCP (K/J 1993).

Schmidt evaluated the distribution of DBCP in groundwater in southeast Fresno County in 1984 (K/J 1993, Appendix E). The study focused on an approximate 0.5 square mile area south and southeast of Fresno. The Site is located approximately 0.13 miles northeast of Schmidt's study area. Concentrations of DBCP reportedly ranged from approximately 0.1 to 5 µg/l. In approximately half of the wells within Schmidt's study area, shallow groundwater was observed to contain more than 1.0 µg/l of DBCP. Schmidt concluded that the presence of DBCP in well water "corresponded fairly closely to the locations of present or former vineyards." Relatively low or undetected DBCP concentrations were present in groundwater beneath urbanized areas and lands not heavily developed as vineyards. Schmidt found that DBCP concentrations exceeding 0.1 µg/l are primarily present in groundwater less than 250 feet below the ground surface (K/J 1993).

THAN collected and analyzed samples of groundwater from domestic wells in the area of the city of Selma (Wells 944 through 957) to provide additional information on regional DBCP concentrations in an area clearly unaffected by the Site. The concentration values of detected DBCP ranged from less than 0.01 to 8.9 µg/l, with an average value of 2.3 µg/l (K/J 1993).

These studies document that, in addition to being associated with the THAN Site, DBCP is a regional groundwater pollutant in the Fresno area, including areas adjacent to the Site.

4.2.4.6 Regional Presence of 1,2,3-TCP in Groundwater

1,2,3-TCP is a manufacturing byproduct found in herbicide formulations such as DD and Telone. Limited amounts of DD were resold by THAN at the Site. 1,2,3-TCP has been detected in groundwater samples collected from onsite and offsite monitoring and domestic wells (Tables 4-8 to 4-10). The maximum concentration of 1,2-3-TCP was detected at a concentration of 7 µg/l in a December 1991 sample from offsite B-zone monitoring well 153-B1. 1,2,3-TCP has been detected in samples from all monitored zones during the April 1996 through December 1997 sampling rounds with the maximum detection of 3.5 µg/l in a sample from Well 183-B1 collected in April 1996 (Table 4-13).

1,2,3-TCP has not been detected in soil samples collected during Site investigations. Based on the presence of 1,2,3-TCP in groundwater from areas clearly unaffected by site activities, and documented land applications of DD and/or Telone in the vicinity of the Site, initial indications are that 1,2,3-TCP is similar to DBCP in being a regional groundwater pollutant (Chaney, 1998).

4.2.4.7 Other Chemicals Detected in Groundwater.

In addition to the chemicals discussed above, other chemicals have been detected in groundwater samples from various onsite and offsite wells. Table 4-7 presents statistics for chemicals detected in groundwater samples collected from onsite and offsite wells during the RI.

4.3 Air Investigation

4.3.1 Ambient Air Quality

Ambient air monitoring was conducted in 1989, prior to the commencement of response actions. High volume air monitoring was performed to assess ambient, background air quality conditions onsite and immediately downwind. The ambient, background air samples were analyzed for selected indicator organochlorine compounds on the basis of their frequency of detection in air and soil samples collected during previous response actions at the Site in 1984. Concentrations of DDT and Dieldrin detected were several orders of magnitude below OSHA Permissible Exposure Limits. Toxaphene and Chlordane were not detected.

In addition to ambient air monitoring, monitoring was performed to assess air quality during plant operations and before and during response actions. Air quality monitoring was performed during plant operations in 1981 for dimethoate and the chemical referred to as DEF. Neither chemical was detected in the impinger samples, with a detection limit of 0.0153 mg/m^3 for dimethoate and 0.0112 mg/m^3 for DEF (K/J 1993). Air quality monitoring was performed at the Site before and during the following investigative activities and response actions: 1984 landfill excavation; January 1988 removal of stockpiled soil; 1988 sampling of building materials and underlying soil; and 1989 onsite soil sampling, structures demolition and soil excavation. Some of the air quality monitoring performed in 1989 was used to evaluate and confirm the effectiveness of worker safety dust control and practices. The data from these four events indicate that maximum airborne chemical concentrations at the Site have not exceeded 1 percent of the applicable Threshold Limit Values (TLVs). The maximum airborne concentrations were detected in 1989 in samples collected during demolition activities (K/J 1993).

4.3.2 Air Chemical Impact Assessment

As discussed above, the results of the ambient air monitoring tests, as well as monitoring performed during demolition and excavation activities, indicate that ambient air has not been adversely impacted by Site remediation activities.

4.4 Soil Gas Investigation

4.4.1 Subsurface Vapor Investigation

Soil gas evaluations have been performed in conjunction with the soil vapor extraction (SVE) pilot program. Preliminary investigations of the feasibility of using SVE to remove volatile and semivolatile organic compounds (VOCs) in vadose zone soils were employed in two areas at the Site. In each area, soil vapor was extracted from wells using a vacuum pump, and VOCs were removed from extracted vapor by an appropriate treatment technology. SVE was implemented in the area surrounding the Former Solvent Storage Area (Area 4) from April 1991 through July 1993 to remove xylenes and other volatile and semivolatile compounds, and in the vicinity of Drainage System A (Area 5) from 1988 to mid-1993 to remove VOCs detected in the soil vapor. The SVE systems were operated successfully, and the remedial action objectives for chemicals in soil were achieved. The SVE systems were closed in mid-1993. A report documenting the operations of the SVE systems and recommending their closure was submitted to the DTSC on 16 September 1996 (K/J 1996). The SVE systems remain in place, but not in operation as THAN awaits written approval from DTSC.

SVE was first considered as a remediation technology for removing chloroform and other VOCs from the unsaturated zone soil in the Drainage System A area. A brief pilot study indicated that SVE was feasible and could be effective for removing VOCs from this area. Continuous vapor extraction began in March 1988, when former Monitoring Well 77 was converted to an SVE well. Additional extraction wells were installed in 1989, but were not utilized for SVE because of the low concentrations of chloroform and other VOCs detected in the soil vapor (K/J 1993). Analytical results for chloroform soil vapor extracted prior to treatment are presented on Table 4-14.

In April 1989, a preliminary investigation was performed in the Former Solvent Storage Area to evaluate the feasibility of removing volatile and semivolatile organic compounds from the vadose zone using SVE. Six SVE wells were installed in the former Solvent Storage Area and screened in stratigraphic layers of the vadose zone which had elevated chemical concentrations as indicated by analytical results for soil or soil vapor samples. Soil gas samples collected from these wells were analyzed, and xylene was detected at concentrations above 1,100 μg/l.

In the Spring of 1990, six additional SVE wells were installed in the Former Solvent Storage Area. In 1991, three more wells were installed. Operation of the SVE system for the removal of VOCs in the Former Solvent Storage Area began in April 1991, following permit approval by the San Joaquin Valley Unified Air Pollution Control District (APCD). Extracted VOCs were destroyed by internal combustion treatment.

The vapor extraction system in the Solvent Storage Area removed and destroyed an average of 20 pounds per day of combined xylenes and ethyl benzene from April through

December 1991. It is estimated that more than 11,700 pounds of xylene and ethyl benzene, and more than 15,800 pounds of total non-methane hydrocarbons were removed during the operation of the system through July 1993. As operations continued, the removal rate decreased with time as VOCs were removed from the soil (Table 4-15). The system was shut down in the summer of 1993. As described above, the SVE system remains in place but not in operation. Confirmation soil sampling conducted during November 1995 indicated that the remedial objectives for VOCs in soils in the Former Solvent Storage area had been achieved (K/J 1996). Xylene and ethyl benzene were detected in soil samples from only one of five confirmation soil borings at maximum concentrations of 0.27 mg/Kg and 0.05 mg/Kg, respectively.

4.4.2 Soil Gas Chemical Impact Assessment

Soil gas sample analytical results indicate the presence of chemicals in Site soil gas (Tables 4-14 and 4-15). Chemicals detected in the soil gas samples include chloroform, 1,2-DCA, xylene, ethyl benzene, and other total nonmethane hydrocarbons. The soil gas samples collected during the operation of the SVE systems were collected after extraction and provide an indication of the change in soil gas concentrations. These samples show a decrease in the chemical concentrations detected in soil gas over time. Chloroform was measured at a concentration of 0.00163 ppmv in a 13 January 1994 sample in the Drainage System A Area. Xylene was measured at 130 ppmv and Ethylbenzene at 27 ppmv in samples taken on 5 October 1994 after a restart of the SVE system in the Former Solvent Storage Area (Table 4-15).

4.5 Biological Investigation

A study and field evaluation was performed to identify any threatened or endangered plant and animal species occurring on the Site (Burnett 1987). This study found no threatened, endangered or candidate plant or animal species onsite. To supplement and update the 1987 study, the California Department of Fish and Game was asked to perform a search of its Natural Diversity Database in the area where the Site is located (USGS Clovis Quadrangle). The habitats of two species were identified as located in this quadrangle, but not in the Site area. No impact on endangered plant or animal species is anticipated (K/J 1993).

5 POTENTIAL RISKS POSED BY CONDITIONS AT THE SITE

5.1 Risk Assessment Approach

Multipathway human health and ecological risk assessments were performed to evaluate the potential public health and ecological risks, if any, posed by chemicals of concern in onsite soils, air, and groundwater. The final Health Risk Assessment (HRA) was submitted to the agencies on 31 January 1996 (ENVIRON 1996).

The major steps of the human health risk assessment described below include selection of chemicals of concern, evaluation of exposure pathways, and finally, risk characterization. The summary provided in this section is taken from ENVIRON's January 1996 final report. Also summarized in this section are the results of the ecological risk assessment for the Site. The assessment included field surveys and evaluation of potential exposures to wildlife.

Given that significant response actions have already been completed by THAN at the Site, the Risk Assessment considered potential risks to public health and the environment assuming that no further action is taken. All residents in the vicinity of the Site with domestic wells affected by chemicals known to be associated with the Site have been provided with alternate water supplies, which include the extension of the City Water System, and the provision of bottled water (or replacement carbon filters) at THAN's expense since 1988. The hypothetical exposure scenarios evaluated in the HRA conservatively did not consider the provision of such alternative water supplies for the purpose of calculating the risks associated with potential exposure to groundwater. The calculated risks would be significantly reduced if these alternative water supplies were taken into account.

5.2 Human Health Risk Assessment

5.2.1 Chemicals of Concern

Chemicals were selected for inclusion in the risk assessment based on approaches described in Risk Assessment Guidance for Superfund (RAGS) (EPA 1989b). This process is used to avoid carrying chemicals through the quantitative risk assessment that are detected infrequently, are present at low concentrations, or present very little risk to potentially exposed populations, thus allowing the risk assessment to focus on those chemicals that pose the most significant health risks at the Site.

Chemicals identified in soil and groundwater at the Site were selected for the risk assessment based on the following criteria: they were detected in the media of concern in at least 5 percent of the samples; chemicals considered to be common laboratory contaminants were present at sample concentrations greater than ten times their concentration in blanks; and metals were present above background concentrations. Prior to excluding any chemical on the basis of infrequent detections, the data were checked to assure that the detections were not clustered (a finding that could suggest the presence of a "hot spot" area). Chemicals recently detected (in investigations of shallow soil, Drainage System H, and groundwater) were of course not considered in the 1996 HRA, but would have been excluded because of the limited number of detections. Following the detection of chemicals, soils in the vicinity of Drainage System H were excavated. The chemicals selected for inclusion in the risk assessment are presented in Table 5-1. Chemicals detected in soil and groundwater were selected separately, due to differences in the chemicals identified in the different media. Because of different potential exposure pathways, separate evaluations were developed for three soil zones at the following depth ranges: 0-1 foot, 0-12 feet, and 0-50 feet depth.

5.2.2 Exposure Pathways

An exposure assessment was performed in which both hypothetical current and future land-use scenarios were evaluated. Potentially exposed populations included:

- Current
  - Onsite Worker (long-term)
  - Offsite Worker (long-term)
  - Offsite Resident (Adult)
  - Offsite Resident (Child)
- Future
  - Onsite Worker (long-term)
  - Onsite Worker (short-term, intrusive of soil)
  - Onsite Trespasser
  - Onsite Resident
  - Offsite Worker (long-term)
  - Offsite Resident

The primary exposure pathways evaluated included the following:

- Soil
  - Ingestion
  - Dermal contact
  - Inhalation of vapors and particulates
- Groundwater
  - Ingestion
  - Dermal contact
  - Inhalation of vapors from showering

The HRA contains calculations of the public health risks which could result from exposure to groundwater containing 1) chemicals known to be associated with the Site, and 2) DBCP, a regional groundwater pollutant, also known to be associated with the Site.

An exposure assessment was then performed to simulate exposure concentrations for selected chemicals present in soil, groundwater, and air at and near the Site. As discussed in the HRA report, because of the uncertainty associated with the statistical distribution of the soil and groundwater data, there is a resulting uncertainty associated with the representation of the chemical concentrations to which a person could potentially be exposed. According to the EPA (1989b), the exposure concentration of a chemical is "the average concentration contacted at the exposure point or points over the exposure period." These exposure concentrations can be estimated from monitoring data, or they may be estimated using fate and transport models. As discussed by the EPA, the exposure point concentration appropriate for estimating the "Reasonable Maximum Exposure" (RME), is the 95 percent upper confidence limit (95% UCL) of the arithmetic average concentration. The RME, according to the EPA (1989b), is the level of exposure that should be the basis for action at Superfund sites. The arithmetic average is appropriate if the data are normally distributed, and a geometric average is appropriate if the data are lognormally distributed. The data for the Site do not precisely match either a normal or lognormal distribution. For completeness, the HRA calculated RME concentrations using both arithmetic and geometric averages. Decisions made by the U.S. EPA and the DTSC will be based on the RME using the arithmetic average. The RME concentrations were then used to calculate potential health risks for several hypothetical current and future land-use scenarios.

5.2.3 Risk Characterization

Risk Characterization is the final step of a risk assessment. It is defined as the combination of the exposure and toxicity assessments to produce an estimate of risk and a characterization of uncertainties in the estimated risk. An estimate of the potential cancer risk associated with exposure to a carcinogen (*i.e.*, the incremental probability that an individual will develop cancer over a lifetime of exposure to that carcinogen) was obtained by multiplying the projected chronic daily intake (CDI) of the carcinogen by the chemical-specific cancer slope factor (CSF). A separate estimated cancer risk for each potential exposure pathway was calculated by summing the chemical-specific risks for the multiple chemicals associated with that exposure pathway. The estimated risks for hypothetical exposure pathways relevant to a potentially exposed population were then summed to estimate the overall multi-chemical, multi-pathway risks for each potentially exposed population.

To assess the noncarcinogenic effects of chemicals, the estimated CDI of a chemical was compared with that chemical's reference dose (RfD) or reference concentration (RfC). The resulting ratio, referred to as the Hazard Quotient (HQ), assumes that there is a level of exposure (*i.e.*, RfD) below which adverse health effects are not expected to occur. If the exposure level (E) exceeds this threshold (*i.e.*, if E/RfD exceeds unity), there may be concern for potential noncancer effects. As a rule, the greater the value of E/RfD above unity, the greater the level of concern. To assess the total noncarcinogenic risk associated with a potential exposure pathway, the HQ of each chemical was summed to provide a value called the Hazard Index (HI) for each exposure pathway. The estimated HIs for hypothetical exposure pathways relevant to a potentially exposed population were then summed to estimate the overall multi-chemical, multi-pathway HI for each potentially exposed population.

As described above, carcinogenic and noncarcinogenic risks were estimated for each potentially exposed population at the Site. In the discussion below, estimated excess cancer risks are expressed using scientific notation (*e.g.*, 1×10^{-6}) and estimated HIs are expressed using decimal notation (*e.g.*, 0.001). An excess cancer risk of 1×10^{-6} and a hazard index of 1 are used as points of reference for discussing hypothetical exposure pathways and specific chemicals contributing to the estimates of risk. It should be noted, however, that an estimate of a lifetime cancer risk in excess of 1×10^{-6}, or an estimate of an HI greater than 1, does not necessarily mean that remediation is required. To help establish remedial objectives for a Superfund site, the risks estimated following the EPA guidelines for Superfund risk assessment are compared with acceptable risk goals that the EPA has recommended in the National Contingency Plan (40 CFR 300.430(e)(2)). For carcinogenic chemicals, the EPA states that "acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as a point of departure for determining remediation goals for alternatives where ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure." For noncarcinogenic chemicals, the EPA states that exposure shall be limited to levels that are "without adverse effect during a lifetime or part of a lifetime." A hazard index (HI) of 1 or less is interpreted as corresponding to no adverse effect. Estimated risks in excess of these benchmark points indicate that "a risk management process" (DTSC 1986) should be initiated. The risk management process includes, among other factors, consideration of the uncertainties associated with the risk estimates and the degree to which health-conservative assumptions have been incorporated into the risk estimates.

The results of the human health risk assessment for potential carcinogenic effects are summarized in Tables 5-2 through 5-5. Table 5-2 provides the results for all chemicals assuming a normal distribution, and Table 5-3 provides the results for all chemicals assuming a lognormal distribution. Tables 5-4 and 5-5 show the results of the carcinogenic risk assessment for DBCP only, assuming normal and lognormal distributions, respectively. The results of the risk assessment for potential noncarcinogenic effects are summarized in Tables 5-6 through 5-9. Tables 5-6 and 5-7 provide the results for all chemicals assuming normal and lognormal distributions, respectively. Tables 5-8 and 5-9 provide the results of the noncarcinogenic risk assessment for DBCP only, assuming normal and lognormal distributions, respectively. The tables showing the contribution of risk from only DBCP are provided to show that a significant portion of the risk associated with chemicals in groundwater is due to the presence of DBCP, a regional groundwater pollutant. The overall results are discussed separately below for the evaluations based on normal and lognormal distributions. The U.S. EPA and the State of California recommend that risk assessment evaluations use statistics based on a normal distribution of data. The data for the Site do not precisely match either a normal or lognormal distribution.

5.2.3.1 Results Based on Normal Distribution

- Soil

  Results of the evaluation of risks assuming a normal distribution and using the 95% UCL of the arithmetic mean to calculate representative concentrations are shown in Tables 5-2 and 5-6. As shown in Table 5-2, the estimated lifetime incremental cancer risks associated with exposure to chemicals in soil under the current exposure scenarios range from $5x10^{-5}$ for an offsite resident child to $2x10^{-3}$ for an onsite worker. For all current exposure scenarios, the estimated lifetime incremental cancer risk was greater than $1x10^{-6}$. The risks estimated under the future scenarios range from $5x10^{-5}$ for an offsite resident child to $4x10^{-3}$ for a hypothetical onsite resident adult. For all future exposure scenarios, the estimated lifetime incremental cancer risk was greater than $1x10^{-6}$. For every hypothetically exposed offsite population, the inhalation of vapors and particulates is the most significant exposure pathway. For every hypothetically exposed onsite population, except an intrusive worker, dermal contact with soil is the most significant exposure pathway. The primary chemicals contributing to the risk were toxaphene, DDT, and Dieldrin.

No adverse noncancer health effects are expected under the current and future exposure scenarios for exposure of offsite populations to soil, given that all of the calculated HI values are less than 1 (Table 5-6). Under the current and future land-use scenarios, the HI values calculated for all onsite populations exceeded 1. The chemicals contributing to the HI values above 1 were DDT, DDE, DDD, Dieldrin, and arsenic.

- Groundwater

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated lifetime incremental cancer risks ranging from $2x10^{-5}$ to $2x10^{-4}$ for an offsite resident child and adult, respectively. Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from $3x10^{-5}$ for an offsite resident child to $1x10^{-3}$ for an onsite resident adult (Table 5-2). In all cases, DBCP accounts for at least 50 percent of the estimated risk.

Under the current land-use scenarios, the estimated risks for bathing with groundwater range from $2x10^{-5}$ for an offsite resident child to $2x10^{-4}$ for an offsite resident adult. For the future land-use scenarios, estimated risks range from $3x10^{-5}$ for an offsite resident child to $2x10^{-3}$ for an onsite resident adult. In all cases, DBCP contributes at least 75 percent of the estimated risk.

Under the current scenarios, the estimated cancer risks for swimming in a pool filled with groundwater are $6x10^{-7}$ for a child and $5x10^{-6}$ for an adult, assuming an exposure of one day per week for 6 years and 30 years, respectively. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are $6x10^{-6}$ and $4x10^{-5}$, and those estimated for children are approximately ten-fold lower. For both the current scenario and the future scenario, DBCP accounts for at least 50 percent of the total estimated risk from swimming.

Cumulative risks combining ingestion, bathing, and swimming ranged from $3x10^{-3}$ for future onsite adult residents to $4x10^{-5}$ for current offsite child residents.

Table 5-6 presents the HI values calculated for the three groundwater exposure scenarios. The HI values that were greater than 1 were for the following scenarios for both ingestion and bathing: current offsite child resident, future onsite worker long-term, future onsite adult resident, future onsite child resident, and future offsite child resident. These scenarios of course also had combined hazards (ingestion, bathing, and swimming) greater than 1. As was true for cancer risks, DBCP is the chemical that contributes the most to the HI values. In all cases, for both adults and children, DBCP accounts for approximately 50 percent of the total calculated HI. The calculated HI values (including cumulative) for other exposure scenarios were less than 1.

In addition to DBCP, the other chemicals in groundwater contributing the most to an unacceptable risk or hazard were chloroform and Dieldrin. The average DBCP concentration in groundwater samples from wells not affected by the Site and clearly affected by regional conditions ranged from 1.9 μg/l to 8.4 μg/l (RI Report, Section 7).

The concentrations used in the HRA for calculating risks due to DBCP were within this range, so the calculated risks from DBCP may be representative of regional risks from background levels.

5.2.3.2 Results Based on Lognormal Distribution

- Soil

As shown in Table 5-3, the estimated lifetime incremental cancer risks associated with exposure to chemicals in soil under the current exposure scenarios range from $6x10^{-7}$ for an offsite resident child to $6x10^{-5}$ for an onsite worker. For all but one current exposure scenario, the estimated lifetime incremental cancer risk was greater than $1x10^{-6}$. The risks estimated under the future scenarios range from $6x10^{-7}$ for an offsite child resident to $2x10^{-4}$ for a hypothetical onsite adult resident. For all future exposure scenarios, the estimated lifetime incremental cancer risk was at least $1x10^{-6}$ except for the offsite child resident. For every hypothetically exposed offsite population, the inhalation of vapors and particulates is the most significant exposure pathway. For every hypothetically exposed onsite population, except an intrusive worker, dermal contact with soil is the most significant exposure pathway. However, for all of the exposed populations listed in Table 5-3, the total cancer risks estimated for exposure to chemicals in soils are within the EPA goal of $1x10^{-4}$ to $1x10^{-6}$ for remediated sites, as provided in the National Contingency Plan (40 CFR Part 300), with the exception of future onsite adult residents. The primary chemicals contributing to the risk were toxaphene, DDT, and Dieldrin.

As shown in Table 5-7, no adverse noncancer health effects are expected under the current scenarios for exposure to soil, given that all of the calculated HI values are less than 1. Under the future land-use scenarios, the HI values calculated for a resident child and adult exceeded 1. The chemicals contributing to the HI values above 1 were DDT and its degradation products, Dieldrin, and arsenic.

- Groundwater

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated lifetime incremental cancer risks ranging from $8x10^{-6}$ to $8x10^{-5}$ for an offsite resident child and adult, respectively (Table 5-3). Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from $1x10^{-5}$ for an offsite resident child to $2x10^{-4}$ for an onsite resident adult. In all cases, DBCP accounts for over 50 percent of the estimated risk.

Under the current land-use scenarios, the estimated risks for bathing with groundwater range from $8x10^{-6}$ for an offsite resident child to $8x10^{-5}$ for an offsite resident adult. For the future land-use scenarios, estimated risks range from $1x10^{-5}$ for an offsite resident child to $2x10^{-4}$ for an onsite resident adult. In all cases, DBCP contributes over 50 percent of the estimated risk.

Under the current scenarios, the estimated cancer risks for swimming in a pool filled with groundwater are $2x10^{-7}$ for a child and $2x10^{-6}$ for an adult, assuming an exposure of one day per week for 6 years and for 30 years, respectively. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are $2x10^{-6}$ and $4x10^{-6}$, and those estimated for children are approximately ten-fold lower. For both the current scenario and the future scenario, DBCP accounts for roughly 50 percent of the total estimated risk from swimming.

Cumulative risks combining ingestion, bathing, and swimming ranged from $4x10^{-4}$ for future onsite adult residents, to $2x10^{-5}$ for current offsite child residents.

Table 5-7 presents the HI values calculated for the three groundwater exposure scenarios. As can be seen in the table, all calculated HI values are less than 1, except for the potential future onsite child residents. As was true for cancer risks, DBCP is the chemical that contributes the most to the HI values. In all cases, for both adults and children, DBCP accounts for over 50 percent of the total calculated HI.

In addition to DBCP, the other chemicals in groundwater contributing the most to an unacceptable calculated risk or hazard were chloroform and Dieldrin.

5.2.3.3 Uncertainty

Development of a quantitative risk assessment for a large hazardous waste site necessarily requires the use of a number of both generic and site-specific assumptions regarding the representativeness of sampling data, human exposures, chemical toxicity, and associated cancer and noncancer health risks. However, many of the assumptions used in the HRA report are conservative, following agency guidance, and reflect a 90th or 95th percentile value, rather than a typical or average value (50th percentile value), for a given parameter. The use of conservative exposure and toxicity assumptions can introduce considerable uncertainty into the risk assessment. By using conservative exposure or toxicity estimates, the risk assessment can develop a significant conservative bias that may substantially overestimate the true risks.

The EPA notes that these procedures are intended to insure that the estimated risks do not underestimate the actual risks posed by a site and that the estimated risks do not necessarily represent actual risks experienced by populations at or near a site. The EPA (1989b) explains the effect of using standardized assumptions in regulatory risk assessments as follows:

> "These values are upperbound estimates of excess cancer risk potentially arising from lifetime exposure to the chemicals in question. A number of assumptions have been made in the derivation of these values, many of which are likely to overestimate exposure and toxicity. The actual incidence of cancer is likely to be lower than these estimates and may be zero."

It is important to keep in mind the fact that the risk estimates presented in HRA report are upper-bound estimates based on assumptions that are selected with the intention of assuring that actual risks are not underestimated. The risk assessment was performed according to regulatory guidelines which are not intended to be interpreted in terms of personal risk. At best, these guidelines produce upper-bound estimates of incremental individual risk. One should also keep in mind the fact that the incidence of cancer in the United States is one in four or 250,000 in a million (USDHHS 1991).

5.3 Ecological Risk Assessment

Potential impacts of Site chemicals on onsite and offsite ecological habitats were also evaluated. The assessment was based on field surveys of the ecological characteristics of the Site and information in the Natural Diversity Data Base compiled by the California Department of Fish and Game. In addition, potential adverse effects to wildlife were evaluated by using the estimated intakes of chemicals by three domestic animal species (cow, chicken, and rabbit) as surrogate estimates of exposures expected for wildlife. Estimated exposures for the domestic animal surrogates were compared to exposure concentrations at which no adverse health effects are expected. The findings of the uptake modeling are based on semi-quantitative analyses which introduced considerable uncertainty into the evaluation. The actual potential exposure to Site chemicals and the associated potential risks for wildlife should be lower than those estimated in the HRA. Potential bioaccumulation of chemical through the food-chain was also considered. The Site is not expected to pose a risk due to the bioaccumulation of chemicals.

The results of the ecological risk assessment indicated that threatened and endangered species are unlikely to be adversely affected by Site conditions. Potential effects of Site chemicals to onsite and offsite ecological habitats are expected to be negligible.

6 IMPACT ON PRESENT, FUTURE, AND PROBABLE BENEFICIAL USES OF RESOURCES

6.1 Present Uses of Land/Water

Currently, the Site is used to support ongoing remedial and related Site activities, including groundwater monitoring. The onsite office is utilized as needed to support these activities. Ornamental plants are maintained along the East McKinley Avenue perimeter. The Site is fenced and Site security is maintained through the locked entrance gate. A connection to the City of Fresno domestic water system is used to supply two sinks and toilets. Groundwater at the Site is also used for onsite irrigation. There are no current plans for additional Site usage.

Groundwater in the vicinity of the Site is currently being used for potable and non-potable purposes. Water wells are located in the area and include municipal supply wells, domestic supply wells and monitoring wells. It is THAN's understanding that domestic wells affected by chemicals known to be associated with the Site are used for non-drinking purposes only. In addition to the presence of site-related chemicals, groundwater in and around the vicinity of the Site is presently affected by the regional presence of DBCP and other chemicals such as nitrate, arsenic, and possibly 1,2,3-TCP.

The HRA report evaluated health risks for several hypothetical current land use scenarios (ENVIRON 1996). The total estimated cancer and noncancer risks from exposure to soil and groundwater associated with these exposures exceed the NCP guidelines for acceptable exposure levels, based on the normal distribution of chemical concentrations. The calculated risks were lower assuming a lognormal distribution, but the use of lognormal mean statistics is not recommended by U.S. EPA or the State of California.

6.2 Future Potential Uses of the Site

There are no current plans to develop the Site. At some future time, it is possible that the Site would be used for light commercial or industrial activity. These activities are consistent with the proposed remedial actions. The preferred remedial action alternative described in Section 7.4 includes deed restrictions to prohibit the future development of the Site for residential use or use by sensitive populations (*e.g.*, hospitals or day-care facilities). This alternative also includes the installation of a protective cap over the onsite soils and restrictions to prevent disturbance of the protective cap.

The HRA evaluated future land-use scenarios, including onsite/offsite intrusive, short-term workers and long-term workers. The total estimated cancer and noncancer risks from exposure to soil and groundwater associated with some of these scenarios exceed the NCP guidelines for acceptable exposure levels, based on the normal distribution of chemical concentration data (Tables 5-2 and 5-4). The calculated risks were lower assuming a lognormal distribution. The HRA calculations do not include the additional reduction in risk which will be incurred upon the implementation of the final remedy. In summary, the presence of chemicals known to be associated with the Site in environmental media is not expected to have a long-term adverse impact on commercial or industrial development of the Site.

6.3 Probable Beneficial Uses of Land/Water

The probable beneficial uses of the Site are industrial and commercial. Installation of a cap over onsite soils will eliminate existing or potential human exposure to surface and subsurface chemically affected soils which pose greater than a 10^{-6} incremental cancer risk or a HI greater than 1. The protective cap will also minimize the potential for migration of chemicals in soil to groundwater or air.

Potential beneficial uses of the groundwater at and in the vicinity of the Site include municipal, domestic, agricultural and industrial, as indicated by the Central Valley Region Water Quality Control Plan for the Tulare Lake Basin (SWRCB 1995). Use of Site groundwater for nonpotable purposes such as irrigation is anticipated to continue to be a beneficial use.

Use of onsite and offsite groundwater for drinking water purposes will continue to be affected by the regional presence of DBCP and by site-related chemicals. As discussed Section 4.2.4, DBCP, in addition to being associated with the THAN site, is a regional pollutant in the Fresno area, including areas adjacent to the Site. In addition, initial indications are that 1,2,3-TCP is also a regional pollutant similar to DBCP.

7 SUMMARY OF REMEDIAL ACTION FEASIBILITY STUDY AND SELECTION OF PREFERRED REMEDIAL ACTION ALTERNATIVE

7.1 Overview of Feasibility Study

The purpose of the FS is to identify appropriate remedial objectives and to evaluate appropriate remedial action alternatives in order to provide a basis for selection of a final remedy for the Site. The detailed evaluation of alternatives is presented in the FS Report (SEACOR 1993a). The FS process included the following steps:

- Develop Remedial Action Objectives (RAOs), which specify chemicals and media of concern, potential exposure pathways and remediation goals, taking into account the potentially Applicable or Relevant and Appropriate Requirements (ARARs) identified for the project.
- Identify, screen and select viable remedial technologies and process options for each medium (soil and groundwater).
- Develop and screen remedial action alternatives from the selected technologies.
- Conduct a detailed analysis of the remaining remedial action alternatives. Alternatives were evaluated using the evaluation criteria set forth in the National Contingency Plan (NCP).

The preferred remedial action alternative was selected on the basis of the detailed evaluation performed during the FS, comments from DTSC and other agencies, and the Technical and Economic Feasibility Evaluation (TEFE) performed for the Site (Appendix B). Section 7.2 presents the ARARs and the RAOs identified for the Site in the FS. Section 7.3 presents all the remedial alternatives evaluated. Section 7.4 describes the preferred remedial action alternative for soil and groundwater.

7.2 Summary of ARARs and Remedial Action Objectives

This section summarizes the discussion of ARARs and RAOs presented in Section 2 of the FS Report.

7.2.1 Applicable or Relevant and Appropriate Requirements (ARARs)

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, requires that remedial actions at a Superfund site achieve a level of remediation that protects human health and the environment. In addition, the remediation must attain legally applicable or relevant and appropriate requirements (ARARs). ARARs are standards, criteria or limits promulgated under federal or state law. Only those state standards that are promulgated, identified by the state in a timely manner and more stringent than federal requirements, may be considered ARARs (40 CFR Section 300.400 (g)(4)).

Applicable requirements are those remedial standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited.

The determination that a requirement is applicable or relevant and appropriate is a two-stage process. First, a federal or state law or regulation should be analyzed to determine whether it is applicable using the definitions previously stated. Applicable requirements are ARARs.

More discretion is allowed in determining whether a requirement is relevant and appropriate. In some cases, a requirement may be relevant, but not appropriate, given site-specific circumstances. Such a requirement would not be an ARAR for the Site. It is possible for only part of a requirement to be considered relevant and appropriate in a given case. If a determination is made that a requirement is both relevant and appropriate, such a requirement should be given the same consideration as an applicable requirement.

Types of ARARs. There are three types of ARARs: chemical-, action-, and location-specific requirements. Chemical-specific ARARs are health- or risk-based concentration limits for specific hazardous substances or chemicals. Examples of this type of ARAR are water quality standards and drinking water standards. Action-specific ARARs are technology-based requirements, the applicability or relevance and appropriateness of which depends on the type of remedial action under consideration. Examples of action-specific ARARs are the Resource Conservation and Recovery Act (RCRA) regulations for hazardous waste treatment, storage, and disposal. Location-specific ARARs impose requirements on certain types of activities based on characteristics of the site. Examples of ARARs specific to location include requirements restricting activities in wetlands, flood plains, and at historical sites.

Nonpromulgated policy, advisories, or guidance documents issued by federal or state agencies may be considered when developing remediation levels necessary to protect public health and the environment, although they are not ARARs. These items are "To Be Considered" and are called "TBCs". Criteria, advisories, or guidance that are selected as requirements for the remedial action are no longer considered TBCs, and instead become requirements that must be met.

7.2.1.1 Preferred Remedial Action Alternative ARARs

The preferred remedial action alternative is presented below in Section 7.4.1. ARARs for the preferred remedial action alternative were selected by screening the potential ARARs identified in the FS. Additionally, at the request of DTSC, the ARARs include State Water Resources Control Board (SWRCB) Resolution No. 92-49, Section III.G., which was not identified in the FS. Citations to the specific ARARs for the preferred remedial action alternative are shown in Table 7-1.

- **Chemical-Specific ARARs.** The federal and state chemical-specific ARARs are the national and more stringent state primary drinking water standards promulgated under the federal and state Safe Drinking Water Acts. These standards are generally relevant and appropriate for aquifers that are existing or potential public or private water sources.

- **Action-Specific ARARs**

  - **Federal Action-Specific ARARs.** If the contingent remedy for onsite/nearsite groundwater involves extraction and treatment, then depending on the method selected for disposing of treated groundwater, the federal action-specific ARARs potentially applicable to the contingent remedy are regulations promulgated under the Clean Water Act regarding the issuance of NPDES permits, discharges to publicly-owned treatment works (POTW), underground injection control, and water quality criteria.

    The FS also identified as potential ARARs certain provisions of RCRA, but California is authorized to administer the state Hazardous Waste Control Law in lieu of RCRA. Accordingly, this RAP identifies as ARARs those applicable or relevant and appropriate hazardous waste regulations promulgated under the State Hazardous Waste Control Law (see discussion below).

  - **State Action-Specific ARARs.** SWRCB Resolution No. 68-16 is a narrative policy requiring the maintenance of existing water quality unless it is demonstrated that the change is consistent with maximum benefit, will not unreasonably affect present or potential uses, and will not result in water quality less than what is prescribed by other state policies. This Resolution is applicable to the preferred remedial action alternative.

    SWRCB Resolutions No. 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), Section III.G. This cleanup is not being conducted pursuant to Section 13304, but Section III.G of the Resolution is relevant and appropriate to the preferred remedial action alternative because it establishes the SWRCB's policy for setting groundwater cleanup levels if background levels cannot be restored.

    CCR Title 23, Section 2550.4, establishes criteria for setting concentration limits for constituents of concern in groundwater, including the factors that must be considered in establishing a concentration limit greater than background. This Section is relevant and appropriate to the selection of FRGs for the remedial action.

    The Tulare Lake Basin Plan Water Quality Control Plan (Basin Plan) establishes water quality objectives for chemical constituents in ground water and surface water in the Basin, and is therefore applicable.

    Department of Water Resources Bulletin 74-81 and Supplement 74-90 regulate the classification, construction, and destruction of groundwater wells and are applicable to groundwater extraction and monitoring wells.

    State Hazardous Waste Control Law. Table 7-1 identifies the specific regulations promulgated under the Hazardous Waste Control Law that are applicable or relevant and appropriate to the preferred alternative. These regulations govern hazardous waste identification; generation and transportation of hazardous waste (potentially applicable if, respectively, hazardous waste is generated as a result of the remedial activities or transported offsite); tank systems (applicable if a contingent remedy is invoked and includes treatment of onsite/nearsite groundwater, because the groundwater treatment system would include tanks); and land disposal restrictions (potentially applicable to spent carbon from a contingent treatment system).

We note that the hazardous waste regulations governing water quality monitoring and response programs at permitted TSD facilities (22 CCR Sections 66264.90-.100) and closure and post-closure care (22 CCR Sections 66264.110-.120), which were identified as potential ARARs in the FS, are not ARARs for the preferred remedial action alternative. These regulations are not applicable because the Site is not a permitted TSD facility. They are not relevant and appropriate to conditions at the Site because they regulate sites where waste management units will remain in place. All known waste management units (*e.g.*, the sumps, cistern and landfill areas) at the Site were removed between 1984 and 1997 as part of the removal activities conducted at the Site. Accordingly, these regulations are neither relevant nor appropriate to remediation of the THAN Site pursuant to this RAP.

San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rule 8020 establishes fugitive dust requirements for the control of fine particulate matter (PM-10) and is applicable to construction and excavation activities conducted as part of the preferred remedy.

7.2.2 Remedial Action Objectives (RAOs)

RAOs are media- and chemical-specific objectives for protecting public health and the environment. RAOs are established for a particular site during the FS process and are used to identify and evaluate remedial action alternatives. RAOs specify the compounds of concern, exposure routes and receptors, and remediation goals for each exposure route. RAOs take into account the following:

- Nature and extent of chemically-affected media and the fate and mobility characteristics of chemicals in those media as described in the RI Report.
- Estimated risks to hypothetical biological receptors from potential current and future exposure to chemicals by pathways described in the HRA Report.
- ARARs

The RAOs that were developed and utilized during the FS to evaluate remedial action alternatives are discussed in Section 2 of the FS Report (SEACOR 1993a). In a letter to THAN dated 6 August 1993 (DTSC 1993), DTSC subsequently identified "key performance objectives" that would need to be met for the soil and groundwater components of the preferred remedial action alternative. These performance objectives are based on, and in some instances are refinements of, the RAOs identified and used in the FS. The performance objectives identified by DTSC in its 6 August 1993 letter are summarized below.

Soil Performance Objectives

- Reduce the toxicity, volume and mobility of chemicals present in Site soils to the extent practical in order to: (1) eliminate existing or potential human exposures which pose a total cancer risk from all exposure routes of greater than $1x10^{-6}$ or a total hazard index greater than one for non-carcinogenic effects, and (2) control the migration of chemicals from Site soils to other media.

Groundwater Performance Objectives

- Comply with ARARs.
- Develop and implement a groundwater extraction and treatment system capable of achieving permanent containment, or removal of, chemicals released on or from the Site, which exceed final remediation goals as will be identified in the RAP/ROD.
- Develop and implement a groundwater monitoring program capable of: (1) verifying that unacceptable human exposures or environmental impacts are not occurring as a result of the presence or movement of chemicals in groundwater, and (2) providing sufficient information to allow for analysis of the effectiveness of the groundwater remediation system.
- Require extracted groundwater to be put to beneficial use to the extent practicable.
- Establish a non-numeric preliminary remedial goal for DBCP in groundwater due to its regional presence, which would require an evaluation of DBCP at the time that final remediation goals for other chemicals known to be associated with the Site in groundwater are attained (See further discussion below).
- Establish provisions to deal with any significant release of DBCP, should it occur, from Site soils to groundwater resulting from a resaturation of the A-zone (See further discussion below).

7.2.3 Final Remediation Goals

Final Remediation Goals (FRGs) are a subset of RAOs and consist of potential exposure pathway- and medium-specific chemical concentration goals that are protective of human health and the environment. As described below, FRGs have been established for groundwater and onsite soils. FRGs were proposed during the draft RAP, and are now finalized. FRGs will serve as the remediation goals for the final remedy.

For groundwater, FRGs may be chemical-specific (*i.e.*, a numerical value that establishes an acceptable concentration of a chemical substance that may remain in groundwater) and/or action-specific (*i.e.*, a numerical value that establishes an acceptable concentration of a chemical substance in groundwater that is extracted, treated and discharged). Ranges of potential chemical-specific applicable or relevant and appropriate requirements for selected chemicals of concern in groundwater were presented in Tables 2-2 and 2-2a of the FS Report. These values are summarized in Table 7-2. The ARARs, health-based criteria, and other pertinent factors as prescribed by applicable law and regulation were evaluated by DTSC to develop FRGs. In a 6 March 1997 letter to THAN, DTSC provided THAN with a list of proposed FRGs, and provided THAN with an opportunity to prepare a TEFE. Based on the TEFE (Appendix B), DTSC agreed in a letter dated 3 October 1997 to a revised list of proposed FRGs. These proposed values are now finalized. Chemical-specific FRGs for groundwater are presented in Table 7-3. The groundwater FRGs presented in Table 7-3 were established for those chemicals of interest currently detected in domestic well or groundwater monitoring well samples. Action-specific FRGs for the discharge of treated groundwater, if necessary, would be set subsequently during the discharge permit application process.

Because of the regional presence of DBCP in groundwater, it would be inappropriate to select a numeric chemical-specific FRG for DBCP in groundwater. Instead, a non-numeric remediation goal for DBCP would be linked to the attainment of chemical-specific FRGs for other chemicals known to be associated with the Site. At such time as the data obtained from the groundwater monitoring program indicate that chemical-specific FRGs have been attained for these other chemicals, an evaluation of the DBCP in groundwater would be performed. That evaluation would include an assessment of the background concentration of DBCP present in groundwater at that time and a comparison of DBCP concentrations found downgradient of the Site with the background concentration. The evaluation would also include an assessment of the mass of DBCP attenuated during implementation of the remedy and a comparison of this mass with the mass of other chemicals attenuated. THAN would then present the results of the evaluation to DTSC and propose further remedial action with regard to DBCP, if determined at that time to be necessary. In addition to the non-numeric remediation goal identified for DBCP above, the final groundwater remedial alternative would be designed to reduce DBCP in groundwater, if any, that is extracted and treated to concentrations that would meet an action-specific FRG for the discharge of such water. As previously mentioned, this action-specific FRG for the discharge of treated groundwater would be set during the discharge permit application process. Another FRG would also be established for DBCP that would address potential future remediation of DBCP in onsite or nearsite groundwater should resaturation of onsite A-zone soils result in an increase in DBCP concentrations in onsite or nearsite groundwater above the FRG for DBCP. This FRG would be based on an evaluation of background groundwater quality conditions to be made at and around the time of A-zone resaturation.

Based on the presence of 1,2,3-TCP in groundwater from areas clearly unaffected by Site activities, and the regional application of DD and/or Telone in the vicinity of the Site, the initial indications are that 1,2,3-TCP is similar to DBCP in being a regional groundwater pollutant (Chaney 1998a). Accordingly, 1,2,3-TCP has a non-numeric remedial goal. If the regional presence of 1,2,3-TCP is confirmed, 1,2,3-TCP will be evaluated in the same manner as DBCP, as discussed above. If 1,2,3-TCP is also found to be associated with the Site, DTSC will establish a site-specific FRG above background.

An appropriate statistical test will be used to evaluate compliance with groundwater FRGs. The statistical test will be proposed to DTSC for approval. The choice of the tests will take into account the following factors:

- Choice of compliance wells.
- Use of non-parametric statistical tests when the FRG is the detection limit or close to the detection limit.
- Use of transformed data (*e.g.*, lognormal) if appropriate.
- Application of the 95% UCL to the cumulative risk (and not individual constituents).
- Rounding of cumulative risk values.
- Excluding 1,2,3-TCP (and DBCP) in the cumulative risk calculations. (The evaluation of 1,2,3-TCP and DBCP is discussed above and in Section 7.4.1.2.)

Details of the statistical methodology and proposed application of the statistical tests will be presented in the remedial design report.

No chemical-specific ARARs for Site soils were identified in the FS. Instead, chemical-specific FRGs were developed for chemically-affected soils. The FRGs were derived from the lesser value (more health protective value) of either the site-specific values calculated from the HRA, or U.S. Preliminary Remediation Goals (PRGs) for industrial land use. Also, the more health protective value based on carcinogenic or non-carcinogenic effects was chosen. As described subsequently in Section 7.4, the preferred alternative includes restrictions to prevent residential development of the Site or other use of the Site involving sensitive receptors. The FRGs for soil are presented in Table 7-4. The FRGs will be used in the development of the final design of the cap to evaluate the extent of chemically-affected soils at the Site that will require capping. On the basis of the FRGs, the entire 5-acre Site will be capped.

7.3 Discussion of Remedial Action Alternatives

7.3.1 Initial Screening Process

In the FS, remedial technologies and process options were identified and screened using the criteria of effectiveness, implementability and relative cost. The retained technologies and process options were then combined to form a range of media-specific (*i.e.*, soil and groundwater) remedial alternatives. These media-specific alternatives were subjected to further screening and combined to form eleven remedial action alternatives for detailed analysis. This initial screening process is described in detail in Sections 2 and 3, and summarized in Tables 2-5 to 2-7 and 3-1 to 3-3, of the FS report.

Following submittal of the final FS report, the TEFE was performed for the Site. Based on the results of the TEFE and discussions with the DTSC, an alternative was developed from modified groundwater components of other alternatives (primarily Alternative 9), and is included in this Final RAP. Also, contingent soil vapor extraction was a component of many alternatives evaluated in the FS. Since the final FS report was submitted, an evaluation has shown that soil vapor extraction is no longer required at the Site because operation of the systems was successful in reducing chemical concentrations in soil to below remedial action objectives. For consistency with the FS, contingent soil vapor extraction is maintained as an option in the applicable alternatives.

7.3.2 Evaluation Criteria for Detailed Analysis of Alternatives

The eleven alternatives that were identified in the FS, and an alternative created from modified groundwater components of other alternatives, were subjected to detailed analysis using the evaluation criteria set forth in the National Contingency Plan (NCP). As described further in Section 7.3.3 below, the scope of the alternatives ranged from no further action to a combination of soil and groundwater removal and treatment. The evaluation criteria are as follows (EPA 1989a):

1. **Overall Protection of Human Health and the Environment**. This criterion is used to evaluate how the alternatives will reduce or control identified risks (both short-term and long-term) to human health and the environment posed by the Site. Environmental protection includes the preservation of beneficial uses of natural resources.

2. **Compliance with ARARs.** This criterion evaluates the extent to which alternatives comply with the ARARs identified during the FS process. The evaluation considers the extent to which the alternatives meet the specifications of the identified federal and state requirements that are applicable, or relevant and appropriate. ARARs may be specific to the remedial action (action-specific ARARs), the site location (location-specific ARARs), or the chemicals present onsite (chemical-specific ARARs).

3. **Long-Term Effectiveness and Permanence**. This criterion evaluates the long-term effectiveness and permanence of the alternative in meeting remedial action objectives. This criterion also addresses the residual risk remaining after the conclusion of the remedial activities. It includes assessment of the adequacy and long-term reliability of the proposed controls to continue to provide protection from treatment residuals or untreated environmental media.

4. **Reduction of Toxicity, Mobility or Volume Through Treatment**. This criterion evaluates the degree to which alternatives utilize treatment technologies to permanently and significantly reduce toxicity, mobility or volume of the hazardous substances.

5. **Short-Term Effectiveness**. This criterion evaluates each alternative with respect to the construction and implementation phase. The key factors to be considered include protection of the community and site workers during remedial actions, and any potential adverse environmental impacts that may result during the implementation phase.

6. **Implementability**. Implementability considers the technical and administrative feasibility and the availability of the required services and materials. Technical feasibility includes the ability to construct and operate the remedial alternative along with the reliability of the technology and the necessary monitoring considerations. Administrative feasibility includes the ability to obtain permits required and the necessity for coordination with other agencies in order to implement the alternative. The availability of treatment, storage, and disposal services, equipment and specialists to implement the alternative, and the availability of new technologies are also considered.

7. **Cost**. The cost criterion evaluates both capital costs and operation and maintenance costs. Direct capital costs include construction, equipment, and site preparation costs. Engineering expenses, permits, agency oversight fees, and contingencies are examples of indirect capital costs. Operation and maintenance (O&M) costs include labor costs, maintenance, materials and services, energy costs, and disposal costs such as regeneration of spent activated carbon.

   Actual costs are dependent upon the operating life of the system and the time required to complete the remediation which may vary between alternatives. In accordance with the NCP, the present worth of each alternative evaluated in the FS was calculated based upon an operation period of 30 years. This allowed the comparison of costs among the alternatives. The cost of Alternative 12 was developed in a manner consistent with the development of costs in the FS.

8. **State Acceptance**. This evaluation addresses administrative issues and concerns that the state may have regarding the alternatives.

9. **Community Acceptance**. This criterion evaluates the issues and concerns the public may have regarding each of the alternatives, and especially the preferred remedial action alternative.

7.3.3 Description of Remedial Action Alternatives

The eleven alternatives that were evaluated in the FS and Alternative 12 are as follows:

- Alternative 1: No Further Action
- Alternative 2: Limited Action
- Alternative 3: Limited Action and Institutional Controls
- Alternative 4: Soil Capping
- Alternative 5: *In situ* Soil Treatment
- Alternative 6: *Ex situ* Soil Treatment
- Alternative 7: Soil Capping and Contingent Onsite and Nearsite Groundwater Extraction
- Alternative 8: Soil Capping and Offsite Groundwater Extraction
- Alternative 9: Soil Capping and Contingent Onsite, Nearsite and Offsite Groundwater Extraction
- Alternative 10: *In situ* Soil Treatment and Offsite Groundwater Extraction
- Alternative 11: *Ex situ* Soil Treatment and Offsite Groundwater Extraction
- Alternative 12: Soil Capping, Contingent Onsite, Nearsite and Offsite Groundwater Extraction, and Monitored Natural Attenuation

The components of the alternatives are presented in Table 7-5. The alternatives considered in the FS are described and compared in the following sections. As discussed above, soil vapor extraction is included in the alternatives evaluated in the FS, even though soil vapor extraction is no longer required because operation of the systems was successful in reducing chemical concentrations to below remedial action objectives. The detailed analysis of the alternatives against the evaluation criteria set forth in the NCP is presented in Section 4 of the FS Report (SEACOR 1993a).

7.3.3.1 Alternative 1: No Further Action

The NCP requires evaluation of a no action or no further action alternative. The no further action alternative serves to provide a baseline for evaluation of the other alternatives. In this case, the alternative involves no further action beyond those remedial measures that have previously been implemented or completed at the Site, and the existing extension of the City Water System. Under this alternative, any ongoing remedial measures, such as soil vapor extraction and groundwater monitoring, would be discontinued. Groundwater monitoring wells would be abandoned. It is assumed that existing Site access restrictions (fencing and security) and provisions for alternate water supplies, other than the existing City Water System extension, would be removed.

7.3.3.2 Alternative 2: Limited Action

This alternative continues the existing institutional controls (fencing to discourage trespassing and provision of alternate water supplies), and includes access restrictions to the Site, monitoring of groundwater and, if necessary, storm water. An air quality monitoring program would be conducted over a period of one year to evaluate the levels of chemical vapors and chemically-affected dust associated with onsite soils. Based on the results of this assessment, the need for long-term air monitoring would be evaluated. The existing City Water System extension would remain in place. Alternate water supplies would be provided as necessary in areas not presently serviced by the existing City Water System extension in the event that concentrations of one or more chemicals known to be associated with the Site are detected in well water used for domestic purposes. Based on the results of the system evaluation, ongoing soil vapor extraction (SVE) and treatment of volatile and semi-volatile chemicals from chemically-affected soils would continue.

7.3.3.3 Alternative 3: Limited Action and Institutional Controls

In addition to the measures provided under Alternative 2, this alternative would include deed restrictions on the Site, Fresno County regional groundwater use restrictions, and a wellhead treatment protection program. A deed restriction would be recorded to limit Site land uses to nonresidential activities and limit the use of onsite groundwater for domestic purposes. The deed restriction would further require controls to prevent worker and nearsite resident exposure to dust during construction activities.

Groundwater use restrictions would be implemented by Fresno County with regard to offsite groundwater by prohibiting shallow domestic well installation in the area of chemically-affected groundwater known to be associated with the Site. These groundwater use restrictions could include restrictions against well installation in those areas with chemically-affected groundwater or could alternately include minimum well construction standards, including a minimum depth of sanitary seal and a minimum screened interval (extraction) depth. A wellhead protection program could include provisions for monitoring, well rehabilitation, and wellhead treatment of municipal supply well PS-102 (or any other potentially-affected water supply wells) with further contingencies for public notification, blending of water supplies, or temporary shut down of the well prior to implementation of mitigation, should chemicals known to be associated with the Site be detected in such wells.

7.3.3.4 Alternative 4: Soil Capping

This alternative includes the installation of an asphaltic and composite cap in conjunction with drainage controls. Existing asphalt-covered areas at the Site would be reconditioned and maintained. The remainder of the affected areas would be covered with a composite cap. A composite cap could consist of one or more layers of compacted clay, soil, synthetic materials, gravel, and vegetation. The cap and drainage controls would minimize infiltration of precipitation and contact with chemically-affected soils, and would further reduce the potential migration of chemicals, fugitive dust, or vapor emissions.

The areal extent and volume of chemically-affected soils to be addressed by this alternative would depend on the exposure scenario and the degree of risk to be mitigated. The soil capping alternative also includes those measures in Alternative 3, with the exception that storm water monitoring and long-term air monitoring would be discontinued. Based upon the results of an evaluation of effectiveness, soil vapor extraction and treatment would continue under this alternative. A deed restriction would be necessary to provide for long-term maintenance of the integrity of the cap.

7.3.3.5 Alternative 5: *In situ* Soil Treatment

Alternative 5 would consist of *in situ* soil treatment by chemical stabilization/solidification followed by installation of a vegetative cover. Stabilization/solidification reduces the potential for migration of chemicals in soil by chemical reaction, sorption, or physical entrapment. Chemically-affected deep soils (from 12 feet to 50 below grade) would be stabilized/solidified by an auger mixing technique. The stabilizing agent is introduced into the soil through the hollow stem augers. The auger mixes the agent into the soil with a lifting and turning action. Surface soils (0-1 feet below grade) would be stabilized/solidified through introduction of the stabilization agent with conventional tilling equipment. Shallow soils (1-12 feet) would also be stabilized/solidified using specialized equipment to achieve remedial action objectives. Once the soils are stabilized and compacted, a layer of topsoil and vegetative cover will be placed above the treated soils.

This alternative would also include the pertinent elements of Alternative 3, including the deed restrictions, groundwater use restrictions, wellhead protection program, alternate water supply (including existing and proposed City Water System extensions), and groundwater monitoring. Based upon the results of an evaluation of effectiveness, soil vapor extraction and treatment would continue under this alternative.

7.3.3.6 Alternative 6: *Ex situ* Soil Treatment

This alternative includes soil vapor extraction and treatment where appropriate, and soil excavation and onsite thermal desorption, followed by onsite soil replacement. Low temperature thermal desorption would separate organic chemicals from chemically-affected soils *ex situ* at temperatures of 300° to 700° Fahrenheit. Chemically-affected soils would be removed using common excavation techniques. Analytical testing would be performed during excavation to verify removal of soils containing chemicals exceeding PRGs and to verify treatment levels prior to replacement. Dust control would be implemented to suppress the generation of fugitive dust during excavation. Volatilized chemicals that are not oxidized by the thermal desorption would be captured by a carbon bed or destroyed with an afterburner. The spent carbon or other treatment residues would require further treatment or disposal. The treated soil resulting from this process would be placed back into the excavation, covered with a layer of topsoil, and a vegetative cover installed.

Thermal desorption is preferred over incineration because of lower anticipated energy requirements and air emissions. However, a treatability study would be required to evaluate the effectiveness of thermal desorption for treatment of onsite soils containing pesticides. Should thermal desorption prove to be ineffective for treatment of chemically-affected onsite soils or prove to be cost-prohibitive, it would be replaced by onsite incineration. The areal extent and volume of chemically-affected soils to be addressed by this alternative would depend on the exposure scenario and the degree of risk to be mitigated.

This alternative would also include the pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. However, the access and deed restrictions on the Site would be rescinded upon completion of remedial actions. Soil vapor extraction would be completed prior to implementation of this alternative.

7.3.3.7 Alternative 7: Soil Capping and Contingent Onsite and Nearsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 4 (Soil Capping) and Contingent Onsite and Nearsite Groundwater Extraction/Treatment/Discharge.

This alternative would conceptually include contingent onsite and nearsite groundwater removal through extraction wells with *ex situ* onsite treatment followed by injection, effluent discharge to Temperance Ditch or Mill Ditch or potable water system reuse pursuant to action-specific FRGs. This groundwater alternative would provide additional protection beyond that afforded by soil vapor extraction and treatment to prevent the migration of chemically-affected groundwater off THAN's property. This alternative would be implemented if concentrations of chemicals known to be associated with the Site, as measured and confirmed in monitoring well samples collected currently or in the future, exceed the chemical-specific FRGs for groundwater. This alternative would protect public health and the environment against the migration of chemicals from onsite soils to offsite groundwater regardless of A-zone water levels. Based on the results of recent groundwater monitoring (Chaney 1998b), there are no chemicals detected above their FRGs in onsite groundwater.

Existing A-zone monitoring wells would be monitored semi-annually for the presence of groundwater. If groundwater is encountered, water samples would be collected and analyzed as part of the groundwater monitoring program. If the A zone becomes resaturated and A-zone groundwater monitoring results confirm that concentrations of DBCP in onsite or nearsite groundwater monitoring well samples exceed the action-specific FRG for DBCP, then submersible pumps and additional extraction wells would be installed or activated (if such wells are not already installed or activated to address other chemicals known to be associated with the Site in excess of chemical-specific FRGs) to hydraulically contain, remove and treat DBCP in onsite and nearsite groundwater. An action-specific FRG for DBCP would be established based on an evaluation of background groundwater quality conditions at and around the time of A-zone resaturation.

The groundwater extraction/infiltration system would consist of three extraction wells and two infiltration wells or galleries. The three extraction wells would be located near the southwestern boundary of the Site and on adjacent property owned by THAN. The conceptual extraction flow rate would be approximately 20 gallons per minute (gpm). Treated groundwater would be discharged through shallow injection wells or infiltration galleries located northwest and southwest of the Site, or reused in a potable water system. Another alternative would be surface water discharge to Mill Ditch or Temperance Ditch.

If new wells are constructed to serve as extraction wells, air-rotary well-drilling methods will be utilized. During design of the extraction system, it may be decided to convert existing groundwater monitoring wells to serve as extraction wells. Piping from the wells to the groundwater treatment system and from the treatment system to the discharge points would be buried in trenches, and double-walled for secondary containment. The infiltration galleries would be excavated using conventional earth-moving equipment. The trenches would be backfilled with granular material overlain by a filter medium layer and a topsoil layer.

Treatment of the extracted groundwater would be accomplished by either air stripping and liquid and vapor phase granular activated carbon (GAC) adsorption, or by liquid phase GAC. The specific treatment option will be selected during the remedial design phase. The comparative analysis and costs for this alternative are based upon use of air stripping and liquid and vapor phase GAC.

The treatment system equipment would be installed in a small enclosure at the Site. Following a startup period, an O&M program for the system would be implemented. A monitoring program would also be implemented to evaluate performance of the treatment system and to meet monitoring and reporting requirements for discharge of treated water.

This alternative would also include the pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. Based upon the results of an evaluation of effectiveness, soil vapor extraction and treatment would continue under this alternative.

7.3.3.8 Alternative 8: Soil Capping and Offsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 4 (Soil Capping), and Offsite Groundwater Extraction/Treatment/Discharge.

This alternative would conceptually include: (1) the offsite extraction of groundwater containing chemicals known to be associated with the Site at concentrations in excess of chemical-specific FRGs, (2) treatment of the extracted water onsite, and (3) discharge of the treated water (subject to action-specific FRGs) by recharge, conveyance to Temperance Ditch or to Mill Ditch or potable water system reuse.

The approximate areal extent of groundwater affected by chemicals known to be associated with the Site in concentrations exceeding FRGs is shown on Figure 3-7. The figure indicates that the areal extent of chemically affected groundwater in excess of FRGs has remained relatively stable over the last several years. It is estimated that the conceptual offsite groundwater extraction system designed on the basis of these results would consist of three 7 gpm extraction wells and two 10 gpm shallow injection wells or infiltration galleries.

The offsite extraction wells conceptually would be located approximately 1,500 feet southwest of the Site centered around existing groundwater monitoring well cluster 182. Extracted groundwater would be conveyed to the Site for treatment in double-contained piping. Property would need to be acquired and easements negotiated in order to install wells and route piping. Treated groundwater could be discharged using two shallow injection wells or infiltration galleries, one located to the northeast and one located to the southeast of the line of extraction wells, or by conveyance to Temperance Ditch or Mill Ditch; or discharged to a potable water system. The injection wells or infiltration galleries would be closer to the Site than the extraction wells to minimize piping costs while preserving the benefits of recharge with respect to groundwater capture and containment.

Treatment of the extracted groundwater would be accomplished by either air stripping and liquid and air phase GAC adsorption, or by liquid phase GAC. The specific treatment option will be selected during the remedial design phase. The comparative analysis and costs for this alternative are based upon use of air stripping and liquid and vapor phase GAC.

The treatment system would be installed in a small enclosure at the Site. Following a startup period, an O&M program for the system would be implemented. A monitoring program would also be implemented to evaluate performance of the treatment system and to meet monitoring and reporting requirements for discharge of treated water.

This alternative would also include the pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. Based upon the results of an evaluation of effectiveness, soil vapor extraction and treatment would continue under this alternative.

7.3.3.9 Alternative 9: Soil Capping and Contingent Onsite, Nearsite and Offsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 4 (Soil Capping), and Contingent Onsite and Nearsite Groundwater Extraction/Treatment/Discharge (an element of Alternative 7) and Offsite Groundwater Extraction/Treatment/Discharge (an element of Alternative 8). Refer to Section 7.3.3.4 for a description of Alternative 4, that portion of Section 7.3.3.7 that describes contingent onsite and nearsite groundwater extraction, and that portion of Section 7.3.3.8 that describes offsite groundwater extraction.

This alternative would also include the pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. Based upon the results of an evaluation of effectiveness, soil vapor extraction and treatment would continue under this alternative.

7.3.3.10 Alternative 10: *In situ* Soil Treatment and Offsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 5 (*in situ* Soil Treatment), and Offsite Groundwater Extraction/Treatment/Discharge (an element of Alternative 8). Refer to Section 7.3.3.5 for a description of Alternative 5, and that portion of Section 7.3.3.8 that describes offsite groundwater extraction.

This alternative would also include the pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. Soil vapor extraction would continue until completion of this alternative. The access and deed restrictions on the Site would be rescinded upon completion of remedial actions.

7.3.3.11 Alternative 11: *Ex situ* Soil Treatment and Offsite Groundwater Extraction

This alternative incorporates all measures included in Alternative 6 (*ex situ* Soil Treatment), and Offsite Groundwater Extraction/Treatment/Discharge (an element of Alternative 8). Refer to Section 7.3.3.6 for a description of Alternative 6, and that portion of Section 7.3.3.8 that describes offsite groundwater extraction.

This alternative would also include the pertinent elements of Alternative 3, including groundwater use restrictions, wellhead protection program, alternative water supply, and groundwater monitoring. However, the access and deed restrictions on the Site would be rescinded upon completion of remedial actions. Soil vapor extraction would be completed prior to the implementation of this alternative.

7.3.3.12 Alternative 12: Soil Capping, Contingent Onsite, Nearsite and Offsite Groundwater Extraction, and Monitored Natural Attenuation

This alternative is based substantially on the results of the TEFE (K/J 1998). The TEFE showed that active groundwater remediation has little associated benefit compared to natural attenuation, and is not cost effective. Alternative 12 was developed from modified groundwater components of other alternatives. It incorporates many of the measures included in Alternative 9 (Soil Capping and Contingent Onsite, Nearsite and Offsite Groundwater Extraction), which by reference includes elements of Alternative 4 (Soil Capping), and pertinent elements of Alternative 3, including deed restrictions, groundwater use restrictions, wellhead protection program, alternative water supply (*i.e.*, funding of domestic water supply connections for residents in the downgradient vicinity of the Site), and groundwater monitoring. It has already been determined that soil vapor extraction and treatment is no longer necessary (K/J 1996).

Similar to Alternative 9, contingent groundwater extraction for containment is included in this alternative. However, the response action under Alternative 12 will likely be different than a response action under Alternative 9. If necessary, groundwater containment will likely occur at a point (expected to be near monitoring well cluster 184) where groundwater treatment is not expected to be required because chemical concentrations at this location are currently below FRGs. Groundwater infiltration/injection without treatment will therefore be the primary method of managing extracted groundwater.

Alternative 12 is unique in using monitored natural attenuation to further reduce low concentrations of chemicals in groundwater. In addition to routine groundwater monitoring, additional parameters will be analyzed to evaluate the effectiveness of monitored natural attenuation (see Section 10.1.2). This information will be used to determine the effectiveness of monitored natural attenuation if chemical concentrations in groundwater remain low.

7.3.4 Comparative Analysis of Feasibility Study Alternatives

This section presents the comparative analysis of remedial action alternatives that was performed in the FS. The alternatives were compared with respect to the same evaluation criteria that were used in the detailed analysis of alternatives in the FS. Alternative 12, developed from components of other alternatives, is also evaluated in this section.

7.3.4.1 Overall Protection of Public Health and the Environment

The NCP requires the evaluation of a no further action alternative (Alternative 1) in the event that significant removal actions have already been completed. Hypothetical conditions were evaluated in the HRA under the assumption that no further action would occur. The continued protection provided by existing controls (such as the use of alternate water supplies) was also not taken into account.

Assuming a normal distribution of chemicals (as recommended by U.S. EPA and the state of California), the lifetime incremental cancer risks calculated in the HRA for potential exposure to chemicals associated with the Site in soils and groundwater as well as regional pollutants in groundwater sometimes exceed the 10^{-4} to 10^{-6} range considered acceptable under the NCP.

Under current exposure scenarios, the highest calculated risk for exposure to soil was 2×10^{-3} for onsite workers, and under future scenarios, the highest calculated risk was 4×10^{-3} for a hypothetical onsite adult resident. No adverse noncancer health effects are expected for soil exposure under the current and future exposure scenarios for offsite populations, as indicated by calculated HI values less than 1. Under the future land-use scenarios, the HI values calculated for all onsite populations exceeded 1. The chemicals contributing to the HI values above 1 were DDT (and its degradation products), Dieldrin, and arsenic.

For use of groundwater for drinking, bathing, or swimming purposes under current land-use scenarios, the maximum calculated risks ranged from 2×10^{-5} to 2×10^{-4} for an offsite resident child and adult, respectively. Under the future land-use scenarios, the maximum calculated risks ranged from 3×10^{-5} for an offsite resident child to 2×10^{-3} for an onsite resident adult. DBCP accounted for over 50 percent of the calculated risk, and Dieldrin accounted for over 10 percent. The maximum calculated HI values for groundwater use were 1 for current exposure scenarios, and greater than 1 for various future land-use scenarios.

Scientific debate exists as to whether arithmetic or geometric mean concentrations provide the best representation of environmental concentrations. The arithmetic mean and normal distribution (discussed above) is the approach preferred by both the U.S. EPA and DTSC. However, a lognormal distribution was also evaluated in the HRA. Assuming a lognormal distribution of chemicals, the risks calculated in the HRA for potential exposure to chemicals associated with the Site in soils and groundwater are within the 10^{-4} to 10^{-6} range considered acceptable under the NCP (excluding the risks associated with DBCP in groundwater at regional concentrations and assuming that no future onsite residential land use will occur). (See ENVIRON 1996, and Tables 5-2 through 5-9 of this report). The calculated risk levels would be reduced substantially if the protection afforded by the existing City Water System extension were taken into account. It should also be noted that the existing City Water System extension would continue under the no further action alternative.

Compared to Alternative 1, Alternatives 2 and 3 would provide additional protection of public health and the environment by further preventing exposure to chemicals in soil and groundwater. Alternatives 2 through 6 provide active means to further reduce the potential exposure to chemicals in onsite soil and the potential migration of chemicals in onsite soil to groundwater by permanently reducing the mobility, toxicity, or volume of chemicals in onsite soil.

Implementation of the onsite and nearsite contingent groundwater extraction system under Alternative 7 would increase the degree of protection of public health and the environment over that provided by Alternatives 1 through 6 by adding the capability to contain, remove and treat chemicals known to be associated with the Site in groundwater in excess of appropriate chemical-specific FRGs. The groundwater component of Alternative 7 further protects public health and the environment by adding the capability to contain, remove and treat DBCP in onsite groundwater should resaturation of onsite A-zone soils result in an increase in DBCP concentrations in onsite or nearsite groundwater above an action-specific FRG for DBCP (which would be based on the regional background level of DBCP to be measured at and around the time of A-zone resaturation).

Alternatives 8, 10 and 11 are more protective of public health and the environment than Alternatives 1 through 6 because the offsite groundwater control measures would remove and treat chemicals known to be associated with the Site in offsite groundwater that are in excess of appropriate chemical-specific FRGs. The offsite groundwater extraction system would not provide the additional protection of offsite groundwater provided by the onsite and nearsite groundwater measures in Alternative 7 which would contain, remove and treat any chemicals before they could leave THAN's property.

The combination of offsite and onsite/nearsite contingent groundwater measures in Alternative 9 provides some incremental additional protection of public health and the environment over that provided by the groundwater control measures included in Alternatives 7 or 8 above. However, the additional protection is not significant in the absence of some regional system to treat regional DBCP in groundwater in excess of its MCL and because all of the alternatives includes the provision of alternate water supplies, (*i.e.*, city water system extension, bottled water, etc.). Furthermore, none of the groundwater control measures included in Alternatives 7 through 11 will provide significant additional protection of public health and the environment in the absence of some regional system to treat DBCP in groundwater in excess of its MCL.

Similar to Alternative 9, Alternative 12 contains a combination of contingent offsite and onsite/nearsite groundwater measures that provide some incremental additional protection of public health and the environment over that provided by the groundwater control measures included in Alternatives 7 and 8. Alternative 12 is unique among all the alternatives in that it includes THAN's agreement to provide water supply connections, as appropriate, to residents in the downgradient vicinity of the Site that may have their water supply affected by potential migration of Site-related chemicals, thereby providing an additional protection of public health.

7.3.4.2 Compliance with ARARs

The FRGs discussed in Section 7.2.3 were developed so as to assure compliance with ARARs. Compliance with FRGs will be the ultimate determining factors in remediating the Site. Therefore, the following discussion focuses on meeting FRGs as an indication of meeting ARARs.

Alternatives 1 through 3 would be expected to meet chemical-specific FRGs for groundwater solely through natural processes, including dispersion, dilution, degradation, and through volatilization under Alternatives 2 and 3 which would remove and treat volatile and semi-volatile chemicals from soils by vapor extraction. Groundwater flow and transport modeling and analyses in the TEFE indicate that the time necessary to meet FRGs through natural processes is approximately 5 years for carbon tetrachloride, 1,2-DCA, and Dieldrin, based on recent detections of these chemicals in groundwater samples. These estimates assume that no further migration of chemicals would occur from onsite soils to groundwater.

Alternatives 2 through 6 and the soil-specific portions of Alternatives 7 through 11, would provide some control on the time estimated to attain chemical-specific groundwater FRGs by natural processes due to the active measures taken to prevent potential future migration of chemicals from onsite soil into groundwater.

Alternatives 7 through 11 would result in compliance with FRGs for groundwater sooner than Alternatives 1 through 6 as a result of the capture, removal, and treatment of groundwater containing chemicals associated with the Site in excess of appropriate chemical-specific FRGs. However, the combination of onsite and nearsite contingent and offsite groundwater extraction systems under Alternative 9 would not be expected to significantly reduce the time necessary to attain chemical-specific FRGs when compared to natural attenuation or the time required by just the onsite and nearsite contingent groundwater extraction system under Alternative 7. Although the time necessary to reduce groundwater concentrations to PRFGs would not be significantly shorter under Alternative 9, the total mass of chemicals associated with the Site removed during this period would be greater. Alternative 7 would be equally effective as Alternative 9 in preventing groundwater in excess of chemical-specific FRGs from migrating off THAN's property. Active groundwater extraction and treatment under any one of Alternatives 7 through 11 could not reduce the concentration of DBCP in groundwater to its MCL. Accordingly, even though chemicals known to be associated with the Site in excess of chemical-specific FRGs would be removed faster with Alternatives 7 through 11, groundwater could not be returned to a quality acceptable for drinking water purposes due to the regional presence of DBCP in groundwater.

Pumping to achieve capture or removal of groundwater affected by chemicals known to be associated with the Site would also result in extraction of groundwater affected by regional, non-point sources of DBCP. Efforts to increase pumping rates to accelerate attainment of chemical-specific ARARs in groundwater would result in the withdrawal of greater amounts of regional DBCP. The regional DBCP could create a burden on treatment technologies, capacities, and discharge options. However, the groundwater treatment system would be designed to reduce DBCP concentrations in extracted groundwater to levels that will meet an action-specific FRG for the discharge of such water.

Similar to active groundwater extraction under Alternatives 7 through 11, Alternative 12 would prevent groundwater containing chemicals associated with the Site at concentrations in excess of FRGs from migrating, either through natural attenuation or active groundwater extraction. However, because of regional sources of DBCP, it is not likely that DBCP concentrations will be reduced to less than its MCL under any of the Alternatives 7 through 12.

7.3.4.3 Long-Term Effectiveness and Permanence

Under Alternative 1, assuming a normal distribution of chemicals, the risks calculated in the HRA for potential exposure to chemicals associated with the Site in soils and groundwater sometimes exceeded the 10^{-4} to 10^{-6} range considered acceptable under the NCP. Use of a normal distribution is the approach preferred by both the U.S. EPA and DTSC. However, the HRA also included an evaluation based on a lognormal distribution. Assuming a lognormal distribution, the risks calculated were lower (See ENVIRON 1996 and Tables 5-2 through 5-9 of this report). The calculated risk levels would be reduced substantially if the protection afforded by the existing City Water System extension were taken into account. Incremental reduction in the magnitude of risk would be attained with the implementation of Alternatives 2 through 10.

Alternative 2 would reduce the risk of potential exposure to chemically-affected soil (via access restrictions and soil vapor extraction and treatment) and chemically-affected groundwater (via alternate water supplies). Alternatives 3 through 5, and 7 through 10 would eliminate the potential for human exposure to chemically-affected soils by preventing residential development of the Site and by providing soil vapor extraction and treatment. Alternatives 4 through 6, and the soil-specific portions of Alternatives 7 through 11, would further reduce any residual risk of exposure to chemically-affected soil onsite by capping or treatment. Long-term maintenance of the protective cap would be required for Alternatives 4, 5, and 7 through 10.

Alternatives 2 through 11 will include effective controls to reduce the risks as a result of potential exposure to chemically-affected groundwater by providing wellhead treatment (if implemented), and alternate water supplies which include existing and future extensions of the City Water System. Alternatives 7 through 11 include the additional capability to capture, extract and treat chemicals known to be associated with the Site in groundwater in excess of appropriate chemical-specific FRGs. Although Alternatives 7 through 11 would be effective in reducing concentrations of chemicals known to be associated with the Site in excess of chemical-specific FRGs, these alternatives would not be effective in reducing concentrations of DBCP in groundwater to its MCL without additional regional treatment because of the regional presence of DBCP. In addition, initial indications are that 1,2,3-TCP is a regional pollutant similar to DBCP. There is currently no MCL for 1,2,3-TCP, but it may be present at concentrations that would be considered a health concern. Consequently, these alternatives cannot return groundwater to its beneficial use as a drinking water supply. Alternatives 7 through 11 will shorten the time required to reduce concentrations of chemicals known to be associated with the Site in groundwater to appropriate chemical-specific FRGs, as compared to the time estimated under Alternatives 1 through 6. However, because of the regional presence of DBCP, Alternatives 7 through 11 would not be capable of significantly improving groundwater quality for drinking water purposes over this time frame.

Alternatives 7 and 9 would be equally effective in preventing chemically-affected groundwater from migrating off THAN's property. Alternatives 7 and 9 would also be equally effective in reducing the potential for DBCP to migrate from onsite soils to offsite groundwater should resaturation of onsite A-zone soils result in an increase in DBCP concentrations in groundwater above an action-specific FRG for DBCP (which would be based on the regional background level of DBCP to be measured at around the time of A-zone resaturation).

The offsite groundwater measures under Alternatives 8, 10, and 11 would permit a greater volume of groundwater to become affected should chemicals known to be associated with the Site migrate from onsite soils. The combination of offsite and on and nearsite contingent groundwater extraction measures under Alternative 9 would not significantly increase the long-term effectiveness provided by natural attenuation or the on and nearsite groundwater extraction component in Alternative 7. However, Alternative 9 will reduce the migration of chemicals known to be associated with the Site already present in offsite groundwater, to groundwater not currently impacted. Alternative 9 will also provide for greater mass removal of chemicals known to be associated with the Site.

Alternative 12 is similar to Alternatives 2 through 11 in including effective controls to reduce the risks as a result of potential exposure to chemically-affected groundwater by providing for alternative water supplies. Also, similar to Alternatives 7 through 11, Alternative 12 includes the additional capability of containing groundwater, and would be effective in reducing chemical concentrations.

7.3.4.4 Reduction of Toxicity, Mobility and Volume Through Treatment or Recycling

A number of response actions have been implemented by THAN at the Site since 1981 to reduce the toxicity, mobility or volume of chemicals in onsite soils, groundwater and building materials. The SVE system specifically employed treatment to remove volatile and semi-volatile organic compounds from onsite soils. These activities provide a basis for the no further action alternative (Alternative 1). Under Alternative 1, no further treatment is used to reduce the toxicity, mobility or volume of chemically-affected soils. However, long-term natural processes would eventually reduce the remaining toxicity, mobility and volume of chemically-affected soils.

Alternatives 2 and 3 would continue to use soil vapor extraction systems to permanently reduce the mobility, toxicity, and volume of chemically-affected soils onsite. However, the soil vapor extraction systems are no longer necessary because they were successful in reducing chemical concentrations to levels less than remedial action objectives. Long-term natural processes would also eventually reduce the toxicity, mobility and volume of chemically-affected soil under Alternatives 2 and 3, as in Alternative 1.

The effectiveness of the soil vapor extraction and treatment systems used in Alternatives 4 and 7 through 9 is enhanced by the installation of a cap to prevent infiltration of rainfall and further reduce the mobility of chemicals in onsite soils. In addition to soil vapor extraction and treatment, Alternatives 5 and 10 would employ physical methods (*i.e.*, solidification/stabilization) to treat chemically-affected soils in-situ. Alternatives 6 and 11 would involve excavation of chemically-affected soils followed by physical treatment (*i.e.*, thermal desorption or in the alternative, incineration), in addition to soil vapor extraction and treatment.

Under Alternative 1, no additional treatment is used to reduce the toxicity, mobility or volume of chemically-affected groundwater. The toxicity and volume of chemicals in groundwater will be reduced as a result of the active measures taken with respect to chemicals in soil under Alternatives 4 through 11 to minimize the potential for further migration of chemicals from the unsaturated soil into groundwater. Implementation of the onsite and nearsite contingent groundwater extraction system under Alternative 7 or the offsite groundwater extraction system under Alternatives 8, 10 and 11 would provide some incremental additional reduction in the toxicity, mobility and volume of chemically-affected groundwater over that provided through natural processes alone. Groundwater extraction would act as a barrier to chemical movement, and minimize expansion of chemically-affected groundwater if natural attenuation processes are not effective. Likewise, the combination of onsite and nearsite contingent and offsite groundwater control measures included in Alternative 9 may provide little additional reduction in the toxicity, mobility and volume of chemically-affected groundwater over that provided through natural processes alone or the onsite and nearsite groundwater control measures under Alternative 7.

The groundwater extraction and treatment systems under Alternatives 7 through 11, without additional regional treatment, would not significantly reduce the toxicity, mobility, or volume of DBCP in groundwater due to its regional presence. Consequently, groundwater could not be returned to its beneficial use as a drinking water supply. Wellhead treatment, if implemented, would also reduce the toxicity, mobility, and volume of chemically-affected groundwater.

Under Alternative 12, the installation of a soil cap will prevent infiltration of rainfall and reduce the mobility of chemicals in onsite soil, similar to Alternatives 4 and 7 through 11.

If the contingent groundwater extraction option of Alternative 12 is implemented, it will provide some incremental additional reduction in the toxicity, mobility, and volume of chemically-impacted groundwater over that provided through natural processes alone. This is similar to Alternatives 7 through 11. There is also the similar issue that without regional treatment, the toxicity, mobility, or volume of DBCP in groundwater would not be significantly reduced due to its regional presence.

7.3.4.5 Short-Term Effectiveness

Each of the alternatives could be implemented without creating unmanageable risks to onsite workers, the community, or the environment. Alternatives 1 through 3 involve no active construction or earthwork and do not create any potential risks. Risks associated with the potential generation of chemically-affected dust or vapor as a result of soil remediation activities or offsite transportation of chemically-affected soils would be mitigated through air monitoring and dust abatement measures. Deep excavations (Alternatives 6 and 11) may create potential risks to onsite workers. However, shoring, benching or sloping of excavation walls in combination with safe working practices will minimize such risks. No significant risks would result from implementation of the onsite and nearsite groundwater extraction and treatment system included within Alternatives 7 and 9. Construction activities associated with the installation of the offsite groundwater extraction system in Alternatives 8 through 11 could create safety hazards or risks to the community which would be addressed through access restrictions and traffic control.

Similar to Alternatives 7 and 9, no significant risks would result from implementation of the contingent onsite and nearsite groundwater extraction system of Alternative 12. Also, similar to Alternatives 8 through 11, construction activities associated with the installation of the contingent offsite groundwater extraction system of Alternative 12 could create safety hazards or risks to the community which would be addressed through access restrictions and traffic control.

7.3.4.6 Implementability

Alternative 1 could be easily implemented. Alternatives 2 and 3 are both technically and administratively feasible. However, substantial regulatory involvement would be required to institute the groundwater use restrictions contemplated under Alternative 3. Alternatives 4 through 6, and the soil-specific portions of Alternatives 7 through 11, are implementable. However, added precautions would be required for deep excavations (Alternatives 6 and 11) to maintain safe working conditions. Bench and pilot-scale testing would be required prior to full-scale implementation of soil remedies under Alternatives 5, 6, 10 and 11.

The groundwater extraction, treatment, and discharge measures under Alternatives 7 through 11 are implementable. However, there are limitations associated with the extraction, treatment and discharge of groundwater in an area affected by non-point sources of DBCP. Pumping rates needed to achieve capture and removal of groundwater affected by chemicals known to be associated with the Site in excess of appropriate chemical-specific FRGs would also result in the capture and removal of groundwater affected by regional, non-point sources of DBCP. If pumping rates are increased to shorten the time necessary to reduce concentrations of chemicals known to be associated with the site in groundwater to chemical-specific FRGs, greater volumes of groundwater containing regional DBCP would be extracted and treated. The regional DBCP could create a burden on treatment technologies, capacities, and discharge options. However, the groundwater treatment system would be designed to reduce DBCP concentrations in extracted groundwater to levels that will meet action specific discharge requirements of such water.

Implementation of Alternatives 7 through 11 may require agency coordination for construction activities, and may be affected by potential land acquisition, and negotiation of easements. Alternatives 8 through 11, because they would include the most extensive offsite groundwater extraction and conveyance facilities, would require significant regulatory approval including construction, encroachment, and grading permits, traffic control and easement agreements.

Similar to Alternatives 4 through 6 and 7 through 11, the soil-specific portion of Alternative 12 is implementable. Also, similar to Alternatives 7 through 11, the contingent groundwater extraction measures of Alternative 12 are implementable, but with the limitations associated with the regional presence of DBCP. There may also be the requirements for agency coordination for construction activities, the potential for land acquisition, and the negotiation of easements. The requirements associated with Alternative 12 would be less than those associated with Alternatives 7 through 11. The monitored natural attenuation measures of Alternative 12 will be easily implementable.

7.3.4.7 Cost

In accordance with the NCP, the 30-year present worth costs for each alternative are used for comparison purposes. Costs are calculated in the FS assuming target remediation goals based on a risk of 10^{-6} in an onsite residential exposure scenario for soil-specific actions and the use of MCLs or state ALs as chemical-specific FRGs for groundwater-specific actions. The costs developed in the FS were presented in 1993 dollars, and have not been updated to 1998 dollars. The cost estimates for each alternative are summarized in Table 7-6. Alternative 1 (No Further Action) is the least costly alternative ($449,000). However, assuming a normal distribution of chemicals (as recommended by U.S. EPA and DTSC), the lifetime incremental cancer risks calculated in the HRA for potential exposure to chemicals associated with the Site in soils and groundwater sometimes exceed the 10^{-4} to 10^{-6} range considered acceptable under the NCP.

Alternative 2, the next least costly alternative, has an estimated total cost of approximately eight times that of Alternative 1. Alternative 3 is more costly than Alternative 2 ($6,360,000 *versus* $3,410,000) because it affords a greater degree of protection by providing for deed restrictions against residential development and domestic use of groundwater at the Site, and a wellhead protection program designed to reduce the potential for exposure to chemically-affected groundwater offsite.

In addition to most of the measures in Alternative 3, including soil vapor extraction and treatment, Alternative 4 provides for capping of the Site to reduce the potential for exposure to chemically-affected soil. The total estimated cost of Alternative 4 is approximately 1.2 times that of Alternative 3. Alternative 5 has a total cost that is greater than Alternative 4 ($9,630,000 *versus* $7,530,000), and offers a greater degree of effectiveness and permanence through additional physical treatment by solidification/stabilization of chemically-affected soils. Alternative 6 provides for permanent reduction of chemical concentrations in soil through thermal desorption, but is disproportionately more costly ($15,060,000) for the small additional benefit achieved as compared to Alternative 5.

Alternative 7 combines the protection of a contingent onsite and nearsite groundwater extraction and treatment system with soil capping and soil vapor extraction and treatment, and has a total cost ($8,990,000) of approximately 1.2 times that of the soil capping alternative (Alternative 4) alone. Alternative 8 combines active offsite groundwater extraction with onsite soil capping and soil vapor extraction and treatment, and has a total estimated cost of $9,730,000. Alternative 9 adds offsite groundwater extraction to soil capping, soil vapor extraction and treatment, and contingent onsite and nearsite pumping already included in Alternative 7, but the total cost of $11,890,000 is significantly greater than Alternative 7 with corresponding minor additional protection. Alternative 10 has a total estimated cost of $11,570,000, and differs from Alternative 8 by substituting onsite soil treatment by solidification/stabilization for soil capping. Alternative 11, which includes removal and thermal desorption of chemically-affected soils in combination with offsite groundwater extraction and treatment is the most costly ($16,850,000) remedy.

The total cost for each soil-specific alternative (*i.e.*, capping, stabilization and thermal desorption) is a function of the areal extent and volume of chemically-affected soils to be addressed, which in turn depends on the potential exposure pathway and risk to be mitigated. For example, the size of the cap for an onsite residential exposure scenario would vary depending on the level of risk to be controlled. The areal extent of a cap for control to the 10^{-6} risk level would be larger than the cap to control to a 10^{-4} risk level. Generally, the size of the cap for a hypothetical commercial/industrial exposure scenario would be smaller than that needed for a residential exposure scenario for a given level of risk.

Assuming an onsite residential exposure scenario, the cost of soil capping (Alternative 4) to achieve a risk level of 10^{-4} is approximately 88% of that associated to achieve a risk level of 10^{-6}. Assuming a 10^{-4} risk level, a cap designed to mitigate risks in a commercial/industrial exposure scenario is approximately 95% of the cost of a cap for a residential scenario. For alternatives that include thermal desorption, the cost of mitigating risk to a 10^{-6} risk level would be 1.7 times the cost associated with mitigating risk to a 10^{-4} level for the residential exposure scenario.

Comparison of the overall cost for Alternatives 1 and 2 indicates that the further risk reduction achieved by limited action (Alternative 2) over no further action would require significant additional cost ($3,410,000 *versus* $449,000). The cost of Alternative 3 is greater than the cost of Alternative 2 as a result of the additional protection afforded by a deed restriction against residential development or domestic use of groundwater from the Site, and a wellhead protection program. Alternatives involving soil removal and treatment by thermal desorption of chemicals in soils (Alternatives 6 and 10) are more costly, and would not appear to be justified with respect to the small incremental reduction in risk afforded with respect to other soil-specific technologies. Alternatives combining groundwater-specific remediation and soil-specific actions (Alternatives 7 through 11) are significantly more costly and provide relatively little risk reduction than alternatives that rely on the natural attenuation of chemicals in groundwater (such as Alternative 12). Furthermore, without additional regional treatment, Alternatives 7 through 11 would not be able to restore groundwater to its beneficial use as drinking water because of DBCP regionally present at concentrations in excess of its MCL.

The soil capping portion of costs for Alternative 12 are the same as those for Alternative 4 and the other alternatives that include soil capping as a component. A range of costs are provided for Alternative 12 because for the groundwater component, there is a major difference between the cost of monitored natural attenuation and the cost to actively contain groundwater by extraction. Monitored natural attenuation ($2,800,000 to $3,500,000) is less costly compared with the alternatives involving groundwater extraction and treatment (Alternatives 7 through 11). Also, the contingent groundwater extraction (without treatment) of Alternative 12 is less expensive than groundwater extraction and treatment (Alternatives 7 through 11). If the groundwater onsite/nearsite extraction and treatment component of Alternative 12 is necessary, the cost will be comparable to that of the similar component in Alternatives 7 through 11.

The costs for all alternatives do not include the extension of the domestic water system, which has already been funded by THAN for approximately $1,200,000.

7.3.5 Justification for Rejected Remedial Action Alternatives

As discussed in Section 7.2.2, following DTSC's review of the FS, DTSC identified in its 6 August 1993 letter to THAN key performance objectives that would need to be met for the soil and groundwater components of the preferred remedial action alternative. These performance objectives are based on, and in some instances are refinements of, the RAOs identified and used in the FS. In its 6 August 1993 letter to THAN, DTSC determined that the preferred remedial action alternative should consist of the following components:

1. Soil capping component to address onsite soil contamination which achieves all of the soil performance objectives. The component would include appropriate soil vapor extraction (SVE) systems, land use restrictions, long-term maintenance procedures and future performance guarantees; and

2. A groundwater extraction and treatment component which achieves all of the groundwater performance objectives. The groundwater component would combine the elements of onsite and nearsite extraction and treatment, as provided in Alternatives 7 and 9, with the elements of offsite extraction and treatment, as provided in Alternatives 9 and 11.

Remedial Action Alternative 12 (Soil Capping, Contingent Onsite, Nearsite and Offsite Groundwater Extraction, and Monitored Natural Attenuation) was developed in order to meet the key performance objectives set forth by DTSC and include all of the soil and groundwater components required by DTSC. Soil vapor extraction is not included in Alternative 12, because soil vapor extraction systems, operated at the site for a period of three years, have already achieved the relevant soil performance objectives (K/J 1996). During preparation of the TEFE for the Site, the effectiveness of offsite groundwater extraction and treatment was shown to be similar to the effectiveness of monitored natural attenuation. Therefore, the groundwater component of Alternative 12 combines contingent onsite and nearsite groundwater extraction and treatment (if necessary), contingent offsite groundwater extraction, and monitored natural attenuation.

Thus, Alternative 12 combines components from several alternatives evaluated in the FS to provide a remedy that will meet the DTSC key performance objectives, address current site soil conditions, and incorporate current knowledge and policy regarding natural attenuation as a viable remedy for current groundwater conditions. For these reasons, other alternatives considered in the FS were either rejected or are incorporated in Alternative 12.

7.4 Preferred Remedial Action Alternative

7.4.1 Description of Preferred Remedial Action Alternative

The preferred remedial action alternative was developed based on current conditions at the Site. Current conditions have been significantly improved by THAN's past interim remedial actions at the Site, which have included the following:

- Onsite source removal by soil excavation and structures demolition
- Removal of an underground storage tank and removal/abandonment of multiple onsite drainage systems
- Onsite source area remediation by soil vapor extraction
- Removal of groundwater as an onsite and offsite exposure pathway by providing connections to municipal water supply for domestic use

In the years since submittal of the FS, a number of factors have led to a revised preferred remedial alternative. Continued monitoring has provided groundwater data showing low chemical concentrations that are slowly declining. Various environmental studies at other sites have shown natural attenuation may be a viable long-term component of remedial programs at sites. Natural attenuation is the reduction in concentration, mass, toxicity, and/or mobility of chemicals of concern with distance and time through naturally occurring processes in the environment. The naturally occurring processes that contribute to natural attenuation include biodegradation, diffusion, dilution, sorption, volatilization, and/or chemical and biochemical stabilization of chemicals. From the mid-1980s, natural attenuation has been an important component in the final remedy selected for a number of federal Superfund sites. The U.S. EPA recently issued guidance outlining situations in which EPA has determined that natural attenuation is appropriate, and stating that monitored natural attenuation can be effective when used in conjunction with other active remedial actions and/or as a follow-up action (EPA 1997).

A Technical and Economic Feasibility Evaluation (TEFE) performed for the THAN site has shown that active groundwater remediation has little associated benefit compared with natural attenuation and is not cost effective (Appendix B). For these reasons, the proposed groundwater extraction and treatment component of the remedial alternative has been revised. In addition, other components have been included to address concerns expressed by the DTSC. The components of the preferred remedial action alternative are presented below:

- Soil Component
  - Soil vapor extraction (completed)

- Design and construction of asphaltic and composite cap to minimize contact with residual chemicals in soil, and minimize movement of chemicals from soil to other media (groundwater and air)
- Land use restrictions (*e.g.*, no residential use or use by sensitive populations)
- Access controls (maintain existing fencing and signs)

- Groundwater Component - Onsite/Nearsite
  - Long-term groundwater monitoring of monitoring wells and domestic wells, as necessary
  - Monitored natural attenuation of low chemical concentrations in groundwater
  - Contingency plan for action (*e.g.*, groundwater extraction and/or treatment, if necessary) if groundwater monitoring results for the A-zone (if groundwater is encountered) or the B-zone show that chemical levels are detected and confirmed to exceed FRGs
- Groundwater Component - Offsite
  - Groundwater containment at the compliance point if chemicals strictly known to be associated with the Site are confirmed at concentrations exceeding FRGs
  - Groundwater containment (at the compliance point) if warranted based on an evaluation of concentrations and trends of chemicals strictly known to be associated with the Site
  - Long-term groundwater monitoring of monitoring wells and domestic wells, as necessary
  - Monitored natural attenuation of low chemical concentrations in groundwater
- Further Engineering/Administrative/Institutional Controls
  - Continued provision (and expansion, as appropriate) of alternate water supply by connections to public water supply system, point-of-use treatment, or bottled water
  - Financial assurances to ensure long-term maintenance and operation of remedial actions
  - A review within five years and every five years thereafter to confirm that the remedy remains effective in protecting human health and the environment

The above components were summarized in Section 7.3.3. Certain optional elements of the contingent groundwater extraction component were described in conceptual terms in the FS. Such elements will need to be modified to best meet DTSC's refined performance objectives. Those adjustments will occur during the remedial design phase. The components of the preferred alternative are summarized below. Specific details of each component will be finalized during the remedial design phase.

7.4.1.1 Soil Component

The preferred alternative includes the design, construction, and maintenance of an asphaltic and composite cap to cover the 5-acre Site. A minor amount of soil along East McKinley Avenue will be consolidated onsite and included under the cap (see Appendix A). The portion of the Site to be addressed is the area enclosed by the fence shown on Figure 3-3. As described in Section 7.3.3.4, the cap will include existing asphalt-paved areas that are used for access and parking. The remaining areas to be capped will be covered with a composite cap consisting of one or more of the following: clay, soil, synthetic materials, gravel, or vegetation. The cap will be constructed to further minimize, if not eliminate, the migration of chemicals from onsite soils to other media, such as groundwater and air. The cap (asphalt, soil, or other material) will be designed to be less permeable to water than native surface soils (with hydraulic conductivities of 10^{-3} to 10^{-2} cm/s). Depending on the design and construction of the asphalt portion of the cap, the paved areas can be made orders of magnitude less permeable than the current soil. Similarly, materials can be chosen and/or soil compacted to provide relatively impermeable covers over other areas of the Site.

For areas where significant chemical migration is of concern, the maximum vertical hydraulic conductivity of the cap will be 10^{-6} cm/s. Areas for which significant migration is of concern are those areas where chemicals are present at concentrations and depths which could result in impacts to groundwater which exceed maximum contaminant levels or groundwater remediation goals based on the specific migration potential of the chemical present. Generally, areas of possible concern include the past operation area near the previously demolished buildings, the old landfill, various drainage systems, the old solvent storage area, and any other areas where chemicals have undergone significant past vertical movements (greater than 12 feet) or are present at elevated concentrations at depths greater than twenty feet as a result of disposal or discharge. The areas of possible migration concern will be specified in the remedial design report.

Other design requirements and materials of construction will be specified in the remedial design report to be prepared by THAN subject to review and approval by DTSC and other interested agencies. The cap will be designed to reduce exposure to those areas containing chemically-affected soils which produce an excess lifetime incremental cancer risk of greater than 10^{-6}, or a hazard index of greater than 1 for non-carcinogens, based on an industrial exposure scenario. A plan will be prepared to provide for ongoing maintenance of the cap.

The alternative will also include appropriate land use restrictions and access controls (maintaining the existing fencing and signs) to prevent future use of the Site by sensitive populations (such as schools, hospitals, or day care facilities) or residential use of the Site, and to maintain the integrity of the cap. The land use restrictions consist of a covenant prepared and recorded against the property deed in accordance with DTSC guidelines as contained in policies and procedures and management memoranda. Maintenance of the cap will be included in an operations and maintenance agreement between DTSC and THAN. The agreement will be prepared in accordance with DTSC guidelines. As discussed in Section 7.4.1.3, appropriate financial assurance will be provided by THAN and/or the other respondents to the Order to assure design, construction, and long-term maintenance of the soil component of the final remedy.

Soil vapor extraction is no longer considered a necessary element of the soil component. An evaluation of the soil vapor extraction systems in the former laboratory and bulk solvent storage areas showed that the systems were effective and reduced chemical concentrations in soil to below remedial action objectives (and FRGs). The soil vapor extraction evaluation report recommended permanent closure of the soil vapor extraction systems (K/J 1996).

7.4.1.2 Groundwater Component

Groundwater monitoring has been performed since the early investigations of the Site, and long-term groundwater monitoring will continue to be an important feature of the groundwater component of the remedy. Groundwater monitoring in recent years has confirmed the presence of low and, in general, slowly declining levels of site-related chemicals in both onsite/nearsite and offsite groundwater. Currently the B- and deeper groundwater zones are being monitored. If the A-zone resaturates, monitoring of the A-zone will also be included in the monitoring program. As discussed above, one of the objectives of the cap as part of the soil component is to minimize movement of chemicals from onsite soil to groundwater.

The groundwater monitoring program will include analyses for the chemicals associated with the Site, not just the chemicals for which FRGs have been established. If in the future a site-related chemical is detected and confirmed in groundwater, then the DTSC may develop a FRG for the chemical using the same methodology as before (see Section 7.2.3).

The TEFE report (Appendix B) documented the time and expense required to accelerate the attainment of FRGs in groundwater. Groundwater in the vicinity of the site is not being used for domestic purposes, so any reduction in potential health risks by reducing chemical concentrations in groundwater is hypothetical. The past response efforts by THAN to connect nearby residents to the Fresno City Water Supply system have reduced potential risks from exposure to groundwater for domestic purposes to essentially zero. Further active efforts to reduce concentrations known to be associated with the Site in groundwater would have a negligible benefit in risk reduction, and would be considerably more expensive.

In addition, the beneficial use of groundwater will not be altered following remediation of chemicals associated with the Site because of the regional presence of DBCP (and in some areas, nitrate and arsenic) in excess of drinking water standards. Also, based on an initial study, the presence of 1,2,3-TCP in groundwater appears to be a regional problem. Finally, active groundwater remediation results in only minor reductions in the time required for remediation compared with natural groundwater flow and natural attenuation of chemical concentrations. The negligible health benefits, lack of change in beneficial use, and the long time required for remediation do not justify the costs of active remediation. Nevertheless, containment of groundwater is a component of the remedy if warranted by groundwater conditions (as discussed below). Monitored natural attenuation is also a component of the remedial action alternative for groundwater.

As discussed in Section 7.4.1.3, appropriate financial assurance will be provided by THAN and/or the other respondents to the Order to assure design, construction, and long-term maintenance of the groundwater component of the final remedy.

Some components of the alternative will differ between onsite/nearsite groundwater and offsite groundwater. The particular aspects of the remedy for onsite/nearsite and offsite groundwater are discussed separately below.

Onsite/Nearsite Groundwater

Existing A-zone monitoring wells onsite and nearsite will be monitored on a regular basis for the presence of groundwater. If groundwater is encountered, water samples will be collected and analyzed as part of the groundwater monitoring program. If the groundwater monitoring results for either the A-zone (if groundwater is encountered) or the B-zone indicate that concentrations of chemicals known to be associated with the Site in onsite/nearsite groundwater samples exceed chemical-specific FRGs for those chemicals, then a special confirmation sampling round will be conducted during the quarter following the initial detection of elevated chemical levels. If the special quarterly sampling event confirms the presence of elevated chemical levels, then a contingency plan will be developed and submitted to the DTSC for approval. The contingency plan will consider the following options:

- Monitoring of all groundwater zones
- Natural attenuation if the chemicals do not appear to be moving and the concentrations are low
- Remediation of the source of chemicals, if identified
- Groundwater containment by extraction and infiltration/injection of untreated extracted water in compliance with action-specific ARARs
- Groundwater extraction and treatment

The contingency plan will be implemented if elevated concentrations (exceeding the FRG) are found in the next semi-annual sampling event, making three consecutive sampling events where concentrations exceeded the FRG. With the special confirmation quarterly sampling event, the initial and two confirmation sampling results will be available within approximately six months.

DBCP is a regional pollutant in addition to being a chemical associated with the Site. In either the A-zone (if resaturated) or the B-zone, if concentrations of DBCP are found to be elevated above background, an FRG for DBCP will be established by DTSC based on an evaluation of background groundwater quality conditions.

As discussed in Section 7.2.3, because of the regional presence of DBCP in groundwater, a non-numerical remedial goal for DBCP has been selected. That goal would be linked to the attainment of chemical-specific FRGs for other chemicals known to be associated with the Site. At such time as the data obtained from the groundwater monitoring program indicate that chemical-specific FRGs have been attained for these other chemicals, an evaluation of the DBCP in groundwater would be performed. The evaluation of DBCP in groundwater would include an assessment of the background concentration of DBCP present in groundwater at that time and a comparison of DBCP concentrations found onsite and nearsite with the background concentration. The evaluation would also include an assessment of the mass of DBCP attenuated during implementation of the final remedy and a comparison of this mass with the mass of other chemicals attenuated. THAN would then present the results of the evaluation to DTSC and propose further remedial action with regard to DBCP, if determined at that time to be necessary.

Based on the presence of 1,2,3-TCP in groundwater from areas clearly unaffected by Site activities, and documented land application of DD and/or Telone in the vicinity of the Site, the initial indications are that 1,2,3-TCP is similar to DBCP in being a regional groundwater pollutant (Chaney 1998a). Accordingly, 1,2,3-TCP has a non-numeric remedial goal. If the regional presence of 1,2,3-TCP in groundwater is confirmed, 1,2,3-TCP will be evaluated in the same manner as DBCP, as discussed above. If 1,2,3-TCP is also found to be associated with the Site, DTSC will establish a site-specific FRG above background.

Offsite Groundwater

Selected offsite monitoring wells and domestic wells will continue to be monitored for the presence of chemicals known to be associated with the Site. Data obtained from the groundwater monitoring program will be used to evaluate the effectiveness of the remedy in reducing chemicals known to be associated with the Site in excess of chemical-specific FRGs.

The compliance point will be in the vicinity of the monitoring well MW-184 cluster. Containment of groundwater (consisting of groundwater extraction followed by infiltration/injection) will be implemented if chemicals strictly known to be associated with the Site are confirmed at concentrations exceeding FRGs. Groundwater will also be contained in the vicinity of the monitoring well MW-184 cluster if warranted based on an evaluation at other wells of concentrations and trends of chemicals strictly known to be associated with the Site. Consideration will be given to the concentration of chemicals, and whether concentrations appear to be increasing based on a trend analysis. If containment is warranted, it will consist of groundwater extraction followed by a method of managing extracted groundwater (such as infiltration or injection) that meets action-specific ARARs.

The quality of groundwater at the monitoring well MW-184 cluster is well characterized. To date at this location, the only detected chemical strictly known to be associated with the Site is chloroform at low concentrations well below the FRG. Therefore, it is expected that the containment will be accomplished by groundwater extraction followed by infiltration. More information regarding a groundwater containment system will be provided in the remedial design report.

THAN has been conducting groundwater monitoring since 1981. Because the chemicals of concern have been present in groundwater over a long period of time, and have substantially attenuated (decreased in concentration), it is likely that this natural attenuation is due to biological, chemical, and physical processes that have historically occurred and are presently occurring. In addition to the routine groundwater monitoring, additional geochemical parameters will be analyzed to evaluate the effectiveness of monitored natural attenuation (see Section 10.1.2 for a discussion of the parameters). This information will be used to determine the effectiveness of monitored natural attenuation if chemical concentrations in groundwater remain low. Biodegradation of chlorinated organics results in changes in groundwater chemistry. These additional geochemical parameters will be used to evaluate the types of natural attenuation processes active at the Site.

7.4.1.3 Further Engineering/Administrative/Institutional Controls

THAN has identified other water purveyors in the vicinity of the Site, and obtained information regarding system configuration and connections. Also, based on available domestic and irrigation well location information, THAN identified a small number of developed (non-agricultural) parcels in the downgradient vicinity of the Site that may not be currently served by a regulated, multi-connection water purveyor. DTSC has expressed concern that residents in these areas may have their water supply affected by potential migration of Site-related chemicals, and that these residents should be afforded the same level of protection as other area residents. THAN agrees to provide water supply connections to these residents in the downgradient vicinity of the Site, as appropriate. This action meets the goal of protecting human health, even if the risk is hypothetical at this time.

The existing Domestic Well Sampling Program and Contingency Plan for Alternative Drinking Water Supply will continue to be implemented. Because of the presence of DBCP and/or 1,2,3-TCP in groundwater as a result of agricultural uses in the vicinity of the Site, the program will be modified as follows: Any well yielding a sample containing only DBCP and/or 1,2,3-TCP will not be added to the Domestic Well Sampling Program or be added to the Peripheral Well Sampling Program solely on the basis of the presence of DBCP and/or 1,2,3-TCP in the sample.

Also, a wellhead protection program will be evaluated for implementation should chemicals known to be associated with the Site be detected above FRGs in municipal supply well PS-102. The program would include, as necessary, one or more of the following elements: provisions for monitoring, well rehabilitation, wellhead treatment, public notification, blending of water supplies, or temporary shut down of the well prior to implementation of mitigation measures.

In order to assure design, construction, and longer term maintenance of the remedy, THAN and/or the other respondents to the Order will provide financial assurances as necessary by selecting from among the financial assurance mechanisms set forth in 22 CCR Section 66264.143 or 22 CCR Section 66264.145, or any other relevant financial assurance mechanisms that may be provided by the Hazardous Substance Account Act if that Act is reauthorized.

The effectiveness of the remedy will be evaluated in each semi-annual groundwater monitoring report following an examination of the groundwater monitoring data. In addition, to comply with the NCP, within five years after the initiation of the remedial action, and every five years thereafter, a full review will be made of the remedy to confirm that the remedy remains effective in protecting human health and the environment. The five-year review will include an evaluation that the remedy is functioning as planned, that the necessary operation and maintenance is being performed, and that the institutional controls are in place and are protective. The review may take place sooner than five years if project conditions indicate the need. If the review finds that the remedy is not effective, then the review will include recommendations to ensure that the remedy becomes effective, identify milestones toward achieving protectiveness, and provide a schedule for THAN to accomplish the necessary tasks.

7.4.2 Justification of Selected Alternative

The preferred remedial action alternative includes all of the soil and groundwater components required by DTSC in its 6 August 1993 letter to THAN, and meets all of DTSC's revised soil and groundwater performance objectives (see Section 7.2.2). This alternative is also preferred for the following reasons:

1. **The selected alternative is protective of human health and the environment.** Implementation of the soil capping portion of this alternative will substantially reduce the potential exposure to chemically-affected soil. Connections to the city water system, groundwater use restrictions and wellhead treatment, if warranted, will substantially reduce potential exposure to chemically-affected groundwater. This alternative will provide for environmental protection by eliminating exposure to chemically-affected surface soils, preventing potential contamination of surface runoff, and reducing any future threat to groundwater quality beneath the Site.

   If required, implementation of the onsite/nearsite and/or offsite contingent groundwater extraction system would increase the degree of protection of public health and the environment by adding the capability to contain, remove, and, if necessary, treat chemicals known to be associated with the Site in onsite/nearsite and/or offsite groundwater in excess of appropriate chemical-specific FRGs, as well as adding the capability to contain, remove, and treat DBCP in onsite/nearsite and/or offsite groundwater should resaturation of onsite A-zone soils result in an increase in DBCP concentrations in onsite and nearsite groundwater above an action-specific FRG for DBCP (which would be based on the regional background level of DBCP to be measured at and around the time of A-zone resaturation).

   Monitored natural attenuation should be effective in attenuating the movement of chemicals in groundwater. If an evaluation of monitored natural attenuation shows that it is not effective, implementation of the onsite/nearsite and/or offsite contingent groundwater control measures would effectively prevent the migration of chemically-affected groundwater off THAN's property. Although some of the chemicals identified in soil are relatively mobile and have the potential for future migration to groundwater, their potential for future migration is considered small because soil vapor extraction and treatment was effective in reducing soil concentrations to below remedial action objectives. In addition, the soil cap will further reduce the potential for chemical migration. Notwithstanding, the onsite and nearsite contingent groundwater extraction and treatment system would be effective at rapidly removing and treating chemicals before they left THAN's property were they to migrate to groundwater in the future.

In addition, onsite/nearsite and/or offsite groundwater extraction and treatment, if implemented, will reduce the concentrations of chemicals known to be associated with the Site in groundwater in excess of appropriate chemical-specific FRGs, thereby decreasing any potential future exposure to such chemicals. However, decreasing the chemicals known to be associated with the Site will not provide any significant additional protection of public health and the environment in the absence of some regional system to treat regional DBCP in groundwater in excess of its MCL. This alternative will provide additional protection of public health and the environment by reducing concentrations of DBCP in extracted groundwater to an action-specific FRG for the discharge of such water.

2. **The selected alternative complies with ARARs.** If implemented based on groundwater data, installation of an offsite groundwater extraction system would contain groundwater containing chemicals known to be associated with the Site in excess of appropriate chemical-specific FRGs. In addition, an onsite and nearsite contingent groundwater extraction system would contain, remove, and treat groundwater containing chemicals known to be associated with the Site in excess of chemical-specific FRGs. However, groundwater extraction under this alternative would not likely reduce the concentration of DBCP in groundwater to its MCL.

   Accordingly, even though chemicals known to be associated with the Site in excess of chemical-specific FRGs may be potentially removed slightly faster by combining the onsite and nearsite contingent and offsite groundwater control measures included in this alternative, groundwater could not be returned to a quality acceptable for drinking water purposes due to the regional presence of DBCP in groundwater. Extraction of groundwater would act as a barrier to migration of chemicals associated with the Site. However, unless necessary to prevent migration, groundwater extraction offers little benefit in risk reduction relative to monitored natural attenuation.

   Pumping to achieve capture or removal of groundwater affected by chemicals known to be associated with the Site would also result in extraction of groundwater affected by regional, non-point sources of DBCP. The regional DBCP could create a burden on treatment technologies, capacities, and discharge options; however, the groundwater treatment system would be designed to reduce DBCP levels in extracted groundwater to concentrations that will meet an action-specific goal for the discharge of such water. The initial indications are that 1,2,3-TCP is a regional pollutant similar to DBCP, and will be handled similarly.

   Soil capping would also provide some control on the time estimated to attain chemical-specific groundwater FRGs . This measure would minimize the infiltration of rainfall and the potential migration of chemicals from soil to groundwater No location-specific ARARs are invoked by this alternative. Action-specific ARARs associated with wellhead protection and groundwater treatment systems will be met.

3. **The selected alternative provides long-term effectiveness and permanence.** In addition to the effectiveness and permanence of soil capping and wellhead treatment (if implemented), this alternative would effectively remove and reduce the concentrations of chemicals associated with the Site which affect onsite, nearsite, and offsite groundwater in excess of chemical-specific FRGs. Because of the regional presence and apparent ongoing source of DBCP, the natural attenuation feature of the groundwater component will not likely be effective in reducing concentrations of DBCP in groundwater to its MCL. In addition, initial indications are that 1,2,3-TCP is a regional pollutant similar to DBCP, and is likely present at concentrations that would be considered a health concern. It also may not be possible to reduce 1,2,3-TCP concentrations to acceptable levels by natural attenuation if there is a regional source.

   The onsite and nearsite contingent groundwater extraction component of this alternative would also be effective in the capture, removal, and treatment of DBCP in onsite groundwater should resaturation of the onsite A-zone soils result in an increase in the DBCP concentration in onsite or nearsite groundwater above an action-specific FRG for DBCP (which would be based on the regional background level of DBCP to be measured at and around the time of A-zone resaturation). Although pump and treat has been demonstrated to be an effective technology for aquifer restoration, because of the regional presence of DBCP, the onsite and nearsite contingent and offsite groundwater control measures included in this alternative would not likely be effective in reducing concentrations of DBCP in groundwater to its MCL without additional regional treatment. Consequently, groundwater would not be returned to its beneficial use as a drinking water supply, and future use of this water would likely require additional treatment for the removal of DBCP.

   Routine groundwater monitoring would provide adequate controls to evaluate reductions in chemical concentrations or potential migrations of chemically-affected groundwater. Operation, Maintenance, and Monitoring (OM&M) functions, if active groundwater extraction were implemented, would include monitoring of the groundwater treatment equipment, and routine maintenance of pumps and equipment.

4. **The selected alternative reduces toxicity, mobility, and volume of chemicals.** Past actions by THAN (including source removal by soil extraction and soil vapor extraction) have resulted in an overall reduction in the toxicity, mobility, and volume of site-related chemicals found in environmental media. Soil capping would further significantly reduce the mobility of chemicals in soils beneath the cap.

   The toxicity and volume of chemicals in groundwater eventually will be reduced. Monitored natural attenuation will result in reduction of the toxicity and volume of chemicals in groundwater. And, if necessary, the addition of the contingent onsite, nearsite, and/or offsite groundwater remediation systems would result in further reduction of the toxicity, mobility, and volume of chemicals detected in offsite groundwater. However, the combining of contingent groundwater extraction and treatment systems, without additional regional treatment, is not likely to significantly reduce the toxicity, mobility, or volume of DBCP in groundwater due to its regional presence. Consequently, groundwater would not be returned to its beneficial use as a drinking water supply without additional future treatment. It is important to note that local and state agencies are developing plans to address the regional presence of DBCP in groundwater in the eastern portion of the Fresno metropolitan area. In addition, initial indications are that 1,2,3-TCP is a regional pollutant similar to DBCP, and may be present at concentrations that would be considered a health concern. Wellhead treatment, if implemented, would also reduce the toxicity, mobility, and volume of chemically-affected groundwater. The only treatment residual created by this alternative is spent GAC which can be regenerated in most cases.

5. **The selected alternative would provide short-term protection of human health.** Workers will be protected from potential exposure to chemicals through implementation of a health and safety program including air monitoring and personal protective equipment.

   Implementation of this alternative involves only minor surface grading and should not create a significant risk to onsite workers. Dust abatement measures in conjunction with a program of air monitoring and personal protective equipment should adequately protect workers from exposure to dust containing chemicals. No risk to the community is anticipated during construction of the soil cap because issues such as dust abatement for community protection will be addressed in health and safety and other pre-construction planning documents. Protection of the community during offsite construction activities associated with the groundwater extraction system (if necessary) can be accomplished through a program of traffic control and access restriction to work areas.

6. **The selected alternative is implementable.** This alternative is implementable using conventional construction technologies for soil, and monitored natural attenuation for groundwater. In addition, if the contingent groundwater extraction portion of the remedy is necessary, it can be implemented with conventional well drilling technologies, or modifications to existing wells. All groundwater treatment equipment is readily available, if necessary. However, there are limitations associated with the extraction, treatment, and discharge of groundwater in an area affected regionally by DBCP. Pumping rates needed to achieve capture and removal of groundwater affected by chemicals known to be associated with the Site in excess of appropriate chemical-specific FRGs would also result in the capture and removal of groundwater affected by regional DBCP. If pumping rates are increased to shorten the time necessary to reduce concentrations of chemicals from the Site in groundwater to chemical-specific FRGs, greater volumes of groundwater containing regional DBCP would be extracted and treated. The regional DBCP could create a burden on treatment technologies, capacities, and discharge options. However, the contingent groundwater treatment system would be designed to reduce DBCP concentrations in extracted groundwater to concentrations that will meet an action-specific goal for the discharge of such water.

   Implementation of this alternative may require agency coordination for offsite construction activities, and could be affected by the ability to acquire land or negotiate easements. Offsite work would likely require an encroachment permit (for work in public rights-of-way), a grading permit, and traffic control. Installation of extraction piping may require the temporary closure of public streets and rerouting of traffic.

7. **The selected alternative is cost effective.** Capital costs associated with installation of the cap include direct costs such as construction (labor and materials) costs, and indirect costs such as engineering design, permitting, and construction supervision. If effective, the monitored natural attenuation component of Alternative 12 is the most cost-effective means of reaching FRGs in groundwater. If extraction of groundwater for containment is necessary, then the cost of Alternative 12 is comparable to the other alternatives that include active groundwater remediation. Capital costs for the contingent combined onsite and nearsite and offsite groundwater extraction system include well installation, installation of pumps and discharge piping, and groundwater treatment equipment. Capital costs also include costs associated with deed restrictions and groundwater use restrictions.

   OM&M costs include periodic inspection and maintenance of the cap, groundwater monitoring (including monitored natural attenuation), agency oversight fees, and, if the groundwater extraction systems are implemented, maintenance of the groundwater extraction systems, possible treatment costs (such as regeneration of spent activated carbon), and energy costs.

   A range of three costs were estimated for this alternative, depending on the actual component implemented for groundwater: A) monitored natural attenuation, if this is shown to be effective, B) onsite/nearsite and offsite groundwater extraction for containment, without treatment, and C) onsite/nearsite groundwater extraction and treatment. The costs for other components, such as installation of the soil cap and groundwater monitoring, are the same for each variation. The estimated total capital expenditure for Alternative 12 ranges from $2,800,000 to $3,500,000 (see Tables 7-7, 7-10, and 7-13). The estimated 30-year present worth of annual OM&M costs ranged from $4,600,000 to $7,600,000 (see Tables 7-8, 7-11, and 7-14 for OM&M costs). Using a 5 percent discount rate, the combined 30-year present worth ranged from $7,400,000 to $11,100,000 (see Tables 7-9, 7-12, and 7-15).

   Although the preferred alternative may be less expensive than some of the other alternatives considered in the FS, it was nevertheless selected because it satisfies all of the DTSC's refined soil and groundwater performance objectives. The alternative addresses reduction of mobility, toxicity, and volume of chemicals in environmental media, and the achievement of FRGs. Actual costs for the final remedy will depend on several factors, including, for example, the identification of the specific elements of the soil and groundwater components (which will occur in the remedial design phase) and the length of time required to meet the soil and groundwater performance objectives. A major cost consideration is whether monitored natural attenuation will be effective in reducing chemical concentrations in groundwater, or whether groundwater extraction will be required for containment.

8. **The selected alternative is acceptable to the regulatory agencies**. The preferred remedial action alternative is acceptable to the regulatory agencies because it includes all of the soil and groundwater components required by DTSC in its 6 August 1993 letter to THAN, and meets all of DTSC's refined soil and groundwater performance objectives (see Section 7.2.2). The alternative is protective of overall public health and the environment (both in the short-term and long-term). The past provision of alternate water supplies has eliminated the potential domestic water exposure pathway for residents with groundwater wells containing chemicals known to be associated with the Site. The alternative includes provisions for providing connections to alternate water supplies for additional downgradient residents, as appropriate, thereby addressing a future potential exposure pathway. Soil capping will reduce potential onsite exposure pathways.

   Past actions by THAN (including source removal by soil extraction and soil vapor extraction) have resulted in an overall reduction in the toxicity, mobility, and volume of Site-related chemicals found in environmental media. Natural attenuation, or, if necessary, groundwater extraction, will result in a further reduction in the toxicity, mobility, and volume of chemicals.

   The alternative was discussed with the DTSC after submittal of the initial TEFE in 1997, prior to development of this Final RAP.

9. **The selected alternative is acceptable to the community**. The draft RAP was reviewed by the community during the 30-day public comment period. The preferred remedial action alternative was acceptable to the community.

7.4.3 Potential Impacts on the Environment

DTSC has performed an initial study environmental analysis in accordance with the California Environmental Quality Act (CEQA), California Public Resources Code, Sections 21000 et seq. Because DTSC concluded that the project will not result in potential environmental impacts that cannot be mitigated during implementation of the remedial design, a negative declaration has been issued.

7.4.4 Consistency with Federal and State Statutory and Regulatory Requirements

This RAP, and the selection of the preferred remedial action alternative, has been prepared to comply with federal and state statutory and regulatory requirements, including the National Contingency Plan, 400 CFR Part 300, and the factors identified in Section 25356.1(d) of the California Health and Safety Code. The state factors are identified below, together with references to sections of this RAP that contain the pertinent information:

- Consideration of health and safety risks posed by conditions at the Site (Section 7.4.7).
- Evaluation of the effect of chemicals known to be associated with the Site on beneficial uses of threatened resources (Section 6).

- Evaluation of the effect of chemicals known to be associated with the Site on the reasonable availability of groundwater resources for present, future and probable beneficial uses (Section 6).
- Consideration of site-specific characteristics, including hydrogeology, the potential for offsite migration of hazardous substances and background contamination levels (Section 4.2).
- Consideration of cost-effectiveness of alternative remedial action measures (Section 7.3.4.7).
- Evaluation of potential environmental impacts of alternative remedial action measures (Sections 7.3.4.1 and 7.3.4.5).

7.4.5 Administrative Requirements

Activities to implement the preferred remedial action alternative at the Site will continue to be performed under the regulatory oversight of DTSC. As necessary, other permits will be obtained.

CERCLA provides that onsite response actions may proceed without obtaining federal, state and local permits (Section 121(e) of CERCLA). This permit exemption allows the response actions to proceed in an expedient manner, free from potentially lengthy delays associated with regulatory agency proceedings. This permit exemption applies to all administrative requirements, whether or not they are actually "permits". A similar permit exemption is provided under the State Hazardous Substance Account Act which provides that, to the extent consistent with RCRA, the DTSC may exclude from the hazardous waste facilities permit process those portions of any removal or remedial action conducted entirely onsite which meet certain criteria, including that the action is selected and carried out pursuant to an approved remedial action plan, and that the remedial action plan complies with all applicable rules and regulations (California Health and Safety Code Section 25358.9).

7.4.6 Offsite Treatment of Hazardous Materials

Construction of any below grade conveyance systems through onsite soils may generate soils requiring offsite management. Chemical analysis of any excavated soils will be performed to facilitate disposal. It is not anticipated that hazardous wastes will be generated during construction of the offsite portion of the groundwater remediation system, if necessary.

Granular activated carbon (GAC) may be used to remove organic chemicals from the extracted groundwater prior to discharge. The GAC system is a closed system which serves to protect human health and the environment at the Site. The GAC has a finite capacity for adsorbing chemicals from the extracted groundwater. The system will be monitored and as the GAC becomes spent, it will be periodically replaced with fresh GAC. The spent GAC will be removed and transported offsite to a permitted carbon regeneration facility. As necessary, the spent carbon or other hazardous wastes will be managed in accordance with the appropriate requirements for generation, transportation and treatment of hazardous waste as set forth in 22 CCR, Sections 66262, 66263 and 66264.

7.4.7 Health and Safety Plan

Health and Safety Plans have been developed to address previous investigation and remediation activities at the Site. The preferred remedial action alternative will be implemented according to site-specific Health & Safety Plans to be generated prior to implementation of remedial actions. Contractors and consultants retained by THAN to implement the preferred remedial action alternative will be required to prepare Health & Safety Plans that address protection of workers, the adjacent community and the environment during the remediation activities. The Health & Safety Plans will be consistent with applicable federal and state occupational health and safety standards for hazardous waste operations (29 CFR 1910.120 and 8 CCR 5192).

Consultants and contractors working at the Site will be required to complete the 40-hour health and safety training in accordance with the state and federal hazardous waste operations standards. In addition, contractors will be required to provide properly trained and licensed operators for hazardous equipment such as earth moving equipment.

Mitigation measures to protect the community during earthmoving activities may include access controls such as fences and posting of warning signs. Dust control measures will also be employed during the earthmoving activities. The construction supervisor will be responsible for preventing unauthorized personnel from entering work areas during construction. THAN will use fact sheets and public meetings to inform the local community about the activities and to request cooperation in safely completing the remedial activities.

8 IMPLEMENTATION SCHEDULE

The following schedule of events was associated with implementation of the project:

Activity	Date
Remedial Action Plan	
THAN – Submittal of Draft RAP	3 May 1999
DTSC – Adoption of Draft RAP as final pending incorporation of required revisions	30 June 1999
THAN – Submittal of Final RAP	12 July 1999
California Environmental Quality Act	
DTSC – Final Revision of Draft CEQA Documents	10 May 1999
DTSC – Preparation of Final CEQA Documents	30 June 1999
DTSC – Filing of Notice of Determination	30 June 1999
Public Participation	
Start Public Comment Period	14 May 1999
DTSC – Public Meeting	26 May 1999
End Public Comment Period	14 June 1999
DTSC – Completion of Responses to Comments	30 June 1999

9 OPERATION, MAINTENANCE, AND MONITORING (OM&M) REQUIREMENTS

9.1 Description of Ongoing and Future OM&M Activities

Future remedial activities regarding the Site will involve the operation, maintenance and monitoring (OM&M) of several systems and remedial components. These OM&M activities are generally discussed in the following sections. A more detailed OM&M plan will be prepared during the remedial design phase.

9.1.1 Groundwater Sampling, Monitoring and Maintenance

THAN has been performing sampling and monitoring of groundwater in accordance with provisions of the Order.

THAN will continue to perform groundwater sampling and monitoring under the Order pending approval of an OM&M Plan to be prepared and submitted during the remedial design phase. Once the remedial design and OM&M plan are approved, groundwater sampling, monitoring and maintenance will be performed in accordance with the schedule set forth in the approved OM&M plan. Groundwater sampling, monitoring and reporting will be performed to allow THAN, the DTSC and others to evaluate the effectiveness of the soil and groundwater components of the preferred remedial action alternative in meeting FRGs.

The proposed OM&M plan will update the current groundwater sampling and monitoring plan under the Order. The OM&M plan will also establish criteria for possible future modifications of various elements of the monitoring and remedial systems, including, for example, adjustment of the number and location of groundwater monitoring wells and extraction wells, groundwater sampling frequency, analytical protocols for testing of groundwater samples and groundwater extraction rates.

The OM&M plan will provide for the continued submission of reports which present the results of the groundwater sampling and monitoring program. In accordance with CERCLA Section 121(c), a comprehensive review of monitoring and sampling data will be performed after five years of operation and every five years thereafter.

9.1.2 Natural Attenuation Monitoring

In addition to groundwater sampling and analysis of chemicals of concern, groundwater samples collected from selected monitoring wells will be analyzed for organic and geochemical parameters to support the occurrence of natural attenuation of chemicals of concern. The organic and geochemical parameters that may be monitored and the purpose for including them, are presented below:

- **Parent Compounds and Breakdown Products:** The most direct measure of reductive dechlorination is the decline in parent compounds and the appearance of more fully degraded breakdown products. For the THAN site, because parent concentrations are currently very low, the breakdown products may be present at even lower concentrations and therefore difficult to measure.
- **Dissolved Oxygen:** If dissolved oxygen (DO) is present in groundwater at a concentration greater than 1 to 2 milligrams per liter (mg/l), aerobic conditions exist and aerobic respiration can occur. Anaerobic conditions are the favorable

environment for reductive dechlorination; therefore, DO concentrations below 1 mg/l indicate potential anaerobic conditions.

- **Oxidation-Reduction Potential:** Oxidation-reduction potential (ORP or Eh) is a measure of electron activity and is an indicator of the relative tendency of a solute to accept (gain) or transfer (lose) electrons. An ORP close to zero or negative is likely indicative of an anaerobic environment. ORP is of qualitative value and can be used to help validate other measurements.

- **Sulfate (SO_4^{2-}) and Sulfide:** Sulfate can be used as an electron acceptor, and is therefore an indicator, along with produced sulfide, of anaerobic biodegradation.

- **Iron:** Iron III (ferric) can act as an electron acceptor during biological transformation of chlorinated compounds. In this process, Iron III is reduced to Iron II (ferrous). High Iron II concentrations in downgradient groundwater compared to upgradient monitoring points can be used as an indicator of anaerobic respiration.

- **Total Organic Carbon:** Total organic carbon (TOC) is a measure of organic matter. TOC is useful to evaluate whether there is an adequate electron donor supply to support reductive dechlorination and co-metabolism of chlorinated compounds.

- **pH, Specific Conductance and Temperature:** These three parameters are typically monitored during routine quarterly groundwater monitoring events and therefore will be part of this protocol. Groundwater pH can be influenced greatly by microbial activity because both aerobic and anaerobic respiration produce excess hydrogen ions, which increase the hydrogen ion activity, decreasing the pH. Specific conductance is a measure of the ability of a solution to conduct electricity and is directly related to the concentration of dissolved ions and particles in solution. Conductivity increases as ionic concentration increases. Temperature affects the solubility of oxygen and concentrations of other geochemical parameters. Temperature also affects microbial metabolism rates, with slower biodegradation occurring at lower temperatures.

- **Alkalinity:** Provides an indication of the buffering capacity of the water and the amount of carbon dioxide dissolved in the water. Carbon dioxide is an end product of biodegradation. Increased alkalinity is indicative of carbon dioxide production due to mineralization of organic compounds.

- **Nitrate (NO_3^-):** Used as an electron acceptor. Produced only under aerobic conditions.

- **Nitrite:** Product of nitrate reduction. Produced only under anaerobic conditions and rarely observed.

- **Chloride (Cl^-):** Provides evidence of dechlorination.

Because of the use of monitored natural attenuation in the proposed remedial alternative, the effectiveness of the remedy will be evaluated after each sampling event, in addition to the formal requirements for five-year reviews under the NCP.

9.1.3 Monitoring and Sampling of Groundwater Treatment System

Should the onsite or nearsite contingent groundwater extraction and treatment option be required, monitoring and sampling will be performed to document performance of the treatment system, to comply with requirements for monitoring, sampling and reporting to be set forth in the NPDES permit, as necessary, and to confirm compliance with the action-specific goals established for discharge of the treated groundwater. Measured parameters may include:

1. Flowrate and volume of groundwater extracted from individual wells.
2. Flowrate and volume of groundwater through the treatment system.
3. Pressure as measured by gauges installed on the system.
4. Flowrate of air discharged from the air-stripping tower (if installed).

Samples of extracted and treated groundwater will also be collected and analyzed periodically to evaluate the efficiency of the groundwater treatment system and to provide an estimate of the mass of each chemical of concern removed from the aquifer through operation of the extraction and treatment system. The treatment system will also be inspected to identify signs of deterioration or wear. Preventative maintenance activities will also be performed according to schedules recommended by the equipment manufacturer.

9.1.4 Monitoring and Maintenance of the Cap

Inspection of the cap will be performed in accordance with a schedule to be developed during the remedial design phase to confirm the integrity of the cap and to evaluate the continued effectiveness of the access controls (*e.g.*, fencing) and institutional controls (*e.g.*, land use restrictions) established in part, to prevent damage to the cap. Monitoring and maintenance activities will be performed to evaluate the effectiveness of the cap in meeting DTSC's refined performance objectives regarding migration of chemicals of concern to other media. Monitoring parameters may include soil moisture and visual evidence of subsidence or soil loss. Irrigation will be performed as necessary to maintain the vegetated portions of the cap.

9.2 Estimate of Duration of OM&M Activities

For the purposes of cost estimating and in accordance with CERCLA guidance, THAN has assumed that groundwater monitoring, and possible extraction and treatment will continue for thirty years following implementation of the remedial option. Operation and maintenance personnel will continue to conduct OM&M activities to optimize system performance and to comply with monitoring requirements. The scope of the OM&M plan may be revised as Site conditions change and actual remediation effectiveness is evaluated. Maintenance of the protective cap and the fencing to control access are anticipated to continue during the 30 year period.

9.3 Estimated Cost of Conducting OM&M and Source of Financing

The estimated present worth cost of OM&M for the preferred remedial action alternative over a 30-year period is approximately $4.6 million to $7.6 million based upon the parameters and assumptions for Alternative 12. The cost of remedial actions is expected to be borne by THAN and other responsible parties. THAN will also obtain the necessary financial assurance mechanism, as necessary, to comply with appropriate federal and state requirements governing implementation of the final remedy.

9.4 Description of Measures to be Taken to Assure Continued OM&M Activities

THAN will provide sufficient financial assurance to ensure that future OM&M activities will be adequately supported financially.

9.5 Description of Measures to Provide for Remediation of Contamination if Discovered in the Future

If previously unknown contamination at the Site is discovered or if future releases should occur, DTSC may require the responsible parties to implement additional remedial measures which are necessary for the protection of human health and the environment. As discussed in Section 7.4.1, existing A-zone monitoring wells will be monitored on a regular basis for the presence of groundwater. If groundwater is encountered, water samples will be collected and analyzed as part of the groundwater monitoring program. If samples from the B-zone, or samples from the A-zone (if it becomes resaturated) confirm that concentrations of chemicals known to be associated with the Site exceed FRGs, then a contingency plan will be developed and submitted to DTSC for approval. The contingency plan will consider options that could include groundwater containment by extraction and either infiltration of untreated extracted water or treatment. An action-specific FRG for DBCP would be established based on an evaluation of background groundwater quality conditions at and around the time of A-zone resaturation.

As required by CERCLA, THAN will prepare information for five-year regulatory agency reviews to evaluate the effectiveness of the remedial activities. The five-year reviews will provide a regulatory mechanism for modifying the remedial activities if the monitoring data indicate the activities are not effective in meeting DTSC's refined soil and groundwater performance objectives.

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TABLES

Tables that are labeled Draft Remedial Action Plan are now considered final, and are included in this Final Remedial Action Plan

TABLE 1-1

Comparison of RAP and Proposed Plan Elements
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

RAP Section	Proposed Plan Equivalent Elements
1 INTRODUCTION	Site identification - site name and location List of lead and support agencies Purpose of the proposed plan
2 EXECUTIVE SUMMARY	
3 DETAILED DESCRIPTION OF SITE CHARACTERISTICS 3.1 Site History 3.2 Physical Description of the Site	Site background Description of site History of waste generation and disposal Major contaminants of concern Contaminated media Extent of contamination
4 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS 4.1 Geological Investigation of the Site 4.2 Hydrogeological Investigation 4.3 Air Investigation 4.4 Biological Investigation	Scope and role of response action Description of lead agency's overall strategy for remediating the site and how the response action being considered fits into that strategy.
5 POTENTIAL RISKS POSED BY CONDITIONS AT THE SITE	Summary of site risks Contaminated media Chemicals of concern Exposure pathways Potentially exposed population Environmental risks Discussion of consistency of preferred alternative with statutory requirements
6 IMPACT ON PRESENT, FUTURE, AND PROBABLE BENEFICIAL USES OF RESOURCES	

TABLE 1-1

Comparison of RAP and Proposed Plan Elements
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

RAP Section	Proposed Plan Equivalent Elements
7 SUMMARY OF REMEDIAL ACTION FEASIBILITY STUDY 7.1 Overview of Feasibility Study 7.2 Summary of ARARs and Remedial Action Objectives 7.3 Discussion of Remedial Action Alternatives 7.4 Preferred Remedial Alternative 7.4.1 Description of the Preferred Remedial Action Alternative 7.4.2 Justification of Selected Alternative 7.4.3 Potential Impacts on the Environment *7.4.4 Consistency with Applicable Federal and State Statutory* and Regulatory Requirements 7.4.5 Administrative Requirements 7.4.6 Offsite Treatment of Hazardous Materials 7.4.7 Health and Safety Plan	Summary of Alternatives Description of remedial action alternatives evaluated in detailed analysis of the FS, including a discussion of engineering and treatment components, estimated present-worth cost of construction, operation, and maintenance for the alternatives, implementation times, and ARARs associated with the alternatives. The evaluation of alternatives and the preferred alternative Identification of preferred remedial action alternative Discussion of nine criteria used to evaluate the alternatives *Comparison of preferred alternative to other alternatives* Rationale for choosing the preferred alternative Description of consistency of preferred alternative with statutory requirements Statement of support agency's concurrence or nonconcurrence with the preferred alternative
8 IMPLEMENTATION SCHEDULE	
9 NON-BINDING PRELIMINARY ALLOCATION OF FINANCIAL RESPONSIBILITY	
10 OPERATION, MAINTENANCE, AND MONITORING (OM&M) REQUIREMENTS	
COMMUNITY PARTICIPATION	Notice of dates of public comment period Notice of time and place for public meeting(s) Location of administrative record files and information repositories and hours of availability Names, phone numbers and addresses of the lead and support agency personnel who will *receive comments or supply additional information*

TABLE 3-1

Timeline of the Sampling and Remedial Activities Undertaken by THAN
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Dates	Sampling/Remedial Activity	Reference
1981	Borings 1-17 drilled and sampled	Status Report - THAN Remedial Program (JHK 1984b)
	Monitoring Wells 1-6 installed and sampled[(a)]	
	Initiation of off-site domestic well sampling[(b)]	
1982	Offsite deep borings 6B, 18B and 19B installed and sampled	THAN Progress - Report #6, Phase II Assessment Plan, (JHK 1982)
1983	Soil Borings 20-28 drilled, and sampled	Status Report - THAN Remedial Program (JHK 1984b)
	Monitoring Wells 29-32 installed, no samples collected	
	Soil Borings 33-49 drilled and sampled	
1984	Soil Borings 50-69 drilled and sampled	Status Report - THAN Remedial Program (JHK 1984b)
	Monitoring Well 70 installed and sampled	
	Soil Borings 71-74 drilled and sampled	
	Monitoring Wells 75-77 installed; no samples collected	
	Deep Soil Borings 78-83 drilled and sampled	
	Soil Borings 87-107 drilled and sampled	
	Deep Borings 109 and 110 drilled and sampled	
	Excavation of Landfill Area, and 2 cisterns, in Drainage System A and surrounding soil and 1 cistern in Drainage System B	
	Demolition of portions of the Formulation Plant	
	Demolition of Tanks	
	Composite Grid samples of Shallow Soil collected, (C-1 through C-74), identified as CSS1-CSS74 in database	
	Perimeter Borings 111-121 drilled and sampled	
	Deep Borings 122-136 drilled and sampled	
	Borings 134 and 135 drilled and sampled near Drainage System B	
	Air Monitoring conducted during excavation activities	"Air Monitoring Report" Status Report - THAN Remedial Program: Appendix E (JHK 1984b)

TABLE 3-1

Timeline of the Sampling and Remedial Activities Undertaken by THAN
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Dates	Sampling/Remedial Activity	Reference
1985	Drainage System Exploration Program: sludge & soil samples from septic systems	Drainage System Exploration Program (JHK 1986)
	Monitoring Wells 138-140 installed, no samples collected	Preliminary Soils Characterization Report, (K/J/C 1988)
	Borings 141-144 drilled and sampled	
	Monitoring Well 145 installed and sampled	Preliminary Soils Characterization Report, (K/J/C 1988)
	Soil Borings 146-148 drilled and sampled	
1987	Phase 1 Groundwater Investigation, Monitoring Well clusters 149-154 installed and sampled[(a)]	
1988	Groundwater investigations: 1 Hydropunch boring for water samples and Monitoring Well 155BO installed and sampled	Interim Remedial Investigation, THAN site, 15 August 1988, Appendix A-1, RI Report, (K/J/C 1993)
	Onsite air sampling completed	Structures Demolition Completion Report, Attachment B, Appendix A-2,
	Building Materials Sampling conducted	RI Report, (K/J 1993)
1989	Soil Borings 156-180 drilled and sampled, Soil Borings (OB1-OB4) drilled and sampled in the orchard, 13 Cone penetrometer holes investigated, 43 soil gas samples and 9 vapor extraction wells installed	Expedited Remedial Investigation at THAN Site, Technical Memorandum, (K/J/C 1989)
	Structures Demolition Project: five onsite structures demolished and several portions of the site excavated; Verification soil samples collected from each excavation prior to closure	Structures Demolition Completion Report, Attachment B, Appendix A-2, RI Report, (K/J 1992)
	Air Monitoring completed at the perimeter of the THAN site during above mentioned excavations	"Site Perimeter Monitoring for Airborne Pesticides THAN Site" (letter from Harding Lawson Associates to K/J/C, June 20, 1989)
1990	Phase II/III Groundwater Investigation completed involving the installation of 4 well clusters (MW-181-184)[(a)]	Phase II/III Groundwater Investigation Report, (K/J/C 1991)
	Monitoring Wells 185BO, 186BO and 155C1 were also installed and sampled	
	Six vapor extraction wells VX-7 - VX-12 were installed	
1991	Additional Soil Borings drilled and sampled, Borings 187-198 drilled and sampled for metal, and borings 199-201 were drilled and installed as vapor extraction wells	RI Report, (K/J 1993)

TABLE 3-1

Timeline of the Sampling and Remedial Activities Undertaken by THAN

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Dates	Sampling/Remedial Activity	Reference
1992	Draft Remedial Investigation (RI) Report submitted to DTSC	
	Draft Risk Assessment (RA) submitted to DTSC	
	Underground Storage Tank removed and soil samples collected	RI Report, (K/J 1993)
	Draft Feasibility Study (FS) submitted to DTSC	
1993	Final RI, RA and FS Reports submitted to DTSC	RI Report (K/J 1993) FS Report (SEACOR 1993) Final Draft RA Report (Environ 1993)
	Shallow soil sampling conducted by DTSC on 8 December 1993	Report on Shallow Soil Sampling (SEACOR 1994)
1994	Soil sampling along Drainage System H	Removal Action Workplan (SEACOR 1996)
1995	Confirmation soil sampling after closure of SVE systems	Closure of SVE Systems (K/J 1996)
1996	Final Health Risk Assessment submitted to DTSC (1/31/96)	Environ 1996
1997	Confirmation soil sampling after removal of Drainage System H	Removal Action Report (Chaney 1997)

Notes:

(a) Since 1985, groundwater monitoring wells have been sampled quarterly. Prior to 1985, the wells were sampled from one to three times annually. Since June 1996, groundwater monitoring is conducted semiannually.

(b) The domestic wells were sampled from one to five times annually prior to 1985 and were sampled on a regular semiannual basis beginning in 1985. Since the extension of the Fresno municipal water supply to this area, the number of domestic wells that are sampled varies.

TABLE 3-2

Key Reports Regarding the THAN Site

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Report Title	Date	Document Description
Preliminary Report (Phase I Preliminary Report)	10/30/81	Soil and water analytical results from borings 1-17 and wells 1-6; listing of chemicals known to have been formulated or processed between 1959-1981.
Report (2 volumes): Groundwater Results and Updated Report April 1983	04/22/83	Reports to RWQCB regarding results in Phase II-A and II-B Assessment Program.
Soils Investigation Report	01/84 - 04/84	Includes shallow soil sampling results for borings; includes physical testing results for borings 65 and 66 to a depth of 25 feet; includes sampling results in cistern area.
Report: Estimate of Mobility of Selected Pesticides in Soil	04/11/84	Summary and evaluation of various pesticides through 5 ft of clean soil, with and without an impervious cap.
Interim Report - THAN Remedial Program	08/03/84	Summarizes the soils characterization data and remedial actions available or completed as of report date.
Status Report - THAN Remedial Program	11/29/84	Summarizes soils characterization, describes remedial activities completed in summer, describes various remedial program elements, summarizes air quality monitoring results.
Concept Report: Proposed System for Groundwater Remediation at the THAN Site	02/08/85	Conceptual description of proposed groundwater treatment system discharge system compatible with extraction system described in 02/12/85 Feasibility Assessment Report.
Feasibility Assessment of Hydrodynamic Groundwater Containment at the THAN Site, Fresno County, California	02/12/85	Describes hydrogeologic conditions at site, assesses feasibility of halting migration of organic constituents offsite, groundwater flow computer model.
Concept Report: Proposed Interim Remedial Measure Program at the THAN Site	05/85	Conceptual description of proposed interim remedial measures program.
Report: Remedial Investigation and Interim Remedial Measure Documents	07/10/85	Provides address inventory for drinking water wells, provides drinking water sampling program and contingency plan, provides bibliography of reports, provides rationale for termination of excavation activities, summarizes QA/QC procedures.
Report: Remedial Investigation and Interim Remedial Measure Documents	08/02/85	Provides updated address inventory; past program for alternate drinking supply; interim groundwater remediation program engineering design; air monitoring and source control contingency plan worker safety, community safety and contingency plans; partial list of pesticides and other substances handled at site; soil characterization work plan; groundwater assessment work plan.
Report: Remedial Investigation and Interim Remedial Measure Documents	08/19/85	Analysis of drainage at the THAN site.
Report: Remedial Investigation and Interim Remedial Measure Documents	09/03/85	Provides final address inventory community well inventory; information required for processing discharge requirements; community relations plan; and feasibility study work plan.
Response to Agency Comments Regarding Remedial Investigation, Interim Remedial Measure Documents	12/13/85	

TABLE 3-2

Key Reports Regarding the THAN Site

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Report Title	Date	Document Description
Final Report: Drainage System Exploration Program	2/12/86	Describes underground drainage systems investigation.
Community Relations Plan	02/86	Describes Community Relations activities.
Kennedy/Jenks/Chilton Draft Feasibility Study, Tasks 1 and 2, THAN, Fresno County, California	07/86	Submitted in accordance with DTSC Remedial Action Order Docket No. HSA 84/85-001 and RWQCB Cleanup and Abatement Order as reissued July 17, 1985.
Report: "Preliminary Groundwater Characterization: Summary of Data Assimilated to Date, Volumes One and Two."	12/16/86	Characterization of existing groundwater and hydrogeologic data
Work Plan for Phase I of Groundwater Assessment	3/09/87	Submitted in Accordance with DTSC Imminent and Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.9.
Quality Assurance Project Plan	05/06/87	Plan for characterization of soil and groundwater quality in the vicinity of the THAN site. Submitted in accordance with DTSC Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.2.
Sampling and Analysis Plan	05/06/87	Describing the Sampling Protocol to be employed during Phase I field activities.
Draft Remedial Investigation/Feasibility Study Workplan	05/87	Submitted to DTSC for comments in accordance with DTSC Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED.
Phase I Ground Water Assessment Summary Volumes I, II and III	11/18/87	Summarizes field activities and the hydrogeologic and water quality data collected during THAN's Phase I Ground Water Assessment. The Phase I Groundwater Assessment Summary report was submitted to DTSC in accordance with Section V.E.1. of DTSC Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No.HSA 86/87-020 ED, dated January 23, 1987, as amended May 8, 1987.
Preliminary Soil Characterization Report Summary of Data Assimilated to Date	05/18/88	Summarizes chemical analyses performed on soil samples collected from the THAN site from 1981 to July 1987.
Quality Assurance Project Plan	07/27/88	Revises draft report submitted on 05/06/87.
Investigation-Derived Residuals Management Plan	09/08/88	Establishes appropriate procedures and protocol for the containment, sampling, and disposal of residuals expected to be generated during the Site Remedial Investigation.
Draft Structures Demolition Plan	10/03/88	Describes the scope, schedule, engineering, and administrative controls proposed by THAN for the proposed structures demolition and soil excavation activities.
Air Monitoring Plan	12/05/88	Describes the monitoring, sampling and analyses for airborne chemicals that will be conducted at the fenced perimeter of the THAN site during the demolition and excavation phases of the structures demolition project (note that this report is bound with the other 12/88 reports listed below).
Site Health and Safety Plan	12/16/88	Establishes general health and safety protocol for Kennedy/Jenks/ Chilton personnel at the THAN site (note is bound with the other 12/88 reports listed).

TABLE 3-2

Key Reports Regarding the THAN Site
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Report Title	Date	Document Description
Dust and Vapor Control Workplan	12/22/88	Describes dust/vapor control methods to be used during all work associated with asbestos removal, structures demolition, soil backfill/ compaction, and transport loading at the THAN site (note that this report is bound with the other 12/88 reports listed).
Transportation Plan	12/23/88	Describes procedures for safe and proper transportation of waste materials to CWM's Kettleman Hills Class I Treatment and Disposal Facility (note that this report is bound with the other 12/88 reports listed).
Description of Soil Vapor Extraction Pilot System	10/90	Describes the pilot program of soil vapor extraction to remove xylenes, ethylbenzene and other volatile and semivolatile compounds in the former solvent storage area.
Draft Public Participation - Community Relations Plan	12/90	
Public Participation - Community Relations Plan	1/92	
Preliminary Draft Remedial Investigation Summary Report and Appendices (Volumes 1 - 8)	3/30/92	Summary of remedial investigation and response actions performed by THAN. Includes evaluation of the nature and extent of chemicals in environmental media and fate and mobility of chemicals.
Preliminary Draft Multipathway Health Risk Assessment Report and Appendices (Volumes I - III)	3/92	Evaluates the risks to human health and the environment based on the data from the RI report.
Preliminary Draft Feasibility Study Report	6/5/92	Develops and evaluates alternatives for remedial action based on appropriate, relevant and applicable requirements.
Public Participation - Community Relations Plan	10/92	
Response to Agency Comments - Revised Draft Remedial Investigation Summary Report	1/30/93	
Draft Feasibility Study Report (Revised)	1/31/93	
Final Remedial Investigation Summary Report and Appendices (Volumes 1 - 8)	5/28/93	
Feasibility Study Report	6/30/93	
Final Draft Health Risk Assessment (Volumes I - III)	7/29/93	
Summary of Results December 1993 Shallow Soil Sampling and Analysis Conducted by Department of Toxic Substances Control	2/23/94	Describes the results of the shallow soil sampling conducted by DTSC on 8 December 1993.
Preliminary Draft Remedial Action Plan	3/22/94	
Final Health Risk Assessment	1/31/96	Evaluates potential health risks of chemicals of concern.

TABLE 3-2

Key Reports Regarding the THAN Site
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Report Title	Date	Document Description
Recommendation for Permanent Closure of Soil Vapor Extraction Systems in the Former Laboratory and Solvent Storage Areas.	9/16/96	Evaluates the effectiveness of the two soil vapor extraction systems at the Site and recommends permanent closure of both systems based on the evaluation.
Removal Site Evaluation Engineering Evaluation/Cost Analysis, and Workplan for Pesticide-Affected Soil Removal	10/4/96	Develops a workplan for removal of drainage system H and pesticide impacted soils in the vicinity of drainage system H.
Report of Removal Action Drainage System "H"	11/5/97	Describes the actions performed to remove drainage system H and pesticide impacted soils in the vicinity of drainage system H.
Draft Technical and Economic Feasibility Evaluation	4/30/97	Presents the technical and economic feasibility of achieving the proposed final remediation goals (PFRGs)
Response to Agency Comments on Preliminary Draft Remedial Action Plan	5/13/98	Provides responses to regulatory agencies comments on the Preliminary Draft Remedial Action Plan submitted on 3/22/94.
Response to Agency Comments on Draft Technical and Economic Feasibility Evaluation	5/14/98	Provides responses to regulatory agencies comments on the Draft Technical and Economic Feasibility Evaluation.

TABLE 3-3

Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemicals Detected in Soil Samples[c]			
1	1,2-Dichloroethane	41	Endosulfan II
2	1,2,4-Trichlorobenzene[d]	42	Endosulfan Sulfate
3	2,4,5-T	43	Endrin
4	2,4,5-TP	44	Endrin Aldehyde
5	2,4-D	45	Ethion
6	2-Methyl Naphthalene	46	Ethyl Benzene
7	2-Nitrophenol	47	Fluoranthene
8	Acetone	48	Guthion
9	Aldrin	49	Heptachlor
10	α-BHC	50	Heptachlor Epoxide
11	Arsenic	51	Hexachlorobenzene
12	Benzene	52	Hexachlorobutadiene[d]
13	Benzo(a)anthracene	53	Indeno(1,2,3-CD)Pyrene
14	Benzo(a)pyrene	54	Isophorone
15	Benzo(b)fluoranthene	55	Lead
16	Benzo(GHI)perylene	56	Lindane
17	Benzo(k)fluoranthene	57	Malathion
18	Beryllium	58	MDE
19	β-BHC	59	Mercury
20	Chlordane	60	Methoxychlor
21	Chloroform	61	Methyl Parathion
22	Chromium	62	Naphthalene
23	Chrysene	63	Nickel
24	Copper	64	Parathion
25	Cyanide	65	PCNB
26	Dacthal	66	Phenanthrene
27	DBCP	67	Phorate
28	DDD	68	Phosalone
29	DDE	69	Pyrene
30	DDT	70	Tetrachloroethene
31	DEF	71	Toluene
32	δ-BHC	72	Toxaphene
33	Di-n-octyl-phthalate	73	Trichloroethene
34	Diazinon	74	Trifluralin
35	Dicofol[e]	75	Xylenes
36	Dieldrin	76	Zinc
37	Dinoseb	77	Zytron
38	Diphenamid		
39	Disulfoton		
40	Endosulfan I		

TABLE 3-3

Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

NOTES:

(a) This table presents the chemicals analyzed for and detected in samples of remaining soil collected on or off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site"). The chemicals are listed in alphanumeric order.
(b) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed. The post-excavation data set includes soil samples collected from unexcavated areas of the Site as well as samples collected from soils remaining on or off the Site after excavation activities were completed. Information regarding chemicals detected in excavated soil is presented in the RI Report (K/J 1993).
(c) Unless otherwise noted the Source is the RI Report, Table 5-5, K/J 1993.
(d) Source: Report on Removal Action Drainage System "H" (Chaney 1997).
(e) Source: Shallow Soil Sampling Results (SEACOR 1994).

TABLE 3-4

Chemicals Detected in Groundwater Samples Collected from Onsite and Offsite Wells[a]

Preliminary Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Chemicals Detected in Groundwater Samples[b]			
1	1,1,1-Trichloroethane	41	Dieldrin[c]
2	1,1,2-Trichloroethane	42	Dimethoate
3	1,1,2,2-Tetrachloroethane	43	Diphenamid[c]
4	1,2-Dichloroethane[c]	44	Dinoseb[c]
5	1,2,3-Trichloropropane	45	Endosulfan I
6	1,4-Dichlorobenzene[d]	46	Endosulfan II
7	2,4-DB	47	Endosulfan Sulfate
8	2,4-DP	48	Endrin
9	α-BHC[c]	49	Endrin Ketone[d]
10	Aldrin	50	Ethyl Benzene[f]
11	Arsenic[e]	51	Ethylene Dibromide
12	β-BHC	52	Heptachlor
13	Barium[e]	53	Heptachlor Epoxide
14	Benzene[d, f]	54	Hexavalent Chromium[e]
15	Bicarbonate[e]	55	Iron[e]
16	bis-(2-ethylhexyl) phthalate	56	Lead[e]
17	Boron(e)	57	Lindane[c]
18	Bromacil	58	Magnesium[e]
19	Bromodichloromethane[d]	59	Malathion[f]
20	Bromoform[d]	60	Manganese[e]
21	Butyl Benzyl Phthalate	61	MBAS (Foaming Agents)[e]
22	Cadmium[e]	62	Mercury[e]
23	Calcium[e]	63	Methyl Parathion
24	Captan	64	Methylene Chloride
25	Carbon Tetrachloride	65	Nitrate[e]
26	Carbonate[e]	66	Parathion
27	Chlordane	67	PCNB[d]
28	Chloride[e]	68	Pentachlorophenol[d, f, h]
29	Chloroform[c]	69	Potassium[e]
30	Copper[e]	70	Silica[e]
31	δ-BHC[c]	71	Sodium[e]
32	Dalapon[d, g]	72	Sulfate[e]
33	DBCP[c]	73	Tetrachloroethene
34	DDD (2,4)	74	Toluene[d]
35	DDE (4,4)	75	Trichloroethene
36	DDT	76	Trichlorofluoromethane
37	DEF	77	Trifluralin
38	Di-N-Butyl Phthalate	78	Trivalent Chromium[e]
39	Diazinon	79	Xylenes[f]
40	Dicofol	80	Zinc[e]

TABLE 3-4

Chemicals Detected in Groundwater Samples Collected from Onsite and Offsite Wells[a]

Preliminary Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

NOTES

(a) This table presents the chemicals analyzed for and detected in groundwater samples collected from monitoring, domestic and irrigation wells on or off the Site currently owned by T H Agriculture and Nutrition, L.L.C. ("the Site"). Unless otherwise noted, this table incorporates analytical data for groundwater samples which have been collected since January 1987 through September of 1991. Analytical data collected prior to January 1987 (marked with superscript (c) were taken from historical concentration tables in the analytical report: *Groundwater Analyses, November 1987 Monitoring Well Sampling, THAN, Eastern Fresno County, California*, J.H. Kleinfelder, April 15, 1988.

(b) The numbers are provided for the reader's convenience.

(c) Analytical data for these chemicals include results collected prior to January 1987.

(d) These chemicals were detected in groundwater samples collected after September 1991.

(e) Analytical data for these chemicals were obtained from inorganic compound analytical results since December 1981.

(f) These chemicals were detected once but not confirmed in subsequent samples.

(g) Dalapon was detected in a groundwater sample collected on 5 December 1997 from monitoring well 155 B0. The reported value was assigned a "Y" qualifier by the laboratory, indicating significant disagreement between results by the primary and secondary columns of the measuring instrument. Based on available data, this is the first time Dalapon has been detected in a THAN groundwater sample.

(h) Pentachlorophenol was detected as a non-target analyte in a groundwater sample collected on 17 October 1995 from Monitoring Well 152 C1. An estimated value was reported (0.08 μg/l) which was less than the reported detection limit (0.1 μg/l).

TABLE 3-5

Monitored Zones and Associated Wells[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75 Page 1of 1

Water-Bearing Zone	Total	Monitoring Well Number
Onsite		
A (shallow)	8	5, 75, 77-A1 (replaced well 77), 138, 139, 140, 145, 155-A1
B (intermediate)	4	77-B1, 904, 155-B0, 186-B0
Offsite		
A (shallow)	9	29-A, 30-A, 31-A, 32-A, 76, 151-A1, 152-A1, 153-A1, 154-A1
B (intermediate)	17	29-B, 30-B, 31-B, 32-B, 905[b], 149-B1, 150-B1, 151-B1, 152-B1, 153-B1, 154-B1, 181-B1, 182-B1, 183-B1, 183-B2, 184-B1, 185-B0
C (deep)	11	149-C1, 150-C1, 151-C1, 152-C1, 153-C1, 154-C1, 155-C1, 181-C0, 182-C1, 183-C1, 184-C1
D (deep)	4	181-D1, 182-D1, 183-D1, 184-D1

Notes

(a) The Site, located in Eastern Fresno County, is currently owned by T H Agriculture & Nutrition, L.L.C. (the "Site") and is defined by the area included within the Site fence boundary. Monitoring Well locations are shown on Figures 3-4 and 3-5.

(b) Well construction data is not available for this well. Based on information on Well 905, it is considered most likely to be screened in the B zone.

Source: RI Report, Table 3-4, K/J 1993.

TABLE 3-6

List of Domestic and Agricultural Wells Sampled by THAN
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Domestic Wells Currently Sampled

916	1598 North Temperance	1006	6262 Belmont
939	7099 East McKinley	1007	6252 Belmont
943	7209 East Pine	1008	6222 Belmont
976	6635 East Floradora	1009	6196 Belmont
980	6901 East Olive	1010	6201 East Olive
984	6585 East Harvey	1011	7230 East Pine
986	1220 North Armstrong	1013	7190 East Pine
990	East Harvey near Armstrong	1017	7027 East Olive
991	6686 East Harvey	3001	7198 East Pine
1005	6691 East Olive	3002	1761 North Hornet

Domestic Wells Previously Sampled

901	1571 North Temperance	926	7083 East Dennett
902	1635 North Temperance	927	2291 North Temperance
903	2044 North Temperance	928	2335 North Temperance
906	6932 East Floradora	929	6857 East Cambridge
907	6866 East Floradora	930	1903 North Temperance
908	6672 East Floradora	931	1839 North Temperance
909	6849 East Floradora	932	2044 North Temperance
910	6891 East Floradora	933	7298 East McKinley
911	1691 North Temperance	934	7298 East McKinley
912	1617 North Temperance	935	7298 East McKinley
913	1525 North Temperance	936	2236 North Temperance
914	6910 East Olive	937	1871 North Temperance
915	6888 East Olive	938	2216 North Armstrong
917	1628 North Temperance	940	1852 North Temperance
918	1556 North Temperance	940B	1852 North Temperance
919	1524 North Temperance	941	6920 East Olive
920	6941 East Cambridge	942	(Now Well No. 905)
921	1601 North Hornet	944[(a)]	6618 East Conejo
922	1653 North Hornet	945[(a)]	6302 East Clemenceau
923	1698 North Hornet	946[(a)]	6882 East Mountain View
924	7419 East Pine	947[(a)]	13282 South Fowler
925	7234 East Olive	948[(a)]	3681 East Mountain View

TABLE 3-6

List of Domestic and Agricultural Wells Sampled by THAN
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Domestic Wells Previously Sampled

949[a]	5720 East Mountain View	987	6271 East Harvey
950[a]	12709 South Sunnyside	988	6227 East Harvey
951[a]	6269 East Nebraska	989	6226 East Harvey
952[a]	13904 South Fowler	992	6566 East Harvey
953[a]	6534 East Saginaw	994	6650 East Olive
954[a]	6634 East Saginaw	993	1927 North Temperance
955[a]	12475 South Fowler	995	1595 North Temperance
956	6724 East Clemenceau	996	6822 East Floradora
957	6652 East Mountain View	997	6804 East Floradora
958	6552 East Olive	998	6766 East Olive
959	6668 East Olive	999	1702 North Temperance
960	6704 East Olive	1000	6546 East Harvey
961	6858 East Olive	1001	1250 North Armstrong
962	6874 East Olive	1002	6632 East Harvey
963	6811 East Olive	1003	6644 East Harvey
964	6745 East Olive	1004	6672 East Harvey
965	6737 East Olive	1012	7272 East Pine
966	6655 East Olive	1021	6754 East Harvey
967	7509 East McKinley	1024	6762 East Belmont
968	6730 East Olive	1026	Ashburns Market, Belmont & Temperance
969	1338 North Armstrong	1027	6709 East Belmont
970	6423 East Olive	1028	6381 East Belmont
971	6649 East Floradora	1032	6170 East Belmont
972	1754 North Temperance	1033	5879 East Belmont
973	6811 East Floradora	1034	1283 North Fowler
974	6731 East Floradora	1037	6165 East Olive
975	6699 East Olive	1038	6158 East Floradora
977	6612 East Olive	1039	6082 East Floradora
978	7763 East McKinley	1042	6709 East Belmont
979	6915 East Olive	2014	5975 East Tulare
981	1090 North Armstrong	2015	5951 East Tulare
981A	6645 East Harvey	2031	6374 East Kings Canyon
982	6729 East Olive	2038	341 North Temperance
983	1448 North Armstrong	2045	6761 East Belmont
985	6584 East Harvey	2048	7375 East Belmont

TABLE 3-6

List of Domestic and Agricultural Wells Sampled by THAN
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Domestic Wells Previously Sampled

3000	1755 North Armstrong	3004	1545 North Hornet
3003	7466 East Pine	3005	1239 North Temperance

Note:

(a) Wells 944 through 957 are located in the City of Selma area.

TABLE 4-1

Chemicals Detected in Soil Samples Collected from Borings Located Offsite[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Boring[b]	Depth (feet)	Location[c]	Chemical Detected	Concentration (mg/kg)	Methods[d]
111	1	East	Dieldrin	0.01	608, 614, DBCP
113	1	East	Dieldrin	0.01	608, 614, DBCP
116	3	South	Dieldrin	0.01	608, 614, DBCP
117	1	South	Dieldrin	0.03	608, 614, DBCP
117	3	South	Dieldrin	0.03	608, 614, DBCP
118	1	South	Dieldrin	0.02	608, 614, DBCP
119	1	South	DDE	0.09	608, 614, DBCP
119	1	South	DDT	0.26	608, 614, DBCP
119	1	South	Dieldrin	0.41	608, 614, DBCP
119	1	South	Endosulfan I	0.02	608, 614, DBCP
119	1	South	Endosulfan II	0.71	608, 614, DBCP
119	1	South	Endosulfan sulfate	0.21	608, 614, DBCP
119	1	South	Toxaphene	0.92	608, 614, DBCP
119	3	South	DDT	0.05	608, 614, DBCP
119	3	South	Dieldrin	0.09	608, 614, DBCP
119	3	South	Endosulfan I	0.01	608, 614, DBCP
119	3	South	Endosulfan II	0.13	608, 614, DBCP
119	3	South	Endosulfan sulfate	0.05	608, 614, DBCP
120	1	South	DDE	0.06	608, 614, DBCP
120	1	South	DDT	0.23	608, 614, DBCP
120	1	South	Dieldrin	0.05	608, 614, DBCP
120	1	South	Endosulfan I	0.06	608, 614, DBCP
120	1	South	Endosulfan II	0.97	608, 614, DBCP
120	1	South	Endosulfan sulfate	0.13	608, 614, DBCP
120	1	South	Toxaphene	0.52	608, 614, DBCP
120	3	South	Dieldrin	0.03	608, 614, DBCP
120	3	South	Endosulfan I	0.07	608, 614, DBCP
120	3	South	Endosulfan II	0.62	608, 614, DBCP
120	3	South	Endosulfan sulfate	0.11	608, 614, DBCP
120	3	South	Toxaphene	0.32	608, 614, DBCP
121	1	South	Dieldrin	0.02	608, 614, DBCP
OB-2	2	West	DDE	0.17	8080, 8140, 8150, 8240, 8270, DBCP
OB-2	2	West	DDT	0.24	8080, 8140, 8150, 8240, 8270, DBCP
OB-2	2	West	Toxaphene	0.05	8080, 8140, 8150, 8240, 8270, DBCP
OB-3	1	South	DDE	0.23	8080, 8140, 8150, 8240, 8270, DBCP
OB-3	1	South	DDT	0.48	8080, 8140, 8150, 8240, 8270, DBCP
OB-3	1	South	DDD	0.46	8080, 8140, 8150, 8240, 8270, DBCP

TABLE 4-1

Chemicals Detected in Soil Samples Collected from Borings Located Offsite[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Boring[b]	Depth (feet)	Location[c]	Chemical Detected	Concentration (mg/kg)	Methods[d]
OB-3	1	South	Toxaphene	0.38	8080, 8140, 8150, 8240, 8270, DBCP
OB-4	2	East	DDE	0.05	8080, 8140, 8150, 8240, 8270, DBCP
OB-4	2	East	DDT	0.18	8080, 8140, 8150, 8240, 8270, DBCP
OB-4	2	East	Toxaphene	0.17	8080, 8140, 8150, 8240, 8270, DBCP
A-1[e]	-	West	DDT	0.29	8080, DBCP
A-1	-	West	DDE	0.53	8080, DBCP
A-1	-	West	DDD	0.18	8080, DBCP
A-2[e]	-	West	DDT	0.05	8080, DBCP
A-2	-	West	DDE	0.06	8080, DBCP
RR 26	3	North	DDT	2.9	8080
RR 27	3	North	DDT	0.05	8080
149C1	Drill Cuttings[f]	Northwest	N/A[g]	N/A	601, 608,DBCP
150C1	Drill Cuttings[f]	South	DDE DDT	0.14 0.1	601, 608,DBCP
151C1	Drill Cuttings[f]	Southwest	N/A	N/A	601, 608,DBCP
154C1	Drill Cuttings[f]	Northeast	DDE DDT	0.058 0.06	601, 608,DBCP
197	1	East	Nickel Zinc	12 33	Priority Pollutant Metals, EDB, DBCP, CYANIDE
197	6	East	Nickel Zinc	69 45	Priority Pollutant Metals, EDB, DBCP, CYANIDE
197	12	East	Nickel Zinc	32 25	Priority Pollutant Metals, EDB, DBCP, CYANIDE
198	1	East	Nickel Zinc	33 25	Priority Pollutant Metals, EDB, DBCP, CYANIDE
198	6	East	Cyanide Nickel	0.1 7	Priority Pollutant Metals, EDB, DBCP, CYANIDE
198	12	East	Zinc Nickel Zinc	14 19 31	Priority Pollutant Metals, EDB, DBCP, CYANIDE

TABLE 4-1

Chemicals Detected in Soil Samples Collected from Borings Located Offsite[(a)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) This table presents analytical results of samples collected from soils located outside the boundaries of the 5-acre parcel in eastern Fresno County, currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site"). This table lists only the chemicals detected in samples collected offsite.

(b) Borings 111 through 121 were collected at depths of 1 and 3 feet in September 1984. Borings OB1 through OB4 were collected at three depths between 1 and 6 feet on 15 March 1989. Borings RR 26 and 27 were collected on 1 March 1989 at a depth of 3 feet.

(c) Location directions are relative to the boundaries of the Site.

(d) Analytical detection method used to evaluate samples.

(e) Borings A-1 and A-2 were collected from property located at the corner of Temperance and McKinley Avenues. Depths of samples are unknown. Data is from a 28 December 1990 letter from Mr. Kevin Shaddy of the California Department of Health Services to Mr. Timothy Casagrande of the Fresno County Environmental Health Department.

(f) Samples from drill cuttings collected and analyzed in October 1987 during these monitoring well installations. Depth of sample is not estimated.

(g) N/A = Not Applicable.

Source: RI Report, Table 5-76, K/J 1993

TABLE 4-2

Statistical Analysis of Chemicals Detected and Confirmed in Soil Samples Collected From Zone 1 (0 - 1 Foot) Onsite and Offsite[a], Post-Excavation[b]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Maximum Concentration Detected (mg/kg)	Arithmetic Mean[c,d] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[e]
DBCP	0.18	0.006	11	90	12
Arsenic	33	5.4	12	12	100
Dieldrin	35	5.7	22	79	28
Lead	55	10	9	12	75
DDD	270	43	35	79	44
DDE	600	67	63	79	80
DDT	2,900	380	65	80	81
Toxaphene	7,900	150	21	78	27
Ethylbenzene	0.04	0.098	3	4	75
Endosulfan I[f]	0.06	7.4	2	47	4.3
Mercury	0.06	0.02	1	12	8.3
Chlordane[f]	0.144	26	1	67	1.5
Xylenes	0.16	0.17	3	4	75
Endosulfan Sulfate[f]	0.21	7.5	2	47	4.3
Endosulfan II[f]	0.97	5.4	2	66	3.0
Malathion	1.15	0.10	11	77	14
PCNB	1.81	0.25	3	25	12
DEF	4.45	0.20	13	67	19
Ethion	10	0.24	12	67	18
Methyl parathion	20	0.40	12	67	18
Copper	29.5	15	12	12	100
Chromium	52.1	20	12	12	100
Parathion	86	2.1	28	77	36
Nickel	143	26	12	12	100
Zinc	154	38	12	12	100
Trifluralin	188	4.9	33	70	47
Diphenamid	4,997	68	11	77	14
Guthion	1.14	0.64	1	66	1.5

TABLE 4-2

Statistical Analysis of Chemicals Detected and Confirmed in Soil Samples Collected From Zone 1 (0 - 1 Foot) Onsite and Offsite[(a)], Post-Excavation[(b)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) This table presents analytical results for samples collected from soils on or off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site").

(b) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed. The post-excavation data set includes soil samples collected from unexcavated areas of the Site as well as samples collected from soils remaining on or off the Site after excavation activities were completed. This table presents chemicals detected and confirmed.

(c) Arithmetic mean is calculated using the sum of detected concentrations and one half of the detection limit if a chemical was not detected.

(d) Every time a chemical was reported as not detected by an analysis, the value of the reported detection limit was entered in the database tables. Note that the reported detection limit was used in calculating the arithmetic mean. In some cases marked with superscript "f" very high detection limits were reported resulting in arithmetic means being larger than the maximum detected concentration.

(e) Percent detects = (Number of detects / Number of Times Analyzed) * 100

(f) Detection limits of soil samples vary. Due to occasional high detection limits, the arithmetic mean is greater than the maximum concentration for this chemical.

Source: RI Report, Table 5-14, K/J 1993

TABLE 4-3

Statistical Analysis of Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical[c]	Maximum Concentration Detected (mg/kg)	Arithmetic Mean[d,e] (mg/kg)	Median[f] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[g]	Boring/ Sample Number[h]	Depth (feet)	Study Area[i]
MDE	0.002	0.002	0.002	1	1	100.0	001	7.0	6
Dacthal	0.03	0.006	0.001	7	7	100.0	016	12.0	1
Mercury	0.06	0.012	0.01	2	36	5.6	187	1	6
Diazinon	0.09	0.056	0.03	4	692	0.6	003	4.0	1
Cyanide	0.1	0.027	0.03	1	36	2.8	198	1	6
Phorate	0.09	0.061	0.03	1	601	0.2	R-102	16.0	1
2,4,5-T	0.1	0.071	0.05	3	193	1.6	157	25.0	6
Acetone[j]	0.11	3.9	0.01	14	18	77.8	079	20.0	5
Endrin aldehyde[j]	0.12	0.51	0.03	1	294	0.3	096	22.0	1
Zytron[j]	0.196	0.98	0.03	7	566	1.2	001	2.0	6
2,4,5-TP	0.2	0.07	0.05	5	195	2.6	179	30.0	3
Benzene[j]	0.2	0.28	0.3	1	389	0.3	144	30.0	6
Di-n-octyl phthalate[j]	0.2	0.99	0.3	1	181	0.6	CI7	16.0	6
Chloroform	0.25	0.23	0.25	27	379	7.1	079	20.0	5
Aldrin	0.27	0.74	0.03	14	778	1.8	110	20.0	4
Disulfoton	0.35	0.08	0.03	3	300	1.0	DIN26	20.0	3
2,4-D	0.4	0.08	0.05	6	193	3.1	171	25.0	1
Toluene	0.59	0.28	0.3	5	389	1.3	175	35.0	4
Beryllium	0.64	0.17	0.1	9	36	25.0	192	12	1
Benzo(ghi)perylene	0.7	1.26	0.3	1	180	0.6	DSG1	15.0	6
Trichloroethene	0.7	0.23	0.25	1	381	0.3	RR54	26.0	2
DBCP	0.78	0.007	0.005	55	714	7.7	R-088	8.0	1
Indeno(1,2,3-cd)pyrene[k]	0.8	1.3	0.3	1	180	0.6	DSG1	15.0	6
Tetrachloroethene	0.8	0.23	0.25	1	381	0.3	RR54	26.0	2
β-BHC	1	0.73	0.03	42	793	5.3	CSS19	2.0	6
Phenanthrene	1.1	0.69	0.3	1	180	0.6	DSG1	15.0	6

TABLE 4-3

Statistical Analysis of Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical[c]	Maximum Concentration Detected (mg/kg)	Arithmetic Mean[d,e] (mg/kg)	Median[f] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[g]	Boring/ Sample Number[h]	Depth (feet)	Study Area[i]
2-nitrophenol	1.3	0.48	0.3	2	181	1.1	DIN28	10.0	3
Endosulfan II	1.3	0.86	0.03	11	696	1.6	DIN28	10.0	3
Heptachlor epoxide	1.82	0.75	0.03	8	795	1.0	R-136	26.0	1
Hexachlorobenzene	2.1	0.56	0.3	1	181	0.6	DIN28	10.0	3
Benzo(a)pyrene	2.3	1.3	0.3	1	180	0.6	DSG1	15.0	6
Benzo(b)fluoranthene	2.3	0.30	0.3	1	142	0.7	DSG1	15.0	6
Benzo(k)fluoranthene	2.3	1.7	0.3	1	180	0.6	DSG1	15.0	6
Endosulfan I	2.5	0.93	0.03	22	586	3.8	109	20.0	4
Heptachlor	2.71	0.74	0.03	12	782	1.5	R-136	26.0	1
Benzo(a)anthracene	3.1	1.0	0.3	1	181	0.6	DSG1	15.0	6
Chrysene	3.4	0.84	0.3	1	180	0.6	DSG1	15.0	6
Naphthalene	4	0.36	0.3	2	181	1.1	RR73	29.0	2
Pyrene	4.1	0.70	0.3	1	180	0.6	DSG1	15.0	6
Fluoranthene	4.2	0.87	0.3	1	181	0.6	DSG1	15.0	6
Phosalone	4.3	0.88	0.03	2	7	28.6	DIN26	20.0	3
2-methyl naphthalene	8.2	0.40	0.3	3	154	1.9	RR73	29.0	2
Ethion	10	0.10	0.03	35	673	5.2	R-077	1.0	1
Endosulfan sulfate	15	0.93	0.03	10	559	1.8	R-141	2.0	1
Methoxychlor	17	1.2	0.03	11	590	1.9	R-001	3.0	1
Isophorone	18.5	2.1	0.3	7	181	3.9	DIN28	10.0	3
Methyl parathion	20	0.11	0.03	28	691	4.1	R-073	1.0	1
δ-BHC	30	0.85	0.03	11	743	1.5	R-088	8.0	1
Copper	31.4	12	9.6	36	36	100.0	189	12	4
Arsenic	33	2.5	1.0	35	36	97.2	187	1	6
α-BHC	40	0.72	0.03	31	847	3.7	R-088	8.0	1
Dinoseb	41	1.6	0.5	8	222	3.6	DIN32	29.0	3

TABLE 4-3

Statistical Analysis of Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical[c]	Maximum Concentration Detected (mg/kg)	Arithmetic Mean[d,e] (mg/kg)	Median[f] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[g]	Boring/ Sample Number[h]	Depth (feet)	Study Area[i]
Chlordane	50	3.5	0.03	22	749	2.9	NE2	7.0	6
Lead	55	7.8	5.9	27	36	75.0	187	1	6
Endrin	60	0.79	0.03	14	837	1.7	R-088	8.0	1
Chromium	76	28	20	36	36	100.0	192	12	1
Lindane	80	0.84	0.03	44	806	5.5	R-088	8.0	1
Guthion	81.5	0.42	0.25	5	631	0.8	DIN28	10.0	3
Parathion	126	1.1	0.03	91	743	12.2	R-076	2.0	1
Nickel	143	40	19	36	36	100.0	187	1	2
Zinc	154	30	22	36	36	100.0	187	1	2
DEF	158	0.39	0.03	27	592	4.6	DIN28	10.0	3
Trifluralin	188	1.1	0.03	103	573	18.0	R-077	1.0	1
1,2-DCA	200	0.76	0.25	4	380	1.1	001	2.0	6
PCNB	207	2.6	0.03	96	470	20.4	CSS24	3.0	1
Dieldrin	223	1.7	0.03	188	846	22.2	R-021	3.0	1
Ethylbenzene	300	3.9	0.3	34	389	8.7	199	21.0	4
DDE	600	13	0.03	337	808	41.7	CSS20	1.0	6
DDD	1,226	9.5	0.03	230	806	28.5	R-076	2.0	1
Malathion	2,766	3.9	0.03	42	742	5.7	R-032	10.0	1
DDT	4,329	73	0.04	442	883	50.1	R-074	2.0	1
Toxaphene	7,900	28	0.1	126	802	15.7	CSS16	1.0	6
Diphenamid	9,715	33	0.5	31	706	4.4	R-076	2.0	1
Xylenes	25,000	220	0.3	60	295	20.3	129	20.0	4

TABLE 4-3

Statistical Analysis of Chemicals Detected in Soil Samples Collected Onsite and Offsite[a], Post-Excavation[b]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) This table presents statistical analysis for samples collected from soils on or off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site").
(b) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed. The post-excavation data set includes soil samples collected from unexcavated areas of the Site as well as samples collected from soils remaining on or off the Site after excavation activities were completed. For information on chemicals detected in samples of excavated soil, see the RI Report (K/J1993).
(c) Arithmetic mean is calculated using the sum of detected concentrations and one half of the detection limit if a chemical was not detected.
(d) Every time a chemical was reported as not detected by an analysis, the value of the reported detection limit was entered in the database tables. Note that the reported detection limit was used in calculating the arithmetic mean. In some cases marked with superscript (i), very high detection limits were reported resulting in arithmetic means being larger than the maximum detected concentration.
(e) The median was calculated for a given chemical using the detected concentration values and one-half the detection limit when a chemical was not detected. The median is the value above which half the data fall.
(f) Percent detects = (number of detects/total number of times analyzed) x100.
(g) Boring or sample number for location of the sample from soil which contained the maximum concentration detected of a specific chemical.
(h) Study areas are assigned numbers, corresponding to Site locations as shown on Figure 3-3 and listed below.

Study Area 1	Landfill	Study Area 2	Railroad Excavation
Study Area 3	Central Area	Study Area 4	Solvent Storage
Study Area 5	Drainage System A	Study Area 6	Remainder of Site

(i) Detection limits of soil samples vary. Due to occasional high detection limits, the arithmetic mean is greater than the maximum concentration for these chemicals.

Source: RI Report, Table 5-9, K/J1993

TABLE 4-4

Statistical Analysis of Chemicals Detected and Confirmed in Soil Samples Collected in Zone 2 (1 - 12 Feet) Onsite and Offsite[(a)], Post-Excavation[(b)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Maximum Concentrations Detected (mg/kg)	Arithmetic Mean[(c)] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[(d)]	Depth of Maximum Concentration (feet)
Chloroform	0.021	0.17	10	150	6.7	10
Beryllium	0.64	0.21	9	24	38	12
DBCP	0.78	0.01	25	399	6.3	8
Arsenic	2.5	0.94	23	24	96	12
Lead	15.9	6.7	18	24	75	12
Lindane	80	0.64	34	439	7.7	8
Dieldrin	223	2.0	124	454	27	3
DDE	594	11	227	442	51	3
DDD	1,226	9.5	165	436	38	2
Toxaphene	3,400	18	67	432	16	4
DDT	4,329	69	298	483	62	2
Disulfoton[(e)]	0.015	0.13	1	138	0.7	8
Ethyl Benzene	0.02	0.24	2	151	1.3	11
Mercury[(e)]	0.02	0.01	1	24	4.2	12
Dacthal	0.03	0.01	5	5	100	12
Heptachlor[(e)]	0.06	0.46	6	411	1.5	10
Acetone	0.08	0.02	7	8	88	5
Diazinon	0.09	0.07	4	381	1.0	4
Heptachlor Epoxide[(e)]	0.11	0.46	3	429	0.7	6
Aldrin[(e)]	0.25	0.47	8	408	2.0	2
β-BHC	1	0.47	21	415	5.1	2
2-Nitrophenol	1.3	0.48	1	63	1.6	10
Endosulfan II	1.3	0.54	5	366	1.4	10
Endosulfan I	1.7	0.58	7	271	2.6	10
Phosalone	1.72	0.45	1	4	25	2
Ethion	2.62	0.09	20	374	5.3	3
Methyl Parathion	5.6	0.10	11	378	2.9	10
Endosulfan Sulfate	15	0.62	6	254	2.4	2
Isophorone	18.5	2.0	1	63	1.6	10
δ-BHC	30	0.58	6	389	1.5	8
Copper	31.4	11	24	24	100	12
α-BHC	40	0.5	20	454	4.4	8
Chlordane	50	1.9	15	396	3.8	7
Endrin	60	0.56	6	450	1.3	8
Zinc	63.8	26	24	24	100	12
Chromium	75.8	32	24	24	100	12
Trifluralin	81	0.83	62	313	20	2
Parathion	126	1.5	53	420	13	2

TABLE 4-4

Statistical Analysis of Chemicals Detected and Confirmed in Soil Samples Collected in Zone 2 (1 - 12 Feet) Onsite and Offsite[(a)], Post-Excavation[(b)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Chemical	Maximum Concentrations Detected (mg/kg)	Arithmetic Mean[(c)] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[(d)]	Depth of Maximum Concentration (feet)
Nickel	130	46	24	24	100	12
DEF	158	0.59	13	335	3.9	10
1,2-Dichloroethane	200	1.5	1	151	0.7	2
PCNB	207	4.2	81	238	34	3
Xylenes	1,228	34	10	104	9.6	10
Malathion	2,766	6.9	27	420	6.4	10
Diphenamid	9,715	44	19	396	4.8	2
2,4,5-T	0.1	0.06	2	65	3.1	3
2,4,5-TP	0.1	0.05	2	65	3.1	5
Zytron[(e)]	0.196	0.59	7	302	2.3	2
2,4-D	0.3	0.06	2	65	3.1	8
Methoxychlor	17	1.1	10	316	3.2	3
Guthion	81.5	0.48	2	337	0.6	10

Notes:

(a) This table presents statistical analysis for samples collected from soils on or off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site").

(b) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed. The post-excavation data set includes soil samples collected from unexcavated areas of the Site as well as samples collected from soils remaining on or off the Site after excavation activities were completed. For information on chemicals detected in samples of soil that has been excavated, see the RI Report (K/J 1993). This table includes chemicals detected and confirmed.

(c) Arithmetic mean is calculated using the sum of detected concentrations and one half of the detection limit if a chemical is reported as not detected

(d) Percent detects = (number of detects / number of times analyzed) * 100

(e) Note that the reported detection limit was used in calculating the arithmetic mean. In some cases very high detection limits were reported, resulting in arithmetic means being larger than the maximum detected concentration.

Source: RI Report, Table 5-15, K/J 1993

TABLE 4-5

Statistical Analysis of Chemicals Detected in Soil Samples Collected from Zone 3 (12 Feet or Deeper) Onsite And Offsite[a], Post-Excavation[b]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Chemical	Maximum Concentrations Detected (mg/kg)	Arithmetic Mean[c] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[d]	Depth of Maximum Concentration (feet)
Lindane	0.12	0.15	10	288	3.5	20
Chloroform[e]	0.25	0.26	17	228	7.5	20
DBCP	0.46	0.01	19	225	8.4	15
Dieldrin	6	0.14	42	313	13	17
DDD	16	0.57	30	291	10	20
DDT	370	2.3	79	320	25	20
DDE	491	2.2	47	287	16	15
Toxaphene	2,400	9.0	38	292	13	20
Dacthal	0.002	0.002	2	2	100	36
1,2-Dichloroethane[e]	0.024	0.27	3	228	1.3	22
Acetone[e]	0.11	7.0	7	10	70	20
β-BHC	0.14	0.11	21	309	6.8	20
Aldrin	0.27	0.10	6	303	2.0	20
Methyl Parathion	0.33	0.04	5	246	2.0	20
Disulfoton	0.35	0.05	2	160	1.3	20
α-BHC	0.37	0.10	11	314	3.5	15
Trifluralin	0.5	0.05	8	190	4.2	45
δ-BHC	1	0.16	5	285	1.8	20
Endosulfan II	1	0.17	4	264	1.5	20
2-Nitrophenol	1.1	0.48	1	117	0.9	20
Endosulfan Sulfate	1.5	0.06	2	258	0.8	22
Heptachlor Epoxide	1.82	0.16	5	287	1.7	26
Chlordane	2.1	0.32	6	286	2.1	29
Endosulfan I	2.5	0.14	13	268	4.9	20
Heptachlor	2.71	0.11	6	304	2.0	26
Phosalone	4.3	1.5	1	3	33	20
Parathion	6.56	0.10	10	246	4.1	20
Ethion	6.9	0.09	3	232	1.3	45
Malathion	9.03	0.09	4	245	1.6	20
Diphenamid	10.92	0.45	1	233	0.4	26
DEF	13.34	0.12	1	190	0.5	26
Isophorone	16.6	2.1	6	117	5.1	33
Endrin	30	0.18	8	308	2.6	15
Dinoseb	41	1.8	8	148	5.4	29
PCNB	171	1.0	12	207	5.8	15
Ethyl Benzene	300	6.4	29	234	12	21
Xylenes	25,000	330	47	187	25	20
2,4,5-T	0.1	0.08	1	127	0.8	25

TABLE 4-5

Statistical Analysis of Chemicals Detected in Soil Samples Collected from Zone 3 (12 Feet or Deeper) Onsite And Offsite[a], Post-Excavation[b]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Maximum Concentrations Detected (mg/kg)	Arithmetic Mean[c] (mg/kg)	Number of Detects	Number of Times Analyzed	Percent Detects[d]	Depth of Maximum Concentration (feet)
2,4,5-TP	0.2	0.08	3	129	2.3	30
Methoxychlor	0.29	0.11	1	208	0.5	20
2,4-D	0.4	0.08	4	127	3.1	25
Toluene	0.59	0.31	5	234	2.1	35
Naphthalene	4	0.38	2	117	1.7	29
2-Methyl Naphthalene	8.2	0.45	3	99	3.0	29
Guthion	16	0.27	2	228	0.9	32

Notes:

(a) This table presents statistical analysis for samples collected from soils on or off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site").

(b) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed. The post-excavation data set includes soil samples collected from unexcavated areas of the Site as well as samples collected from soils remaining on or off the Site after excavation activities were completed. For information on chemicals detected in samples of soil that has been excavated, see the RI Report (K/J 1993). This table includes chemicals detected and confirmed.

(c) Arithmetic mean is calculated using the sum of detected concentrations and one-half of the detection limit if a chemical was not detected.

(d) Percent detects = (number of detects / number of times analyzed) * 100

(e) Every time a chemical was reported as not detected by an analysis, the value of the reported detection limit was entered in the database tables. Note that the reported detection limit was used in calculating the arithmetic mean. In some cases, very high detection limits were reported resulting in arithmetic means being larger than the maximum detected concentration.

Source: RI Report, Table 5-16, K/J 1993

TABLE 4-6

Number of Detections in Soil Samples of Selected Chemicals in Given Concentration Ranges
Soil Samples Collected Onsite and Offsite[a,b], Post-Excavation[c]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Total Number of Samples Analyzed	Total Number of Detects	Number of Detects by Concentration Range (concentrations in mg/kg)									
			0 <conc. <=0.0001	0.0001 <conc. <=0.01	0.01 <conc. <=0.1	0.1 <conc. <=1	1 <conc. <=10	10 <conc. <=100	100 <conc. <=1000	1,000 <conc. <=10,000	10,000 <conc. <=100,000	>100,000
1,2-Dichloroethane	360	4	0	1	2	0	0	0	1	0	0	0
Acetone	18	14	0	7	6	1	0	0	0	0	0	0
alpha-BHC	838	31	0	19	5	4	2	1	0	0	0	0
Chloroform	359	27	0	8	15	4	0	0	0	0	0	0
DBCP	704	54	0	23	23	8	0	0	0	0	0	0
DDT*[d]	883	469	0	39	59	75	85	122	70	19	0	0
delta-BHC	734	11	0	4	1	4	1	1	0	0	0	0
Dieldrin	837	188	0	37	47	50	39	14	1	0	0	0
Ethylbenzene	378	34	0	0	9	5	8	7	5	0	0	0
Lindane	797	44	0	23	12	5	3	1	0	0	0	0
Toxaphene	802	126	0	0	13	30	36	27	16	4	0	0
Xylenes	284	60	0	0	4	15	7	6	19	7	2	0

Notes:

(a) This table presents the number of detections for select chemicals within the concentration ranges defined.
(b) The soil samples were collected from soils on or off the Site in Eastern Fresno County currently owned by T H Agriculture and Nutrition, L.L.C. ("the Site").
(c) Post-excavation data set excludes results from samples collected from soil which was subsequently excavated and removed.
(d) This is the sum of the chemicals DDD, DDE, and DDT.

Source: RI Report, Table 5-74, K/J 1993

TABLE 4-7

Statistical Analysis of Chemicals Detected in Groundwater Samples Collected from Onsite and Offsite Wells[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Maximum Concentration Detected (µg/l)	Arithmetic Mean[b] (µg/l)	Number Of Times Detected	Number Of Times Analyzed	Percent Detects[c]
Chlordane	0.05	0.03	1	1082	0.1
Heptachlor	0.06	0.02	1	1082	0.1
DDE (4,4)	0.07	0.03	3	1082	0.3
Captan	0.07	0.03	1	957	0.1
Aldrin	0.09	0.03	1	1082	0.1
Dicofol	0.09	0.03	1	409	0.2
Diazinon	0.18	0.03	7	534	1.3
DDT	0.16	0.03	7	1082	0.6
Endosulfan Sulfate	0.25	0.03	3	1082	0.3
Methyl Parathion	0.34	0.03	3	534	0.6
DEF	0.38	0.03	1	534	0.2
Heptachlor Epoxide	0.47	0.03	2	1082	0.2
Dimethoate	0.48	0.03	6	534	1.1
2,4-DB	0.50	0.25	1	294	0.3
DDD (2,4)	0.66	0.03	4	1082	0.4
2,4 DP	0.70	0.25	1	294	0.3
Parathion	0.84	0.03	2	534	0.4
Ethylene Dibromide	0.90	0.04	1	24	4.2
Trifluralin	0.93	0.04	6	310	1.9
Endrin	1.0	0.03	10	1082	0.9
Trichloroethene	1.0	0.28	8	1174	0.7
Trichlorofluoromethane	1.0	0.37	2	481	0.4
Mercury[d]	2.0	1	4	13	31
Endosulfan II	2.0	0.03	10	938	1.1
Endosulfan I	2.0	0.03	9	938	1.0
Cadmium[d]	2.0	1	5	56	8.9
1,1,2,2 Tetrachloroethane	2.3	0.29	16	1048	1.5
1,1,2 Trichloroethane	2.8	0.26	4	1174	0.3
1,1,1 Trichloroethane	2.8	0.26	3	1174	0.3
Bromacil	3.0	1.2	15	31	48
Malathion	3.38	0.03	2	534	0.4
1,2,3 Trichloropropane	4.7	0.48	86	365	24
Lindane[e]	6.0	0.05	205	1519	14
α-BHC[e]	8.8	0.09	173	1477	12
δ-BHC[e]	12	0.10	74	1348	5.5
Dieldrin[e]	12.8	0.13	248	1425	17
Methylene Chloride	14	2.4	3	1045	0.3
Lead[d]	19	5.0	2	56	3.6
Hexavalent Chromium[d]	20	4.0	1	13	7.7

TABLE 4-7

Statistical Analysis of Chemicals Detected in Groundwater Samples Collected from Onsite and Offsite Wells[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Maximum Concentration Detected (µg/l)	Arithmetic Mean[b] (µg/l)	Number Of Times Detected	Number Of Times Analyzed	Percent Detects[c]
Tetrachloroethene	22.8	0.29	21	1123	1.9
β-BHC	23.6	0.13	40	1082	3.7
Carbon Tetrachloride	33	0.32	33	1175	2.8
Ethyl Benzene	44	0.49	2	223	0.9
Xylenes	53	0.77	2	223	0.9
DBCP[e]	61	1.3	1678	1876	89
1,2 Dichloroethane[e]	63.6	0.74	191	1378	14
Trivalent Chromium[d]	13	6.0	9	13	69
Butyl Benzyl Phthalate	306	11	6	173	3.5
Bis-(2-Ethylhexyl) Phthalate	340	11	12	173	6.9
Copper[d]	460	11	34	205	17
Dinoseb[e]	474.4	5.7	43	553	7.8
MBAS (Foaming Agent)[d]	480	52	2	149	1.3
Manganese[d]	520	14	26	156	17
Barium[d]	500	210	12	13	92
Boron[d]	560	53	33	42	79
Zinc[d]	740	70	162	205	74
Arsenic[d]	840	18	11	78	14
Di-N-Butyl Phthalate	1,250	27	48	173	28
Diphenamid[e]	7,266.6	35	38	797	4.8
Carbonate[d]	14,000	650	3	156	1.9
Chloroform[e]	16,667	98	539	1452	37
Iron[d]	34,000	260	34	156	22
Silica[d]	76,000	52,000	108	110	98
Chloride[d]	110,000	11,000	210	213	99
Sodium[d]	230,000	28,000	213	213	100
Magnesium[d]	100,000	18,000	212	213	100
Nitrate[d]	100,000	35,000	164	167	98
Calcium[d]	140,000	43,000	212	213	100
Sulfate[d]	190,000	29,000	208	213	98
Potassium[d]	190,000	3,600	157	167	94
Bicarbonate[d]	639,000	200,000	170	171	99

TABLE 4-7

Statistical Analysis of Chemicals Detected in Groundwater Samples Collected from Onsite and Offsite Wells[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) This table presents the chemicals analyzed for and detected in groundwater samples collected from monitoring, domestic and irrigation wells on or off the Site in Eastern Fresno County currently owned by TH Agriculture and Nutrition, L.L.C. ("the Site"). This table incorporates analytical data for groundwater samples which have been collected since January 1987 through September 1991. Analytical data collected prior to January 1987 (marked with superscript [e])were taken from historical concentration tables in the analytical report: *Groundwater Analyses, November 1987 Monitoring Well Sampling, THAN, Eastern Fresno County, California*, J.H. Kleinfelder, April 15, 1988.

(b) Arithmetic mean is calculated using the sum of detected concentrations and one half of the reported detection limit if a chemical was not detected.

(c) Percent detects = (number of detects ÷ total number of times analyzed) x 100.

(d) Analytical data for these chemicals were obtained from inorganic compounds analytical results since December 1981.

(e) Analytical data for these chemicals incorporates results collected prior to January 1987.

TABLE 4-8

Maximum Concentrations of Chemicals Of Concern in Groundwater Samples from Onsite Monitoring Wells
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Onsite A-Zone Wells						
1,2-Dichloroethane	183	0139	01-Jul-85	0.9	0077 A	17-Sep-92
1,2,3-Trichloropropane	0.5	0077 A	10-Mar-93	<0.5[e]	N/A	N/A
Acetone	NM[f]	N/A[g]	N/A	<10	N/A	N/A
Carbon Tetrachloride	79	0077	25-Oct-84	<0.5	N/A	N/A
Chloroform	20,000	0077	25-Oct-84	1.7	0077 A	17-Sep-92
DBCP	81.4	0077	17-Jul-84	0.77	0077 A	15-Dec-92
Dieldrin	12.8	0006	01-Jul-84	0.35	0145	23-Jun-92
Ethylbenzene	<0.5	N/A	N/A	<0.5	N/A	N/A
Lindane	6	0006	01-Jul-81	<0.05	N/A	N/A
Xylenes	<0.5	N/A	N/A	<1	N/A	N/A
α-BHC	5	0003	28-Oct-82	0.06	0077 A	23-Jun-92
δ-BHC	19	0070	14-Jul-84	<0.05	N/A	N/A
Onsite B-Zone Wells						
1,2,3-Trichloropropane	1.4	0904	7-Jun-91	0.5	0186 B0	17-Sep-92
1,2-Dichloroethane	<0.5	N/A	N/A	<0.5	N/A	N/A
Acetone	NM	N/A	N/A	<10	N/A	N/A
Carbon Tetrachloride	<0.5	N/A	N/A	<0.5	N/A	N/A
Chloroform	18	0155 B0	03-Jan-89	<0.5	N/A	N/A
DBCP	1.28	0155 B0	18-Dec-89	0.1	0186 B0	26-Mar-92
Dieldrin	0.23	0904	10-Dec-90	0.21	0186 B0	18-Dec-91

TABLE 4-8

Maximum Concentrations of Chemicals Of Concern in Groundwater Samples from Onsite Monitoring Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Ethylbenzene	<0.5	N/A	N/A	<0.5	N/A	N/A
Lindane	<0.05	N/A	N/A	<0.05	N/A	N/A
Xylenes	<0.5	N/A	N/A	<1	N/A	N/A
α-BHC	<0.05	N/A	N/A	<0.05	N/A	N/A
δ-BHC	<0.05	N/A	N/A	<0.05	N/A	N/A

Notes:

(a) Historical data includes groundwater data through September 1991 which was used in preparing the RI report.
(b) The October 1991 to December 1997 results are based on data available since submittal of the Draft RI report.
(c) In 1996, Proud Data Service obtained access to Kleinfelder data summaries, and updated the THAN groundwater database with data from July 1980 to October 1984. Monitoring data collected before October 1984 from the same well on the same day were averaged and entered in the groundwater database used in the RI data analysis. These averages were replaced with the more detailed data from the Kleinfelder data summaries during this update, resulting in differences between the historical maximum concentrations detected as reported in this table, compared with the historical maximum concentrations reported in the RI data tables included in this report.
(d) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.
(e) A concentration value preceded by a "<" indicates that the chemical was not detected at that detection limit.
(f) NM = Not measured
(g) N/A = Not Applicable

TABLE 4-9

Maximum Concentrations of Chemicals of Concern in Groundwater Samples from Offsite Monitoring Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Offsite A-Zone Wells						
1,2,3-Trichloropropane	NM[e]	N/A[f]	N/A	0.29	0029 A	10-May-97
1,2-Dichloroethane	3.2	0030 A	25-Oct-84	<0.5[g]	N/A	N/A
Acetone	NM	N/A	N/A	<10	N/A	N/A
Carbon Tetrachloride	<0.5	N/A	N/A	<0.5	N/A	N/A
Chloroform	3,700	0031 A	25-Oct-84	<0.5	N/A	N/A
DBCP	5.2	0029 A	18-Sep-89	0.03	0029 A	10-May-97
Dieldrin	0.64	0030 A	04-Nov-87	0.04	0029 A	10-May-97
Ethyl benzene	44	0031 A	15-Jul-88	<0.5	N/A	N/A
Lindane	6.6	0030 A	20-Jul-83	<0.05	N/A	N/A
Xylenes	53	0031 A	15-Jul-88	0.7	0029 A	10-May-97
α-BHC	16.4	0029 A	20-Jul-83	<0.05	N/A	N/A
δ-BHC	0.82	0030 A	04-Nov-87	<0.05	N/A	N/A

TABLE 4-9

Maximum Concentrations of Chemicals of Concern in Groundwater Samples from Offsite Monitoring Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Offsite B-Zone Wells						
1,2,3-Trichloropropane	4.7	0153 B1	10-Mar-91	7	0153 B1	17-Dec-91
1,2-Dichloroethane	2.2	0183 B2	04-Jun-91	2	0182 B1 0183 B2	25-Apr-96
Acetone	NM	N/A	N/A	<10	N/A	N/A
Carbon tetrachloride	1	0183 B2	04-Jun-91	1.5	0183 B2	25-Jun-96
Chloroform	160	0182 B1	02-Oct-90	89	0182 B1	25-Jun-92
DBCP	7.1	0030 B	20-Jul-83	2.8	0153 B1	27-Mar-92
Dieldrin	1.1	0153 B1	02-Oct-90	0.71	0153 B1	17-Dec-91
Ethylbenzene	<0.5	N/A	N/A	<0.5	N/A	N/A
Lindane	0.09	0153 B1	10-Dec-90	<0.05	N/A	N/A
Xylenes	<0.5	N/A	N/A	1	0151 B1	5-Apr-95
α-BHC	17.6	0029 B	20-Jul-83	<0.05	N/A	N/A
δ-BHC	0.03	0031 B	09-Feb-84 01-May-85	<0.05	N/A	N/A

TABLE 4-9

Maximum Concentrations of Chemicals of Concern in Groundwater Samples
from Offsite Monitoring Wells
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (μg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (μg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Offsite C-Zone Wells						
1,2,3-Trichloropropane	1.4	0151 C1	6-Jun-91	3	0153 C1	4-Apr-95
1,2-Dichloroethane	1.2	0153 C1	15-Apr-88	<0.5	N/A	N/A
Acetone	NM	N/A	N/A	NM	N/A	N/A
Carbon Tetrachloride	<0.5	N/A	N/A	<0.5	N/A	N/A
Chloroform	7	0182 C1	10-Sep-91	15	0182 C1	7-Dec-97
DBCP	5.6	0153 C1	2-Oct-90	4.9	0153 C1	17-Sep-92
Dieldrin	<0.05	N/A	N/A	<0.05	N/A	N/A
Ethylbenzene	<0.5	N/A	N/A	NM	N/A	N/A
Lindane	<0.05	N/A	N/A	0.16	0183 C1	25-Jun-92
Xylenes	<1	N/A	N/A	NM	N/A	N/A
α-BHC	<0.05	N/A	N/A	<0.05	N/A	N/A
δ-BHC	<0.05	N/A	N/A	<0.05	N/A	N/A

TABLE 4-9

Maximum Concentrations of Chemicals of Concern in Groundwater Samples from Offsite Monitoring Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/l)	Well of Maximum Detection[d]	Date of Maximum Detection
Offsite D-Zone Wells						
1,2,3-Trichloropropane	<0.5	N/A	N/A	0.4	0182 D1	13-Sep-94
DBCP	0.22	0181 D1	10-Mar-91	0.7	0182 D1	22-Sep-93

Notes:

(a) Historical data includes groundwater data through September 1991 which was used in preparing the RI report.
(b) The October 1991 to December 1997 results are based on data available since submittal of the Draft RI report.
(c) In 1996, Proud Data Service obtained access to Kleinfelder data summaries, and updated the THAN groundwater database with data from July 1980 to October 1984. Monitoring data collected before October 1984 from the same well on the same day were averaged and entered in the groundwater database used in the RI data analysis. These averages were replaced with the more detailed data from the Kleinfelder data summaries during this update, resulting in differences between the historical maximum concentrations detected as reported in this table, compared with the historical maximum concentrations reported in the RI data tables included in this report.
(d) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.
(e) NM = Not Measured
(f) N/A = Not Applicable
(g) A number with a "<" preceding it indicates that the Chemical was not detected at that detection limit. Except DBCP and 1,2-3-trichloropropane, the chemicals of concern were not detected in the offsite D-Zone Monitoring Wells.

TABLE 4-10

Maximum Concentrations of Chemicals of Concern in Groundwater Samples from Domestic and Irrigation Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Compound	Historical[a]			October 1991 through December 1997[b]		
	Maximum Concentration Detected[c] (µg/L)	Well of Maximum Detection[d]	Date of Maximum Detection	Maximum Concentration Detected (µg/L)	Well of Maximum Detection	Date of Maximum Detection
Domestic/Irrigation Wells						
1,2,3-Trichloropropane	1.2	0972	11-Dec-89	2	0991	17-Apr-96
1,2-Dichloroethane	7.4	0902	17-Sep-84	2.7	0911	20-Oct-95
Acetone	NM[e]	N/A[f]	N/A	NM	N/A	N/A
Carbon tetrachloride	33	0972	12-Jun-89	1.1	0911	17-Jun-93 04-Apr-95 20-Oct-95
Chloroform	190	0906	01-Dec-84	100	0909	22-Jun-92
DBCP	28.5	0939	26-Jun-82	5.12	0943	16-Dec-91
Dieldrin	0.38	0902	13-Jun-88	0.32	0940 B	28-Jun-96
Ethylbenzene	<0.5[g]	N/A	N/A	<0.5	N/A	N/A
Lindane	0.33	0906	01-Oct-84	<0.05	N/A	N/A
Xylenes	<1	N/A	N/A	<0.5	N/A	N/A
α-BHC	0.15	0923	08-Apr-82	<0.05	N/A	N/A
δ-BHC	0.07	0960	30-Jan-87	<0.05	N/A	N/A

TABLE 4-10

Maximum Concentrations of Chemicals of Concern in Groundwater Samples from Domestic and Irrigation Wells

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) Historical data includes groundwater data through September 1991 which was used in preparing the RI report.
(b) The October 1991 to December 1997 results are based on data available since submittal of the Draft RI report.
(c) In 1996, Proud Data Service obtained access to Kleinfelder data summaries, and updated the THAN groundwater database with data from July 1980 to October 1984. Monitoring data collected before October 1984 from the same well on the same day were averaged and entered in the groundwater database used in the RI data analysis. These averages were replaced with the more detailed data from the Kleinfelder data summaries during this update, resulting in differences between the historical maximum concentrations detected as reported in this table, compared with the historical maximum concentrations reported in the RI data tables included in this report.
(d) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.
(e) NM = Not Measured
(f) N/A = Not Applicable
(g) A number with a "<" preceding it indicates that the Chemical was not detected at that detection limit.

TABLE 4-11

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected Onsite[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Water Bearing Zone[b]	Maximum Concentration Detected (µg/l)	Well Number[c]	Arithmetic Mean[d] (µg/l)	Number Of Times Detected	Number Of Times Tested	Percent Detects[e]
Diazinon	A	0.10	145	0.031	2	24	8.3
DDT	A	0.16	2	0.031	2	35	5.7
Endosulfan Sulfate	A	0.25	138	0.031	1	35	2.9
Methyl Parathion	A	0.34	2	0.045	3	24	12.5
DEF	A	0.38	140	0.040	1	24	4.2
Heptachlor Epoxide	A	0.47	145	0.042	2	35	5.7
Dimethoate	A	0.48	2	0.095	5	24	20.8
1,2,3 Trichloropropane	A	0.50	77A	0.300	1	5	20.0
Trifluralin	A	0.65	77A	0.34	1	2	50.0
DDD (2,4)	A	0.66	145	0.076	3	35	8.6
Parathion	A	0.84	2	0.061	2	24	8.3
Bromacil	A	1.0	155A1	1.0	1	1	100.0
Trichloroethene	A	1.0	139	0.930	2	38	5.3
Endrin	A	1.0	145	0.11	5	35	14.3
1,1,2 Trichloroethane	A	1.2	77A	0.30	2	38	5.3
Endosulfan II	A	2.0	75	0.24	7	33	21.2
Endosulfan I	A	2.0	75	0.24	6	33	18.2
α--BHC[f]	A	3.3	77	0.46	108	162	66.7
Malathion	A	3.38	139	0.17	1	24	4.2
Lindane[f]	A	6.0	6	0.23	106	160	66.7
δ--BHC[f]	A	12.0	77	0.59	53	163	32.5
Dieldrin[f]	A	12.8	6	0.80	93	161	57.8
Bis-(2-Ethylhexyl) Phthalate	A	21.8	145	1.0	1	4	25.0
Tetrachloroethene	A	22.8	75	1.1	11	36	30.6
β--BHC	A	23.6	139	3.0	29	35	82.9

TABLE 4-11

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected Onsite[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Water Bearing Zone[b]	Maximum Concentration Detected (µg/l)	Well Number[c]	Arithmetic Mean[d] (µg/l)	Number Of Times Detected	Number Of Times Tested	Percent Detects[e]
DBCP[f]	A	61	2	2.981	149	161	92.6
1,2 Dichloroethane[f]	A	63.6	139	5.257	51	103	49.5
Di-N-Butyl Phthalate	A	79.8	145	28.700	2	4	50.0
Dinoseb[f]	A	474	140	41.260	35	71	49.3
Diphenamid[f]	A	7,266	3	181.135	37	152	24.3
Chloroform[f]	A	16,667	77	1235.280	79	103	76.7
DDE (4,4)	B	0.07	904	0.026	1	39	2.4
DDT	B	0.09	140, 904	0.027	2	39	9.8
Dieldrin[f]	B	0.23	904	0.041	4	39	9.8
Trifluralin	B	0.30	155B0	0.034	1	30	3.3
DBCP[f]	B	1.28	155B0, 150B1	0.197	48	49	98.0
1,2,3 Trichloropropane	B	1.4	904	0.326	3	23	13.0
Butyl Benzyl Phthalate	B	6.8	904	5.831	1	13	7.7
Chloroform[f]	B	18	155B0	1.174	5	39	12.8
Di-N-Butyl Phthalate	B	85.3	904	9.923	2	13	15.4

TABLE 4-11

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected Onsite[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) This table presents the chemicals analyzed for and detected in groundwater samples collected from monitoring wells located on the Site in Eastern Fresno County currently owned by T H Agriculture and Nutrition, L.L.C. ("the Site"). The Site is defined by the area included within the Site fence boundary. This table incorporates analytical data for groundwater samples which have been collected since January 1987 through September 1991. Analytical data collected prior to January 1987 (marked with superscript [f]) were taken from historical concentration tables in the analytical report: *Groundwater Analyses, November 1987 Monitoring Well Sampling, THAN, Eastern Fresno County, California*, J.H. Kleinfelder, April 15, 1988.
(b) A water-bearing zone is a distinct layer of permeable deposits vertically separated from other water-bearing zones by a distinct relatively impermeable layer or layers. The water-bearing zones designated A through D are defined as follows:
A-Zone (Shallow Zone): monitoring wells are screened between 19 and 50 feet below ground surface (bgs);
B-Zone (Intermediate Zone): monitoring wells are screened between 57 and 77 bgs;
C-Zone (Deep Zone): monitoring wells are screened between 135 and 167 bgs;
D-Zone (Deep Zone): monitoring wells are screened between 185 and 213 bgs.
(c) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.
(d) Arithmetic mean is calculated using the sum of detected concentrations and one-half of the detection limit if a chemical was not detected.
(e) Percent detects = (number of detects ÷ total number of times analyzed) x 100.
(f) Analytical data for these chemicals incorporates results collected prior to January 1987.

Source: RI report, Table 5-23, K/J 1993.

TABLE 4-12

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected from Offsite Monitoring Wells[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Water Bearing Zone[b]	Maximum Concentration Detected (µg/l)	Location Of Max[c] (Well ID)	Arithmetic Mean[d] (µg/l)	Number Of Times Detected	Number Of Times Tested	Percent Detects[e]
DDT	A	0.08	76	0.026	1	49	2.0
Diazinon	A	0.18	31A	0.034	4	44	9.1
Endosulfan Sulfate	A	0.19	30A	0.028	1	49	2.0
Diphenamid[f]	A	0.30	32A	0.50	1	117	0.9
DDD (2,4)	A	0.55	31A	0.036	1	49	2.0
1,1,2,2 Tetrachloroethane	A	0.60	30A	0.266	2	38	5.3
Dieldrin[f]	A	0.64	30A	0.053	31	122	25
δ-BHC[f]	A	0.82	30A	0.038	17	122	14
Tetrachloroethene	A	1	32A	0.30	4	40	10
Endosulfan II	A	1.1	31A	0.058	3	40	7.5
Dinoseb[f]	A	1.1	30A	0.46	6	50	12
Endosulfan I	A	1.1	31A	0.060	3	40	7.5
β-BHC	A	1.6	30A	0.12	6	49	12
1,2 Dichloroethane[f]	A	1.9	31A	0.33	9	98	9.2
Lindane[f]	A	3.3	30A	0.061	24	122	20
DBCP[f]	A	5.2	29A	0.45	104	121	86
α-BHC[f]	A	8.2	29A	0.10	25	122	21
Ethyl Benzene	A	44	31A	6.3	2	9	22
Xylenes	A	53	31A	7.4	2	9	22
Chloroform[f]	A	1,450	31A	45	45	98	46
δ-BHC[f]	B	0.03	31B	0.03	3	314	1.0
DDE (2,4)	B	0.06	152B1	0.03	2	250	0.8
Captan	B	0.07	153B1	0.03	1	242	0.4
Lindane[f]	B	0.09	153B1	0.03	2	313	0.6
Dicofol	B	0.09	153B1	0.03	1	153	0.7
Diazinon	B	0.11	30B	0.03	1	245	0.4
Endrin	B	0.11	153B1	0.03	5	250	2.0

TABLE 4-12

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected from Offsite Monitoring Wells[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Water Bearing Zone[b]	Maximum Concentration Detected (µg/l)	Location Of Max[c] (Well ID)	Arithmetic Mean[d] (µg/l)	Number Of Times Detected	Number Of Times Tested	Percent Detects[e]
β-BHC	B	0.23	31B	0.03	5	250	2.0
Trifluralin	B	0.50	154B1	0.05	1	152	0.7
Trichloroethene	B	0.70	30B	0.26	1	251	0.4
Tetrachloroethene	B	1	29B	0.27	3	228	1.3
Trichlorofluoromethane	B	1	31B, 32B	0.39	2	154	1.3
Carbon Tetrachloride	B	1	183B2	0.27	7	251	2.8
Dieldrin[f]	B	1.1	153B1	0.06	51	313	17
1,2 Dichloroethane[f]	B	2.2	183B2	0.32	27	290	9.3
1,1,2,2 Tetrachloroethane	B	2.3	153B1	0.28	7	243	2.9
Bromacil	B	3	152B1	2.0	11	12	92
1,2,3 Trichloropropane	B	4.7	153B1	0.72	54	139	39
DBCP[f]	B	5.7	153B1	0.72	288	313	92
Dinoseb[f]	B	7.68	153B1	0.53	1	219	0.5
α-BHC[f]	B	8.8	29B	0.05	3	313	1.0
Methylene Chloride	B	14	150B1	2.6	1	242	0.4
BIS-(2-Ethylhexyl) Phthalate	B	25.6	153B1	5.7	1	74	1.4
DI-N-Butyl Phthalate	B	92	150B1	8.5	15	74	20
Chloroform[f]	B	160	182B1	9.5	98	290	34
Malathion	C	0.05	149C1	0.03	1	142	0.7
Dimethoate	C	0.05	151C1	0.03	1	142	0.7
Heptachlor	C	0.06	154C1	0.02	1	141	0.7
Aldrin	C	0.09	154C1	0.03	1	141	0.7
2,4 DB	C	0.50	182C1	0.25	1	89	1.1
2,4 DP	C	0.70	184C1	0.26	1	89	1.1
Trifluralin	C	0.93	154C1	0.03	2	89	2.2
1,2 Dichloroethane[f]	C	1.2	153C1	0.28	8	143	5.6
1,2,3 Trichloropropane	C	1.4	151C1	0.40	19	80	24

TABLE 4-12

Statistical Analysis of Organic Chemicals Detected in Groundwater Samples Collected from Offsite Monitoring Wells[a]
(In Order of Water-Bearing Zone and Maximum Concentration)
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Water Bearing Zone[b]	Maximum Concentration Detected (μg/l)	Location Of Max[c] (Well ID)	Arithmetic Mean[d] (μg/l)	Number Of Times Detected	Number Of Times Tested	Percent Detects[e]
1,1,2,2 Tetrachloroethane	C	1.7	151C1	0.27	4	144	2.8
Dinoseb[f]	C	4.15	150C1	0.52	1	135	0.7
DBCP[f]	C	5.6	153C1	1.0	141	141	100
Chloroform[f]	C	7	182C1	0.60	18	143	13
Butyl Benzyl Phthalate	C	306	154C1	16	5	65	7.7
BIS-(2-Ethylhexyl) Phthalate	C	340	150C1	20	9	65	14
DI-N-Butyl PHTHALATE	C	1,250	152C1	57	25	65	39
DBCP[f]	D	0.22	181D1	0.08	19	26	74

Notes:

(a) This table presents the chemicals analyzed for and detected in groundwater samples collected from monitoring wells located off the Site in Eastern Fresno County currently owned by T H Agriculture & Nutrition, L.L.C. ("the Site"). Offsite is defined by the area outside the Site fence boundary. This table incorporates analytical data for groundwater samples which have been collected since January 1987. Analytical data collected prior to January 1987 (marked with superscript [f]) were taken from historical concentration tables in the analytical report: *Groundwater Analyses, November 1987 Monitoring Well Sampling, THAN Site, Eastern Fresno County, California*, J.H. Kleinfelder, April 15, 1988.

(b) A water-bearing zone is a distinct layer of permeable deposits vertically separated from other water-bearing zones by a distinct relatively impermeable layer or layers. The water-bearing zones designated A through D are defined as follows:
- A-Zone (Shallow Zone): monitoring wells are screened between 19 and 50 feet below ground surface (bgs);
- B-Zone (Intermediate Zone): monitoring wells are screened between 57 and 77 bgs;
- C-Zone (Deep Zone): monitoring wells are screened between 135 and 167 bgs;
- D-Zone (Deep Zone): monitoring wells are screened between 185 and 213 bgs.

(c) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.

(d) Arithmetic mean is calculated using the sum of detected concentrations and one-half of the detection limit if a chemical was not detected.

(e) Percent detects = (number of detects ÷ total number of times analyzed) x 100.

(f) Analytical data for these chemicals incorporate results collected prior to January 1987.

Source: RI report, Table 5-24.

TABLE 4-13

Groundwater Monitoring Results - Recent Four Rounds of Sampling[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical[b]	April 1996		June 1996[e]		May 1997		December 1997	
	Maximum Concentration Measured[c] (µg/l)	Well[d]	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well
Onsite B Zone Monitoring Wells								
1,2,3-Trichloropropane	<0.5[f]	N/A[g]	0.06	0904	0.1	0077 B1	0.09	0186 B0
Arsenic	NM[h]	N/A	5.1	0155 B0	NM	N/A	NM	N/A
4,4'-DDT	<0.05	N/A	<0.05	N/A	0.02	0186 B0	<0.05	N/A
Bromacil	<1	N/A	<1	N/A	<1	N/A	0.4	0155 B0
Dalapon[i]	<1	N/A	<1	N/A	<1	N/A	1	0155 B0
DBCP	<0.01	N/A	<0.01	N/A	<0.02	N/A	0.02	0155 B0
Offsite A Zone Monitoring Wells								
1,2,3-Trichloropropane	NM	N/A	NM	N/A	0.29	0029 A	NM	N/A
DBCP	NM	N/A	NM	N/A	0.03	0029 A	NM	N/A
Dieldrin	NM	N/A	NM	N/A	0.04	0029 A	NM	N/A
Toluene	NM	N/A	NM	N/A	1	0029 A	NM	N/A
Xylenes	NM	N/A	NM	N/A	0.07	0029 A	NM	N/A
Offsite B Zone Monitoring Wells								
1,1,1-Trichloroethane	10	0182 B1	<0.5	N/A	<0.5	N/A	<0.5	N/A
1,2,3-Trichloropropane	3.5	0183 B1	1.52	0183 B1	1.1	0183 B1	0.58	0183 B1
1,2-Dichloroethane	2	0182 B1 0183 B2	1.1	0183 B2	0.8	0183 B2	0.8	0183 B2
4,4'-DDE	<0.05	N/A	<0.05	N/A	0.05	0151 B1	<0.05	N/A
4,4'-DDT	0.07	0182 B1	<0.05	N/A	<0.05	N/A	<0.05	N/A
Alachlor	<0.05	N/A	0.07	0182 B1	<0.05	N/A	<0.05	N/A
Arsenic	NM	N/A	6	0152 B1	NM	N/A	NM	N/A
Bromacil	0.5	0152 B1	<1	N/A	0.3	0182 B1	0.2	0182 B1
Carbon Tetrachloride	0.9	0183 B2	1.5	0183 B2	1	0183 B2	1.1	0183 B2
Chloroform	6.8	0182 B1	8.8	0182 B1	5.9	0182 B1	5.1	0182 B1

TABLE 4-13

Groundwater Monitoring Results - Recent Four Rounds of Sampling[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical[b]	April 1996		June 1996[e]		May 1997		December 1997	
	Maximum Concentration Measured[c] (µg/l)	Well[d]	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well
DBCP	0.79	0183 B2	0.89	0183 B2	0.73	0183 B2	0.96	0183 B2
Dichlorodifluoromethane	3.5	0184 B1	<1	N/A	3.3	0184 B1	3	0184 B1
Dieldrin	0.11	0150 B1 0153 B1	0.11	0150 B1	0.08	0150 B1 0183 B1	0.1	0183 B1
Methylene Chloride	83	0182 B1 0183 B2	<5	N/A	<5	N/A	<5	N/A
Trichloroethene	0.8	0182 B1 0183 B2	<0.5	N/A	0.3	0183 B2	<0.5	N/A
Offsite C Zone Monitoring Wells								
1,2,3-Trichloropropane	1.1	0153 C1	0.894	0153 C1	0.8	0153 C1	0.76	0153 C1
Arsenic	NM		5.7	0149 C1	NM	N/A	NM	N/A
Chloroform	12	0182 C1	13	0182 C1	14	0182 C1	15	0182 C1
DBCP	2.5	0153 C1	2.58	0153 C1	1.4	0153 C1	1.2	0153 C1
Offsite D Zone Monitoring Wells								
1,2,3-Trichloropropane	<0.5	N/A	<0.5	N/A	0.19	0182 D1	0.16	0182 D1
Arsenic	NM	N/A	4.2	0182 D1	NM	N/A	NM	N/A
DBCP	0.58	0182 D1	0.59	0182 D1	0.63	0182 D1	0.37	0182 D1
Domestic and Irrigation Wells								
1,2,3-Trichloropropane	2	0991	1.9	0960	1.4	0926	1.3	0926
1,2-Dichloroethane	1.9	0911	2.3	0999	2	0911	0.8	0994
1,2-Dichloropropane	<0.5	N/A	0.4	0917	<0.5	N/A	<0.5	N/A
1,4-Dichlorobenzene	<0.5	N/A	1.3	0979	<0.5	N/A	<0.5	N/A
Arsenic	NM	N/A	5.8	0931	NM	N/A	NM	N/A
Bromacil	0.3	0905	<1	N/A	0.2	0905	0.2	0905

TABLE 4-13

Groundwater Monitoring Results - Recent Four Rounds of Sampling[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Chemical[b]	April 1996		June 1996[e]		May 1997		December 1997	
	Maximum Concentration Measured[c] (µg/l)	Well[d]	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well	Maximum Concentration Measured (µg/l)	Well
Bromodichloromethane	0.6	0939	0.3	0931 0939	<0.5	N/A	<0.5	N/A
Bromoform	1.9	0939	0.9	0939	<0.5	N/A	<0.5	N/A
Carbon Tetrachloride	0.9	0911	0.7	0902 0912	<0.5	N/A	<0.5	N/A
Chloroform	26	0909	36	0906	29	0911	24	0994
DBCP	3.7	0916	2	0938	1.2	0943	1.7	0916
Dibromochloromethane	0.8	0939	0.6	0931	<0.5	N/A	<0.5	N/A
Dieldrin	0.1	0905	0.32	0940 B	0.11	0905	0.1	0905
EDB	0.83	0980	0.75	0980	0.56	0980	0.36	0980
Lead	NM	N/A	8.3	1026	NM	N/A	NM	N/A
Tetrachloroethene	<0.5	N/A	0.6	0981	<0.5	N/A	<0.5	N/A
Trichloroethene	<0.5	N/A	0.3	0902 0911	<0.5	N/A	<0.5	N/A

Notes:

(a) This table presents data for the most recent four groundwater monitoring events (April 1996, June 1996, May 1997 and December 1997). For additional information refer to the *Second Semiannual 1997 Groundwater Monitoring Report* submitted to the DTSC on 27 May 1998 (Chaney 1998).
(b) Data are presented for chemicals that were detected at least once in the monitored groundwater zone during the four recent rounds.
(c) The maximum concentration of a chemical detected.
(d) Well from which a groundwater sample was collected that contained the maximum concentration detected for a given chemical.
(e) The June 1996 sampling round includes supplemental groundwater sampling conducted in September 1996.
(f) A concentration value preceded by a "<" indicates that the chemical was not detected at the detection limit.
(g) N/A = Not Applicable.
(h) NM = Not measured.
(i) *Dalapon was reported at the quantitation limit in the 5 December 1997 groundwater sample from Monitoring Well 0155 B0.* The reported value was assigned a "Y" qualifier by the laboratory, indicating significant disagreement between results by the primary and secondary columns of the measuring instrument. Based on available data, this is the first reported detection of dalapon in a THAN groundwater sample.

TABLE 4-14

Summary of Chloroform Soil Vapor Extraction Data from Well No. 77[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/j 844083.75

Sample Date[b]	Chloroform (ppmv)[c]	Sample Date[b]	Chloroform (ppmv)[c]
14-Mar-88	63	3-Jun-92	0.0022
22-Mar-88	16	26-Jun-92	0.0022
6-Apr-88	1	20-Jul-92	<0.0004
20-Apr-88	5.1	21-Aug-92	0.0028
22-Apr-88	1	16-Oct-92	0.0011
12-May-88	15.5	19-Nov-92	0.0042
10-Jun-88	4.8	24-Dec-92	0.0013
16-Jun-88	10.9	20-Jan-93	0.0034
29-Jun-88	2.7	18-Feb-93	0.0016
7-Jul-88	0.96	24-Mar-93	0.0030
14-Jul-88	4.9	30-Apr-93	0.0033
21-Jul-88	1.2	25-May-93	0.0042
26-Sep-91	<0.00033[d]	24-Jun-93	0.0024
16-Oct-91	0.0034	12-Aug-93	0.0015
21-Nov-91	0.0027	24-Sep-93	0.0017
26-Dec-91	0.0021	03-Nov-93	<0.0005
27-Jan-92	0.0082	22-Nov-93	0.0012
27-Feb-92	<0.01	14-Dec-93	0.00091
19-Mar-92	0.0021	13-Jan-94	0.00163

Notes:

(a) This table presents the analytical results for soil vapor samples collected from Well No. 77 during soil vapor extraction operations. Groundwater Monitoring Well No. 77 was converted to a soil vapor extraction well on 14 March 1988.

(b) Chloroform analytical data for 1988 are obtained from the *Draft Vapor Extraction of Chloroform Report, THAN Site, Fresno, California*, Converse Environmental Consultants California, dated 25 July 1988. Chloroform analytical data for 1991-93 are obtained from analytical reports prepared by Environmental Analytical Services, Inc.

(c) Chloroform concentrations are reported as parts-per-million by volume.

(d) Non-detect analytical results are reported as less than the analytical detection limit.

TABLE 4-15

Summary of Analytical Data from the Former Solvent Storage Area
Soil Vapor Extraction System[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Sample Date	Benzene (ppmv)[b]	Toluene (ppmv)	Ethylbenzene (ppmv)	Xylenes (ppmv)	Total Non-Methane Hydrocarbons (ppmc)[e]
23-Apr-91	0.95	15	227	1,720	20,000
07-May-91	0.50	20	760	2,400	22,000
24-May-91	0.23	9.6	18	180	18,000
07-Jun-91	2.0	305	88	305	10,000
21-Jun-91	0.15	7.8	360	1,200	15,000
19-Jul-91	0.25	4	49	120	13,000
16-Aug-91	0.02	2.6	160	650	6,600
18-Sep-91	0.03	3.6	250	1,071	8,700
16-Oct-91	ND[c]	1.2	90	380	4,500
20-Nov-91	ND	1.9	180	770	7,100
26-Dec-91	0.52	1.23	110	490	6,000
04-Feb-92	0.14	2.0	210	940	11,000
27-Feb-92	ND	0.78	94	420	5,400
19-Mar-92	ND	1.3	180	780	8,500
21-Apr-92	ND	0.9	120	510	6,100
26-May-92	ND	0.77	120	490	6,000
26-Jun-92	ND	1	156	658	8,100
20-Jul-92	ND	0.5	102	440	5,500
31-Aug-92	0.91	0.36	88	390	5,200
02-Oct-92	ND	0.43	33	110	5,200
16-Oct-92	ND	0.36	93	420	5,500
19-Nov-92	ND	ND	81	400	5,500
24-Dec-92	ND	ND	53	250	3,200
20-Jan-93	ND	ND	15	71	970
25-Feb-93	ND	ND	6.7	33	450
24-Mar-93	ND	0.12	44	210	3,000
30-Apr-93	ND	0.098	23	110	1,600
25-May-93	ND	0.14	40	190	2,600
24-Jun-93	0.012	0.15	24	120	1,600
04-Oct-94[d]	ND	0.13	34	170	2,400
05-Oct-94[d]	ND	0.13	27	130	1,600

TABLE 4-15

Summary of Analytical Data from the Former Solvent Storage Area
Soil Vapor Extraction System[(a)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Notes:

(a) This table presents the analytical results for soil vapor samples collected from the inlet to the soil vapor extraction system in the xylenes area. Analytical data are obtained from analytical reports prepared by Environmental Analytical Services, Inc.
(b) Analytical results are reported as parts-per-million by volume.
(c) ND = Non-detect.
(d) Results from October 1994 restart of pilot program. Results presented are for samples taken after 1,000 minutes of operation.
(e) Reported as parts per million (carbon).

TABLE 5-1

Chemicals Included in the Health Risk Assessment

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Soil			Groundwater			
				Current		Future	
	0-1'	0-12'	0-50'	Onsite	Offsite	Onsite	Offsite
Acetone		♦[(a)]	♦				
α-Benzene hexachloride						♦	
β-Benzene hexachloride			♦	♦		♦	
δ-Benzene-hexachloride				♦		♦	
Bromacil				♦	♦	♦	♦
Carbon tetrachloride					♦		♦
Chloroform		♦	♦	♦	♦	♦	♦
Dacthal		♦	♦				
DDD	♦	♦	♦				
DDE	♦	♦	♦				
DDT	♦	♦	♦				
DEF	♦	♦					
Dibromochloropropane (DBCP)	♦	♦	♦	♦	♦	♦	♦
1,2-Dichloroethane (1,2-DCA)				♦	♦	♦	♦
Dieldrin	♦	♦	♦	♦	♦	♦	♦
Dimethoate						♦	
Dinoseb (DNBP)						♦	
Diphenamid	♦	♦				♦	
α-Endosulfan						♦	
β-Endosulfan						♦	
Endrin						♦	
Ethion	♦	♦	♦				
Ethyl benzene			♦				
Lindane		♦	♦			♦	
Malathion	♦	♦	♦				
Methyl parathion	♦	♦				♦	
Parathion	♦	♦	♦				
Pentachloronitrobenzene (PCNB)	♦	♦	♦				
Phosalone		♦	♦				
Tetrachloroethylene						♦	
Toxaphene	♦	♦	♦				
1,2,3-Trichloropropane (1,2,3-TCP)				♦	♦	♦	♦
Trifluralin	♦	♦	♦				
Xylenes		♦	♦				
Arsenic	♦	♦					
Nickel		♦					

Notes:

(a) ♦ indicates chemical was selected for purposes of quantitative risk estimates in the environmental media listed at the top of the column.

Source: Environ 1996

TABLE 5-2

Calculated Cancer Risks
Based on a Normal Distribution of Chemicals of Concern
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K./J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil Chemicals				Exposure to Groundwater Chemicals		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Cancer Risk	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	1×10^{-4}	8×10^{-4}	8×10^{-4}	2×10^{-3}	NA[b]	NA	NA
Offsite Workers (long-term)	1×10^{-7}	4×10^{-7}	1×10^{-4}	2×10^{-4}	7×10^{-5}	7×10^{-5}	NA
Offsite Residents (adult)	4×10^{-7}	1×10^{-6}	3×10^{-4}	3×10^{-4}	2×10^{-4}	2×10^{-4}	5×10^{-6}
Offsite Residents (child)	1×10^{-7}	1×10^{-7}	5×10^{-5}	5×10^{-5}	2×10^{-5}	2×10^{-5}	6×10^{-7}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	1×10^{-4}	8×10^{-4}	8×10^{-4}	2×10^{-3}	4×10^{-4}	7×10^{-4}	NA
Onsite Workers (intrusive)	7×10^{-6}	4×10^{-6}	4×10^{-4}	4×10^{-4}	NA	NA	NA
Onsite Trespassers	3×10^{-5}	7×10^{-5}	4×10^{-6}	1×10^{-4}	NA	NA	NA
Onsite Residents (adults)	5×10^{-4}	2×10^{-3}	1×10^{-3}	4×10^{-3}	1×10^{-3}	2×10^{-3}	4×10^{-5}
Onsite Residents (child)	2×10^{-4}	2×10^{-4}	3×10^{-4}	6×10^{-4}	1×10^{-4}	2×10^{-4}	5×10^{-6}
Offsite Workers (long-term)	1×10^{-7}	4×10^{-7}	2×10^{-4}	2×10^{-4}	9×10^{-5}	9×10^{-5}	NA
Offsite Residents (adults)	4×10^{-7}	1×10^{-6}	3×10^{-4}	3×10^{-4}	3×10^{-4}	3×10^{-4}	6×10^{-6}
Offsite Residents (child)	1×10^{-7}	1×10^{-7}	5×10^{-5}	5×10^{-5}	3×10^{-5}	3×10^{-5}	8×10^{-7}

Notes:

(a) Source: Table IX-17a. Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.
(b) Not Applicable

TABLE 5-3

Calculated Cancer Risks Associated with Potential Exposure Pathways Based on a Lognormal Distribution of Chemicals of Concern

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil Chemicals				Exposure to Groundwater Chemicals		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Cancer Risk	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-6}	4×10^{-5}	9×10^{-6}	6×10^{-5}	NA[b]	NA	NA
Offsite Workers (long-term)	2×10^{-8}	4×10^{-8}	2×10^{-6}	2×10^{-6}	2×10^{-5}	2×10^{-5}	NA
Offsite Residents (adult)	7×10^{-8}	1×10^{-7}	3×10^{-6}	3×10^{-6}	8×10^{-5}	8×10^{-5}	2×10^{-6}
Offsite Residents (child)	3×10^{-8}	1×10^{-8}	6×10^{-7}	6×10^{-7}	8×10^{-6}	8×10^{-6}	2×10^{-7}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-6}	4×10^{-5}	9×10^{-6}	6×10^{-5}	5×10^{-5}	5×10^{-5}	NA
Onsite Workers (intrusive)	2×10^{-7}	8×10^{-8}	1×10^{-6}	1×10^{-6}	NA	NA	NA
Onsite Trespassers	2×10^{-6}	3×10^{-6}	4×10^{-8}	5×10^{-6}	NA	NA	NA
Onsite Residents (adults)	3×10^{-5}	1×10^{-4}	1×10^{-5}	2×10^{-4}	2×10^{-4}	2×10^{-4}	4×10^{-6}
Onsite Residents (child)	1×10^{-5}	9×10^{-6}	3×10^{-6}	2×10^{-5}	2×10^{-5}	2×10^{-5}	5×10^{-7}
Offsite Workers (long-term)	2×10^{-8}	4×10^{-8}	2×10^{-6}	2×10^{-6}	3×10^{-5}	3×10^{-5}	NA
Offsite Residents (adults)	7×10^{-8}	1×10^{-7}	3×10^{-6}	3×10^{-6}	1×10^{-4}	1×10^{-4}	2×10^{-6}
Offsite Residents (child)	3×10^{-8}	1×10^{-8}	6×10^{-7}	6×10^{-7}	1×10^{-5}	1×10^{-5}	3×10^{-7}

Notes:

(a) Source: Table IX-1a, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996
(b) Not applicable

TABLE 5-4

Kennedy/Jenks Consultants

Calculated Cancer Risks
Based on a Normal Distribution of DBCP
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil DBCP				Exposure to DBCP in Groundwater		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Cancer Risk	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	4×10^{-8}	2×10^{-7}	2×10^{-6}	2×10^{-6}	NA[b]	NA	NA
Offsite Workers (long-term)	3×10^{-17}	2×10^{-16}	4×10^{-7}	4×10^{-7}	7×10^{-5}	7×10^{-5}	NA
Offsite Residents (adult)	1×10^{-16}	6×10^{-16}	6×10^{-7}	6×10^{-7}	2×10^{-4}	2×10^{-4}	5×10^{-6}
Offsite Residents (child)	5×10^{-17}	5×10^{-17}	1×10^{-7}	1×10^{-7}	2×10^{-5}	2×10^{-5}	6×10^{-7}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	4×10^{-8}	2×10^{-7}	2×10^{-6}	2×10^{-6}	3×10^{-4}	3×10^{-4}	NA
Onsite Workers (intrusive)	7×10^{-9}	4×10^{-9}	3×10^{-8}	4×10^{-8}	NA	NA	NA
Onsite Trespassers	9×10^{-9}	2×10^{-8}	9×10^{-9}	4×10^{-8}	NA	NA	NA
Onsite Residents (adults)	2×10^{-7}	6×10^{-7}	3×10^{-6}	4×10^{-6}	1×10^{-3}	1×10^{-3}	2×10^{-5}
Onsite Residents (child)	5×10^{-8}	6×10^{-8}	6×10^{-7}	7×10^{-7}	1×10^{-4}	1×10^{-4}	3×10^{-6}
Offsite Workers (long-term)	3×10^{-17}	2×10^{-16}	4×10^{-7}	4×10^{-7}	9×10^{-5}	9×10^{-5}	NA
Offsite Residents (adults)	1×10^{-16}	6×10^{-16}	6×10^{-7}	6×10^{-7}	3×10^{-4}	3×10^{-4}	6×10^{-6}
Offsite Residents (child)	5×10^{-17}	5×10^{-17}	1×10^{-7}	1×10^{-7}	3×10^{-5}	3×10^{-5}	8×10^{-7}

Notes:

(a) Source: Appendix M, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.
(b) Not Applicable

TABLE 5-5

Calculated Cancer Risks Based On A Lognormal Distribution Of DBCP
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil DBCP				Exposure to DBCP in Groundwater		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Cancer Risk	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-9}	5×10^{-8}	6×10^{-7}	7×10^{-7}	NA[b]	NA	NA
Offsite Workers (long-term)	1×10^{-17}	7×10^{-17}	1×10^{-7}	1×10^{-7}	2×10^{-5}	2×10^{-5}	NA
Offsite Residents (adult)	4×10^{-17}	2×10^{-16}	2×10^{-7}	2×10^{-7}	7×10^{-5}	7×10^{-5}	1×10^{-6}
Offsite Residents (child)	1×10^{-17}	2×10^{-17}	4×10^{-8}	4×10^{-8}	7×10^{-6}	7×10^{-6}	2×10^{-7}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-9}	5×10^{-8}	6×10^{-7}	7×10^{-7}	3×10^{-5}	3×10^{-5}	NA
Onsite Workers (intrusive)	2×10^{-9}	1×10^{-9}	9×10^{-9}	1×10^{-8}	NA	NA	NA
Onsite Trespassers	2×10^{-9}	4×10^{-9}	3×10^{-9}	9×10^{-9}	NA	NA	NA
Onsite Residents (adults)	3×10^{-8}	1×10^{-7}	1×10^{-6}	1×10^{-6}	9×10^{-5}	9×10^{-5}	2×10^{-6}
Onsite Residents (child)	1×10^{-8}	1×10^{-8}	2×10^{-7}	2×10^{-7}	9×10^{-6}	9×10^{-6}	2×10^{-7}
Offsite Workers (long-term)	1×10^{-17}	7×10^{-17}	1×10^{-7}	1×10^{-7}	3×10^{-5}	3×10^{-5}	NA
Offsite Residents (adults)	4×10^{-17}	2×10^{-16}	2×10^{-7}	2×10^{-7}	1×10^{-4}	1×10^{-4}	2×10^{-6}
Offsite Residents (child)	1×10^{-17}	2×10^{-17}	4×10^{-8}	4×10^{-8}	1×10^{-5}	1×10^{-5}	3×10^{-7}

Notes:

(a) Source: Appendix J, Multipathway Health Risk Assessment, 31 January 1996, 1993, ENVIRON, 1996.
(b) Not Applicable

TABLE 5-6

Calculated Noncancer Hazard Indices Based on a Normal Distribution of Chemicals Of Concern

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil Chemicals				Exposure to Groundwater Chemicals		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Noncancer HI	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-1}	5×10^{0}	7×10^{-1}	6×10^{0}	NA[b]	NA	NA
Offsite Workers (long-term)	1×10^{-3}	8×10^{-3}	1×10^{-1}	1×10^{-1}	2×10^{-1}	2×10^{-1}	NA
Offsite Residents (adult)	1×10^{-2}	2×10^{-2}	2×10^{-1}	2×10^{-1}	5×10^{-1}	5×10^{-1}	1×10^{-2}
Offsite Residents (child)	4×10^{-2}	4×10^{-2}	8×10^{-1}	9×10^{-1}	1×10^{0}	1×10^{0}	4×10^{-2}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-1}	5×10^{0}	7×10^{-1}	6×10^{0}	2×10^{0}	2×10^{0}	NA
Onsite Workers (intrusive)	2×10^{0}	2×10^{0}	7×10^{0}	1×10^{1}	NA	NA	NA
Onsite Trespassers	8×10^{-1}	2×10^{0}	1×10^{-2}	3×10^{0}	NA	NA	NA
Onsite Residents (adults)	6×10^{0}	1×10^{1}	9×10^{-1}	2×10^{1}	5×10^{0}	6×10^{0}	2×10^{-1}
Onsite Residents (child)	2×10^{1}	2×10^{1}	4×10^{0}	5×10^{1}	1×10^{1}	1×10^{1}	5×10^{-1}
Offsite Workers (long-term)	1×10^{-3}	8×10^{-3}	1×10^{-1}	1×10^{-1}	2×10^{-1}	2×10^{-1}	NA
Offsite Residents (adults)	1×10^{-2}	2×10^{-2}	2×10^{-1}	2×10^{-1}	6×10^{-1}	6×10^{-1}	2×10^{-2}
Offsite Residents (child)	4×10^{-2}	4×10^{-2}	8×10^{-1}	9×10^{-1}	1×10^{0}	1×10^{0}	3×10^{-2}

Notes:

(a) Source: Table IX-17b, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.
(b) Not Applicable

TABLE 5-7

Calculated Noncancer Hazard Indices Based on a Lognormal Distribution of Chemicals of Concern
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil Chemicals				Exposure to Groundwater Chemicals		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Noncancer HI	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-2}	4×10^{-1}	2×10^{-2}	5×10^{-1}	NA[b]	NA	NA
Offsite Workers (long-term)	2×10^{-4}	8×10^{-4}	4×10^{-3}	5×10^{-3}	6×10^{-2}	6×10^{-2}	NA
Offsite Residents (adult)	1×10^{-3}	2×10^{-3}	6×10^{-3}	9×10^{-3}	2×10^{-1}	2×10^{-1}	7×10^{-3}
Offsite Residents (child)	5×10^{-3}	4×10^{-3}	3×10^{-2}	3×10^{-2}	4×10^{-1}	4×10^{-1}	2×10^{-2}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-2}	4×10^{-1}	2×10^{-2}	5×10^{-1}	2×10^{-1}	2×10^{-1}	NA
Onsite Workers (intrusive)	8×10^{-2}	3×10^{-2}	3×10^{-2}	1×10^{-1}	NA	NA	NA
Onsite Trespassers	8×10^{-2}	2×10^{-1}	4×10^{-4}	2×10^{-1}	NA	NA	NA
Onsite Residents (adults)	6×10^{-1}	1×10^{0}	3×10^{-2}	2×10^{0}	5×10^{-1}	5×10^{-1}	2×10^{-2}
Onsite Residents (child)	2×10^{0}	2×10^{0}	1×10^{-1}	4×10^{0}	1×10^{0}	1×10^{0}	5×10^{-2}
Offsite Workers (long-term)	2×10^{-4}	8×10^{-4}	4×10^{-3}	5×10^{-3}	8×10^{-2}	8×10^{-2}	NA
Offsite Residents (adults)	1×10^{-3}	2×10^{-3}	6×10^{-3}	8×10^{-3}	2×10^{-1}	2×10^{-1}	8×10^{-3}
Offsite Residents (child)	5×10^{-3}	4×10^{-3}	3×10^{-2}	3×10^{-2}	5×10^{-1}	5×10^{-1}	1×10^{-2}

Notes:

(a) Source: Table IX-1b, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.
(b) Not Applicable

TABLE 5-8

Calculated Noncancer Hazard Indices Based on a Normal Distribution of DBCP

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil DBCP				Exposure to DBCP in Groundwater		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Noncancer HI	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-5}	5×10^{-4}	4×10^{-3}	5×10^{-3}	NA[b]	NA	NA
Offsite Workers (long-term)	7×10^{-14}	4×10^{-13}	8×10^{-4}	8×10^{-4}	1×10^{-1}	1×10^{-1}	NA
Offsite Residents (adult)	5×10^{-13}	1×10^{-12}	1×10^{-3}	1×10^{-3}	4×10^{-1}	4×10^{-1}	8×10^{-3}
Offsite Residents (child)	2×10^{-12}	2×10^{-12}	5×10^{-3}	5×10^{-3}	9×10^{-1}	9×10^{-1}	2×10^{-2}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	8×10^{-5}	5×10^{-4}	4×10^{-3}	5×10^{-3}	7×10^{-1}	7×10^{-1}	NA
Onsite Workers (intrusive)	7×10^{-4}	5×10^{-4}	3×10^{-3}	4×10^{-3}	NA	NA	NA
Onsite Trespassers	8×10^{-5}	2×10^{-4}	8×10^{-5}	3×10^{-4}	NA	NA	NA
Onsite Residents (adults)	6×10^{-4}	1×10^{-3}	6×10^{-3}	7×10^{-3}	2×10^{0}	2×10^{0}	4×10^{-2}
Onsite Residents (child)	2×10^{-3}	2×10^{-3}	3×10^{-2}	3×10^{-2}	5×10^{0}	5×10^{0}	1×10^{-1}
Offsite Workers (long-term)	7×10^{-14}	4×10^{-13}	8×10^{-4}	8×10^{-4}	2×10^{-1}	2×10^{-1}	NA
Offsite Residents (adults)	5×10^{-13}	1×10^{-12}	1×10^{-3}	1×10^{-3}	5×10^{-1}	5×10^{-1}	1×10^{-2}
Offsite Residents (child)	2×10^{-12}	2×10^{-12}	5×10^{-3}	5×10^{-3}	1×10	1×10^{0}	2×10^{-2}

Notes:

(a) Source: Appendix M, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.

(b) Not Applicable

TABLE 5-9

Calculated Noncancer Hazard Indices Based on a Lognormal Distribution Of DBCP[a]
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Potentially Exposed Population	Potential Exposure Pathway[a]						
	Exposure to Soil DBCP				Exposure to DBCP in Groundwater		
	Ingestion	Dermal Contact	Inhalation of Vapors and Particulates	Total Estimated Noncancer HI	Ingestion	Bathing	Swimming
CURRENT LAND-USE SCENARIOS							
Onsite Workers (long-term)	2×10^{-5}	1×10^{-4}	1×10^{-3}	1×10^{-3}	NA[b]	NA	NA
Offsite Workers (long-term)	2×10^{-14}	1×10^{-13}	3×10^{-4}	3×10^{-4}	4×10^{-2}	4×10^{-2}	NA
Offsite Residents (adult)	2×10^{-13}	3×10^{-13}	4×10^{-4}	4×10^{-4}	1×10^{-1}	1×10^{-1}	2×10^{-3}
Offsite Residents (child)	6×10^{-13}	7×10^{-13}	2×10^{-3}	2×10^{-3}	3×10^{-1}	3×10^{-1}	7×10^{-3}
FUTURE LAND-USE SCENARIOS							
Onsite Workers (long-term)	2×10^{-5}	1×10^{-4}	1×10^{-3}	1×10^{-3}	6×10^{-2}	6×10^{-2}	NA
Onsite Workers (intrusive)	2×10^{-4}	2×10^{-4}	9×10^{-4}	1×10^{-3}	NA	NA	NA
Onsite Trespassers	2×10^{-5}	4×10^{-5}	3×10^{-5}	8×10^{-5}	NA	NA	NA
Onsite Residents (adults)	1×10^{-4}	2×10^{-4}	2×10^{-3}	2×10^{-3}	2×10^{-1}	2×10^{-1}	3×10^{-3}
Onsite Residents (child)	4×10^{-4}	5×10^{-4}	9×10^{-3}	9×10^{-3}	4×10^{-1}	4×10^{-1}	1×10^{-2}
Offsite Workers (long-term)	2×10^{-14}	1×10^{-13}	3×10^{-4}	3×10^{-4}	6×10^{-2}	6×10^{-2}	NA
Offsite Residents (adults)	2×10^{-13}	3×10^{-13}	4×10^{-4}	4×10^{-4}	2×10^{-1}	2×10^{-1}	3×10^{-3}
Offsite Residents (child)	6×10^{-13}	7×10^{-13}	2×10^{-3}	2×10^{-3}	4×10^{-1}	4×10^{-1}	8×10^{-3}

Notes:

(a) Source: Appendix J, Multipathway Health Risk Assessment, 31 January 1996, ENVIRON, 1996.
(b) Not Applicable

TABLE 7-1

ARARs for Preferred Remedial Action Alternative 12

Draft Remedial Action Plan, THAN Site, Fresno County, California
K/J 844083.75

Standard, Requirement, or Criteria and Citation	Description	Comments
Federal: Chemical-Specific		
SDWA - Maximum Contaminant Level Goals (MCLGs) 40 CFR Sections 141.50-141.52	Non-enforceable health goals for public water systems set at levels that would result in no known or anticipated adverse health risks.	Potentially relevant and appropriate where set above zero.
SDWA - Maximum Contaminant Levels (MCLs) 40 CFR Sections 141.11-141.16; 40 CFR Sections 141.60-141.63	National primary drinking water standards.	Applicable for public water systems that provide water for at least 15 connections or at least 25 people. Generally relevant and appropriate for aquifers that are existing or potential public or private water sources (EPA, Superfund Public Health Evaluation Manual, 1986).
Federal: Action-Specific		
CWA - NPDES Permit 40 CFR Sections 122.1 - 122.64 and Sections 125.1 - 125.124	Requirements for permits and limitations for discharges of effluent to surface waters.	Potentially applicable if extracted groundwater is discharged to surface water.
CWA - Discharge to POTW Section 307 of CWA, 40 CFR Sections 403.1 - 403.6 and Sections 403.12 - 403.17	Requirements for permits and limitations for discharges to POTWs.	Potentially applicable if extracted groundwater is discharged to local POTW.
CWA - Water Quality Criteria 40 CFR Sections 131.1 - 131.13	Federal water quality criteria are guidelines from which states determine their water quality standards. Criteria are developed for the protection of human health and aquatic life.	Water quality criteria are potentially relevant and appropriate for setting limitations for discharges to surface waters.
CWA - Underground Injection Control 40 CFR Part 144	Regulates injection of wastes to the subsurface through wells.	Potentially applicable, if underground injection is part of the contingency plan for groundwater.
State: Chemical-Specific		
California SDWA Primary Drinking Water Standards/MCLs 22 CCR Sections 64431, 64444 and 64439	Establishes primary drinking water standards for public water supply systems.	Relevant and appropriate for aquifers that are current or potential public or private supply sources. Specific California MCLs are relevant and appropriate when they are more stringent than federal MCLs.

TABLE 7-1

ARARs for Preferred Remedial Action Alternative 12

Draft Remedial Action Plan, THAN Site, Fresno County, California
K/J 844083.75

Standard, Requirement, or Criteria and Citation	Description	Comments
	State: Action-Specific	
SWRCB Resolution No. 68-16 (SWRCB Statement of Policy with Respect to Maintaining High Quality of Waters in California) (sometimes referred to as "Anti-Degradation Policy")	Narrative policy requiring maintenance of existing water quality unless demonstrated that the change is consistent with maximum benefit, will not unreasonably affect present or potential uses, and will not result in water quality less than what is prescribed by other state policies.	Applicable. Considered in conjunction with other potential ARARs.
SWRCB Resolution No. 92-49 (SWRCB Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), Section III.G	Pursuant to Section III.G, must either attain background levels or best water quality which is reasonable if background levels cannot be restored. In applying alternative cleanup levels less stringent than background, apply 23 CCR Section 2550.4.	Relevant and appropriate.
23 CCR Section 2550.4 (re concentration limits for response programs at waste management units).	Establishes criteria for setting concentration limits for constituents of concern in groundwater, including the factors that must be considered in establishing a concentration limit greater than background.	Relevant and appropriate to the selection of remedial goals.
RWQCB - Tulare Lake Basin Plan	Water Quality Control Plan report for region that, among other things, establishes water quality objectives for chemical constituents in ground water and surface water.	Applicable.
DWR Bull. 74-81 and Suppl. 74-90 (California Well Standards)	Regulates the classification, construction, and destruction of groundwater wells.	Applicable to groundwater monitoring wells.
Hazardous Waste Control Act (HWCA) H&SC Section 25100 et seq. and implementing regulations specified below.		
• Hazardous Waste Identification 22 CCR Sections 66261.1 - 66261.126	Standards for identifying whether a waste is hazardous waste.	Potentially applicable. Soil and spent activated carbon may be classified as hazardous waste.
• Generation of Hazardous Waste 22 CCR Sections 66262.10 - 66262.47	Standards applicable to generators of hazardous waste.	Applicable if hazardous waste generated.
• Hazardous Waste Transportation 22 CCR Sections 66263.1 - 66263.46	Standards applicable to transporters of hazardous waste.	Applicable if hazardous waste transported off-site.

TABLE 7-1

ARARs for Preferred Remedial Action Alternative 12
Draft Remedial Action Plan, THAN Site, Fresno County, California
K/J 844083.75

Standard, Requirement, or Criteria and Citation	Description	Comments
• Tank Systems 22 CCR Sections 66264.190 - 66264.199	Requirements for hazardous waste storage or treatment.	Potentially applicable, if groundwater is treated. Granulated activated carbon treatment system considered a tank system.
• Land Disposal Restriction 22 CCR Sections 66268.1 - 66268.124	Requires that certain hazardous wastes meet minimum treatment standards prior to land disposal.	Potentially applicable. Spent carbon may be considered hazardous waste, subject to land disposal restrictions.
Toxic Injection Well Control Act H&SC Sections 25159.10 - 25159.25	Prohibits any injection of hazardous waste above, into, or below a potential source of drinking water unless properly permitted and operated. Recharge by wells into same aquifer is exempt.	Potentially applicable, if reinjection is part of the contingency plan for groundwater. DTSC approval required for reinjection of treated groundwater.
San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) Rules and Regulations Rule 8020	Establishes fugitive dust requirements for control of fine particulate matter (PM-10) on construction, excavation and extraction activities.	Applicable.

TABLE 7-2

Potential Chemical-Specific ARARs, Health-Based Criteria, and Detection Limits for Chemicals of Concern In Groundwater

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical of Concern in Groundwater[a]	Public Health Criteria				Environmental Protection Criteria (Potentially Applicable To Discharge Of Treated Groundwater)				Calculated Health-Based Criteria		Detection Limit[h] (µg/l)
	EPA MCL[b] (µg/l)	Calif. MCL[c] (µg/l)	EPA MCLG[d] (µg/l)	Calif. Action Level[e] (µg/l)	Water and Fish Inges-tion[f] (units/l)	Fish Cons.[f] (units/l)	Fresh-water Aquatic Criteria Acute[f] (µg/l)	Freshwater Aquatic Criteria Chronic[f] (µg/l)	10^{-4} Cancer Risk Concentration Estimate[g]	10^{-6} Cancer Risk Concentration Estimate[g]	
Carbon tetrachloride	5	0.5	0		0.4 µg	6.94 µg	35,200		50	0.50	0.5
Chloroform	100[i]				0.19 µg	15.7 µg	28,900	1,240	98	0.98	0.5
1,2-Dichloroethane (1,2-DCA)	5	0.5	0		0.94 µg	243 µg	118,000	20,000	47	0.47	0.5
Dieldrin				*0.05* (LOQ)	*0.071 ng*	*0.076 ng*	*2.5*	*0.0019*	*0.3*	*0.003*	*0.05*
Dibromochloropropane (DBCP)	0.2	0.2	0						5[j]	0.05[j]	0.01
1,2,3-Trichloropropane (1,2,3-TCP)									0.2[j]	0.002[j]	0.05

Notes:

(a) Table entries for chemicals of public health or environmental concern identified in the HRA Report (ENVIRON, A 1996) as constituting the chemicals of most significant potential public health or environmental concern on the basis of historical detection and confirmation of concentrations in excess of potential PFRGs, or having the potential for future migration from soil to groundwater. Units are nanograms (ng), micrograms (µg), and liters (l), as appropriate. "LOQ" denotes the limit of quantification. "<" denotes not detected at concentration above stated detection limit. Acceptable Drinking Water Levels (ADWLs) defined in the Order (DHS Docket No. HSA 86/87-020 ED as amended) consist of EPA MCLs, California MCLs, and California Action Levels as shown on this Table.

(b) U.S. Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) (*Region IX Drinking Water Standards and Health Advisory Table*, January, 1991, and 40 CFR 141 (B) and (G)).

(c) California MCL (*Summary of California Drinking Water Standards*, California Department of Health Services, October, 1990, and Title 22 CCR Section 64444.5).

(d) U.S. EPA MCL Goal (MCLG) (*Region IX Drinking Water Standards and Health Advisory Table*, January, 1991, and 40 CFR 141 (B) and (G)).

(e) California Action Level (*Summary of California Drinking Water Standards*, California Department of Health Services, October 24, 1990).

(f) Ambient Water Quality Criteria, CWA Section 304 (a), (*The Gold Book*, 1986).

(g) See ENVIRON, HRA Report 1996 for a listing of concentrations which would pose a 10^{-6} cancer risk (if carcinogenic) given a lifetime of exposure via ingestion, inhalation of vapors and dermal contact.

(h) Typical laboratory detection limit in the absence of elevated concentrations of interfering compounds (Agriculture & Priority Pollutants Laboratories, Inc.).

(i) The EPA MCL indicated is for total trihalomethanes (the sum of concentrations of bromodichloromethane, bromoform, chloroform, and dibromochloromethane). The EPA MCL for total trihalomethanes is established as the ADWL for chloroform in the Order.

(j) Taken from Technical and Economic Feasibility Evaluation (Appendix B, Table 5).

Source: Table 2-2 of Feasibility Study report (SEACOR 1993a).

TABLE 7-3

Final Remediation Goals for Groundwater

Final Remedial Action Plan, THAN Site, Eastern Fresno County, California
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Chemical of Concern	Promulgated Regulation Level[(a)] (ppb)	Health-Based Level[(b)] (ppb)	Detection Limit (ppb)	Final Remediation Goal (ppb)
Carbon Tetrachloride	0.5	17[(e)]	0.5	0.5
Chloroform	100	98	0.5	100
1,2-DCA	0.5	47	0.5	0.5
Dieldrin	0.05 (LOQ)	0.3	0.05	0.3
1,2,3-TCP	UR[(c)]	0.16[(e)]	0.05	NN[(f)]
DBCP	0.2	4.8[(e)]	0.01	NN[(g)]

Notes:

(a) California MCL, California Action Level, or federal MCL, whichever is most stringent.
(b) Either 10^{-4} cancer risk for carcinogens or HI =1 risk for systemic toxicants, from THAN Multipathway Health Risk Assessment unless otherwise noted.
(c) Unregulated
(d) Not available
(e) From US EPA PRG Table, 1 August 1996.
(f) Nonnumeric - Because 1,2,3-TCP has been detected in groundwater clearly unaffected by site-related activities, a numeric remediation goal has been deferred by DTSC. If 1,2,3-TCP were found to be strictly site-related, then using the criteria applied to site-related chemicals, a health-based level of 0.2 ppb would be established.
(g) Nonnumeric - Due to regional DBCP levels, satisfactory remediation of DBCP will be based on mass of DBCP attenuated by the remedy and an evaluation of its background levels at the time the other remediation goals have been met.

TABLE 7-4

Final Remediation Goals for Soil - Industrial Land Use
Final Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Chemical	Calculated Health Based Concentration (mg/kg)		Final Remediation Goal (mg/kg)
	Site Specific[a]	US EPA[b]	
Acetone	770	8,800	770
Arsenic	2.7	2.4	2.4
Chloroform[c]	0.16	0.53	0.16
Dacthal	2,100,000	100,000	100,000
DBCP[c]	0.0041	1.4	0.0041
DDD	3.2	7.9	3.2
DDE	2.3	5.6	2.3
DDT	2.0	5.6	2.0
DEF	4.6	NA[d]	4.6
1,2-Dichloroethane[c]	NA[d]	0.55	0.55
Dieldrin[c]	0.047	0.12	0.05
Diphenamid	4,600	20,000	4,600
Ethion	140	340	140
Ethylbenzene	NA[d]	230	230
Lindane[c]	1.9	1.5	1.5
Malathion	3,500	14,000	3,500
Methyl Parathion	68	170	68
Parathion	1,000	4,100	1,000
PCNB[c]	1.8	7.3	1.8
Phosalone	630,000	NA	630,000
Toxaphene[c]	0.079	1.7	0.08
Trifluralin[c]	87	250	87
Xylenes	1,000	320	320

Notes:

(a) Based on exposure to chemicals by ingestion of and dermal contact with soil, and inhalation of vapors and particulates.
(b) US EPA PRG Table, August 1996; pathways considered are inhalation of vapors, soil ingestion, and dermal contact for semivolatile compounds.
(c) Carcinogenic chemicals. See Chapter VII of Health Risk Assessment (ENVIRON 1996) for a classification of carcinogens.
(d) NA = not available

TABLE 7-5

Components of Remedial Action Alternatives
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Process Options	Feasibility Study Remedial Action Alternatives[a]											
	1	2	3	4	5	6	7	8	9	10	11	12
Deed Restrictions			•	•	•		•	•	•	•		•
Permit Restrictions			•	•	•	•	•	•	•	•	•	•
Security		•	•	•	•	•	•	•	•	•	•	•
Groundwater Monitoring		•	•	•	•	•	•	•	•	•	•	•
Air Monitoring		•	•									
Soil Vapor Extraction[b]		•	•	•	•	•	•	•	•	•	•	
Alternate Water Supply		•	•	•	•	•	•	•	•	•	•	•
Wellhead Treatment			•	•	•	•	•	•	•	•	•	(c)
Asphalt Cap/Composite Cap				•			•	•	•			•
Vegetative Cover				•	•		•	•	•	•		•
Stabilization/Solidification					•					•		
Thermal Desorption						•					•	
Onsite Replacement/Offsite Disposal						•					•	
Extraction Wells							•	•	•	•	•	(c)
Groundwater Treatment/Air Stripping and/or Carbon Adsorption							•	•	•	•	•	(c)
Treated Water Injection or Surface Water Recharge							•	•	•	•	•	(c)

Notes:

(a) Source: Table 4.1 of Feasibility Study report (SEACOR 1993a).
(b) Soil vapor extraction no longer required because systems were successful in remediating soil to remedial action objectives.
(c) Contingent option depending on results of groundwater monitoring.

TABLE 7-6

Summary of Estimated Costs for Remedial Alternatives

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Remedial Alternative	Description	Estimated Capital Costs[a] ($000)	Estimated Present Worth of O&M Costs[a] ($000)	Total Present Worth of Capital and O&M Costs[a, b] ($000)
1	No Further Action	21	428	449
2	Limited Action	60	3,348	3,408
3	Limited Action and Institutional Controls	1,475	4,885	6,360
4	Soil Capping	1,640-2,830	4,700-4,730	6,370-7,530
5	In Situ Soil Treatment	2,900-4,880	4,750-4,780	7,680-9,630
6	Ex Situ Soil Treatment	4,370-10,460	4,600	8,970-15,060
7	Soil Capping and Contingent Onsite and Nearsite Groundwater Extraction	3,160	5,620	8,780
8	Soil Capping and Offsite Groundwater Extraction	3,430	6,094	9,524
9	Soil Capping and Contingent Onsite, Nearsite, and Offsite Groundwater Extraction	3,980	7,910	11,890
10	In Situ Soil Treatment and Offsite Groundwater Extraction	5,480	6,090	11,570
11	Ex Situ Soil Treatment and Offsite Groundwater Extraction	11,070	5,780	16,850
12[c,d]	Soil Capping and Contingent Onsite, Nearsite, and Offsite Groundwater Extraction with Monitored Natural Attenuation	A) 2,832 B) 2,973 C) 3,517	A) 4,579 B) 4,849 C) 7,605	A) 7,411 B) 7,822 C) 11,122

Notes:

(a) Source: Appendix C of Feasibility Study report (SEACOR 1993a).
(b) Present worth based upon 5% discount rate over 30-year period.
(c) As presented in Section 7.4, variations in groundwater component are: A) monitored natural attenuation; B) groundwater extraction for containment without treatment; and C) onsite/nearsite groundwater extraction for containment with treatment.
(d) Cost details are presented in Tables 7-7 to 7-9 for Alternative 12A, Tables 7-10 to 7-12 for Alternative 12B, and Tables 7-13 to 7-15 for Alternative 12C.

TABLE 7-7

Alternative 12A - Capital Costs
Soil Capping, Contingent Onsite, Nearsite, and Offsite Groundwater Extraction and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Description	Cost ($)	Unit	Quantity	Cost[b] ($)
Capital Construction Costs:				
Deed Restriction/Permit				50,000
Alternative Water Supply				250,000
Soil Capping:				
Site Preparation	25,000	qt	1	25,000
Grading	1	cy	15,206	15,200
Soil/15% Cement	1	sf	273,700	273,700
Granular Material	15	cy	5,069	76,035
Filter Medium	0.5	sf	273,700	136,850
Top Soil	10	cy	10,137	101,370
Asphalt	2	sf	34,000	68,000
Public Water Treatment	400,000	ea	1	400,000
Site Preparation	1	ea	25,000	25,000
Site Improvements				49,800
Subtotal Capital Construction Costs				1,471,000
General Conditions (mobilization, temporary utilities, permits, etc.)				147,100
Subtotal Construction Costs				1,618,100
Contingency				404,525
Total Construction Costs				2,022,600
Engineering, Supervision				505,700
Construction Expenses				202,300
Contractor's Fee				101,100
Total Capital Costs				**2,831,700**

Notes:

(a) For cost estimation purposes, Alternative 12A includes soil capping and monitored natural attenuation. Contingent onsite, nearsite, and offsite groundwater extraction is assumed to not be necessary.
(b) Based extensively on information provided in the FS report (SEACOR 1993a).

TABLE 7-8

Alternative 12A - Operation and Maintenance Costs
Soil Capping, Contingent Onsite, Nearsite, and Offsite Groundwater Extraction and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Annual Fixed Costs

Description	Cost ($)	Unit	Quantity	Costs[b] ($)
Groundwater Monitoring	62,000	semi	2	124,000
Cap Maintenance	10,000	yr	1	10,000
Site Maintenance	12,000	yr	1	12,000
Public Water Treat.	100,000	ea	1	100,000
Annual Inspections	100	hr	24	2,400
Annual Survey	500	ea	1	500
DTSC O&M Oversight Fees	26,600	yr	1	26,600
Total Annual Fixed Costs				275,500

Annual Variable Costs

DTSC RAP & Remedial Design Oversight Fees (Year 0)	52,100
Final Remedial Action Oversight Fees (Year 1)	44,400
Remedial Action Plan Administration (Year 0)	250,000

Notes:

(a) For cost estimation purposes, Alternative 12A includes soil capping and monitored natural attenuation. Contingent onsite, nearsite, and offsite groundwater extraction is assumed to not be necessary.

(b) Based extensively on information provided in the FS report (SEACOR 1993a), with additional information obtained from the TEFE (Appendix B).

TABLE 7-9

Alternative 12A - Present Worth Analysis
Soil Capping, Contingent Onsite, Nearsite, and Offsite Groundwater Extraction
***and Monitored Natural Attenuation*[a]**
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Year	Capital Cost[b] ($)	Operation and Maintenance[c] ($)	Present Worth[d] ($)
0	2,831,700	302,100	3,133,800
1	0	319,900	304,700
2	0	275,500	249,900
3	0	275,500	238,000
4	0	275,500	226,700
5	0	275,500	215,900
6	0	275,500	205,600
7	0	275,500	195,800
8	0	275,500	186,500
9	0	275,500	177,600
10	0	275,500	169,100
11	0	275,500	161,100
12	0	275,500	153,400
13	0	275,500	146,100
14	0	275,500	139,100
15	0	275,500	132,500
16	0	275,500	126,200
17	0	275,500	120,200
18	0	275,500	114,500
19	0	275,500	109,000
20	0	275,500	103,800
21	0	275,500	98,900
22	0	275,500	94,200
23	0	275,500	89,700
24	0	275,500	85,400
25	0	275,500	81,400
26	0	275,500	77,500
27	0	275,500	73,800
28	0	275,500	70,300
29	0	275,500	66,900
30	0	275,500	63,700
Total Present Worth			**7,410,900**

TABLE 7-9

Alternative 12A - Present Worth Analysis
Soil Capping, Contingent Onsite, Nearsite, and Offsite Groundwater Extraction and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) For cost estimation purposes, Alternative 12A includes soil capping and monitored natural attenuation. Contingent onsite, nearsite, and offsite groundwater extraction is assumed to not be necessary.
(b) See Table 7-7.
(c) See Table 7-8.
(d) Calculated using an interest rate of 5 percent.

TABLE 7-10

Alternative 12B - Capital Costs
Soil Capping, Contingent Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Description	Cost ($)	Unit	Quantity	Cost[b] ($)
Capital Construction Costs:				
Deed Restriction/Permit				50,000
Alternative Water Supply				250,000
Public Water Treatment	1		400,000	400,000
Soil Capping:				
Grading	1	cy	15,206	15,200
Soil/15% Cement	1	sf	273,700	273,700
Filter Medium	0.5	sf	273,700	136,900
Granular Material	15	cy	5,069	76,000
Top Soil	10	cy	10,137	101,400
Asphalt	2	sf	34,000	68,000
Groundwater Extraction				
Off-site Wells	8,900	ea	2	17,800
Pump/Controller/Box	5,830	ea	2	11,700
Collection Piping	25	ft	700	5,000
Groundwater Infiltration				
Excavation	25	cy	160	4,000
Backfill Material	15	cy	100	1,500
Plumbing/Trenching	2,800	ea	2	5,600
Permit Application	12,000	ea	1	12,000
Instrumentation	11,500	ea	1	11,500
Electrical	9,900	ea	1	9,900
Site Preparation	7,500	ea	1	7,500
Subtotal Capital Construction Costs				1,451,7000
General Conditions (mobilization, temporary utilities, permits, etc.)				159,300
Subtotal Construction Costs				1,617,000
Contingency				400,300
Total Construction Costs				2,021,300
Engineering, Supervision				594,300
Construction Expenses				238,500
Contractor's Fee				118,900
Total Capital Costs				**2,973,000**

TABLE 7-10

Alternative 12B - Capital Costs
Soil Capping, Contingent Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

<u>**Notes:**</u>

(a) For cost estimation purposes, Alternative 12B includes soil capping, offsite groundwater extraction, and monitored natural attenuation.

(a) Based extensively on information provided in the FS report (SEACOR 1993a), with additional information obtained from the TEFE (Appendix B).

TABLE 7-11

Alternative 12B – Operation and Maintenance Costs Soil Capping, Contingent Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[(a)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Annual Fixed Costs

Description	Cost ($)	Unit	Quantity	Costs[(b)] ($)
Groundwater Monitoring	62,000	semi	2	124,000
Public Water Treatment	100,000	yr	1	100,000
Electrical	200	mo	12	2,400
Cap Maintenance	10,000	Yr	1	10,000
Annual Inspections	hr	yr	48	4,800
Site Maintenance	18,000	yr	1	18,000
Annual Survey	1,000	ea	1	1,000
DTSC O&M Oversight Fees	26,600	ea	1	26,600
Total Annual Fixed Costs				286,800

Annual Variable Costs

DTSC RAP & Remedial Design Oversight Fees (Year 0)	52,100
DTSC Final Remedial Action Oversight Fees (Year 1)	44,400
Offsite Easements (Year 1)	100,000
Remedial Action Plan Administration (Year 0)	250,000

<u>Notes;</u>

(a) For cost estimation purposes, Alternative 12B includes soil capping, offsite groundwater extraction, and monitored natural attenuation.

(a) Based extensively on information provided in the FS report (SEACOR 1993a), with additional information obtained from the TEFE (Appendix B).

TABLE 7-12

Alternative 12B – Present Worth Analysis
Soil Capping, Contingent Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
/J 844083.75

Year	Capital Cost[b] ($)	Operation and Maintenance[c] ($)	Present Worth[d] ($)
0	2,973,000	302,100	3,275,100
1	0	431,200	410,700
2	0	286,800	260,100
3	0	286,800	247,700
4	0	286,800	236,000
5	0	286,800	224,700
6	0	286,800	214,000
7	0	286,800	203,800
8	0	286,800	194,100
9	0	286,800	184,900
10	0	286,800	176,100
11	0	286,800	167,700
12	0	286,800	159,700
13	0	286,800	152,100
14	0	286,800	144,900
15	0	286,800	138,000
16	0	286,800	131,400
17	0	286,800	125,100
18	0	286,800	119,200
19	0	286,800	113,500
20	0	286,800	108,100
21	0	286,800	102,900
22	0	286,800	98,000
23	0	286,800	93,400
24	0	286,800	88,900
25	0	286,800	84,700
26	0	286,800	80,700
27	0	286,800	76,800
28	0	286,800	73,200
29	0	286,800	69,700
30	0	286,800	66,400
Total Present Worth			**7,821,600**

TABLE 7-12

Alternative 12B – Present Worth Analysis
Soil Capping, Contingent Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

/J 844083.75

Notes:

(a) For cost estimation purposes, Alternative 12B includes soil capping, offsite groundwater extraction, and monitored natural attenuation.
(b) See Table 7-10.
(c) See Table 7-11.
(d) Calculated using an interest rate of 5 percent.

TABLE 7-13

Alternative 12C - Capital Costs
Soil Capping, Onsite and Nearsite Groundwater Extraction,
Offsite Groundwater Extraction for Containment,
and Treatment for Containment
Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Description	Cost ($)	Unit	Quantity	Cost ($)
Capital Construction Costs:				
Deed Restriction/Permit				50,000
Alternative Water Supply				250,000
Public Water Treatment	1	ea	400,000	400,000
Soil Capping:				
Grading	1	cy	15,206	15,200
Soil/15% Cement	1	sf	273,700	273,700
Filter Medium	0.5	sf	273,700	136,900
Granular Material	15	cy	5,069	76,000
Top Soil	10	cy	10,137	101,400
Asphalt	2	sf	34,000	68,000
Groundwater Extraction				
On-site wells	7,500	ea	2	15,000
Off-site Wells	8,900	ea	2	17,800
Pump/Controller/Box	5,830	ea	4	23,300
Collection Piping	25	ft	400	10,000
Groundwater Infiltration				
Excavation	25	cy	320	8,000
Backfill Material	15	cy	200	3,000
Plumbing/Trenching	3,800	ea	4	11,200
Groundwater Treatment				
Liquid GAC Unit	5,690	ea	4	22,800
Site Work	10,000	ea	1	10,000
Groundwater Discharge				
Permit Application	12,000	ea	1	12,000
Plumbing/Trenching/Paving	30,000	ea	1	30,000
Instrumentation	40,000	ea	1	40,000
Electrical	20,000	ea		20,000
Site Preparation	37,500	qt	1	37,500
Site Improvements				92,900
Subtotal Capital Construction Costs				1,724,700
General Conditions (mobilization, temporary utilities, permits, etc.)				188,500
Subtotal Construction Costs				1,913,200

TABLE 7-13

Alternative 12C - Capital Costs
Soil Capping, Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Treatment for Containment

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Description	Cost ($)	Unit	Quantity	Cost ($)
Contingency (25%)				478,000
		Total Construction Costs		2,931,500
Engineering, Supervision				703,100
Construction Expenses				282,000
Contractor's Fee				140,600
Total Capital Costs				**3,517,400**

<u>Notes:</u>

(a) For cost estimation purposes, Alternative 12C includes soil capping, onsite and nearsite groundwater extraction and treatment, offsite groundwater extraction, and monitored natural attenuation.
(b) Based extensively on information provided in the FS report (SEACOR 1993a), with the additional information obtained from the TEFE (Appendix B).

TABLE 7-14

Alternative 12C – Operation and Maintenance Costs
Soil Capping, Onsite and Nearsite Groundwater Extraction,
Offsite Groundwater Extraction for Containment,
and Monitored Natural Attenuation[(a)]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California

K/J 844083.75

Annual Fixed Costs

Description	Cost ($)	Unit	Quantity	Costs[(b)] ($)
Labor	160	hr	144	23,000
Analytical	400	ea	224	89,600
Equipment Replacement	42,000	yr	1	42,000
Groundwater Monitoring	62,000	semi	2	124,000
Public Water Treatment	100,000	yr	1	100,000
Electrical	400	mo	12	4,800
Cap Maintenance	10,000	yr	1	10,000
Annual Inspections	100	hr	48	4,800
Site Maintenance	18,000	yr	1	18,000
Annual Survey	1,000	ea	1	1,000
DTSC O&M Oversight Fees	26,600	ea	1	26,600
Total Annual Fixed Costs				443,800

Annual Variable Costs

DTSC RAP & Remedial Design Oversight Fees (Year 0)				52,100
DTSC Final Remedial Action Oversight Fees (Year 1)				44,400
Offsite Easements (Year 1)				100,000
Remedial Action Plan Administration (Year 0)				250,000
Groundwater Treatment:				
Year 1 Carbon	2.64	lb	15,840	41,800
Year 2 Carbon	2.64	lb	14,245	37,600
Year 3 Carbon	2.64	lb	12,830	33,900
Year 4 Carbon	2.64	lb	11,547	30,500
Year 5 Carbon	2.64	lb	10,393	27,400
Year 6 Carbon	2.64	lb	9,353	24,700
Year 7 Carbon	2.64	lb	8,418	22,200
Year 8 Carbon	2.64	lb	7,576	20,000
Year 9 Carbon	2.64	lb	6,819	18,000
Year 10-30 Carbon	2.64	lb	6,137	16,200

TABLE 7-14

Alternative 12C – Operation and Maintenance Costs Soil Capping, Onsite and Nearsite Groundwater Extraction, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) For cost estimation purposes, Alternative 12C includes soil capping, onsite and nearsite groundwater extraction and treatment, offsite groundwater extraction, and monitored natural attenuation.
(b) Based extensively on information provided in the FS report (SEACOR 1993a), with the additional information obtained from the TEFE (Appendix B).

TABLE 7-15

Alternative 12C – Present Worth Analysis
Soil Capping, Onsite and Nearsite Groundwater Extraction and Treatment, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Year	Capital Cost[b] ($)	Operation and Maintenance[c] ($)	Present Worth[d] ($)
0	3,517,400	302,100	3,819,500
1	0	630,000	600,000
2	0	481,400	436,600
3	0	477,700	412,700
4	0	474,300	390,200
5	0	471,200	369,200
6	0	468,500	349,600
7	0	466,000	331,200
8	0	463,800	313,900
9	0	461,800	297,700
10	0	460,000	282,400
11	0	460,000	269,000
12	0	460,000	256,100
13	0	460,000	243,900
14	0	460,000	232,000
15	0	460,000	221,300
16	0	460,000	210,700
17	0	460,000	200,700
18	0	460,000	191,100
19	0	460,000	182,000
20	0	460,000	173,400
21	0	460,000	165,100
22	0	460,000	157,300
23	0	460,000	149,800
24	0	460,000	142,600
25	0	460,000	135,800
26	0	460,000	129,400
27	0	460,000	123,200
28	0	460,000	117,300
29	0	460,000	111,800
30	0	460,000	106,400
	Total Present Worth		**3,819,500**

TABLE 7-15

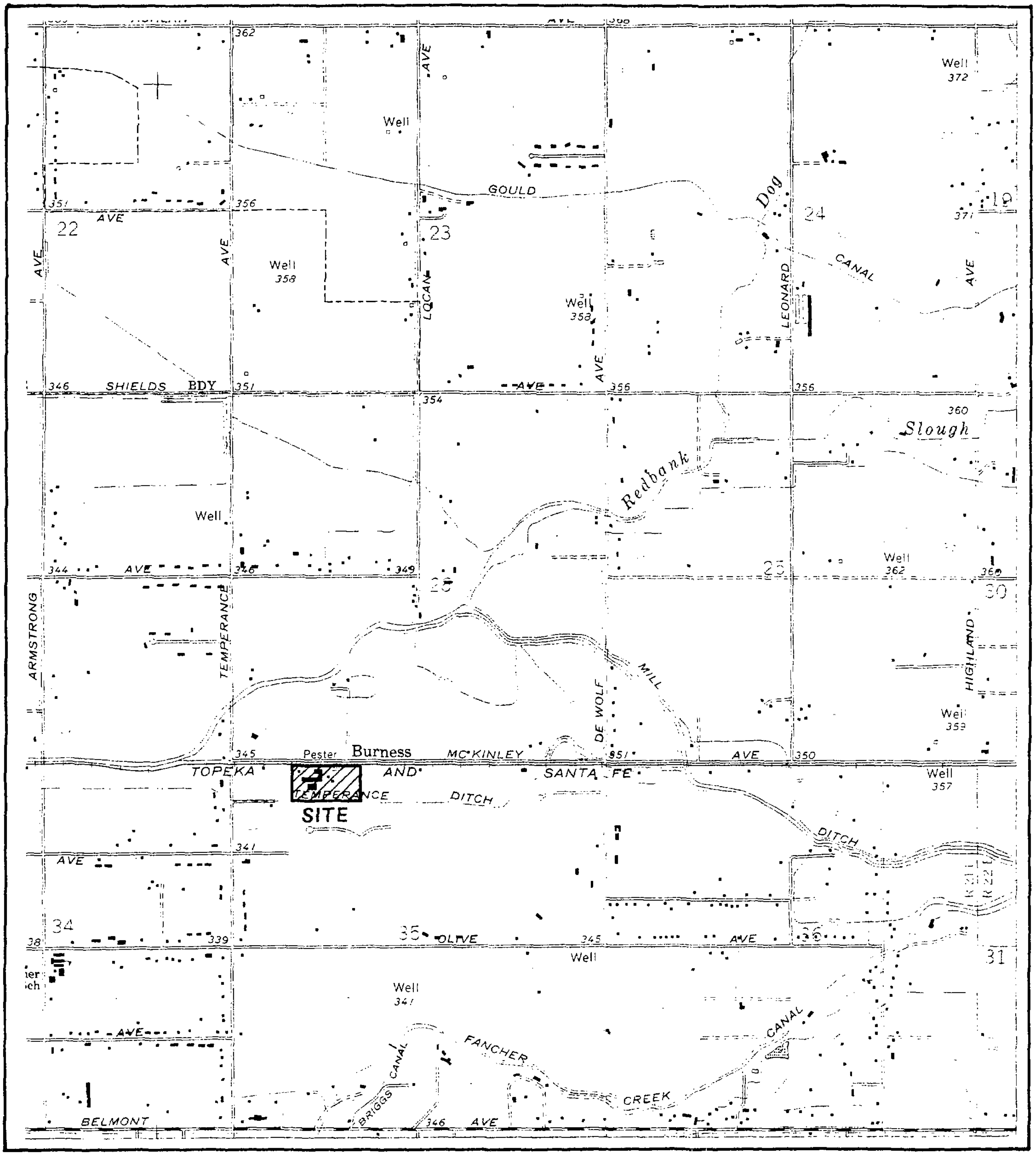
Alternative 12C – Present Worth Analysis
Soil Capping, Onsite and Nearsite Groundwater Extraction and Treatment, Offsite Groundwater Extraction for Containment, and Monitored Natural Attenuation[a]

Draft Remedial Action Plan, THAN Site, Eastern Fresno County, California
K/J 844083.75

Notes:

(a) For cost estimation purposes, Alternative 12C includes soil capping, onsite and nearsite groundwater extraction and treatment, offsite groundwater extraction, and monitored natural attenuation.
(b) See Table 7-13.
(c) See Table 7-14.
(d) Calculated using an interest rate of 5 percent.

FIGURES



N

0 2000 4000

Approximate Graphic Scale in Feet

Source: U.S.G.S. Topographic Quadrangle 7.5 Minute Series - Clovis, CA. 1981 Photo Revised

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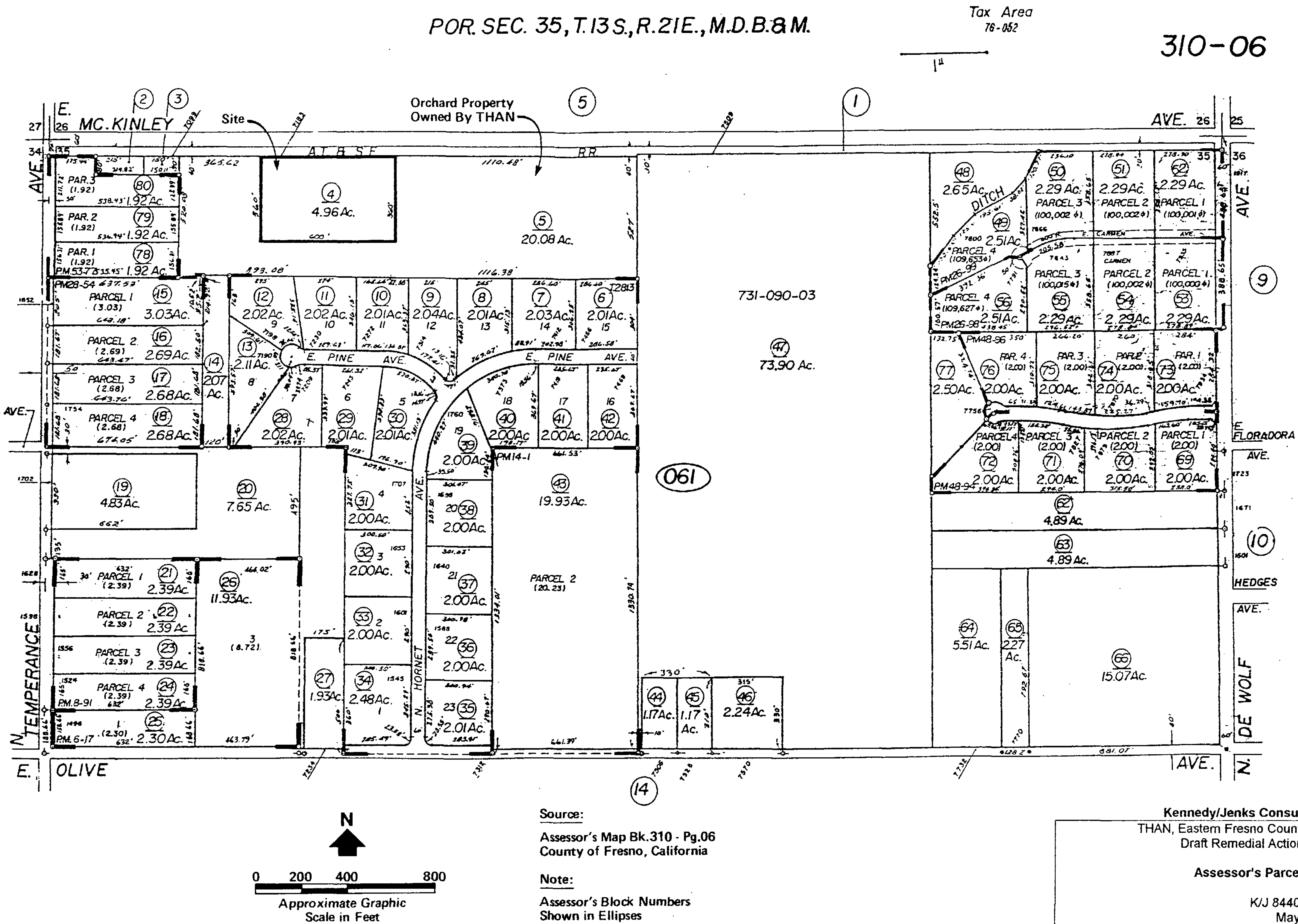
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Location Map

K/J 844083.75
May 1999
Figure 1-1



Approximate Graphic Scale in Feet

Source:

Assessor's Map Bk.310 - Pg.06
County of Fresno, California

Note:

Assessor's Block Numbers Shown in Ellipses

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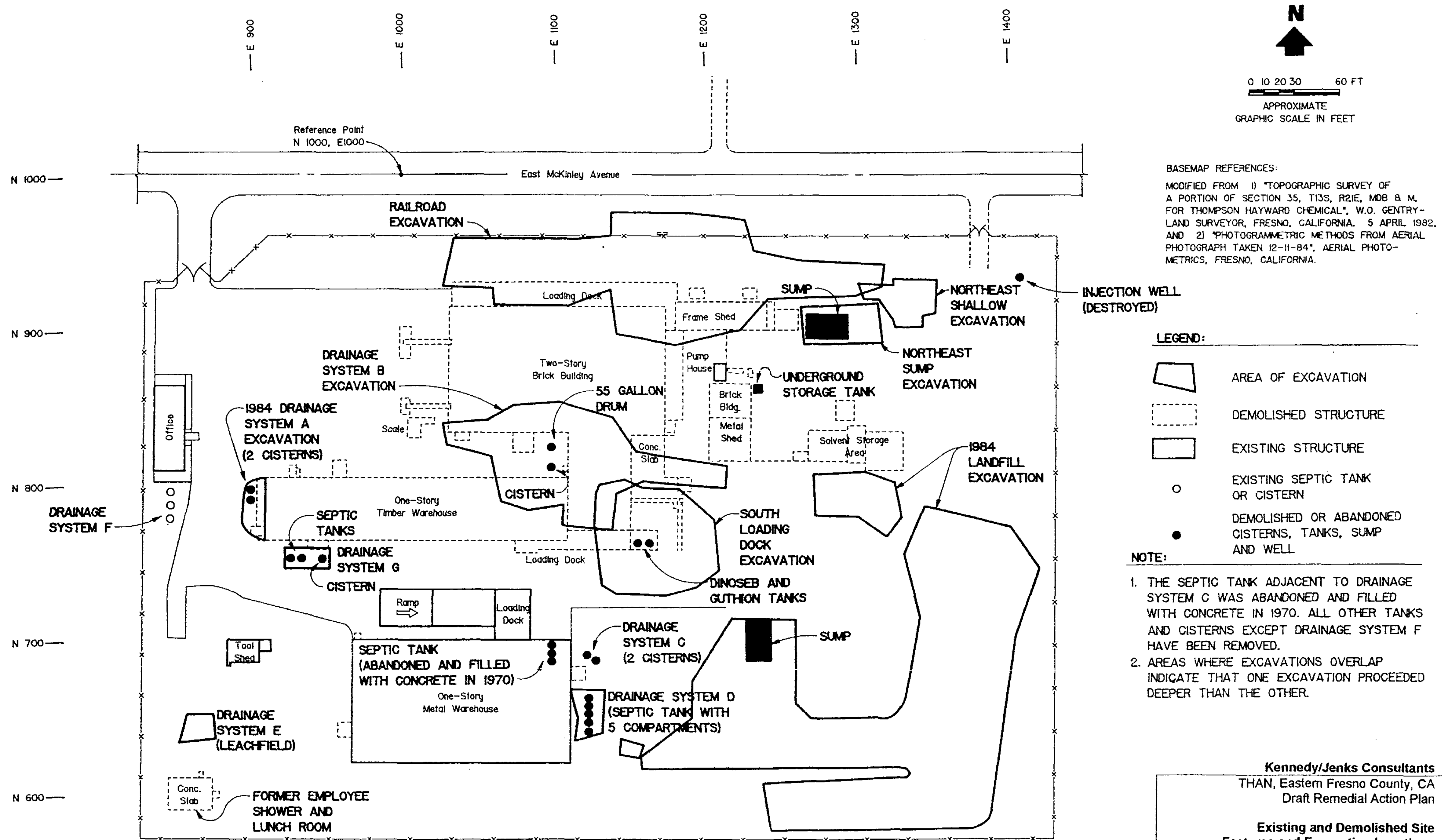
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Assessor's Parcel Map

K/J 844083.75
May 1999
Figure 3-1



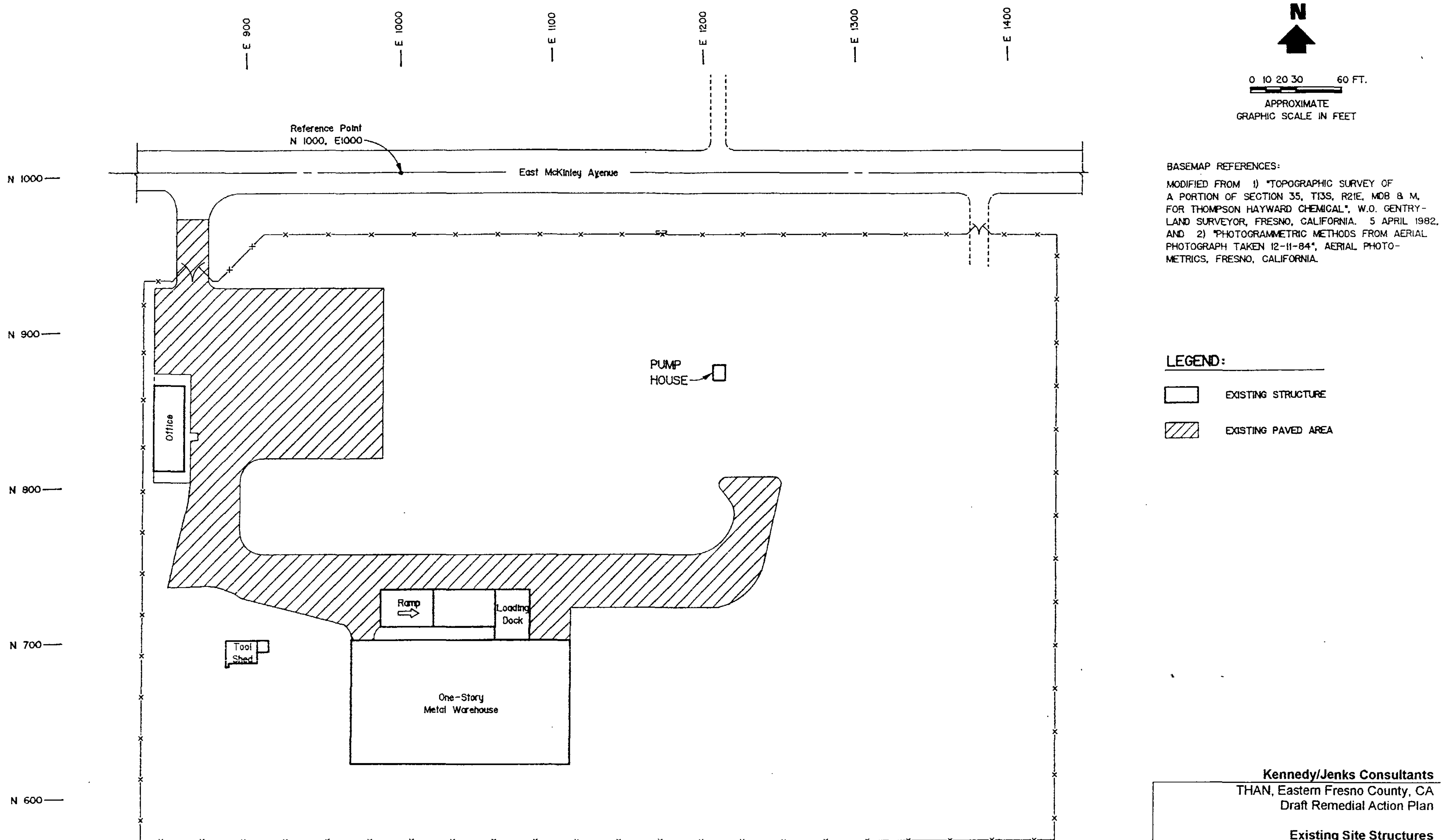
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Existing and Demolished Site Features and Excavation Locations

K/J 844083.75
May 1999
Figure 3-2



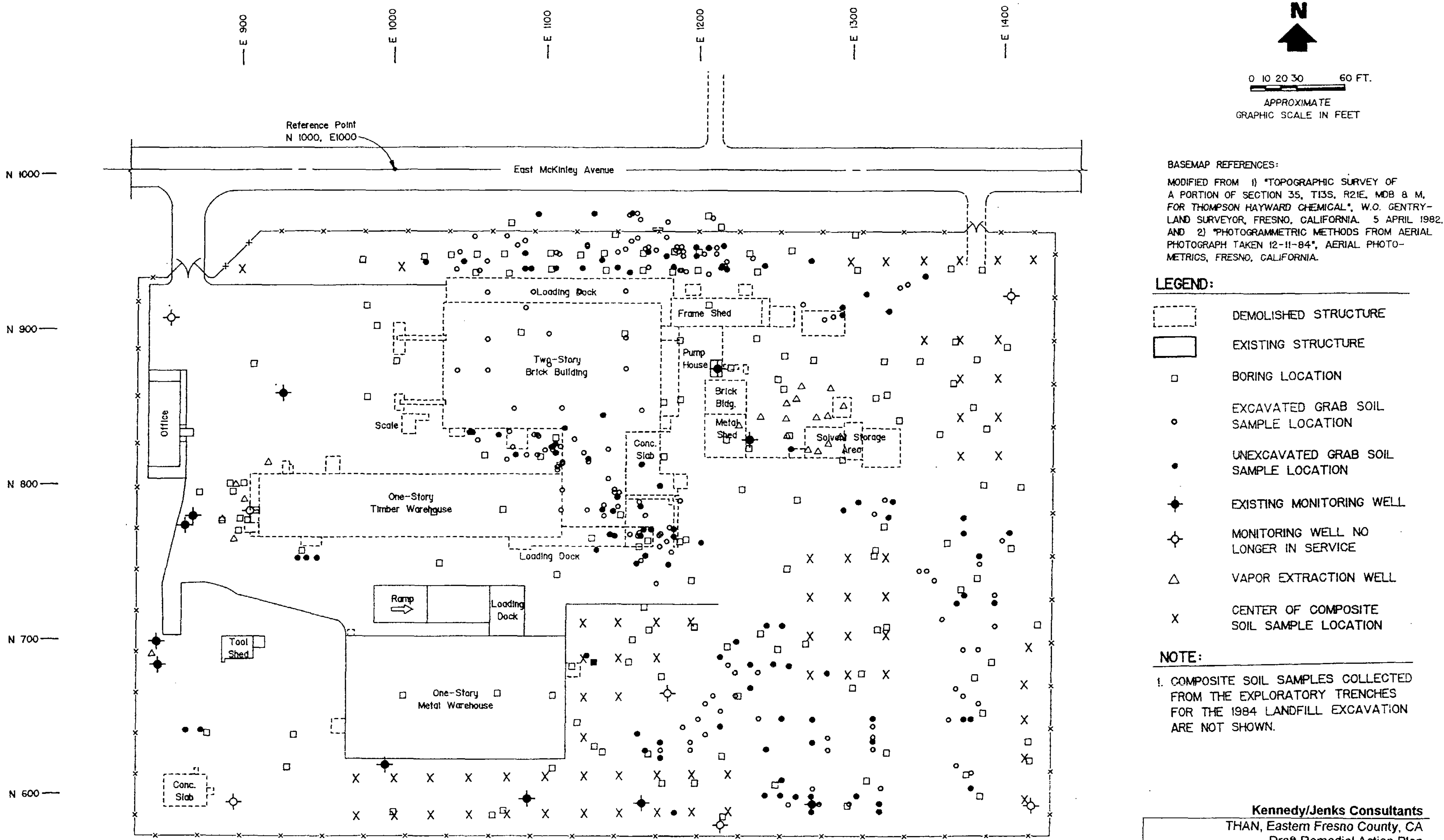
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Existing Site Structures and Paved Areas

K/J 844083.75
May 1999
Figure 3-3



Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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THAN, Eastern Fresno County, CA

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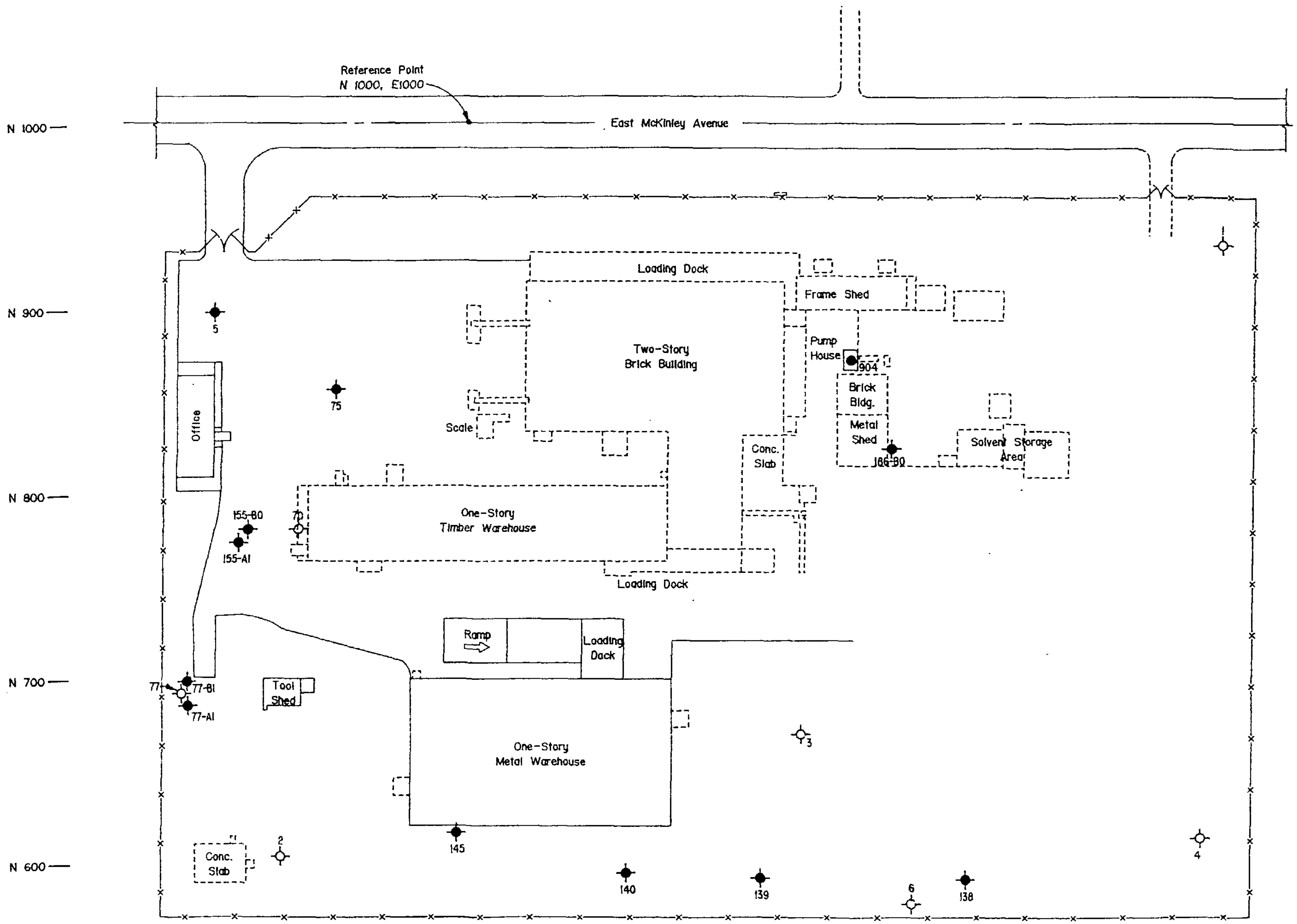
Boring, Soil Sample, Monitoring and Vapor Extraction Well Locations

K/J 844083.75

May 1999

Figure 3-4



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- DEMOLISHED STRUCTURE
- EXISTING STRUCTURE
- 139 EXISTING MONITORING WELL
- 77 MONITORING WELL NO LONGER IN SERVICE
- PLANT SUPPLY WELL

NOTES:

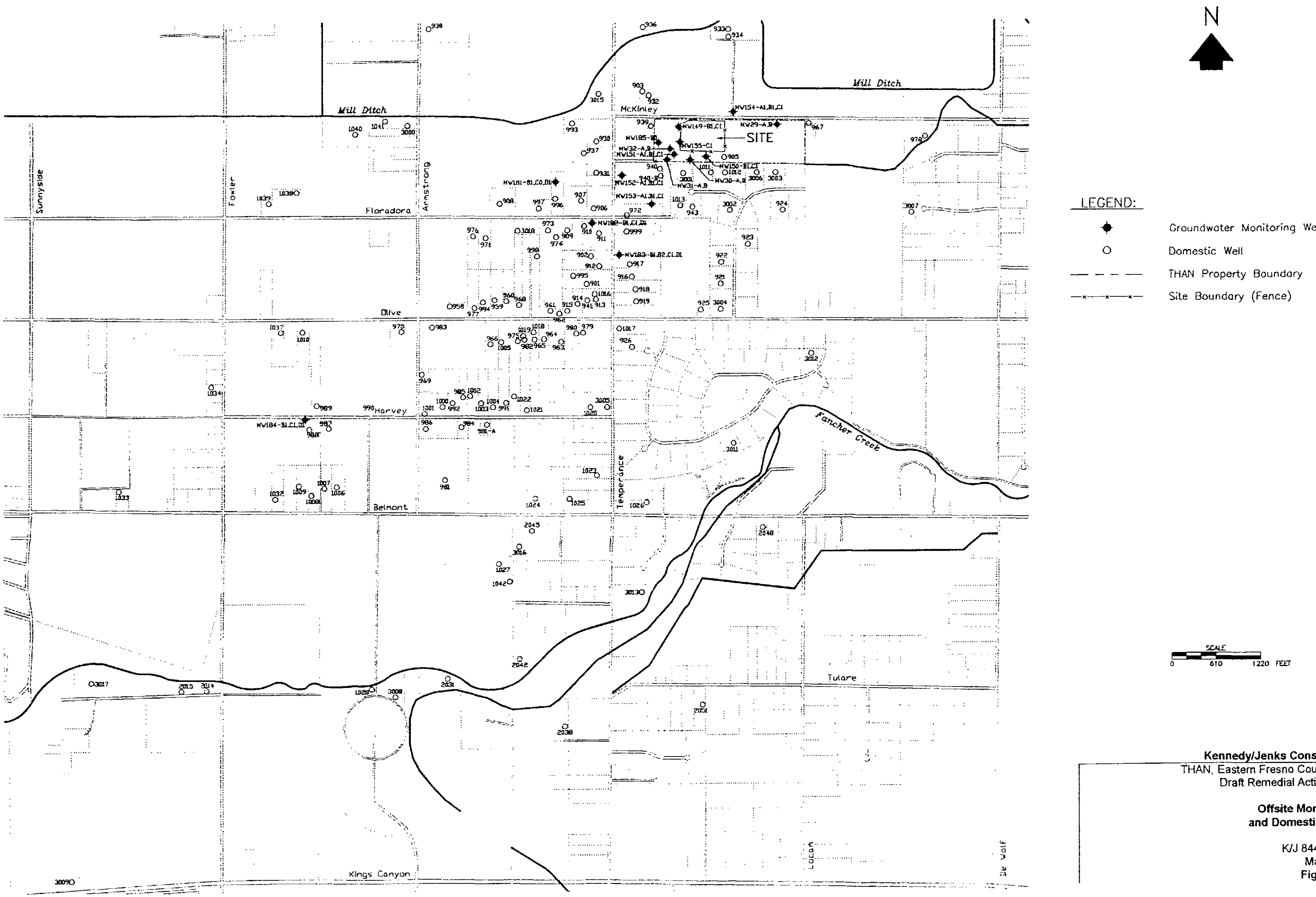
1. WELL 904 HAS SOLID CASING TO 92 FEET BELOW GROUND SURFACE (BGS) AND IS AN OPEN HOLE TO 105 FEET BGS.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Onsite Monitoring Wells

K/J 844083.75
May 1999
Figure 3-5



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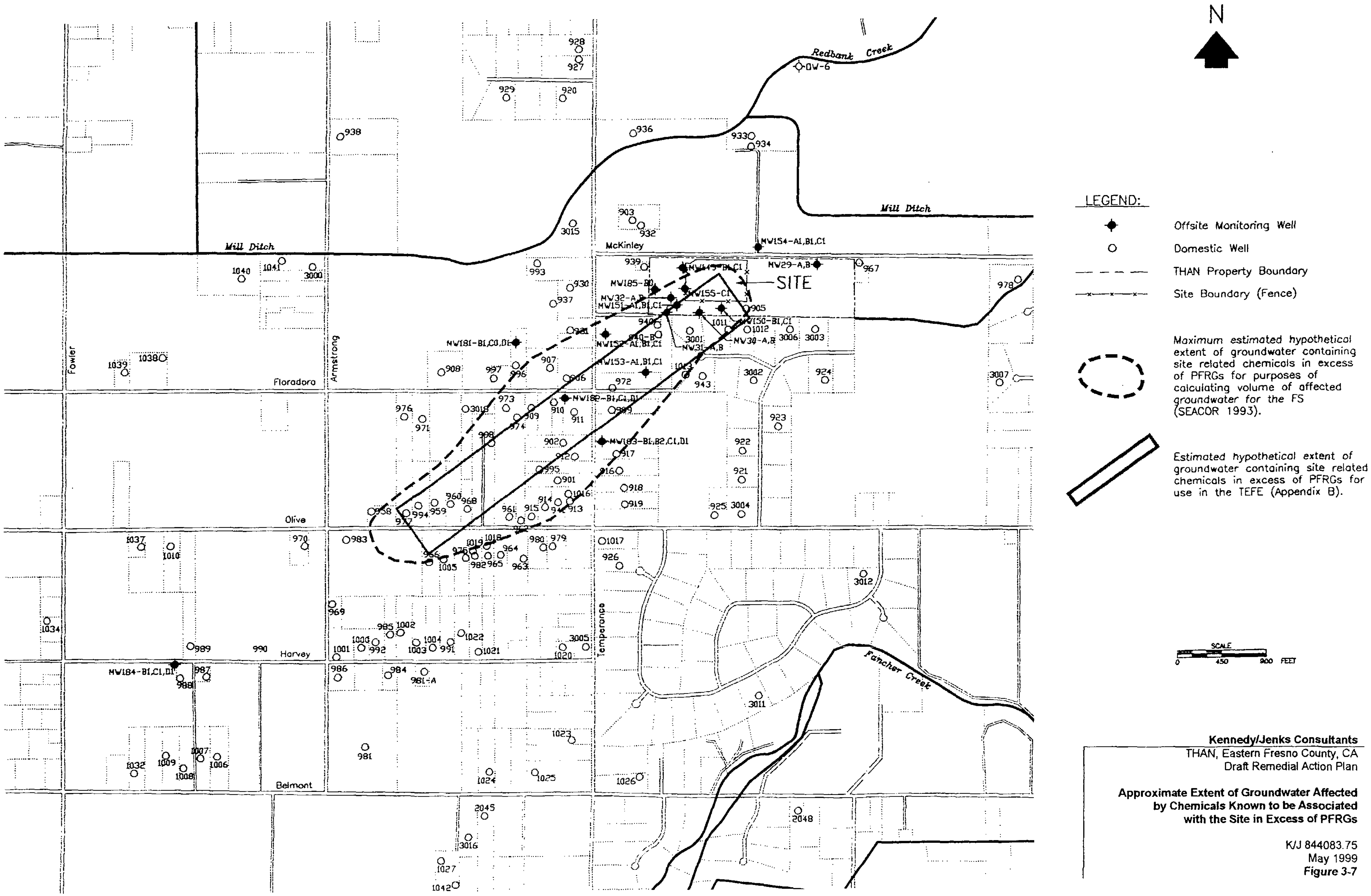
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Offsite Monitoring and Domestic Wells

K/J 844083.75
May 1999
Figure 3-6



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THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Approximate Extent of Groundwater Affected by Chemicals Known to be Associated with the Site in Excess of PFRGs

K/J 844083.75
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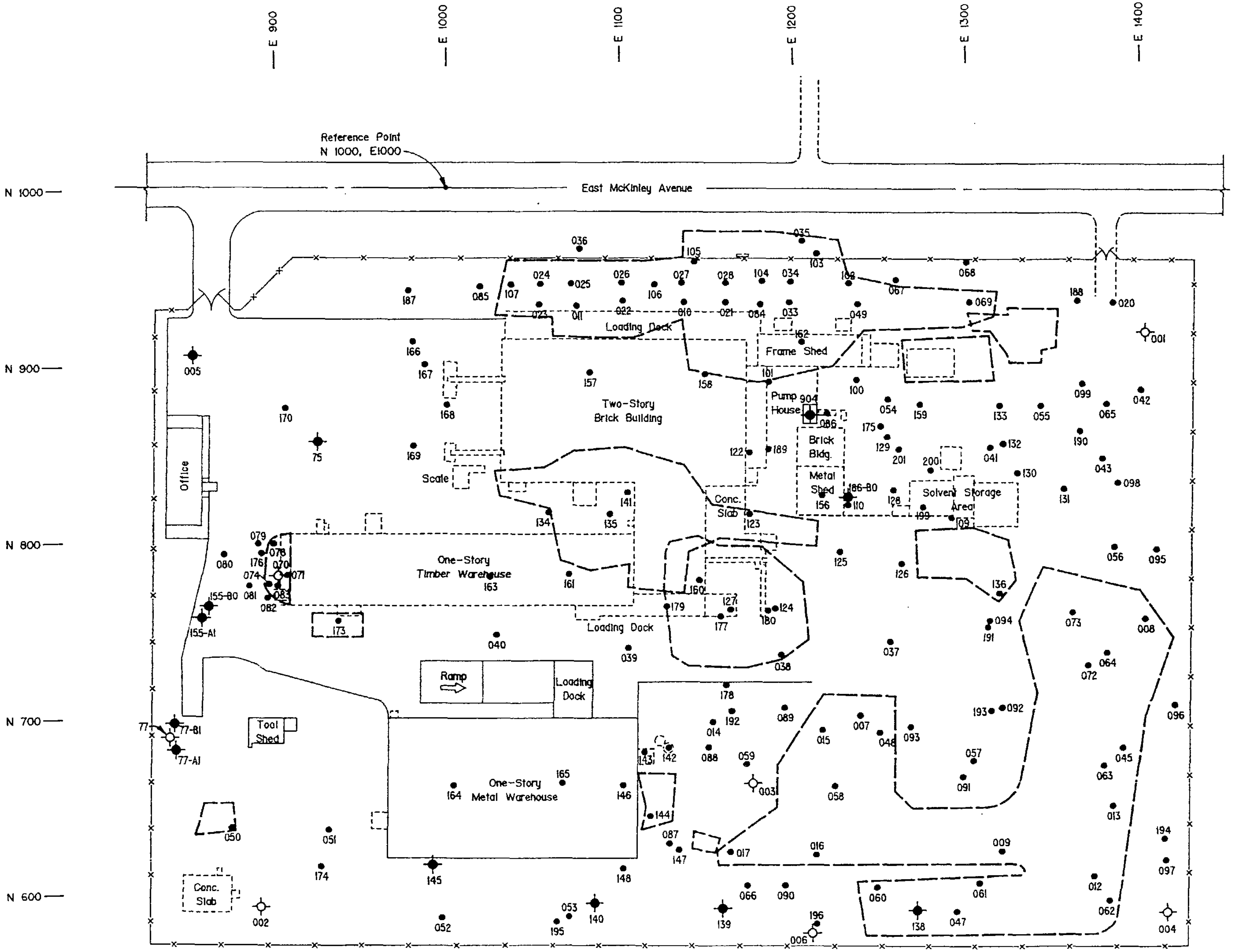
Figure 3-7



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M. FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- AREA OF EXCAVATION
- 131 BORING LOCATION AND IDENTIFICATION NUMBER
- DEMOLISHED STRUCTURE
- EXISTING STRUCTURE
- 139 EXISTING MONITORING WELL
- 77 MONITORING WELL NO LONGER IN SERVICE

NOTES:

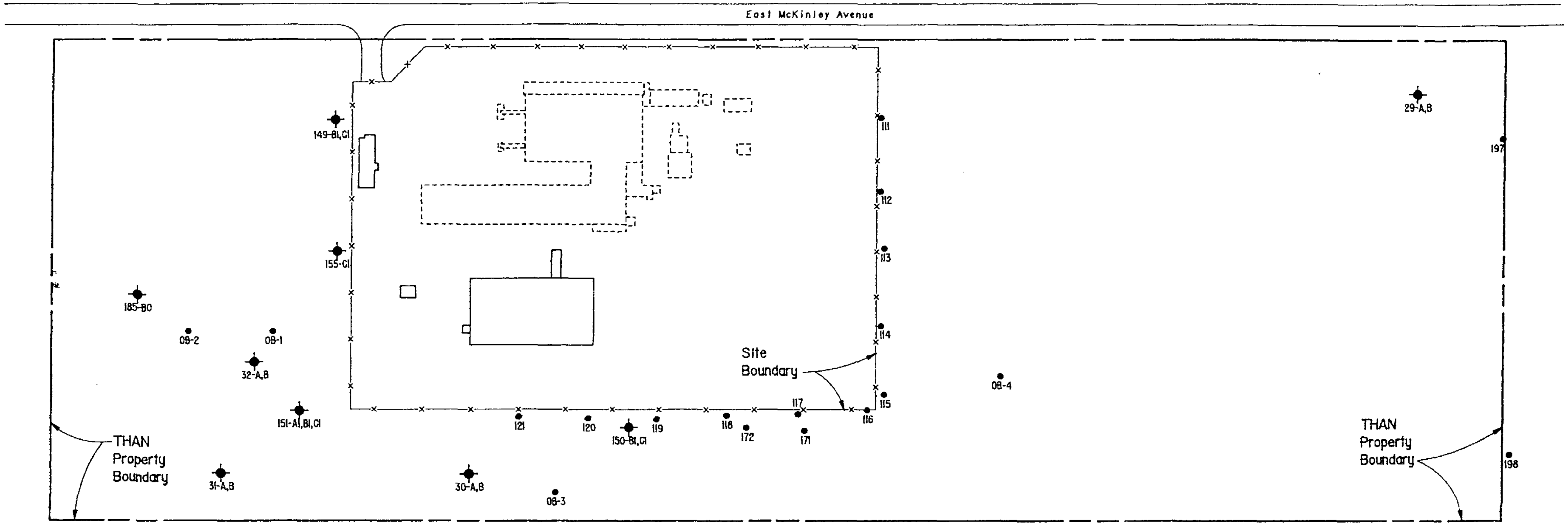
1. SOIL SAMPLES WERE COLLECTED AND ANALYZED FROM THE BORINGS SHOWN IN THIS FIGURE.
2. SOIL SAMPLES WERE COLLECTED AND ANALYZED FROM BORINGS WHERE MONITORING WELLS 1-6, 70 AND 155-BO WERE INSTALLED.

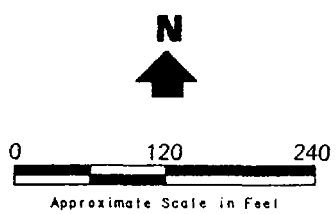
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Onsite Boring Locations

K/J 844083.75
May 1999
Figure 4-1





LEGEND:

PROPERTY BOUNDARY

SITE BOUNDARY

OB3 SOIL BORING LOCATION

30-A,B MONITORING WELL LOCATION

DEMOLISHED STRUCTURE

EXISTING STRUCTURE

NOTES:

1. THIS FIGURE SHOWS BORINGS IN THE OFFSITE ORCHARD FROM WHICH SAMPLES OF SOIL WERE COLLECTED AND ANALYZED.
2. THIS FIGURE SHOWS OFFSITE MONITORING WELLS LOCATED ON THAN PROPERTY.
3. ADDITIONAL BORING OR SAMPLE LOCATIONS ARE SHOWN ON FIGURE 4-1, AND 3-7 THROUGH 3-10.

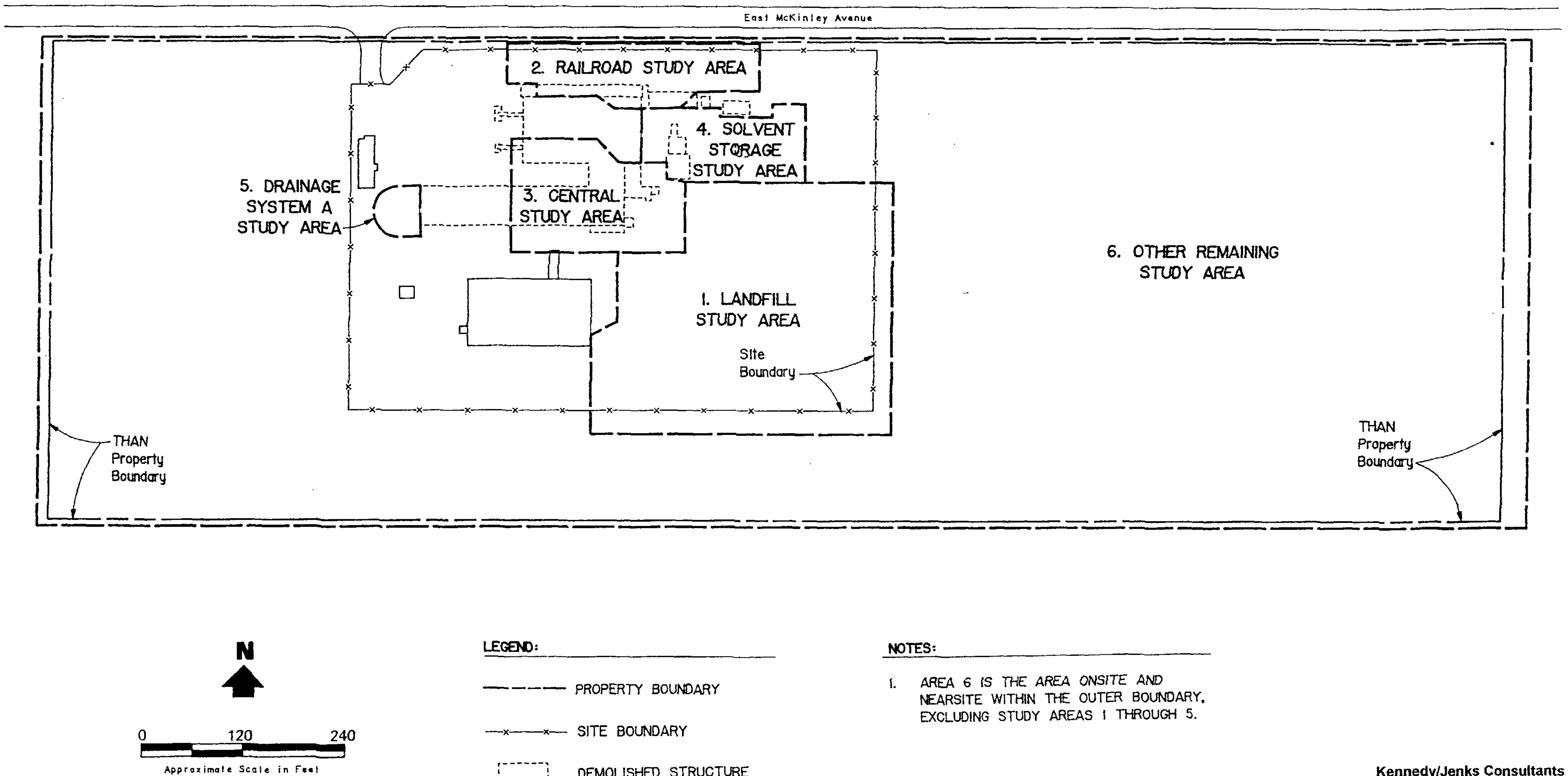
Source:
Remedial Investigation Summary Report, Kennedy/Jenks Consultants May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Nearsite Boring and Monitoring Well Locations

K/J 844083.75
May 1999
Figure 4-2



LEGEND:

- PROPERTY BOUNDARY
- SITE BOUNDARY
- DEMOLISHED STRUCTURE
- EXISTING STRUCTURE
- ONSITE AND NEARSITE STUDY AREAS

NOTES:

1. AREA 6 IS THE AREA ONSITE AND NEARSITE WITHIN THE OUTER BOUNDARY, EXCLUDING STUDY AREAS 1 THROUGH 5.

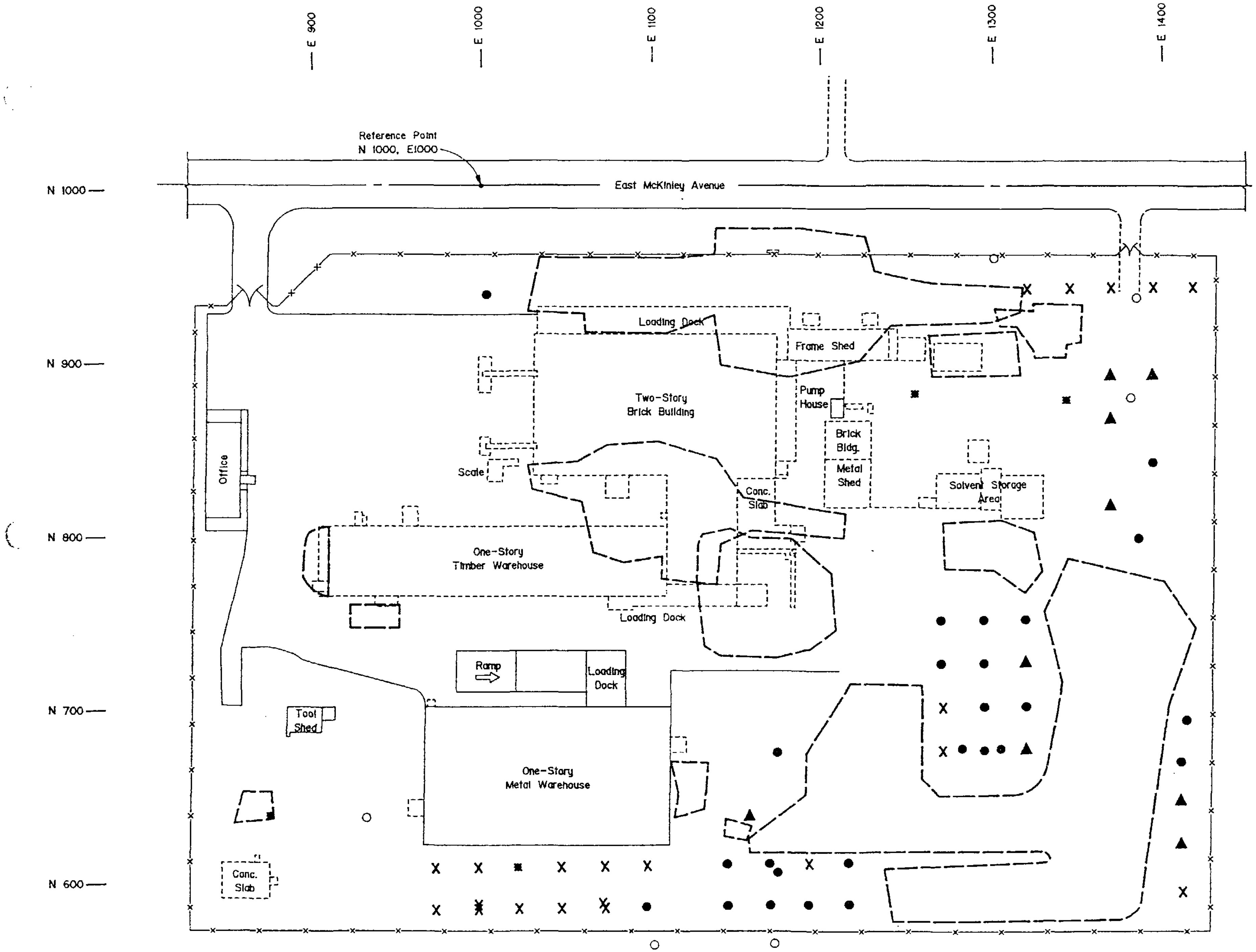
Source:
Remedial Investigation Summary Report, Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Onsite and Nearsite Study Area Locations

K/J 844083.75
May 1999
Figure 4-3



N

0 10 20 30 60 FT.
APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

EXISTING STRUCTURES

DEMOLISHED STRUCTURES

EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

○ 0.0008 - 1.0 mg/kg

✱ > 1.0 - 10 mg/kg

X > 10 - 100 mg/kg

● > 100 - 1000 mg/kg

▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. THIS FIGURE DOES NOT INCLUDE ALL OFFSITE DETECTIONS LOCATED IN STUDY AREA 6.
3. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DDT AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

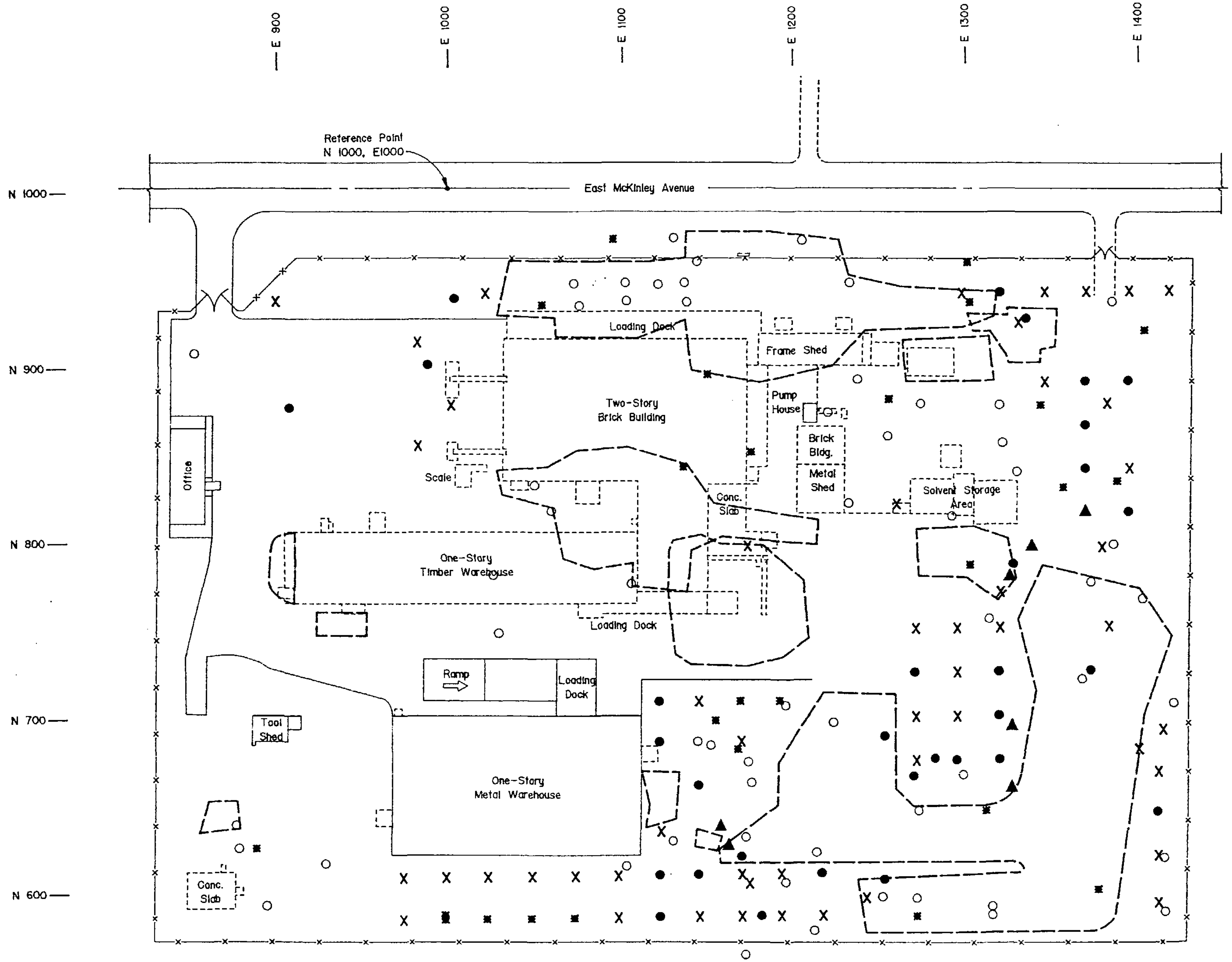
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

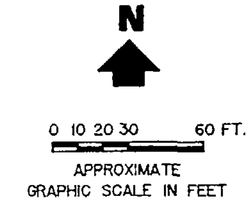
Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of the Sum of DDT, DDD, and DDE at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-4





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0008 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. THIS FIGURE DOES NOT INCLUDE ALL DETECTIONS LOCATED IN STUDY AREA 6.
3. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DDT AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

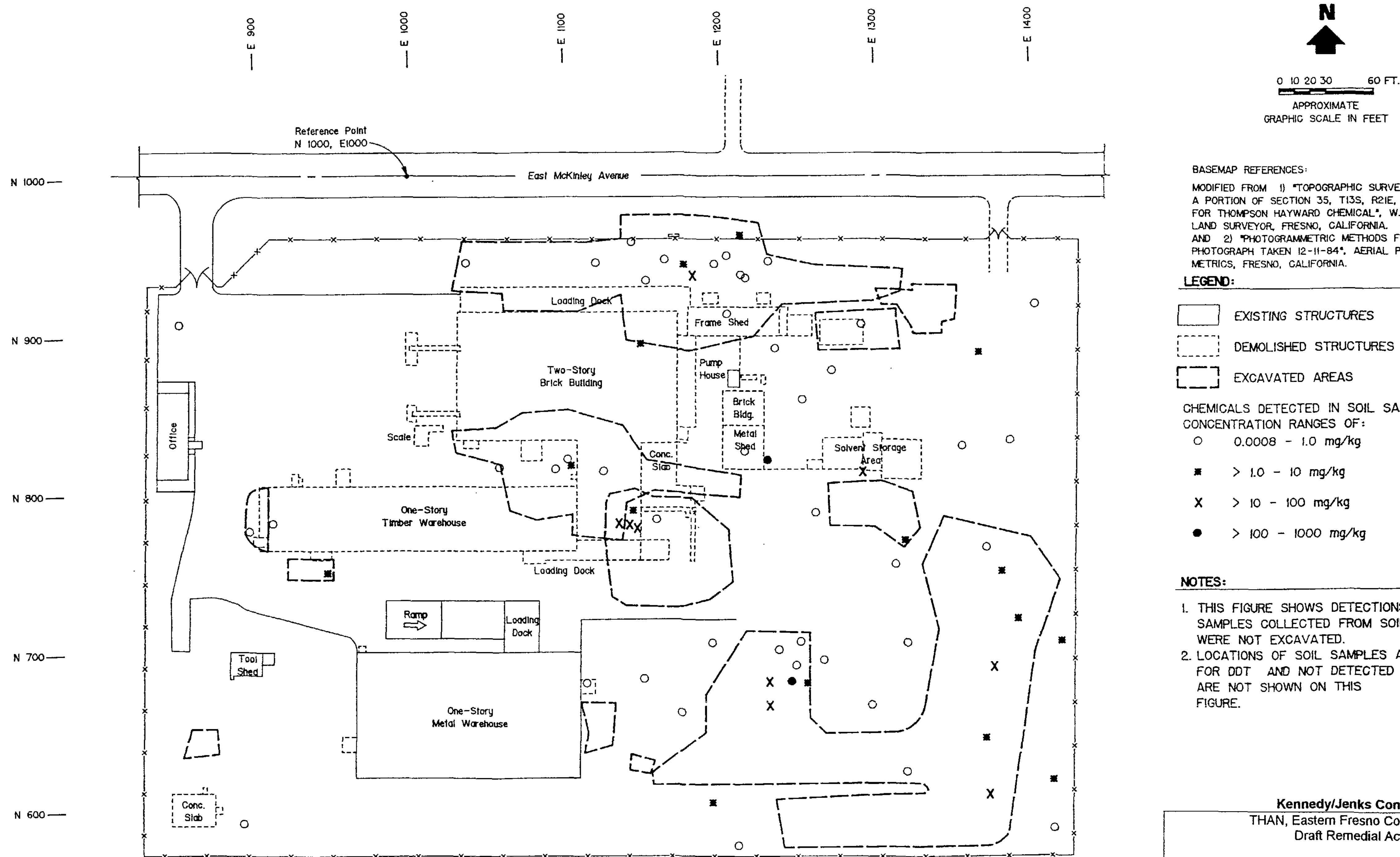
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of the Sum of DDT, DDD, and DDE at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-5



BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0008 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DDT AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

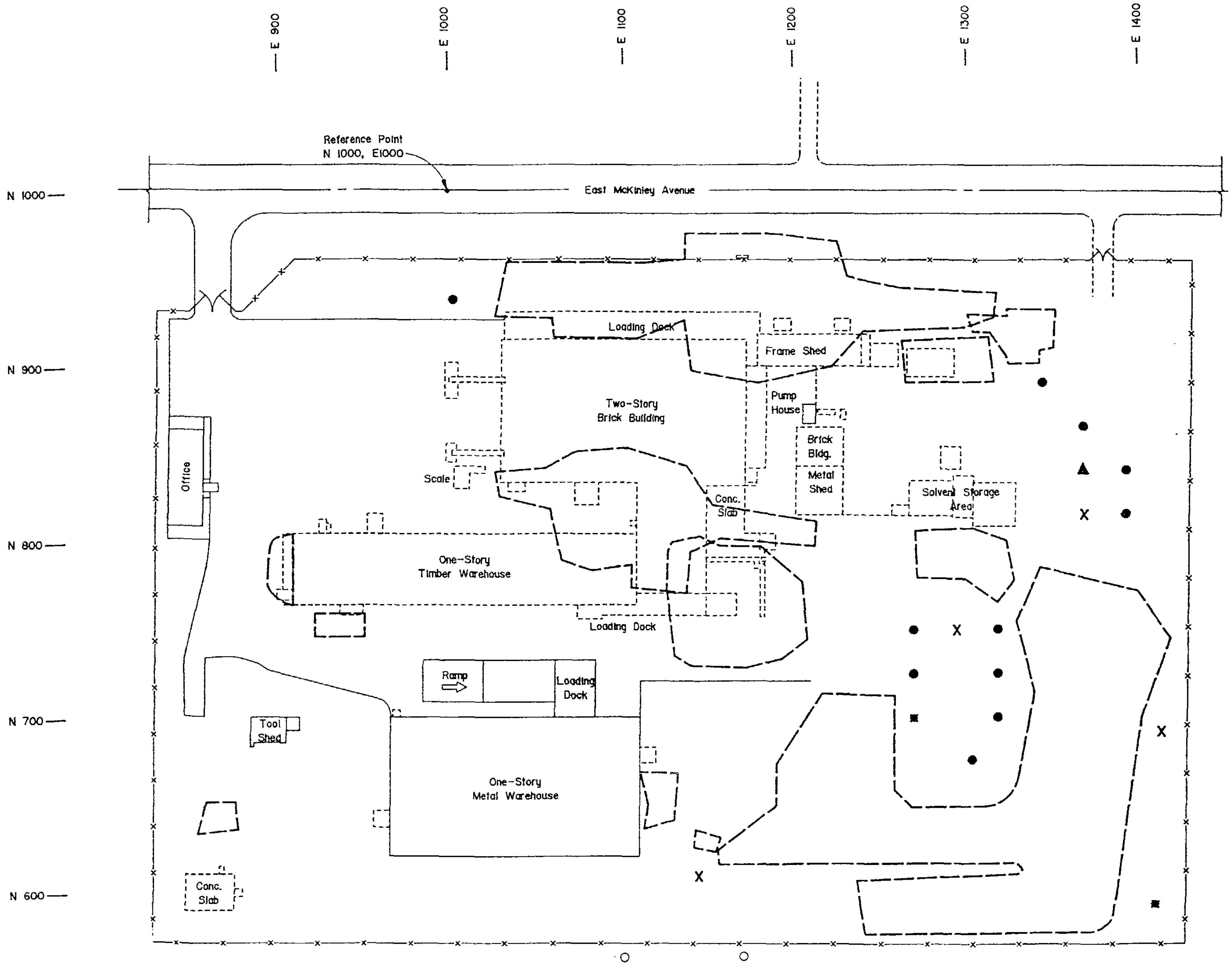
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

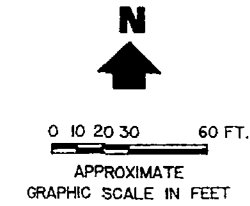
Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of the Sum of DDT, DDD, and DDE at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-6





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. THIS FIGURE DOES NOT INCLUDE ALL OFFSITE DETECTIONS LOCATED IN STUDY AREA 6.
3. LOCATIONS OF SOIL SAMPLES ANALYZED FOR TOXAPHENE AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

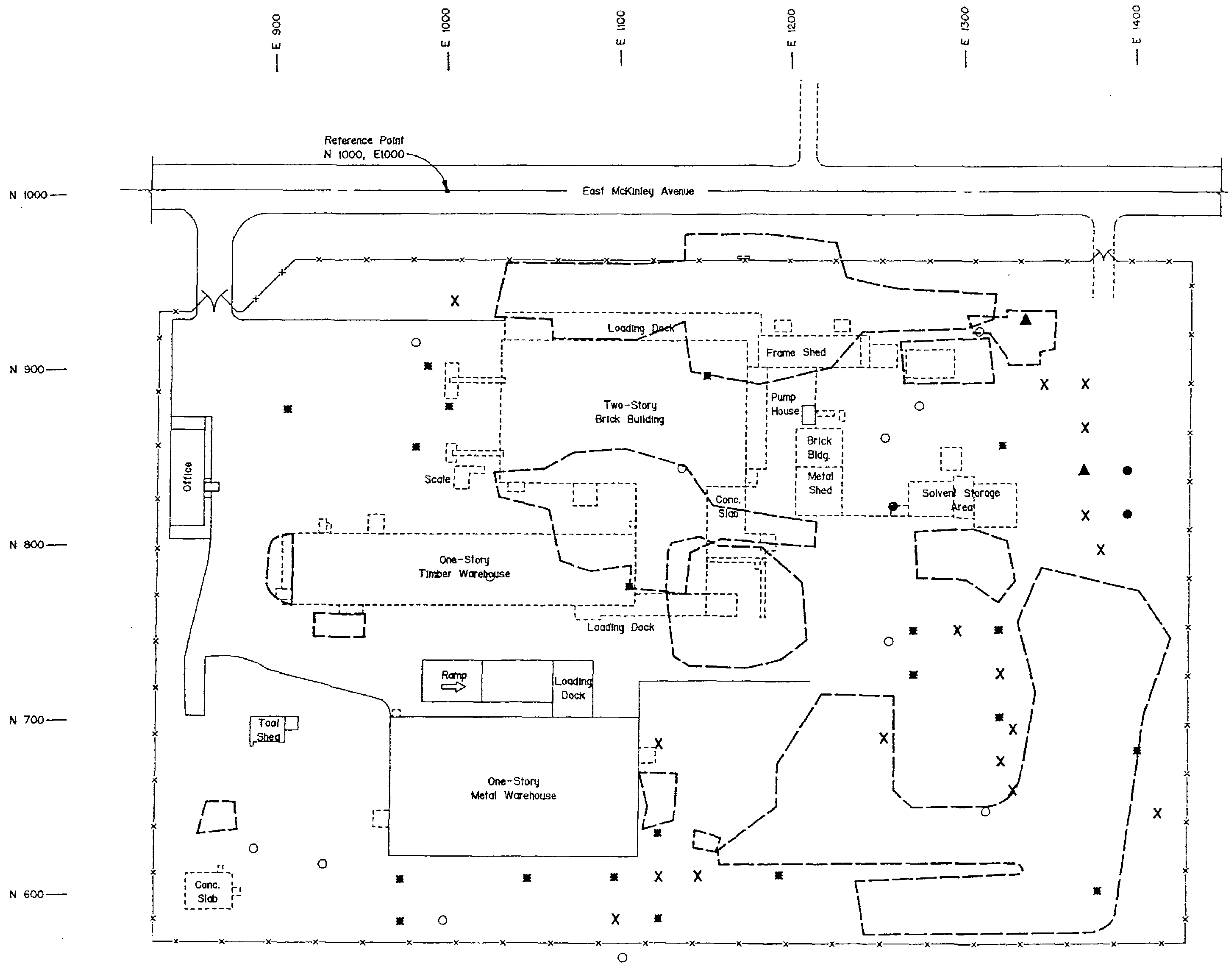
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Toxaphene at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-7



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. THIS FIGURE DOES NOT INCLUDE ALL DETECTIONS LOCATED IN STUDY AREA 6.
3. LOCATIONS OF SOIL SAMPLES ANALYZED FOR TOXAPHENE AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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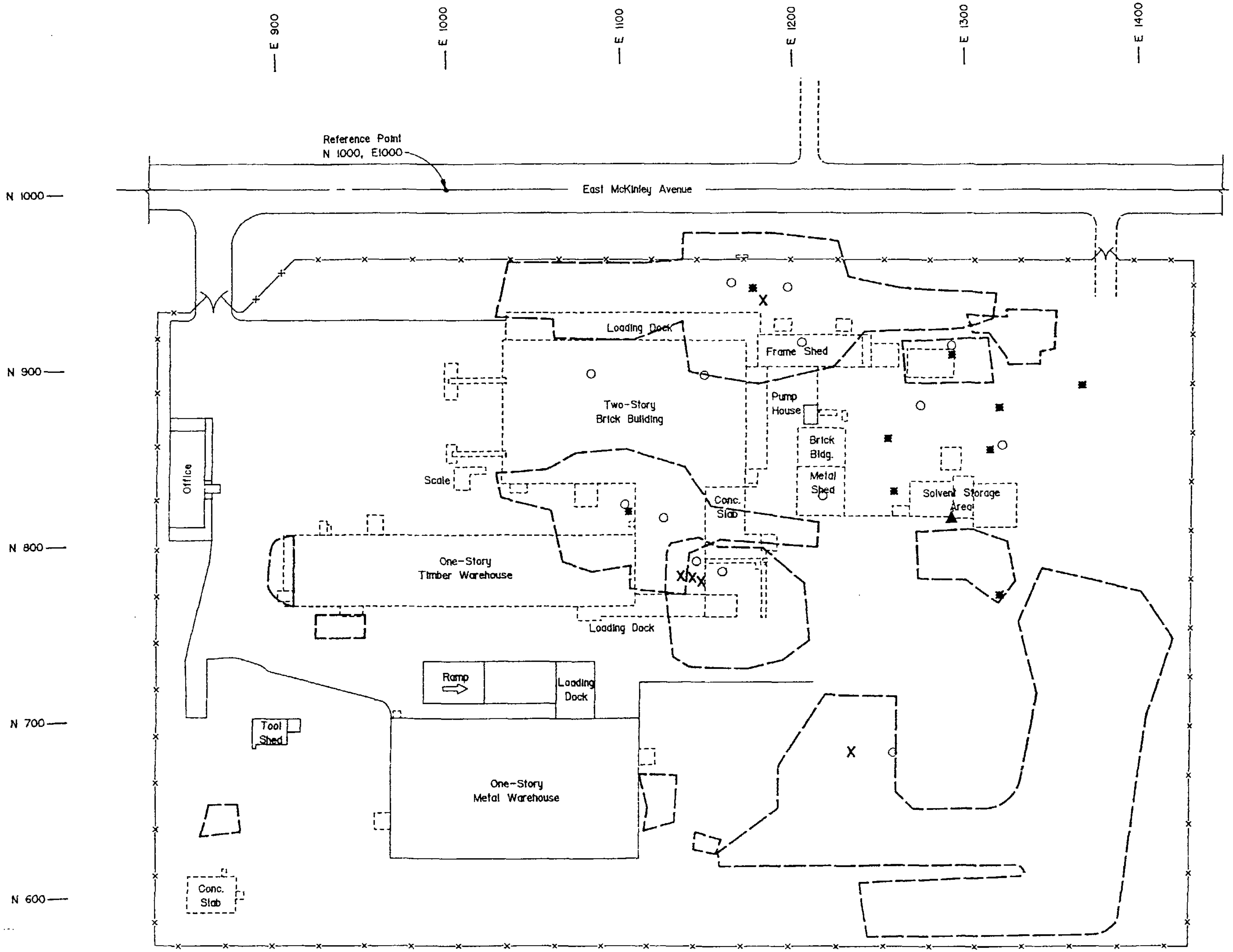
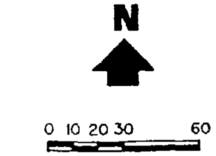
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Toxaphene at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-8





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M. FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982. AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR TOXAPHENE AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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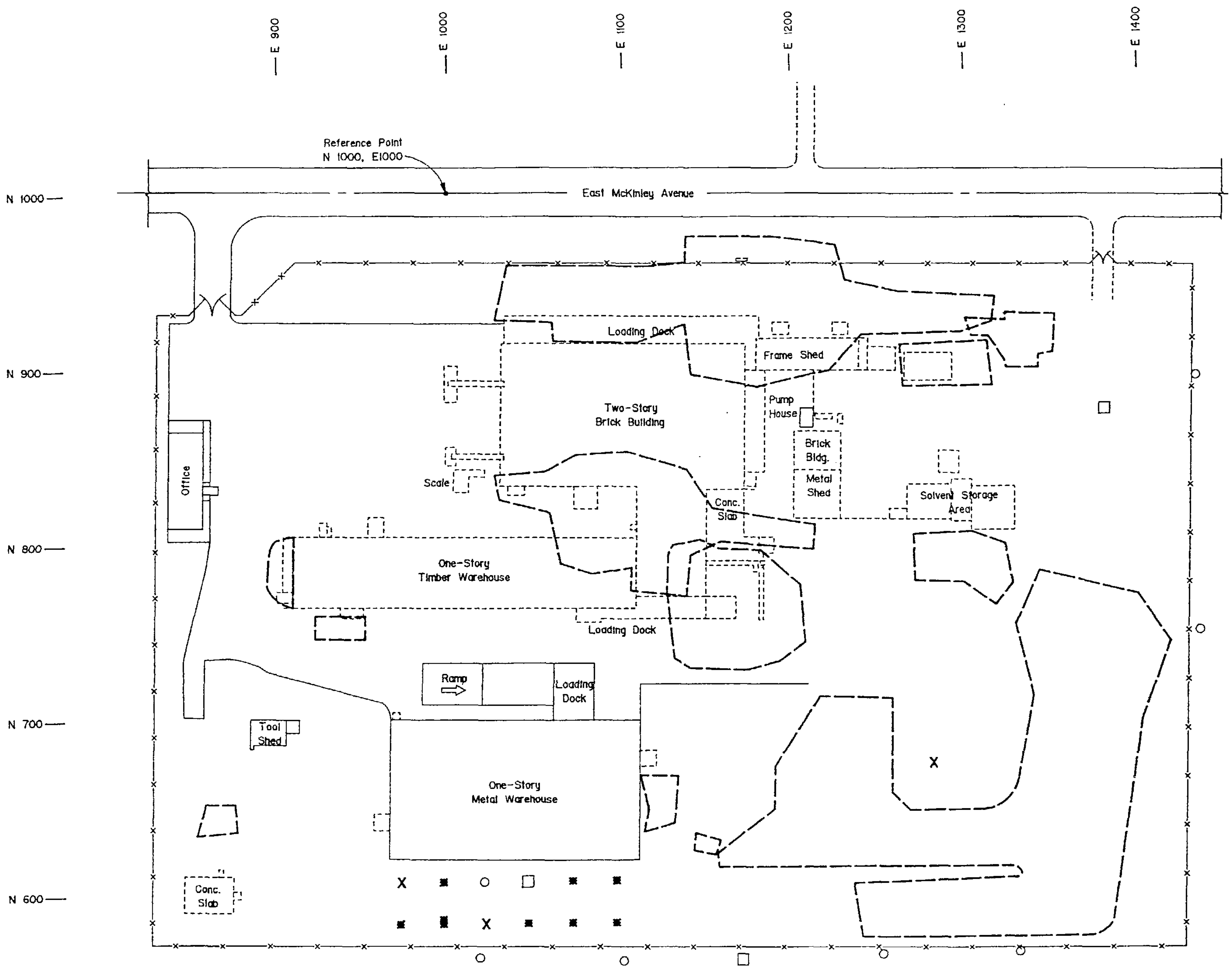
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Toxaphene at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-9



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M. FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0008 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DIELDRIN AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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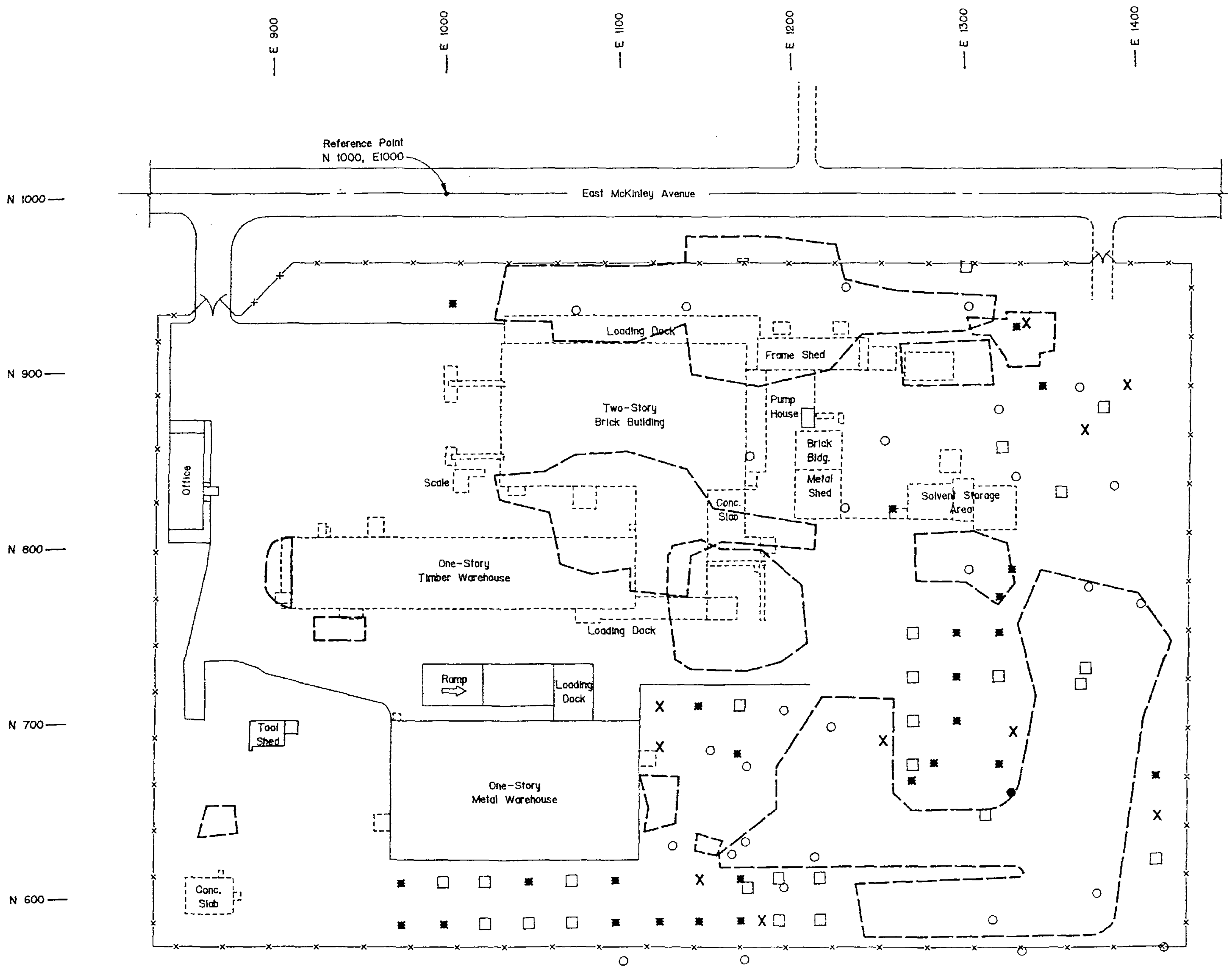
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Dieldrin at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-10



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

EXISTING STRUCTURES

DEMOLISHED STRUCTURES

EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

○ 0.0008 – 0.1 mg/kg

□ > 0.1 – 1.0 mg/kg

✱ > 1.0 – 10 mg/kg

X > 10 – 100 mg/kg

● > 100 – 1000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DIELDRIN AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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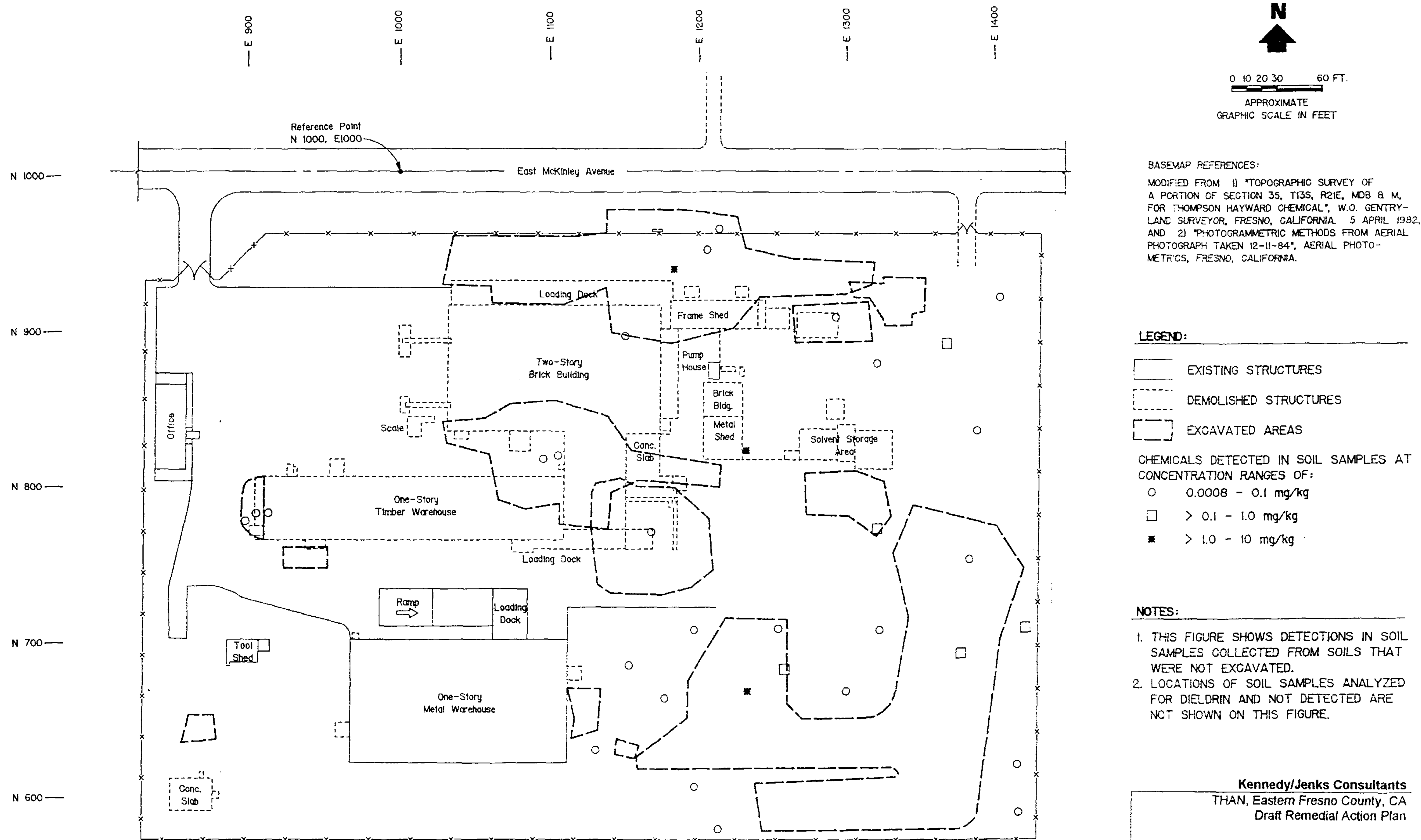
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Dieldrin at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-11



Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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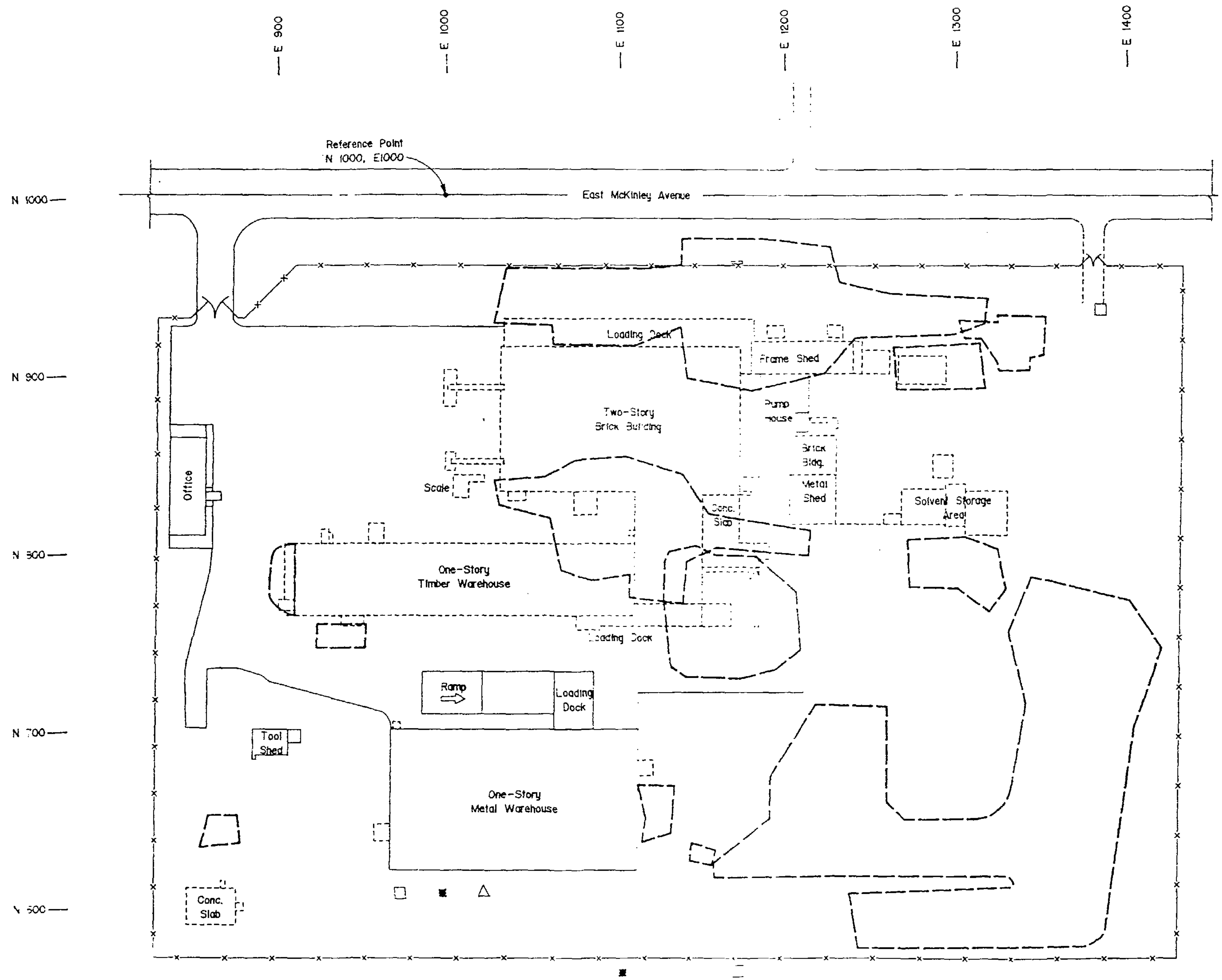
Distribution of Dieldrin at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-12



BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M. FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0004 - 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ORGANOCHLORINE COMPOUNDS AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. ORGANOCHLORINES = SUM OF ORGANOCHLORINE COMPOUNDS (EPA METHOD 8080) EXCEPT DDD, DDE, DDT, TOXAPHENE, & DIELDRIN.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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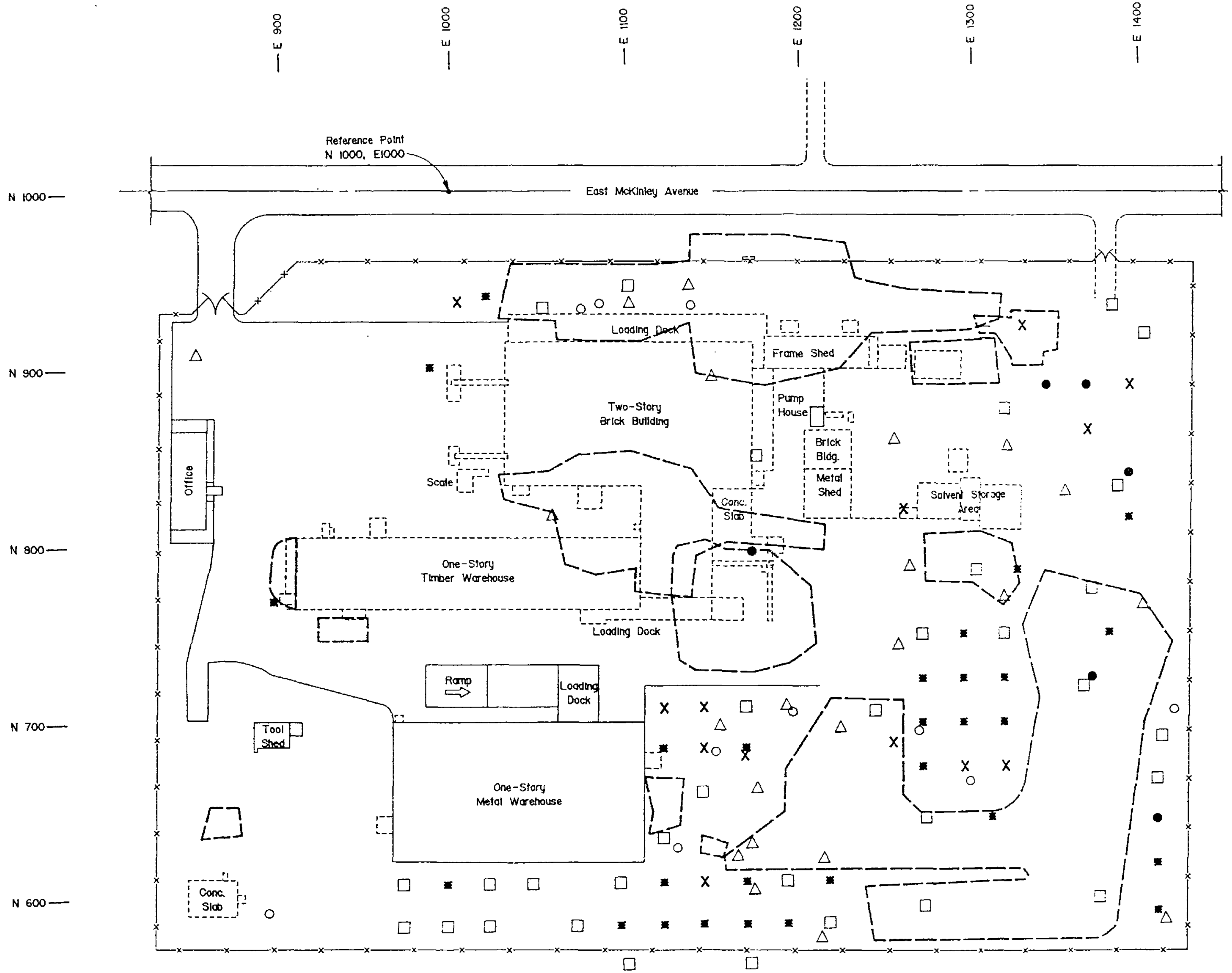
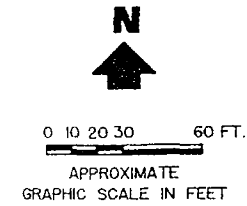
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Other Organochlorines at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-13





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0004 - 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100-1000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ORGANOCHLORINE COMPOUNDS AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. ORGANOCHLORINES = SUM OF ORGANOCHLORINE COMPOUNDS (EPA METHOD 8080) EXCEPT DDD, DDE, DDT, TOXAPHENE, & DIELDRIN.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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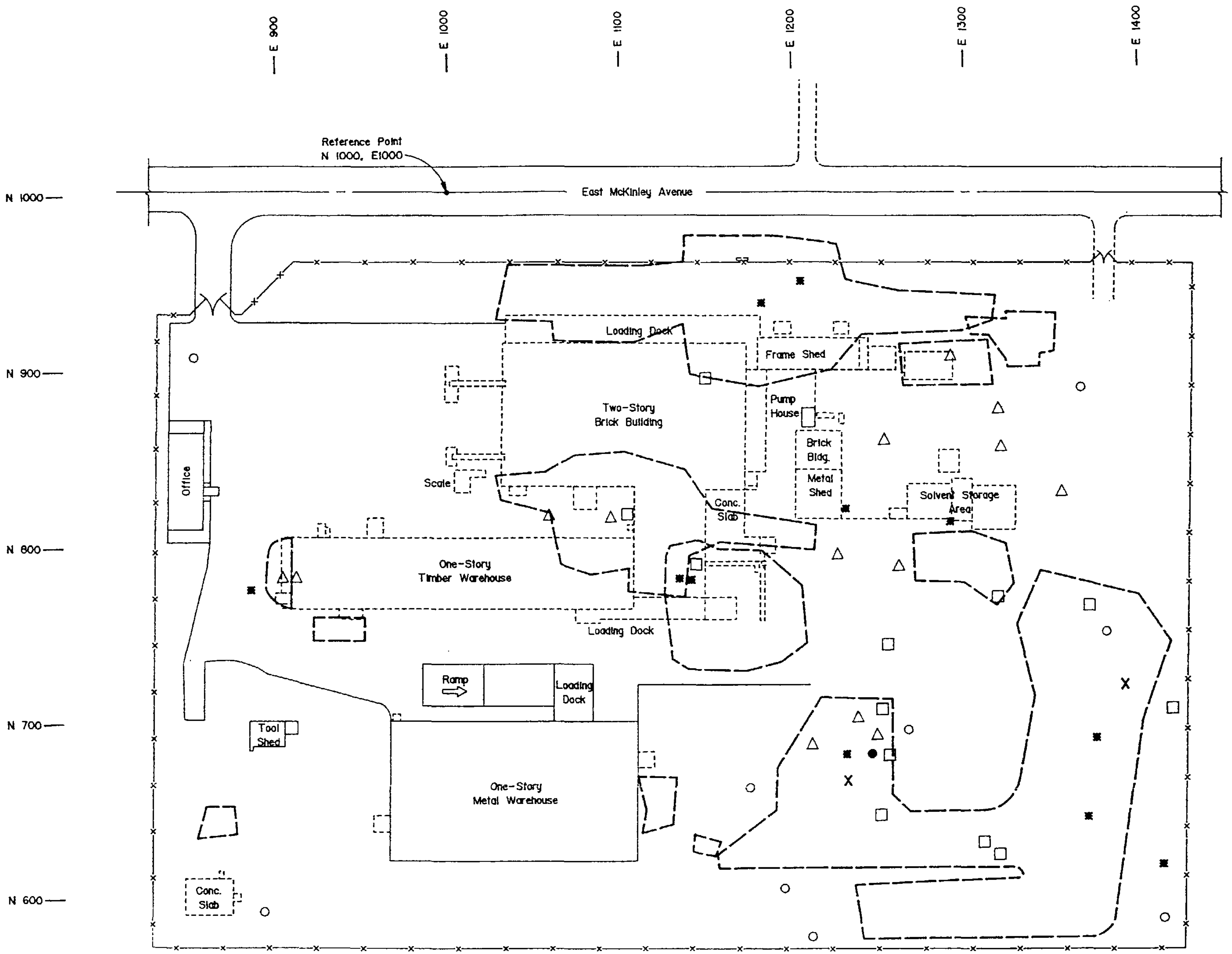
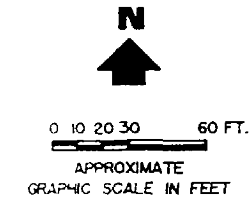
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Other Organochlorines at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-14





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.0004 - 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100-1000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ORGANOCHLORINE COMPOUNDS AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. ORGANOCHLORINES = SUM OF ORGANOCHLORINE COMPOUNDS (EPA METHOD 8080) EXCEPT DDD, DDE, DDT, TOXAPHENE, & DIELDRIN.

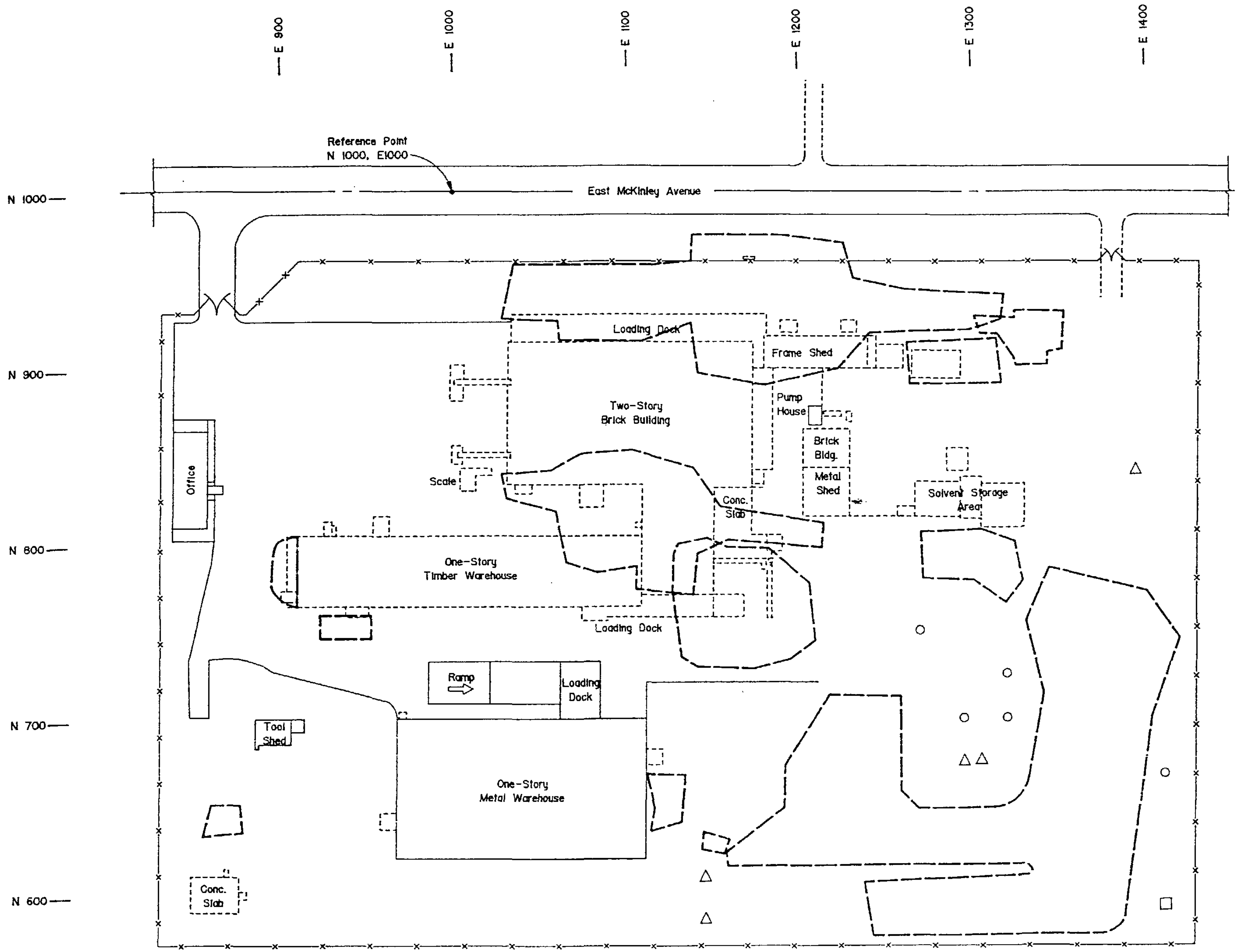
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

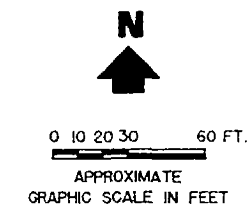
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Other Organochlorines at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-15



Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993



BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.001 – 0.01 mg/kg
- △ > 0.01 – 0.1 mg/kg
- □ > 0.1 – 1.0 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DBCP AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

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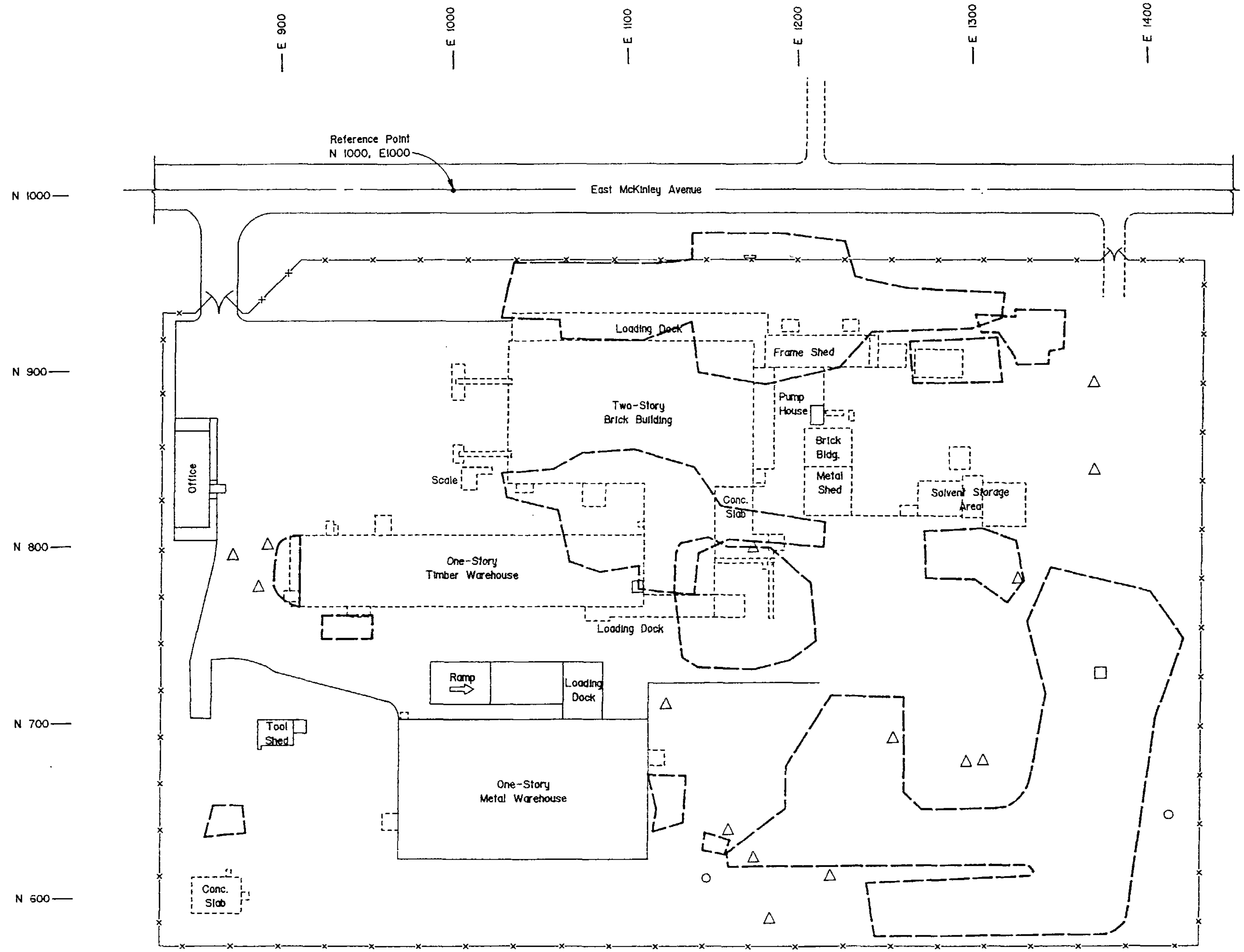
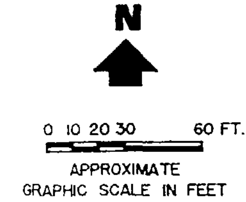
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of DBCP at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-16





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.001 - 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DBCP AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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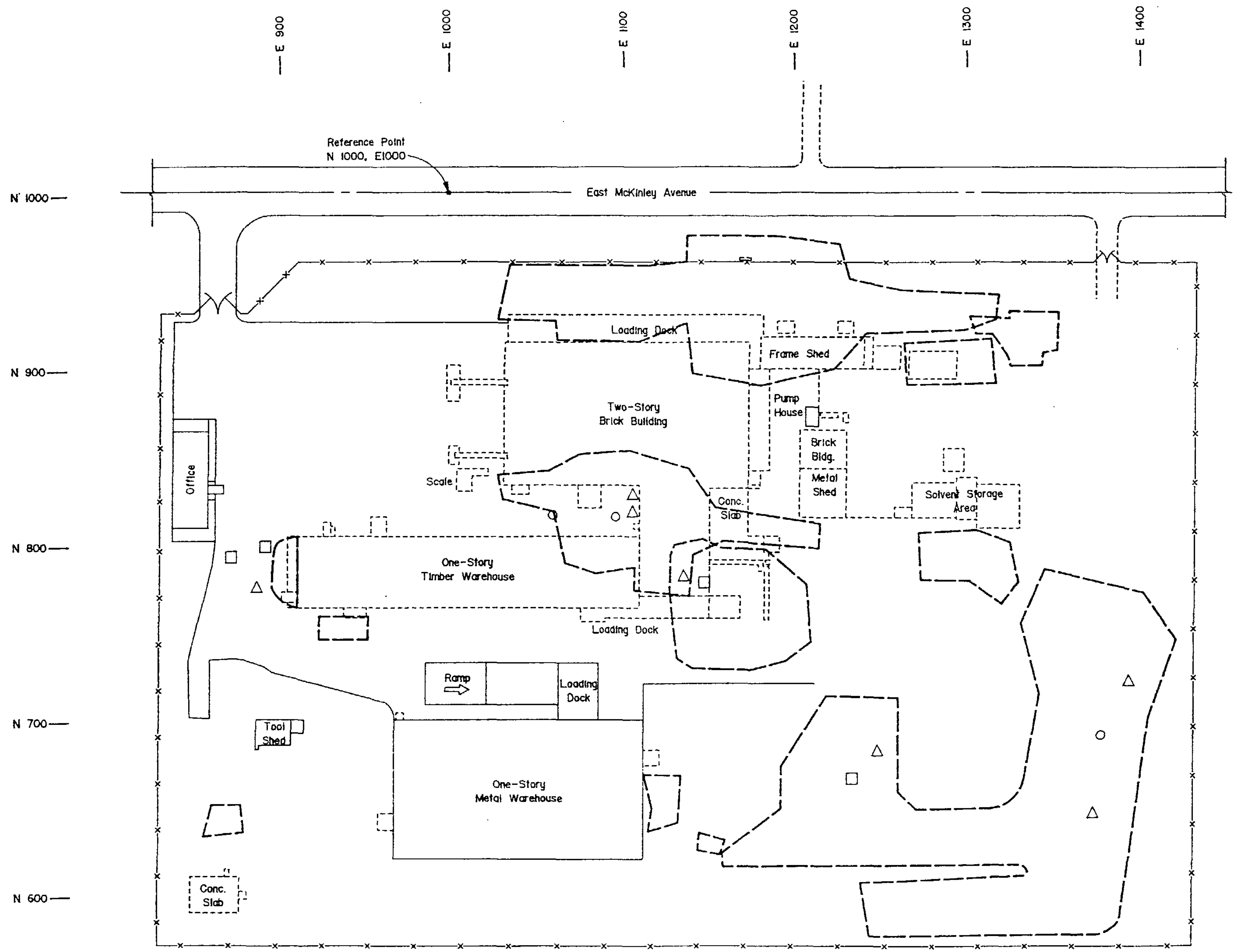
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of DBCP at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-17



BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.001 - 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg
- □ > 0.1 - 1.0 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR DBCP AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

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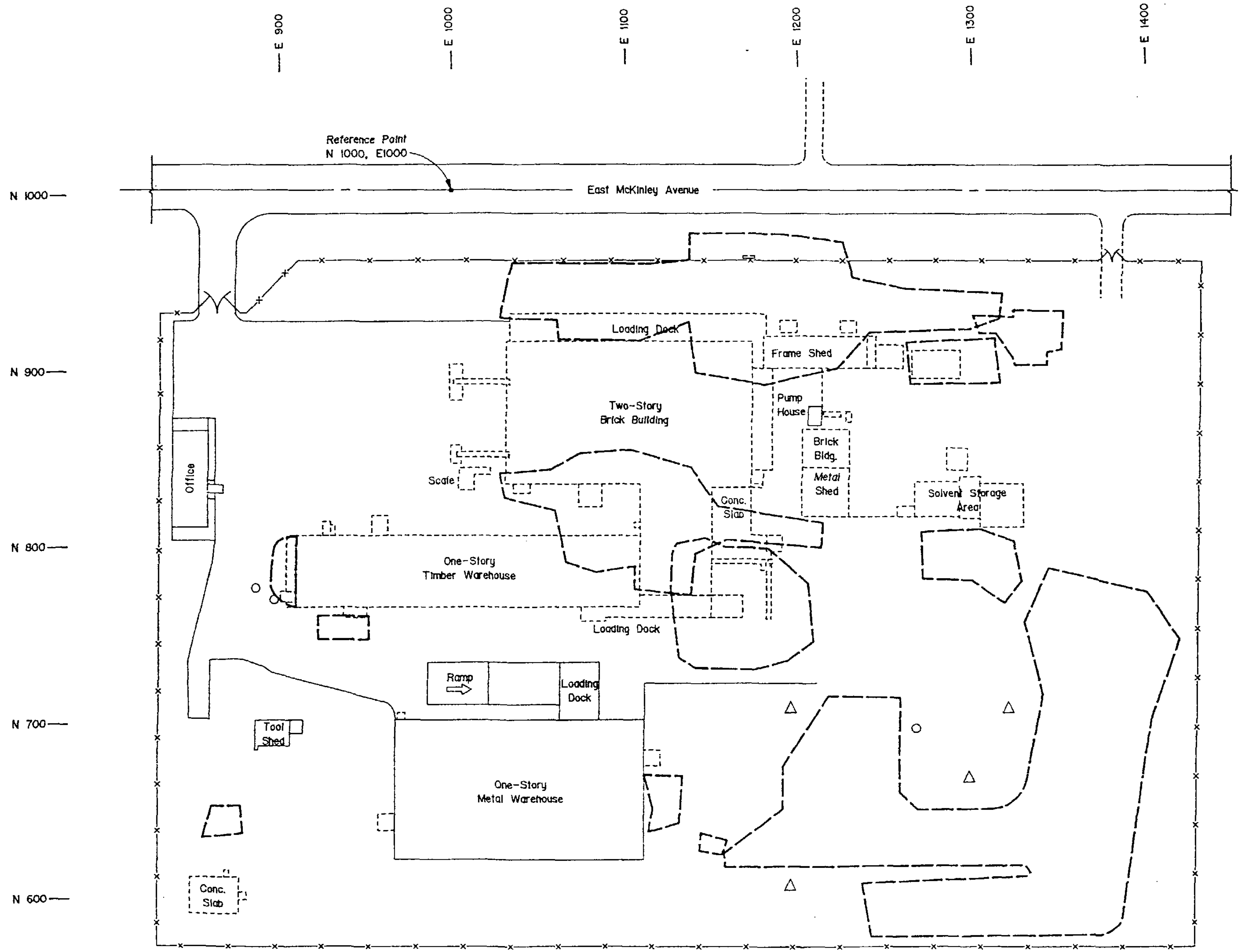
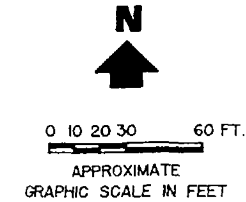
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of DBCP at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-18





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982. AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 mg/kg
- △ > 0.01 - 0.1 mg/kg

NOTES:

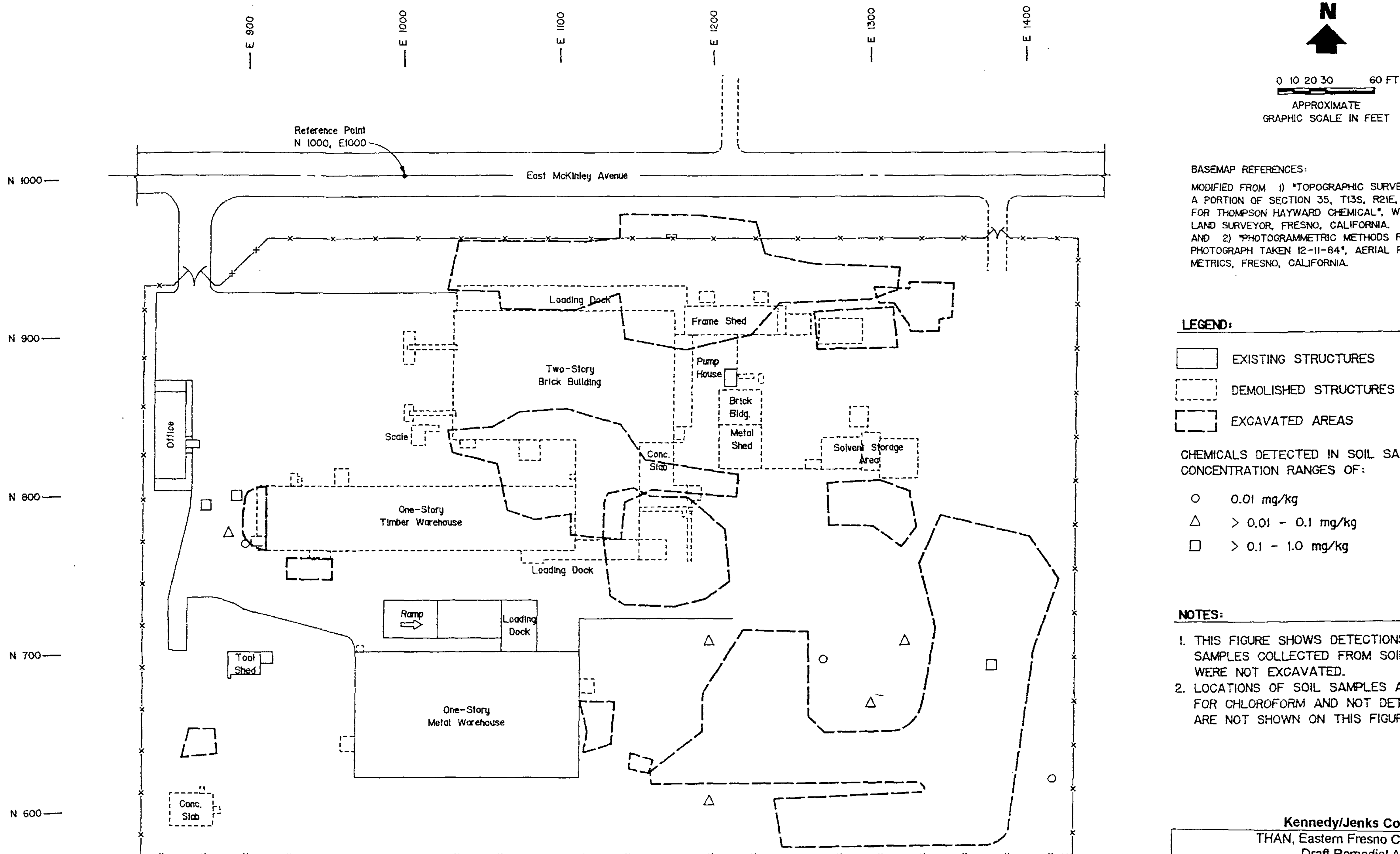
1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR CHLOROFORM AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Chloroform at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-19



BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

EXISTING STRUCTURES

DEMOLISHED STRUCTURES

EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

○ 0.01 mg/kg

△ > 0.01 - 0.1 mg/kg

□ > 0.1 - 1.0 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR CHLOROFORM AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.

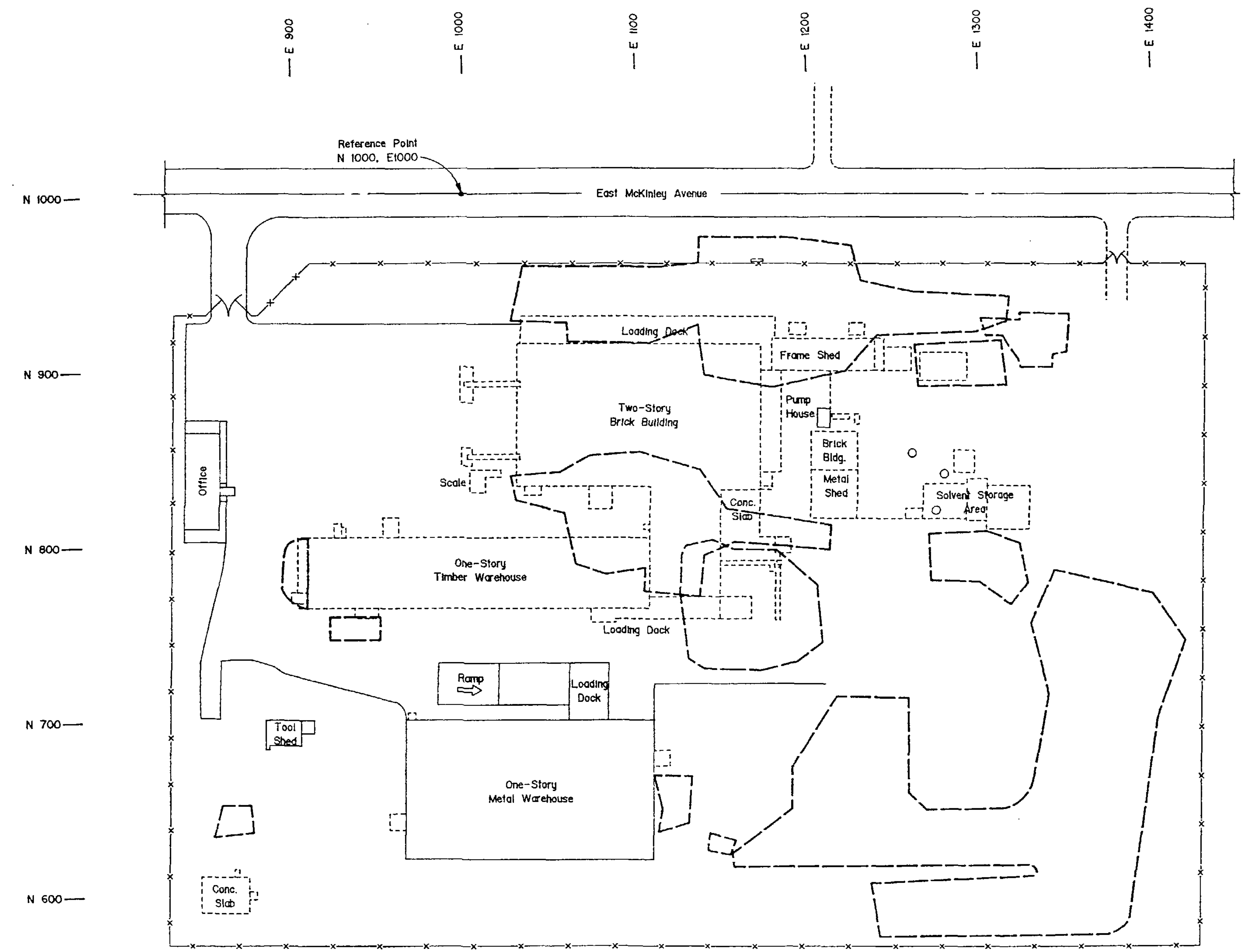
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

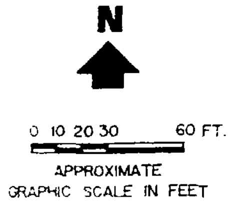
Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Distribution of Chloroform at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-20





BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

EXISTING STRUCTURES

DEMOLISHED STRUCTURES

EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

○ 0.01 – 1.0 mg/kg

NOTES:

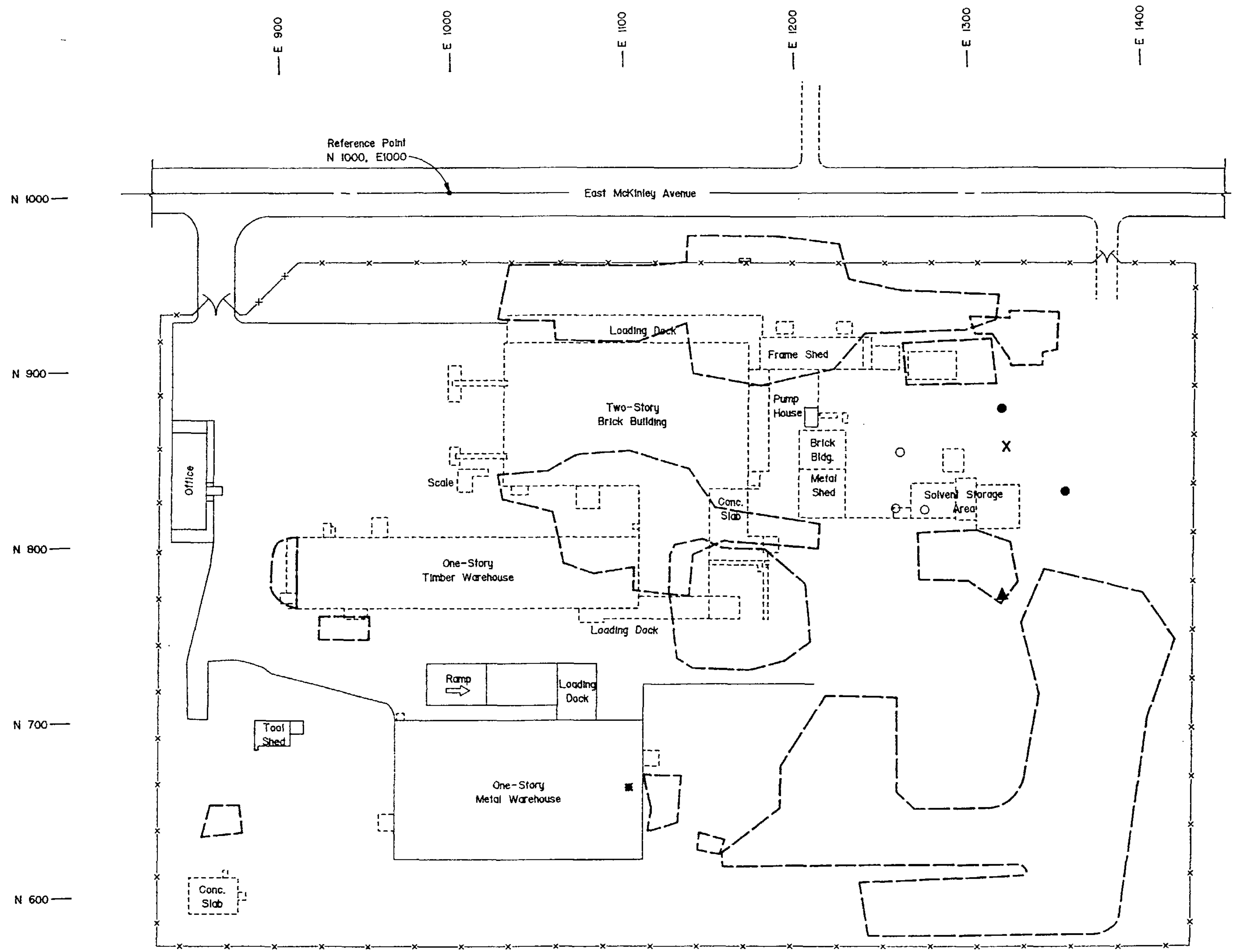
1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED PRIOR TO 1990 FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ETHYLBENZENE AND XYLENES AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. CONCENTRATIONS POSTED ARE A SUMMATION OF ETHYLBENZENE AND XYLENES CONCENTRATIONS.
4. CONCENTRATIONS DO NOT REFLECT CURRENT CONDITIONS BECAUSE REMEDIATION OF SOIL USING VAPOR EXTRACTION IN 1991 TO 1993 SUBSTANTIALLY REDUCED THE CONCENTRATION OF XYLENE AND ETHYLBENZENE IN THE AREAS REMEDIATED.

Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Past Distribution of Ethylbenzene and Xylenes at Depths of 0-1 Feet

K/J 844083.75
May 1999
Figure 4-21



N

0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED PRIOR TO 1990 FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ETHYLBENZENE AND XYLENES AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. CONCENTRATIONS POSTED ARE A SUMMATION OF ETHYLBENZENE AND XYLENES CONCENTRATIONS.
4. CONCENTRATIONS DO NOT REFLECT CURRENT CONDITIONS BECAUSE REMEDIATION OF SOIL USING VAPOR EXTRACTION IN 1991 TO 1993 SUBSTANTIALLY REDUCED THE CONCENTRATION OF XYLENE AND ETHYLBENZENE IN THE AREAS REMEDIATED.

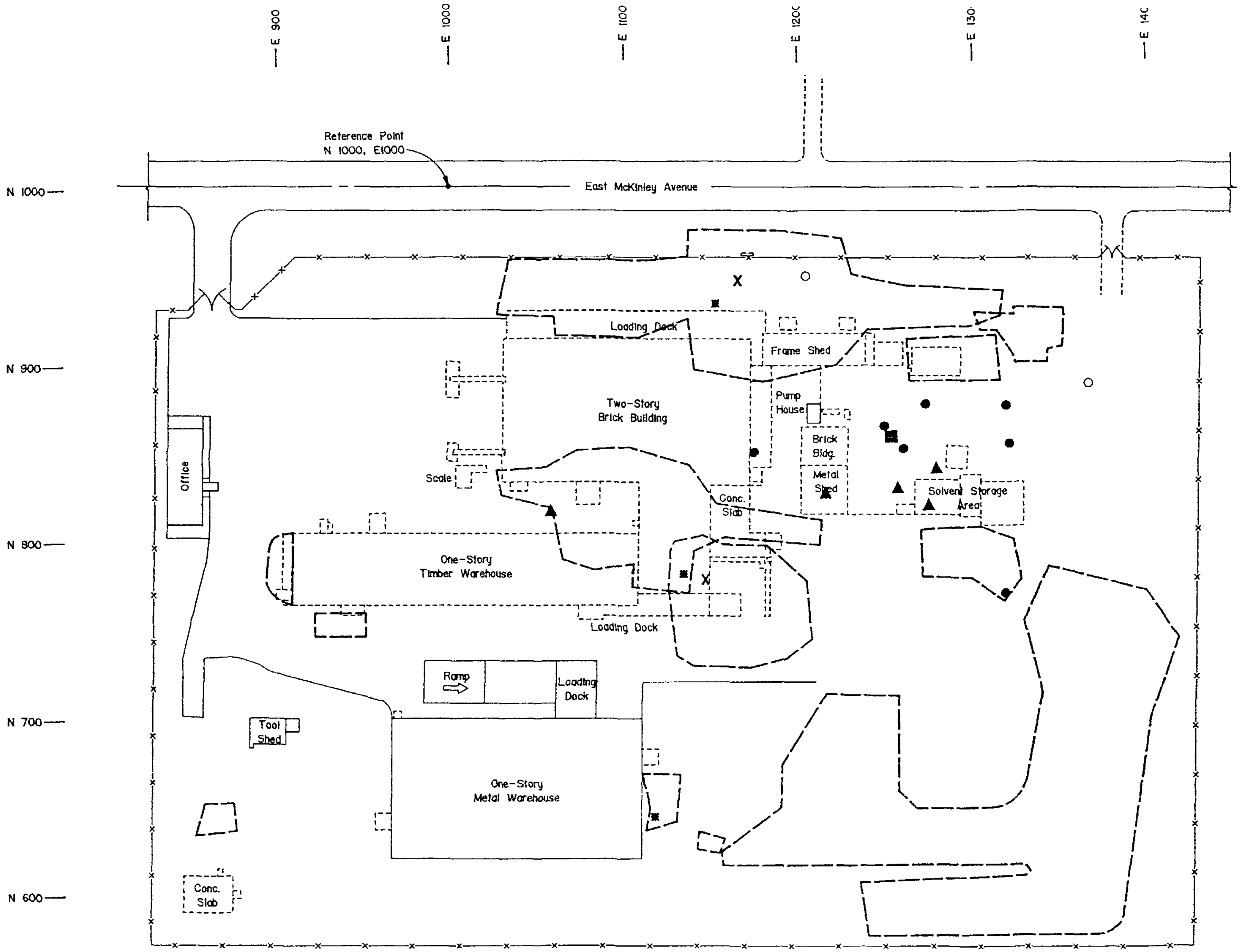
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Past Distribution of Ethylbenzene and Xylenes at Depths of 1-12 Feet

K/J 844083.75
May 1999
Figure 4-22



0 10 20 30 60 FT.

APPROXIMATE
GRAPHIC SCALE IN FEET

BASEMAP REFERENCES:

MODIFIED FROM 1) "TOPOGRAPHIC SURVEY OF A PORTION OF SECTION 35, T13S, R21E, MDB & M, FOR THOMPSON HAYWARD CHEMICAL", W.O. GENTRY-LAND SURVEYOR, FRESNO, CALIFORNIA. 5 APRIL 1982, AND 2) "PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPH TAKEN 12-11-84", AERIAL PHOTO-METRICS, FRESNO, CALIFORNIA.

LEGEND:

- EXISTING STRUCTURES
- DEMOLISHED STRUCTURES
- EXCAVATED AREAS

CHEMICALS DETECTED IN SOIL SAMPLES AT CONCENTRATION RANGES OF:

- ○ 0.01 - 1.0 mg/kg
- ✱ > 1.0 - 10 mg/kg
- X > 10 - 100 mg/kg
- ● > 100 - 1000 mg/kg
- ▲ > 1000 - 10,000 mg/kg
- ■ > 10,000 - 100,000 mg/kg

NOTES:

1. THIS FIGURE SHOWS DETECTIONS IN SOIL SAMPLES COLLECTED PRIOR TO 1990 FROM SOILS THAT WERE NOT EXCAVATED.
2. LOCATIONS OF SOIL SAMPLES ANALYZED FOR ETHYLBENZENE AND XYLENES AND NOT DETECTED ARE NOT SHOWN ON THIS FIGURE.
3. CONCENTRATIONS POSTED ARE A SUMMATION OF *ETHYLBENZENE AND XYLENES CONCENTRATIONS.*
4. CONCENTRATIONS DO NOT REFLECT CURRENT CONDITIONS BECAUSE REMEDIATION OF SOIL USING VAPOR EXTRACTION IN 1991 TO 1993 SUBSTANTIALLY REDUCED THE CONCENTRATION OF XYLENE AND ETHYLBENZENE IN THE AREAS REMEDIATED.

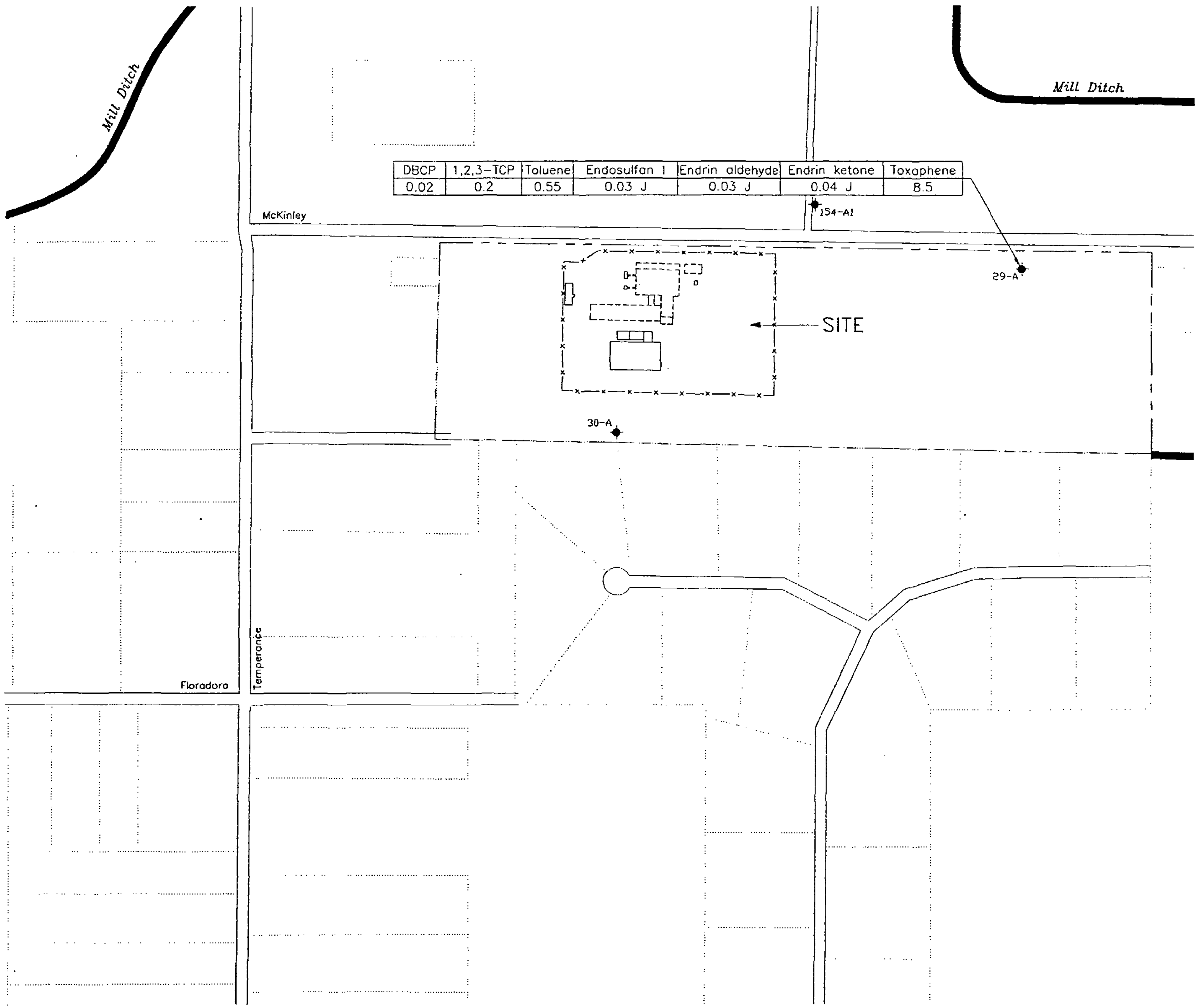
Source:
Remedial Investigation Summary Report,
Kennedy/Jenks Consultants
May, 1993

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Past Distribution of Ethylbenzene and Xylenes at Depths Greater Than 12 Feet

K/J 844083.75
May 1999
Figure 4-23



DBCP	1,2,3-TCP	Toluene	Endosulfan I	Endrin aldehyde	Endrin ketone	Toxaphene
0.02	0.2	0.55	0.03 J	0.03 J	0.04 J	8.5

LEGEND:

Groundwater Monitoring Well

Former Building Location

THAN Property Boundary

Site Boundary (Fence)

		ADWL
DBCP	Dibromochloropropane	0.2
1,2,3-TCP	1,2,3-Trichloropropane	NA
	Toluene	150
	Endosulfan I	74
	Endrin aldehyde	NA
	Endrin ketone	NA
	Toxaphene	3

NOTES:

1. All measurements and ADWLs (Acceptable Drinking Water Levels) in micrograms per liter. NA indicates that no ADWL has been established for the chemical.
2. Only detected compounds shown.
3. Toluene detected in the sample from well 29-A may be due to the use of gasoline-powered sampling equipment and is not considered representative of groundwater conditions.
4. The laboratory assigned "J" qualifier denotes an estimated value.

Source: Chaney, Walton & McCall, Groundwater Monitoring Report, First Semiannual Sampling of 1998

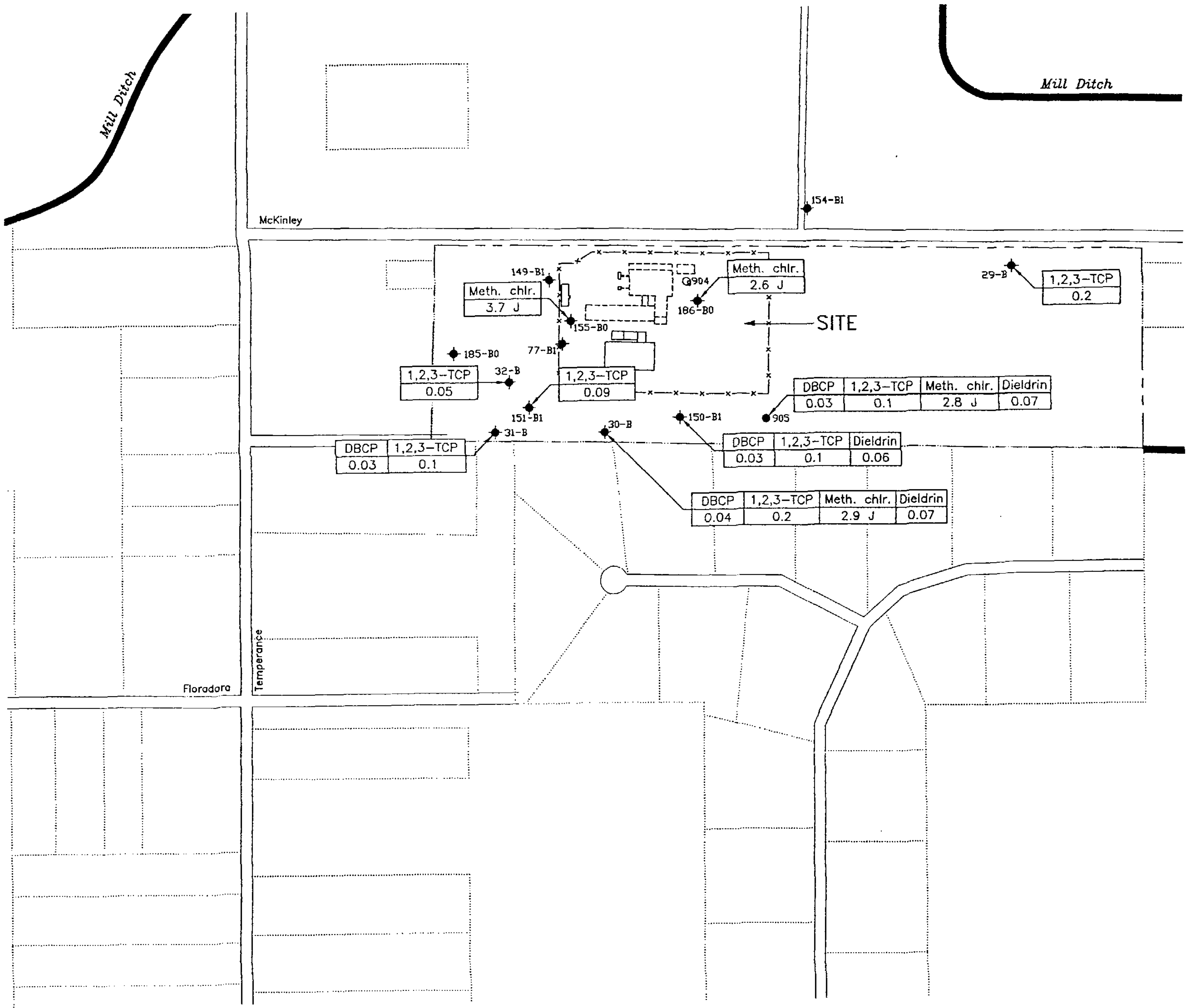
SCALE
0 150 300 FEET

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Chemical Concentrations in Samples from Shallow (A Water-Bearing Zone) Monitoring Wells First Semiannual 1998

K/J 844083.75
May 1999
Figure 4-24



LEGEND:

- Groundwater Monitoring Well
- Domestic Well
- Irrigation Well
- Former Building Location
- THAN Property Boundary
- Site Boundary (Fence)

		ADWL
DBCP	Dibromochloropropane	0.2
1,2,3-TCP	1,2,3-Trichloropropane	NA
Meth. chlr.	Methylene chloride	5
	Dieldrin	0.05

NOTES:

1. All measurements and ADWLs (Acceptable Drinking Water Levels) in micrograms per liter. NA indicates that no ADWL has been established for the chemical.
2. Only detected compounds shown.
3. The laboratory assigned "J" qualifier denotes an estimated value.
4. Methylene chloride also detected in associated field blank and travel blank.

Source: Chaney, Walton & McCall, Groundwater Monitoring Report, First Semiannual Sampling of 1998

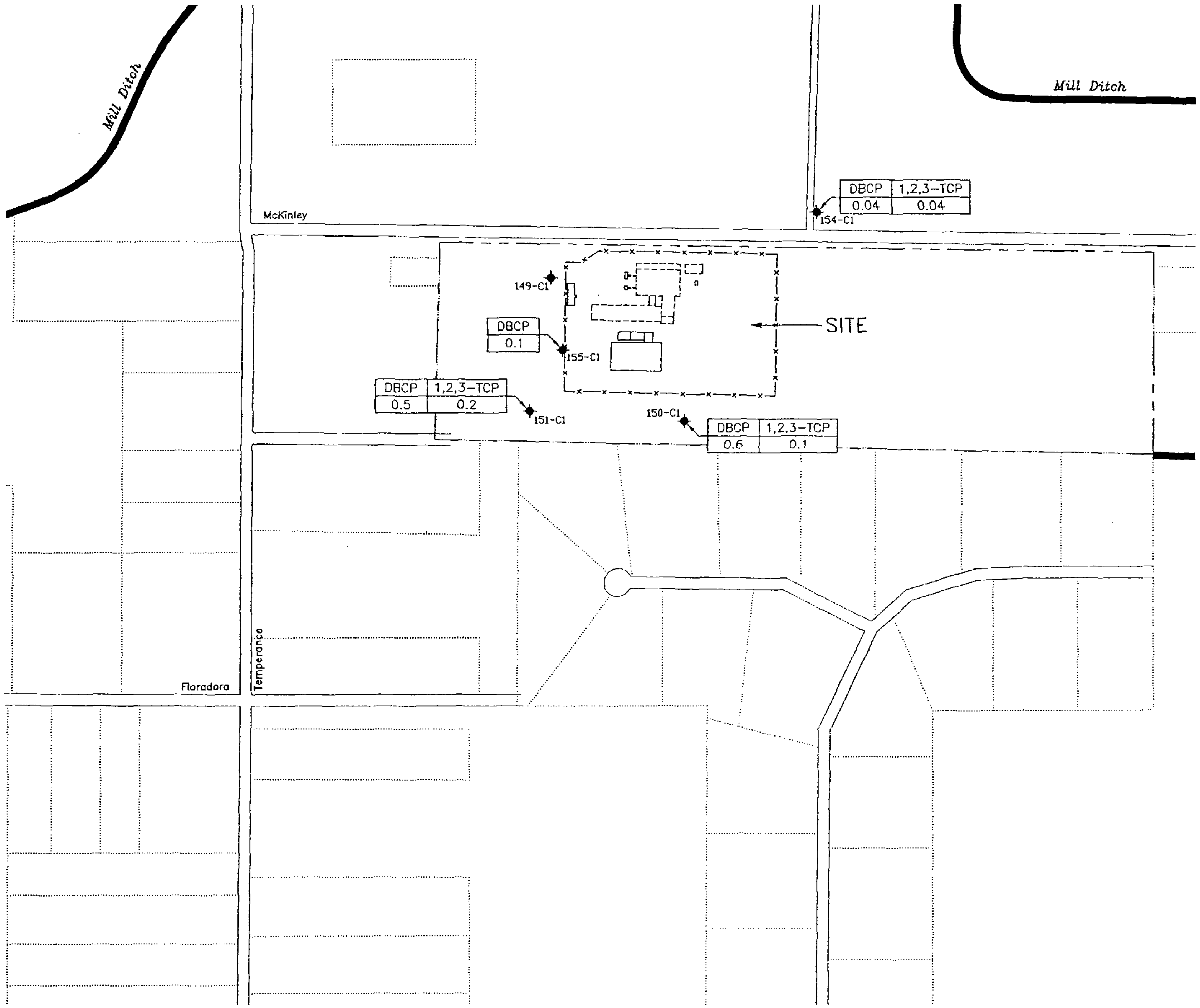
SCALE
0 150 300 FEET

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Chemical Concentrations in Samples from THAN Domestic and Irrigation Wells from Onsite and Nearsite Intermediate Depth (B Water-Bearing Zone) Monitoring Wells First Semiannual 1998

K/J 844083.75
May 1999
Figure 4-25



LEGEND:

Symbol	Meaning	
◆	Groundwater Monitoring Well	
(dashed outline)	Former Building Location	
— — — —	THAN Property Boundary	
—x—x—x—	Site Boundary (Fence)	
		ADWL
DBCP	Dibromochloropropane	0.2
1,2,3–TCP	1,2,3–Trichloropropane	NA

NOTES:

1. All measurements and ADWLs (Acceptable Drinking Water Levels) in micrograms per liter. NA indicates that no ADWL has been established for the chemical.
2. Only detected compounds shown.

Source: Chaney, Walton & McCall, Groundwater Monitoring Report, First Semiannual Sampling of 1998

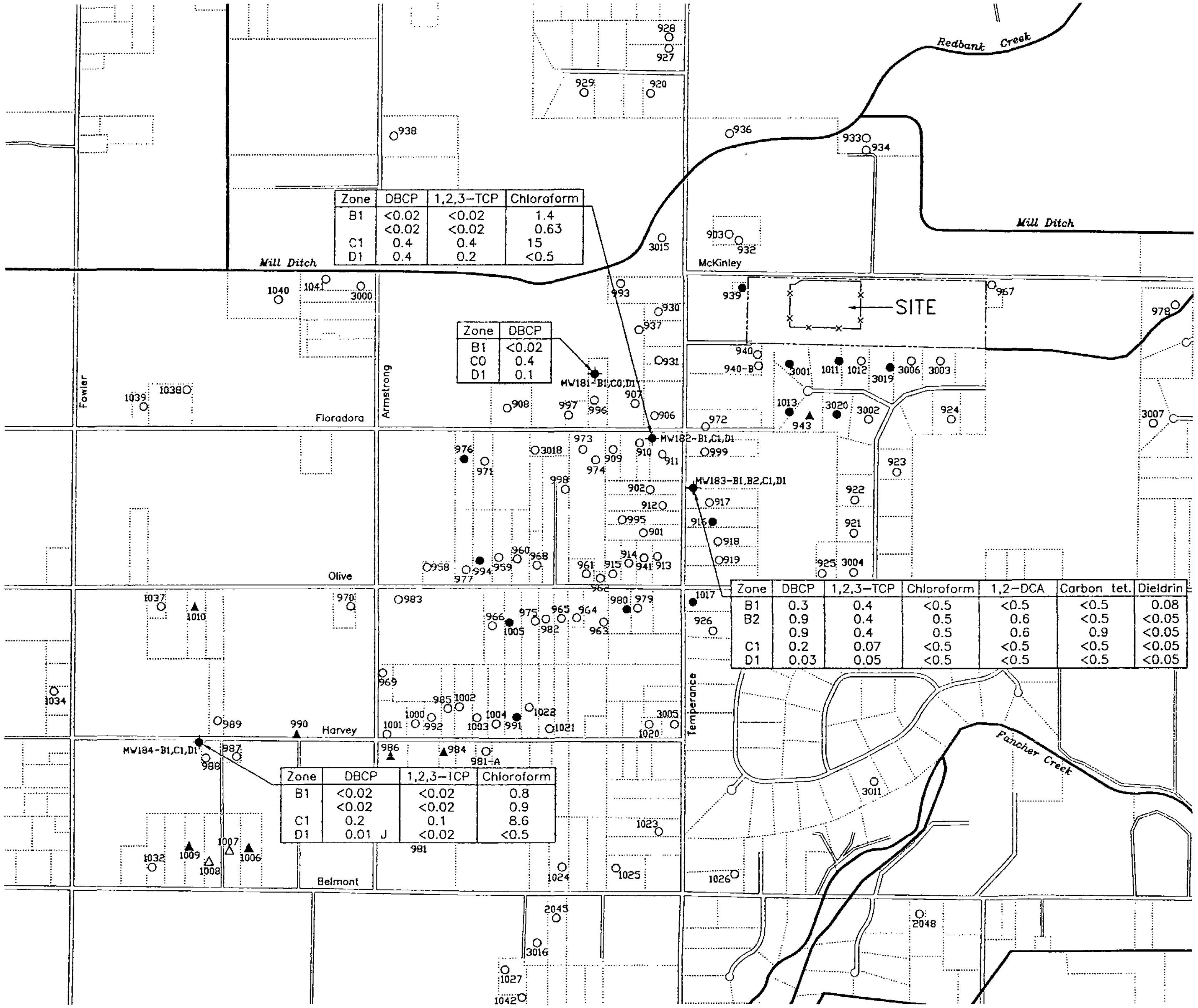
SCALE
0 150 300 FEET

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Chemical Concentrations in Samples from Onsite and Nearsite Deep (C Water-Bearing Zone) Monitoring Wells First Semiannual 1998

K/J 844083.75
May 1999
Figure 4-26



Zone	DBCP	1,2,3-TCP	Chloroform
B1	<0.02	<0.02	1.4
	<0.02	<0.02	0.63
C1	0.4	0.4	15
D1	0.4	0.2	<0.5

Zone	DBCP
B1	<0.02
C0	0.4
D1	0.1

Zone	DBCP	1,2,3-TCP	Chloroform	1,2-DCA	Carbon tet.	Dieldrin
B1	0.3	0.4	<0.5	<0.5	<0.5	0.08
B2	0.9	0.4	0.5	0.6	<0.5	<0.05
	0.9	0.4	0.5	0.6	0.9	<0.05
C1	0.2	0.07	<0.5	<0.5	<0.5	<0.05
D1	0.03	0.05	<0.5	<0.5	<0.5	<0.05

Zone	DBCP	1,2,3-TCP	Chloroform
B1	<0.02	<0.02	0.8
	<0.02	<0.02	0.9
C1	0.2	0.1	8.6
D1	0.01 J	<0.02	<0.5

LEGEND:

- Groundwater Monitoring Well
- Domestic Well
- Peripheral Domestic Well
- Domestic Well Sampled
- Peripheral Domestic Well Sampled
- THAN Property Boundary
- Site Boundary (Fence)

		ADWL
DBCP	Dibromochloropropane	0.2
1,2,3-TCP	1,2,3-Trichloropropane	NA
	Chloroform	100
1,2-DCA	1,2-Dichloroethane	0.5
Carbon tet.	Carbon tetrachloride	0.5
	Dieldrin	0.05

NOTES:

1. All measurements and ADWLs (Acceptable Drinking Water Levels) in micrograms per liter. NA indicates that no ADWL has been established for the chemical.
2. Only detected compounds shown; "<" denotes not detected at stated quantitation limit.
3. The laboratory assigned "J" qualifier denotes an estimated value.
4. Paired data represent replicate measurements.

Source: Chaney, Walton & McCall, Groundwater Monitoring Report, First Semiannual Sampling of 1998

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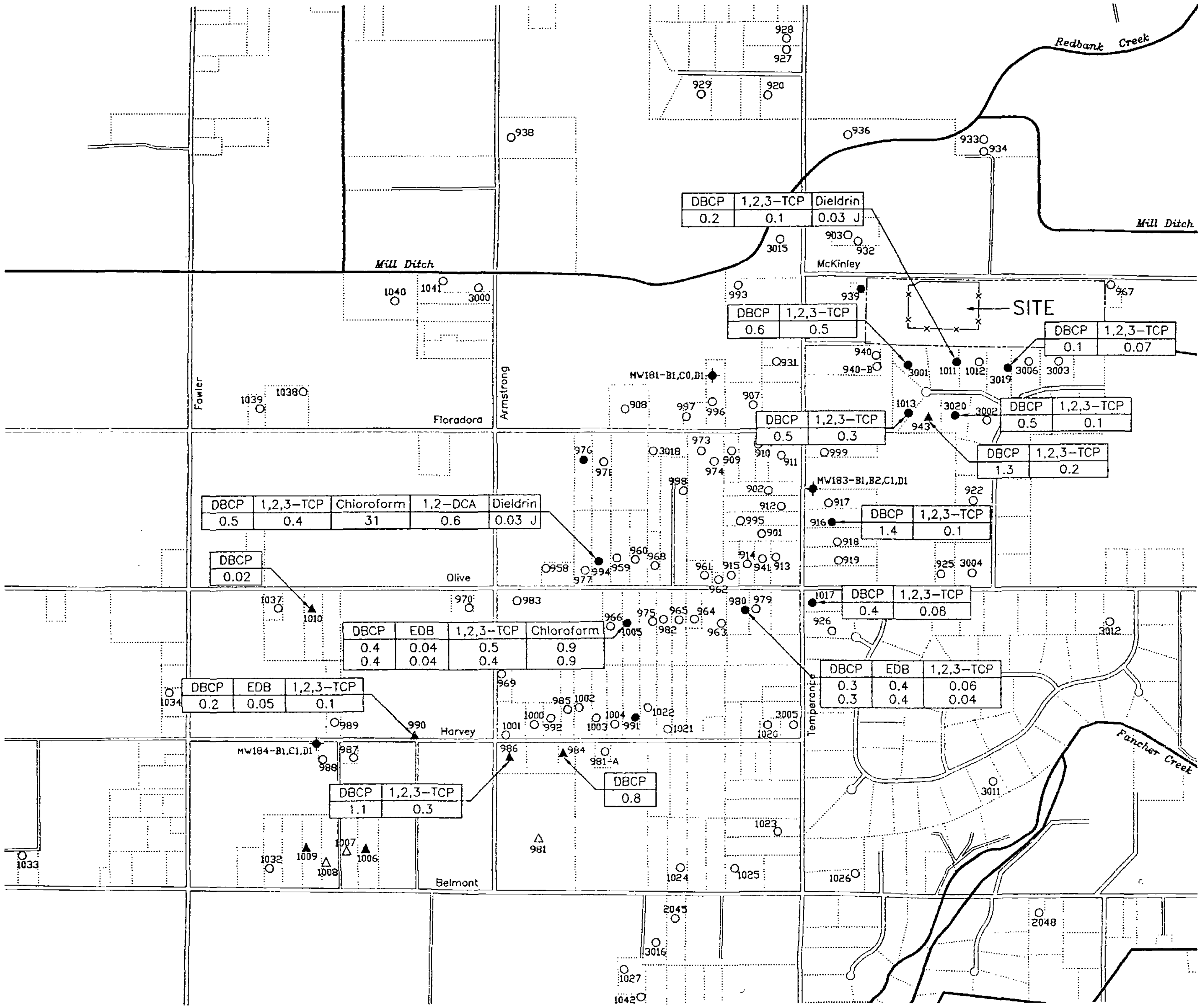
THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Chemical Concentrations in Samples from Offsite Monitoring Wells First Semiannual 1998

K/J 844083.75
May 1999
Figure 4-27



LEGEND:

Symbol	Description
⌖	Groundwater Monitoring Well
○	Domestic Well
△	Peripheral Domestic Well
●	Domestic Well Sampled
▲	Peripheral Domestic Well Sampled
----	THAN Property Boundary
-x-x-	Site Boundary (Fence)

		ADWL
DBCP	Dibromochloropropane	0.2
EDB	*Ethylene dibromide*	0.05
1,2,3-TCP	1,2,3-Trichloropropane	NA
	Chloroform	100
1,2-DCA	1,2-Dichloroethane	0.5
	Dieldrin	0.05

NOTES:

1. All measurements and ADWLs (Acceptable Drinking Water Levels) in micrograms per liter. NA indicates that no ADWL has been established for the chemical.
2. Only detected compounds shown.
3. The laboratory assigned "J" qualifier denotes an estimated value.
4. Paired data represent replicate measurements.

Source: Chaney, Walton & McCall, Groundwater Monitoring Report, First Semiannual Sampling of 1998

SCALE 0 450 900 FEET

Kennedy/Jenks Consultants

THAN, Eastern Fresno County, CA
Draft Remedial Action Plan

Chemical Concentrations in Samples from Domestic Wells First Semiannual 1998

K/J 844083.75
May 1999
Figure 4-28

APPENDIX A

DECEMBER 1993 SHALLOW SOIL SAMPLING AND ANALYSIS

February 23, 1994

SEACOR

Wade W. Smith
Project Manager
T H Agriculture & Nutrition Company, Inc.
20700 Ventura Boulevard, Suite 207
Woodland Hills, California 91364

Summary of Results
December 1993 Shallow Soil Sampling and Analysis
Conducted by Department of Toxic Substances Control
T H Agriculture & Nutrition Company, Inc. Site
Fresno County, California

Dear Mr. Smith:

The Science & Engineering Analysis Corporation *(SEACOR)* is pleased to submit this report summarizing the shallow soil sampling activities conducted in December 1993 by the Department of Toxic Substances Control (DTSC) in the vicinity of the T H Agriculture & Nutrition Company, Inc. (THAN) facility in Fresno County, California (the Site). Soil sampling activities were conducted by Mr. Kevin Shaddy of the DTSC on December 8, 1993. The activities were observed and split samples received by a *SEACOR* representative at THAN's request.

Soil Sampling Procedures

A total of twelve soil samples from six sampling locations were collected by DTSC at the locations shown on Figure 1. At each of the six sampling locations one upper sample was collected from depths between 1 and 3 inches below ground surface (bgs) (KLM001 through KLM006), and a second lower sample was collected from depths between 9 and 15 inches bgs (KLM001A through KLM006A). Each of the twelve samples was subsequently split into two samples, one of which was retained by the DTSC and the other by *SEACOR*. Photographs of sampling are reproduced on the attached Figures 2A through 3B.

The soil samples were collected by Mr. Shaddy and a DTSC assistant. The upper soil samples were collected using a small hand scoop and placed in glass sample containers (Figure 2A). The lower soil samples were collected using a hand auger to reach the desired sampling depth (Figure 2B) and then relatively undisturbed soil samples were obtained in brass sample tubes using a hand-operated slide-hammer soil sampler (Figure 3A). The split soil samples were then placed in cooled containers for transportation to the laboratories (Figure 3B) by the respective parties.

On the basis of information provided to THAN by DTSC, the soil samples retained by the DTSC were transported to the DTSC Hazardous Materials Laboratory in Los Angeles, California and Eureka Laboratories, Inc. in Sacramento, California under chain-of-custody documentation.

G:\DONM\DTSCSOIL.RPT
50022-014-01

90 New Montgomery Street, Suite 620, San Francisco, CA 94105-4503 (415) 882-1548 Ph (415) 882-4406 Fax

Collected soil samples were analyzed by EPA Methods 8141 and 8081 using the EPA Method 3540 extraction procedure and EPA Method 8150.

Soil samples retained by *SEACOR* were transported to Agriculture & Priority Pollutants Laboratories, Inc. (APPL) in Fresno, California under chain-of-custody documentation. These soil samples were analyzed by EPA Methods 8080, 8140, and 8150. Copies of the chain-of-custody and laboratory analysis reports for the samples retained for THAN by *SEACOR* are attached to this report.

Soil Sampling Results

The results of laboratory analysis of soil samples reported by DTSC indicate detection of 4,4'-DDE, 4,4'-DDT, and *o,p*'-DDE from soil samples KLM001 through KLM006, with samples KLM001 through KLM003 containing the highest concentrations. Soil sample KLM003 was reported by DTSC to contain the maximum concentrations of 4,4'-DDE, 4,4'-DDT, and *o,p*'-DDE at 75.0 milligrams per kilogram (mg/kg), 34.0 mg/kg, and 26.0 mg/kg, respectively. The compound *o,p*'-DDE was a nontarget analyte identified by EPA Method 8081. No other analytes were detected by DTSC in these soil samples. No chemicals were reported as detected by DTSC in soil samples KLM001A through KLM006A. A summary of DTSC analytical results is included in the attached Table 1.

Laboratory analyses of the soil samples retained and submitted by *SEACOR* detected dicofol, dieldrin, 2,4'-DDT, 4,4'-DDE, 4,4'-DDT, 4,4'-TDE/DDD, and toxaphene from soil samples KLM001 through KLM003. Maximum concentrations were reported from soil sample KLM002, which was also reported to contain endrin ketone. Analysis of soil samples KLM004 through KLM006 and KLM001A detected 4,4'-DDE and 4,4'-DDT. Analysis of soil sample KLM006 detected 2,4'-DDT. No other chemicals were detected in the soil samples analyzes. Analysis of soil samples KLM002A and KLM006A did not detect any analytes. A summary of the results of analysis of soil samples retained by *SEACOR* are summarized in the attached Table 2.

Discussion

Results from analysis of soil samples KLM001 through KLM003 retained by *SEACOR* detected dieldrin and toxaphene at maximum concentrations of 0.66 mg/kg and 7.4 mg/kg, respectively. These compounds were not reported as detected in the DTSC samples although the quantitation limits for these compounds by DTSC analysis were greater than the concentrations reported by APPL. The compounds dicofol, endrin ketone, 2,4'-DDT, and 4,4'-TDE/DDD were detected in soil samples analyzed by APPL. These compounds were not included in the analytical methods used by the DTSC.

It has been a pleasure to assist THAN with this project. Please do not hesitate to call with any questions or comments.

Sincerely yours,

Science & Engineering Analysis Corporation

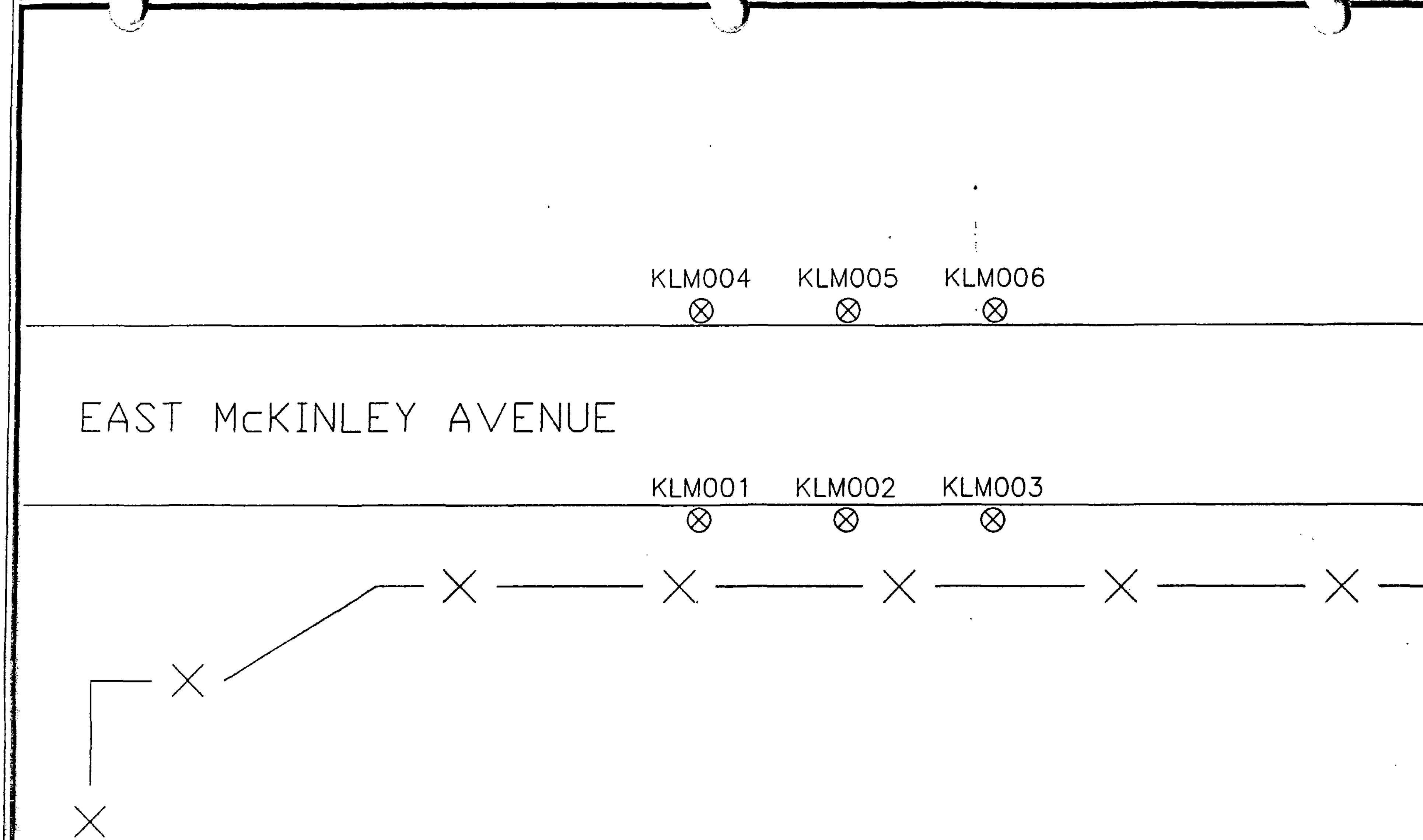
Donald W. Moore
Project Geologist

Jonathon C. Goldman, P.E.
Principal Civil Engineer

DWM/mms

Attachments:
- Figure 1 - Soil Sample Locations
- Figures 2 and 3 - Photographs of Soil Sampling Procedures
- Table 1 - Soil Analytical Results, DTSC Samples
- Table 2 - Soil Analytical Results, SEACOR Samples
- Chain-of-Custody and Laboratory Analytical Reports

cc: John J. Gregory, Esq. -- **McCutchen, Doyle, Brown & Enersen**
Robert S. Chrobak, P.E. -- **Kennedy/Jenks Consultants**



LEGEND:

⊗ Sampling Location

Site Boundary (Fence)

SCALE 0 25 50 FEET

NOTES:

All samples collected 5 feet from edge of pavement

FIGURE 1

DTSC SOIL SAMPLE LOCATIONS 12/8/93

THAN, Eastern Fresno County, CA

Client: T H Agriculture & Nutrition Co., Inc.

Project: 50022-014-01

Date: 2/21/94

SEACOR

FIGURE 2A - Collection of upper soil sample using hand scoop.

FIGURE 2B - Advancing to desired lower sample depth using hand auger.

FIGURE 3A - Collection of lower soil sample using slide hammer soil sampler.

FIGURE 3B - Preparing samples for transport to laboratory.

TABLE 1
SOIL ANALYTICAL RESULTS FOR DTSC SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Organophosphorus Pesticides by EPA Method 8141 with 3540 Extraction Procedure, DTSC Laboratory												
Mevinphos	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Naled	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Diazinon	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Ronnel	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Chlorpyrifos	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Malathion	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Sulprofos	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
EPN	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Coumaphos	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
DDVP	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Ethoprop	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Phorate	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Disulfoton	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Methyl Parathion	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Ethyl Parathion	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Fenthion	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Tetrachlorovinphos	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Azinphos Methyl	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5

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50022-007-01

TABLE 1 (continued)
SOIL ANALYTICAL RESULTS FOR DTSC SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Organochlorine Pesticides by EPA Method 8081 with 3540 Extraction Procedure, DTSC Laboratory												
Alpha-BHC	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Gamma-BHC(Lindane)	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Beta - BHC	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Delta - BHC	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Heptachlor Epoxide	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan I	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4-4' DDE	28.0	52.0	75.0	0.97	1.1	1.6	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endrin	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4-4' DDD	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4-4'DDT	14.0	25.0	34.0	0.36	0.43	0.8	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan Sulfate	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Aldrin	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Dieldrin	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan II	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endrin Aldehyde	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Methoxychlor	ND<2.5	ND<5.0	ND<10.0	ND<0.1	ND<0.1	ND<0.1	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chlordane	ND<25	ND<50	ND<100	ND<0.5	ND<0.5	ND<0.1	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Toxaphene	ND<125	ND<250	ND<500	ND<2.5	ND<2.5	ND<0.1	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<2.5	ND<2.5
O,P'-DDE (Nontarget Compound)	7.5	15.0	26.0	0.13	0.17	0.26	NI	NI	NI	NI	NI	NI

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50022-007-01

TABLE 1 (continued)
SOIL ANALYTICAL RESULTS FOR DTSC SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Chlorinated Herbicides by EPA Method 8150, Eureka Laboratory												
2,4-D	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	NA	NA	NA	NA	NA	NA
2,4-DB	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	NA	NA	NA	NA	NA	NA
2,4,5-T	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	NA	NA	NA	NA	NA	NA
2,4,5-TP (silvex)	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	NA	NA	NA	NA	NA	NA
Dalapon	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	NA	NA	NA	NA	NA	NA
Dicamba	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	NA	NA	NA	NA	NA	NA
Dichloroprop	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	ND<0.04	NA	NA	NA	NA	NA	NA
Dinoseb	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	NA	NA	NA	NA	NA	NA
MCPA	ND<1.2	ND<1.2	ND<1.2	ND<1.2	ND<1.2	ND<1.2	NA	NA	NA	NA	NA	NA
MCPP	ND<1.2	ND<1.2	ND<1.2	ND<1.2	ND<1.2	ND<1.2	NA	NA	NA	NA	NA	NA

NOTES: All sample results reported in milligrams per kilogram (mg/kg).
ND: Not detected at specified laboratory quantitation limit.
NA: Not analyzed.
NI: Not identified.
See Figure 1 for soil sample locations.

TABLE 2
SOIL ANALYTICAL RESULTS FOR *SEACOR* SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Organochlorine Pesticides by EPA Method 8080, APPL Laboratory												
Alachlor	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Aldrin	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Benefin	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
α-BHC	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
β-BHC	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
δ-BHC	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Captan	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Carbophenothion	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chlordane	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Dicofol	0.32	0.41	0.22	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Dieldrin	0.44	0.66	0.63	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
DMPA	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan I	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan II	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endosulfan sulfate	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endrin	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endrin aldehyde	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Endrin ketone	ND<0.05	0.07	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Heptachlor	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Heptachlor epoxide	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05

TABLE 2 (continued)
SOIL ANALYTICAL RESULTS FOR *SEACOR* SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Lindane	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
2,4'-DDT	1.2	1.8	1.5	ND<0.05	ND<0.05	0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
2,4'-TDE/DDD	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4,4'-DDE	20	36	28	0.72	1.0	1.0	0.87	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4,4'-DDT	14	22	19	0.34	0.43	0.62	0.54	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
4,4'-TDE/DDD	0.34	0.51	0.47	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Methoxychlor	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Nitrofen	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
PCNB	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Toxaphene	6.6	7.4	3.9	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0
Organophosphorous Pesticides by EPA Method 8140, APPL Laboratory												
Azinphosmethyl	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Def	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Diazinon	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Dimethoate	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Diphenamid	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Disulfoton	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Ethion	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Malathion	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2
Methyl parathion	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Methyl trithion	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1

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50022-007-01

TABLE 2 (continued)
SOIL ANALYTICAL RESULTS FOR *SEACOR* SAMPLES
7100 Block, East McKinley Avenue
THAN Site, Eastern Fresno County, California

COMPOUND	Soil Sample Identification Numbers, Results Reported in mg/kg											
	KLM001	KLM002	KLM003	KLM004	KLM005	KLM006	KLM001A	KLM002A	KLM003A	KLM004A	KLM005A	KLM006A
Parathion	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Phorate	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Prometon	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Trifluralin	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Trithion	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Chlorinated Herbicides by EPA Method 8150, APPL Laboratory												
Dicamba	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	NA	NA	NA	NA	NA	NA
2,4-D	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	NA	NA	NA	NA	NA	NA
2,4-DB	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	NA	NA	NA	NA	NA	NA
Dichlorprop (2,4-DP)	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	NA	NA	NA	NA	NA	NA
2,4,5-T	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	NA	NA	NA	NA	NA	NA
Dinoseb (DNBP)	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1	NA	NA	NA	NA	NA	NA
Dalapon	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	ND<0.2	NA	NA	NA	NA	NA	NA
MCPA	ND<50	ND<50	ND<50	ND<50	ND<50	ND<50	NA	NA	NA	NA	NA	NA
MCPP	ND<50	ND<50	ND<50	ND<50	ND<50	ND<50	NA	NA	NA	NA	NA	NA

NOTES: All sample results reported in milligrams per kilogram (mg/kg).
ND: Not detected at specified laboratory quantitation limit.
NA: Not analyzed.
See Figure 1 for soil sample location.

G:\DONM\DTSC.TB2
50022-007-01

appl AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.

4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM001
APPL Sample No: R15926-99712

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	0.32	0.05
8080	Dieldrin	mg/kg	0.44	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	1.2	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	20	0.50
8080	4,4'-DDT	mg/kg	14	0.50
8080	4,4'-TDE/DDD	mg/kg	0.34	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	6.6	1.0

ND = None Detected

Tested by: Steve Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM001
APPL Sample No: R15926-99712

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM001
APPL Sample No: R15926-99712

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/14/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

APPL Agriculture & Priority Pollutants Laboratories, Inc.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM002
APPL Sample No: R15926-99713

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	0.41	0.05
8080	Dieldrin	mg/kg	0.66	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	0.07	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	1.8	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	36	0.50
8080	4,4'-DDT	mg/kg	22	0.50
8080	4,4'-TDE/DDD	mg/kg	0.51	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	7.4	1.0

ND = None Detected

Tested by: Steve Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM002
APPL Sample No: R15926-99713

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM002
APPL Sample No: R15926-99713

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/14/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.

4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM003
APPL Sample No: R15926-99714

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	0.22	0.05
8080	Dieldrin	mg/kg	0.63	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	1.5	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	28	0.50
8080	4,4'-DDT	mg/kg	19	0.50
8080	4,4'-TDE/DDD	mg/kg	0.47	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	3.9	1.0

ND = None Detected

Tested by: Steve Tallman

Checked by: Mike Ray

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM003
APPL Sample No: R15926-99714

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM003
APPL Sample No: R15926-99714

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/14/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM004
APPL Sample No: R15926-99715

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	0.72	0.05
8080	4,4'-DDT	mg/kg	0.34	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: *Steven Tallman*

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM004
APPL Sample No: R15926-99715

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM004
APPL Sample No: R15926-99715

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/14/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

APPL Agriculture & Priority Pollutants Laboratories, Inc.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/28/93

Sample I.D. No: 50022-012-04-00
KLM005
APPL Sample No: R15926-99716

Date Received: 12/09/93
Date Extracted: 12/22/93
Date Analyzed: 12/28/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	1.0	0.05
8080	4,4'-DDT	mg/kg	0.43	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM005
APPL Sample No: R15926-99716

Date Received: 12/09/93
Date Extracted: 12/22/93
Date Analyzed: 12/24/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM005
APPL Sample No: R15926-99716

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/14/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

appl AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.
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SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM006
APPL Sample No: R15926-99717

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	0.05	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	1.0	0.05
8080	4,4'-DDT	mg/kg	0.62	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM006
APPL Sample No: R15926-99717

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/20/93

Sample I.D. No: 50022-012-04-00
KLM006
APPL Sample No: R15926-99717

Date Received: 12/09/93
Date Extracted: 12/10/93
Date Analyzed: 12/15/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

APPL Agriculture & Priority Pollutants Laboratories, Inc.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM001A
APPL Sample No: R15926-99718

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	0.87	0.05
8080	4,4'-DDT	mg/kg	0.54	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM001A
APPL Sample No: R15926-99718

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/28/93

Sample I.D. No: 50022-012-04-00
KLM002A
APPL Sample No: R15926-99719

Date Received: 12/09/93
Date Extracted: 12/22/93
Date Analyzed: 12/28/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steve Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM002A
APPL Sample No: R15926-99719

Date Received: 12/09/93
Date Extracted: 12/22/93
Date Analyzed: 12/24/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

APPL — Agriculture & Priority Pollutants Laboratories, Inc.
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SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM003A
APPL Sample No: R15926-99720

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM003A
APPL Sample No: R15926-99720

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM004A
APPL Sample No: R15926-99721

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM004A
APPL Sample No: R15926-99721

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/22/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM005A
APPL Sample No: R15926-99722

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM005A
APPL Sample No: R15926-99722

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/21/93

Sample I.D. No: 50022-012-04-00
KLM006A
APPL Sample No: R15926-99723

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: 12/08/93
Report Date: 12/29/93

Sample I.D. No: 50022-012-04-00
KLM006A
APPL Sample No: R15926-99723

Date Received: 12/09/93
Date Extracted: 12/18/93
Date Analyzed: 12/21/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Tested by: Steven Tallman

Checked by: [signature]

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SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: NA
Report Date: 12/29/93

Sample I.D. No: **BLANK** *Associated samples were taken: 12/08/93*
APPL Sample No: R15926-931218S

Date Received: NA
Date Extracted: 12/18/93
Date Analyzed: 12/18/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Checked by: Pamela Cooper

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AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: NA
Report Date: 12/29/93

Sample I.D. No: **BLANK** *Associated samples were taken: 12/08/93*
APPL Sample No: R15926-931221S

Date Received: NA
Date Extracted: 12/21/93
Date Analyzed: 12/25/93

Results of OP Pesticides Soil Analysis by EPA Method 8140

EPA #	Compound	Units	Concentration	Quantitation Limit
8140	Azinphosmethyl	mg/kg	ND	0.5
8140	Def	mg/kg	ND	0.05
8140	Diazinon	mg/kg	ND	0.05
8140	Dimethoate	mg/kg	ND	0.05
8140	Diphenamid	mg/kg	ND	0.05
8140	Disulfoton	mg/kg	ND	0.05
8140	Ethion	mg/kg	ND	0.05
8140	Malathion	mg/kg	ND	0.2
8140	Methyl parathion	mg/kg	ND	0.05
8140	Methyl trithion	mg/kg	ND	0.1
8140	Parathion	mg/kg	ND	0.05
8140	Phorate	mg/kg	ND	0.05
8140	Prometon	mg/kg	ND	0.05
8140	Trifluralin	mg/kg	ND	0.05
8140	Trithion	mg/kg	ND	0.05

ND = None Detected

Checked by: Pamela Cook

APPL Agriculture & Priority Pollutants Laboratories, Inc.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: NA
Report Date: 12/28/93

Sample I.D. No: **BLANK** *Associated samples were taken: 12/22/93*
APPL Sample No: R15926-931222S

Date Received: NA
Date Extracted: 12/22/93
Date Analyzed: 12/27/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Checked by: Pamela Cooper

appl AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.
4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: NA
Report Date: 12/20/93

Sample I.D. No: **BLANK** *Associated samples were taken: 12/08/93*
APPL Sample No: R15926-931218S

Date Received: NA
Date Extracted: 12/18/93
Date Analyzed: 12/18/93

Results of OCl Pesticides Soil Analysis by EPA Method 8080

EPA #	Compound	Units	Concentration	Quantitation Limit
8080	Alachlor	mg/kg	ND	0.05
8080	Aldrin	mg/kg	ND	0.05
8080	Benefin	mg/kg	ND	0.05
8080	α-BHC	mg/kg	ND	0.05
8080	ß-BHC	mg/kg	ND	0.05
8080	δ-BHC	mg/kg	ND	0.05
8080	Captan	mg/kg	ND	0.05
8080	Carbophenothion	mg/kg	ND	0.05
8080	Chlordane	mg/kg	ND	0.05
8080	Dicofol	mg/kg	ND	0.05
8080	Dieldrin	mg/kg	ND	0.05
8080	DMPA	mg/kg	ND	0.05
8080	Endosulfan I	mg/kg	ND	0.05
8080	Endosulfan II	mg/kg	ND	0.05
8080	Endosulfan sulfate	mg/kg	ND	0.05
8080	Endrin	mg/kg	ND	0.05
8080	Endrin aldehyde	mg/kg	ND	0.05
8080	Endrin ketone	mg/kg	ND	0.05
8080	Heptachlor	mg/kg	ND	0.05
8080	Heptachlor epoxide	mg/kg	ND	0.05
8080	Lindane	mg/kg	ND	0.05
8080	2,4'-DDT	mg/kg	ND	0.05
8080	2,4'-TDE/DDD	mg/kg	ND	0.05
8080	4,4'-DDE	mg/kg	ND	0.05
8080	4,4'-DDT	mg/kg	ND	0.05
8080	4,4'-TDE/DDD	mg/kg	ND	0.05
8080	Methoxychlor	mg/kg	ND	0.05
8080	Nitrofen	mg/kg	ND	0.05
8080	PCNB	mg/kg	ND	0.05
8080	Toxaphene	mg/kg	ND	1.0

ND = None Detected

Checked by: Pamela Cooper

appl AGRICULTURE & PRIORITY POLLUTANTS LABORATORIES, INC.

4203 West Swift ▼ Fresno, California 93722 ▼ Phone 209.275-2175 ▼ Fax 209.275-4422

SEACOR
90 New Montgomery St., #620
San Francisco, CA 94105
Attn: Jonathan C. Goldman

Sample Date: NA
Report Date: 12/20/93

Sample I.D. No: **BLANK** *Associated samples were taken: 12/08/93*
APPL Sample No: R15926-931210S

Date Received: NA
Date Extracted: 12/10/93
Date Analyzed: 12/10/93

Results of Herbicide Soil Analysis by EPA Method 8150

EPA #	Compound	Units	Concentration	Quantitation Limit
8150	Dicamba	mg/kg	ND	0.1
8150	2,4-D	mg/kg	ND	0.2
8150	2,4-DB	mg/kg	ND	0.2
8150	Dichlorprop (2,4-DP)	mg/kg	ND	0.2
8150	2,4,5-T	mg/kg	ND	0.1
8150	2,4,5-TP (Silvex)	mg/kg	ND	0.1
8150	Dinoseb (DNBP)	mg/kg	ND	0.1
8150	Dalapon	mg/kg	ND	2.0
8150	MCPA	mg/kg	ND	50
8150	MCPP	mg/kg	ND	50

ND = None Detected

Checked by: Pamela Cooper

Chain-of-Custody Number: A 7722

SEACOR Chain-of-Custody Record

Address:
THAN
7183 E. McKinley Ave
Fresno

Project # ______ Task # ______
Project Manager: Jonathon Goldman
Laboratory: APPL, Inc.
Turn-around time: Standard
Sampler's Name: Kevin Shaddy
Sampler's Signature: Kevin Shaddy

Analysis Request

Sample ID	Date	Time	Matrix	TPHg/BTEX 8015 (modified)/8020	TPHd 8015 (modified)	TPH 418.1	Aromatic Volatiles 602/8020	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Semi-volatile Organics 625/8270 (GC/MS)	Pesticides/PCB's 608/8080	Total Lead 7421	Priority Pollutant Metals (13)	TCLP Metals	Organophosphates	Chlorinated Herbicides		Comments/ Instructions	Number of Containers
KLM001	12/8/93	12:00	Soil								X				X	X			
KLM002	12/8/93	↓	↓								X				X	X			
KLM003	↓	↓	↓								X				X	X			
KLM004	↓	↓	↓								X				X	X			
KLM005	↓	↓	↓								X				X	X			
KLM006	↓	↓	↓								X				X	X			
KLM001A	↓	↓	↓								X				X				
KLM002A	↓	↓	↓								X				X				
KLM003A	↓	↓	↓								X				X				
KLM004A	↓	↓	↓								X				X				

Special Instructions/Comments:
KLM001A through KLM004A sample from end Marked A

Relinquished by:	Received by:
Sign: Kevin Shaddy	Sign: [signature]
Print: Kevin Shaddy	Print: K. Heiss
Company: DTSC	Company: ~~DTSC~~ Appl.
Time: 1:45pm Date: 12/8/93	Time: 1:45 Date: 12/8/93

Relinquished by:	Received by:
Sign: [signature]	Sign: T. Woodward
Print: Kurt Heiss	Print: T. Woodward
Company: SEACOR	Company: Appl
Time: 8:00 Date: 12/9/93	Time: 8:00 Date: 12-9-93

Sample Receipt

Total no. of containers:
Chain of custody seals:
Rec'd good condition/cold:
Conforms to record:

Client:
Client Contact:
Client Phone Number:

received by: [signature] APPL 12/9/93 8:35a

Date 12/8/93 Page 1 of 2

Chain-of-Custody Number: A 7601

SEACOR Chain-of-Custody Record

Address:
THAN
7183 E. Mckinley Ave.
Fresno

Project # ______ Task # ______
Project Manager: Jonathan Goldman
Laboratory: APPL Inc.
Turn-around time: Standard
Sampler's Name: Kevin Shaddy
Sampler's Signature: Kevin Shaddy

Analysis Request

Sample ID	Date	Time	Matrix	TPHg/BTEX 8015 (modified)/8020	TPHd 8015 (modified)	TPH 418.1	Aromatic Volatiles 602/8020	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Semi-volatile Organics 625/8270 (GC/MS)	Pesticides/PCB's 608/8080	Total Lead 7421	Priority Pollutant Metals (13)	TCLP Metals	Organophosphates			Comments/ Instructions	Number of Containers
KLM005A	12/8/93	12:00	Soil								X				X				
KLM006A	12/8/93	12:00	Soil								X				X				

Special Instructions/Comments:
KLM005A and KLM006A
Sample from end A

	Relinquished by	Received by
Sign	Kevin Shaddy	T. Woodward
Print	Kevin Shaddy	T. Woodward
Company	DTSC	~~SEACOR~~ APPL
Time	1:45pm	145
Date	12/8/93	12/8/93

	Relinquished by	Received by
Sign	Kurt Heiss	T. Woodward
Print	Kurt Heiss	T. Woodward
Company	SEACOR	APPL
Time	8:00	8:00
Date	12/9/93	12-9-93

Sample Receipt
Total no. of containers:
Chain of custody seals:
Rec'd good condition/cold:
Conforms to record:

Client:
Client Contact:
Client Phone Number:

received by: [illegible] APPL 12/9/93 8:35a

Date 12/8/93 Page 2 of 2

APPENDIX B

TECHNICAL AND ECONOMIC FEASIBILITY EVALUATION

TECHNICAL AND ECONOMIC FEASIBILITY EVALUATION

THAN SITE, EASTERN FRESNO COUNTY, CALIFORNIA

Revised
July 1998

K/J 844083.82

REGISTERED PROFESSIONAL ENGINEER
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C047154
Exp. 12/31/99
CIVIL
STATE OF CALIFORNIA

Prepared for:

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Prepared by:

KENNEDY/JENKS CONSULTANTS
303 Second Street, 10th Floor
San Francisco, CA 94107

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
FRG	Final Remediation Goal
FS	Feasibility Study
HI	Hazard Index
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
ppb	parts per billion
PFRG	Proposed Final Remediation Goal
RAP	Remedial Action Plan
RI	Remedial Investigation
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board

CHEMICALS

1,2-DCA	1,2-dichloroethane
1,2,3-TCP	1,2,3-trichloropropane
DBCP	1,2-dibromo-3-chloropropane
VOC	Volatile Organic Compound

1 INTRODUCTION

This report presents a technical and economic feasibility evaluation in support of the selection of proposed final remediation goals (PFRGs) for chloroform and other chemicals of concern detected in groundwater in the vicinity of the T H Agriculture & Nutrition, L.L.C. (THAN) site located at 7183 East McKinley Avenue in Eastern Fresno County, California (the Site).

In March 1994, Kennedy/Jenks Consultants prepared a draft Remedial Action Plan (RAP) for the Site (Kennedy/Jenks 1994). In a 6 March 1997 letter to THAN, the Department of Toxic Substances Control (DTSC) provided additional comments on the draft RAP, including PFRGs for chemicals of concern in groundwater associated with the Site. DTSC's PFRGs were derived as follows:

For two of the chemicals of concern, carbon tetrachloride and 1,2-dichloroethane, DTSC proposed setting the PFRGs at the federal (or more stringent California) Maximum Contaminant Levels (MCLs) because the MCLs for these chemicals are chemical-specific applicable or relevant and appropriate requirements (ARARs), the MCLs adequately protect human health, and they are not inconsistent with State water quality ARARs.

In the case of chloroform, DTSC identified the promulgated regulation level as 100 parts per billion (ppb), based on the MCL for total trihalomethanes. However, DTSC proposed a range of chloroform PFRGs from a health-based level of 1.0 ppb to 48 ppb, with any PFRG exceeding 1.0 ppb to be selected based upon a technical and economic feasibility analysis performed in accordance with State water quality law ARARs.

Another chemical of concern, 1,2,3-trichloropropane (1,2,3-TCP), is unregulated. DTSC proposed to set the PFRG for 1,2,3-TCP at the detection limit.

The fifth Site-related chemical of concern, Dieldrin, does not have an established MCL, and DTSC proposed setting the PFRG at the California Action Level, which is also the detection limit. The California Action Level is not a promulgated drinking water standard and is therefore not an ARAR for remediation of the groundwater.

Taking the DTSC's approach to PFRGs as a point of departure, THAN proposes to harmonize the approach based on risk analysis. As demonstrated below, this approach will comply with the National Contingency Plan and State water quality ARARs, and will achieve a health-based risk level for all of the Site-related chemicals of concern in the groundwater.

2 FRAMEWORK FOR ESTABLISHING FINAL REMEDIATION GOALS

2.1 National Contingency Plan

The selection of final remedial goals for groundwater remedial actions at the THAN Site must comply with the National Contingency Plan (NCP) (40 CFR Part 300) established pursuant to CERCLA. According to the NCP, remedial actions must be protective of human health and the environment, be cost-effective, and meet federal and more-stringent State ARARs, unless the ARARs are waived in accordance with CERCLA and the NCP.

Generally, the NCP establishes MCLs and non-zero MCLGs (maximum contaminant level goals) as the chemical-specific ARARs to be used in the cleanup of groundwater that is a potential source of drinking water. In cases involving multiple contaminants or exposure pathways, where attainment of chemical-specific ARARs will result in cumulative risk in excess of 10^{-4}, one may also consider the following criteria in determining the cleanup level to be attained:

- For known or suspected carcinogens, acceptable exposure levels are generally in the 10^{-4} to 10^{-6} risk range, except that the 10^{-6} risk level is used as point of departure for determining remediation goals when ARARs are not available or are not sufficiently protective because multiple contaminants or exposure pathways are present at the site.

- Factors related to technical limitations such as detection/quantification limits for contaminants.

- Factors related to uncertainty.

- Other pertinent information.

(40 CFR Section 300.430(e)(2)(i) [Criteria relating to systemic toxicants omitted]).

2.2 State ARARs: SWRCB Resolution 68-16 and the Tulare Lake Basin Plan

The remedial action also must meet State ARARs that are more stringent than federal requirements, unless State ARARs are waived. The State ARARs identified in the RAP for groundwater remedial actions include SWRCB Resolution 68-16 and the Tulare Lake Basin Plan (RWQCB 1995) (Basin Plan). SWRCB Resolution 68-16 established the State's "anti-degradation policy" which the SWRCB has described as a "policy statement that existing quality be maintained when it is reasonable to do so." The Basin Plan establishes the analytical framework for determining what is reasonable to do in setting final remediation goals for groundwater associated with the THAN Site.

According to the Basin Plan, groundwater cleanup levels are to be established based on:

1. Background concentrations of individual pollutants.

2. Applicable water quality objectives to protect the designated beneficial uses of the water body.

3. Concentrations which do not pose a significant risk to human health or the environment, considering risks from toxic constituents to be additive across all media of exposure and, in the absence of scientifically valid data to the contrary, additive for all constituents having similar toxicological effects or having carcinogenic effects.

4. The technologic and economic feasibility of attaining background concentrations and of attaining concentrations lower than defined by b. and c., above.

(RWQCB 1995, Section IV-24, 7.a - 7.d).

If background levels are technologically or economically infeasible to achieve, cleanup levels are set between background concentrations and concentrations that meet the criteria set forth in 7.b (ground water quality objectives) and 7.c (concentrations which pose no significant risk, considering the additive effect of carcinogens). Within this concentration range, cleanup levels must be set at the lowest concentrations that are technologically and economically feasible to achieve.

"Economic feasibility" refers to the objective balancing of the incremental benefit of attaining more stringent levels of constituents of concern as compared with the incremental cost of achieving those levels. "Technologic feasibility" is determined by the availability of technologies shown to be effective in reducing concentrations of constituents of concern to established cleanup levels (RWQCB 1995, Section IV-24, 7.f).

The Basin Plan refers to Title 23, California Code of Regulations, Chapter 15, Article 5, Section 2550.4(d) for the factors to be considered in establishing a cleanup level greater than background. Section 2550.4(d) addresses the potential adverse effects of waste constituents on both surface and ground water quality and beneficial uses. The provisions relevant to groundwater are set forth in Section 2550.4(d)(1).

2.3 Summary of Legal Standards and Proposed FRGs

In summary, the following legal standards govern the selection of PFRGs for chemicals of concern in groundwater. In the absence of multiple contaminants or exposure pathways, the NCP establishes MCLs (or non-zero MCLGs) as the chemical-specific ARARs to be used in the cleanup of groundwater. Where multiple contaminants are present and attainment of chemical-specific ARARs will result in cumulative risk in excess of 10^{-4}, the 10^{-6} risk level is used as point of departure for determining PFRGs for carcinogens (acceptable exposure levels are generally in the 10^{-4} to 10^{-6} risk range). The PFRGs will be presented in the draft Remedial Action Plan (RAP). After the draft RAP undergoes public review, it will be finalized. At this point the PFRGs will become Final Remediation Goals (FRGs).

Under the Basin Plan, where background levels are infeasible to achieve, cleanup levels must be set at the lowest concentration that is technologically and economically feasible to achieve, considering the factors in Section 2550.4(d). This concentration must meet applicable water quality objectives and pose no significant risk to human health or the environment, considering risks from carcinogens to be additive.

At the THAN Site, the groundwater containing chemicals known to be associated with the Site is best characterized in terms of its two distinct regions: the upgradient portion where each of the non-regional chemicals associated with the Site have been detected ("Area 1"), and the downgradient portion where chloroform is the primary chemical of concern associated with the Site ("Area 2"). Figure 1 shows Area 1 and Area 2 in relation to the general site vicinity. Figures 2 through 5 depict the Site-related chemicals detected in groundwater. Figure 6 depicts the concentration of 1,2,3-TCP, a chemical which appears to be a regional pollutant in the Fresno area similar to DBCP.

As discussed in detail below, THAN proposes to 1) set the PFRG for chloroform and other individual Site-related chemicals at a health-based risk level of 10^{-4} or the MCL, whichever is lower (see Table 5), and 2) set a cumulative risk limit of 10^{-4} in groundwater samples from compliance wells where more than one chemical of concern is present. The practical effect of this approach is that, if only one chemical is detected in a groundwater sample from a compliance well, then a comparison with the individual health-based level or MCL is all that is required. If more than one chemical of concern is detected, then the individual chemicals must be less than the respective health-based level or MCL and the sum of the potential health risks associated with each chemical of concern must be no greater than 10^{-4}. As demonstrated below, this approach will achieve the standards imposed by both the NCP and the Basin Plan.

3 PROJECT BACKGROUND

The Site consists of a 5-acre parcel located at 7183 East McKinley Avenue in Fresno County, about three miles northeast of Fresno, California. The location of the Site is shown in Figure 1. THAN and prior owners of the Site, including the Geigy Corporation, Inc. (now Novartis Crop Protection, Inc.) and Olin Mathieson Chemical Corporation (now Olin Corporation), formulated agricultural chemicals at the Site. The Site was used by several owners for the formulation, packaging, and warehousing of agricultural chemicals. THAN discontinued operations at the Site in 1981. Interim remedial activities completed at the Site have included soil excavation, structures demolition, soil vapor extraction, and the provision of alternative drinking water supplies to nearby residents. Bottled water was provided beginning in 1984. The extension of the City water supply in 1988 and 1989 essentially eliminated residential exposure to chemicals in groundwater in the affected area.

The chemicals of primary interest in groundwater are carbon tetrachloride, chloroform, 1,2-dichloroethane (1,2-DCA), Dieldrin, and 1,2,3-trichloropropane (1,2,3-TCP). The maximum and mean detected concentrations are shown in Table 1 for comparison with background levels. Generally, low concentrations of chemicals are found in groundwater in the vicinity of the Site. The groundwater situation is complicated by the presence of 1,2-dibromo-3-chloropropane (DBCP), a constituent present in pesticides that were handled at the Site and also were widely used in the vicinity of the Site. DBCP is considered a regional groundwater problem in the Fresno area. For this reason, the DTSC is not proposing a numeric PFRG for DBCP. Based on an initial study, the presence of 1,2,3-TCP in groundwater also appears to be a regional problem. 1,2,3-TCP has not been determined to be associated with the Site. For these reasons, the DTSC is not proposing a numeric PRFG for 1,2,3-TCP unless the chemical is shown to be associated with the Site at levels above background.

The area of groundwater historically affected by chemicals known to be associated with the Site extends approximately 4,000 to 7,000 feet southwest of the Site. The approximate width of the historically affected groundwater is 800 feet. The chemicals of interest are primarily present in a groundwater zone designated as the B zone, which occurs approximately 60 to 120 feet below ground surface.

Following DTSC review of the Feasibility Study (FS) Report (SEACOR 1993), DTSC identified "key performance objectives" that would need to be met for the soil and groundwater components of the preferred remedial action alternative (DTSC 1993). These performance objectives are based on, and in some instances are refinements of, the remedial action objectives that are identified and used in the FS report. In summary, the DTSC's groundwater performance objectives included the following components:

- Comply with ARARs.
- Develop and implement a groundwater extraction and treatment system capable of achieving permanent containment, or removal, of chemicals released on or from the Site, which exceed final remediation goals to be identified in the RAP/ROD.
- Develop and implement a groundwater monitoring program capable of: (1) verifying that unacceptable human exposures or environmental impacts are not occurring as

a result of the presence or movement of chemicals in groundwater, and (2) providing sufficient information to allow for analysis of the effectiveness of the groundwater extraction and treatment system.

- Require treated groundwater to be put to beneficial use to the extent practicable.
- Establish a non-numeric preliminary remediation goal for DBCP in groundwater due to its regional presence, which would require an evaluation of DBCP at the time that final remediation goals for other chemicals in groundwater known to be associated with the Site are attained.
- Establish provisions to deal with any significant release of DBCP, should it occur, from Site soils to groundwater resulting from a resaturation of the A zone.

Similar to the objective for DBCP, the DTSC is expected to establish a non-numeric PFRG for 1,2,3-TCP in groundwater due to its regional presence. The groundwater remedy required by DTSC will likely consist of an offsite groundwater extraction component if PFRGs are exceeded.

4 FEASIBILITY OF ACHIEVING BACKGROUND LEVELS

4.1 Technical Feasibility

The Feasibility Study Report (SEACOR 1993) considered groundwater extraction and treatment with liquid phase carbon adsorption (pump and treat) as the primary active remedial technology for addressing chloroform and other chemicals of concern in groundwater. This technology is well established, as discussed in the Feasibility Study and summarized in Section 7 of the preliminary draft RAP (Kennedy/Jenks 1994).

Pump and treat technology generally is effective in reducing the mass of chemicals in groundwater, particularly when high levels of chemicals are present. However, the effectiveness of pump and treat technology is subject to limitations which EPA has documented in a study of groundwater remediation performed at a number of National Priorities List (NPL) sites (EPA 1992). In its evaluation of these sites, EPA found that site managers typically underestimated both the time and the costs required to achieve final remedial goals. Moreover, most sites were unable to achieve MCLs as a groundwater cleanup goal because chemicals in groundwater reached asymptotic concentrations in a relatively short period of time. Table 2 shows examples of sites where asymptotic concentration levels were reached. These levels generally were well above final remedial goals.

Other regulatory and advisory organizations have reached the same conclusions. The State Water Resources Control Board (SWRCB) states that "there is now nearly universal agreement that it is technologically infeasible to restore many groundwater pollution sites to water quality objectives with current technology in reasonable time frames, e.g., on the order of decades." (SWRCB 1996) The National Research Council, in a report on the technological limitations of pump and treat technology, identified the following limitations to reaching drinking water standards in groundwater: 1) the physical heterogeneity of aquifer material, 2) the presence of nonaqueous-phase liquids, 3) the migration of chemicals to inaccessible regions of the aquifer, 4) the sorption of chemicals to surface materials, and 5) the difficulties in characterizing the subsurface. (NRC 1994)

Chemical partitioning between water and soil is a dynamic process. The concentrations adsorbed to soil and the concentrations dissolved in groundwater maintain an equilibrium described by the relevant partition coefficients. Consequently, groundwater extraction generally results in an initial decline in concentrations of the chemicals in groundwater followed by an asymptotic concentration. When high levels of chemicals are present in groundwater, chemical removal rates initially are high but drop off quickly as the asymptotic level is reached. At lower starting chemical concentrations, chemical removal rates may be slow from the beginning. In either case, the ability to extract to low levels of chemicals in groundwater is limited, and low cleanup objectives (e.g., MCLs) are rarely achieved. Where the chemical concentrations in groundwater are already relatively low, the costs of pump and treat remediation may be extremely high in relation to the benefit obtained.

Table 1 shows maximum and mean detected chemical concentrations in the two identified areas of groundwater containing chemicals known to be associated with the Site for comparison with background levels. As shown, chemicals of concern associated with the Site are already at very low concentrations in the groundwater. The potential for reducing the chemicals to even lower concentrations is very limited, and it is unlikely that background concentrations can be reached within a reasonable time, if at all.

The Final Feasibility Study Report for a nearby site, the Fresno Sanitary Landfill, includes a discussion of the technical and economic infeasibility of reaching background levels in groundwater (Camp Dresser & McKee 1996). The Report discusses the limitations of pump and treat technology for remediating chemicals in groundwater to low levels. The time periods for restoring aquifers to background levels ranged from 148 to 310 years. Costs per pound of chemical removed were not explicitly presented, but are expected to be quite high. In this case, the EPA agreed that cleanup goals should be set at MCLs and not background. EPA set the remedial goal for chloroform at its MCL (100 ppb for total trihalomethanes).

For the THAN Site, and Area 1 in particular, the times required to reach background levels are very long. As discussed in further detail below, active remediation (option 2) only reduces the time to remediate to background levels by approximately ten percent when compared to natural groundwater flow. For instance, for Dieldrin, the remediation time is reduced from 160 years (option 1) to 140 years (option 2).

To summarize, based on the experience at other sites that have employed pump and treat technology, it is unlikely that background levels can be achieved in groundwater at the THAN Site in a reasonable time.

4.2 Economic Feasibility

4.2.1 Groundwater Characterization and Development of Remediation Costs

In order to evaluate the economic feasibility of achieving background levels, groundwater containing chemicals known to be associated with the Site was divided into two areas based upon groundwater monitoring results obtained for the June 1996 sampling event (see Figure 1). Area 1 is the upgradient portion, where multiple chemicals associated with the Site are detected. Area 1 extends approximately 4,050 feet southwest of the Site. Area 2 is the downgradient portion, where chloroform is the primary Site-related chemical of concern. Area 2 extends 2,700 feet southwest of the distal end of Area 1.

Figures 2 through 5 show the detected concentrations for each of the Site-related chemicals based upon the June 1996 sampling event. The detected concentrations of 1,2,3-TCP, which has not been shown to be strictly associated with the Site, are shown in Figure 6. In general, chloroform is the principal chemical of concern in Area 2. In the June 1996 sampling event, 1,2-DCA was also detected in this area in Well 1001. Also, 1,2,3-TCP has been detected in Area 2. However, given its distribution in relation to the Site, 1,2,3-TCP is likely a regional groundwater contaminant similar to DBCP. Finally, DBCP is detected in this area, but it is known to be a regional groundwater contaminant. Accordingly, it appears appropriate to consider Area 2 as primarily containing chloroform.

For the purposes of this evaluation, the groundwater areas were modeled as rectangles, with a length corresponding to the furthest distance from the Site at which chemicals were detected, a width equal to the expected influence of two extraction wells (based on modeling results, the estimated radius of influence of an extraction well would be 125 feet), and a depth equal to the estimated thickness of the targeted water-bearing zone. For

Area 1, the dimensions were 4,050 ft. x 500 ft. x 15 ft. For Area 2, the dimensions were 2,700 ft. x 500 ft. x 15 ft. These dimensions were used in order to obtain a conservative estimate of remediation costs for purposes of balancing remediation costs against incremental benefit.

By using the mean concentration of chemicals detected in groundwater, and considering soil-water partitioning, estimates of the amount of chemical present in the groundwater areas were calculated. The results are shown in Table 3.

A chemical soil-water partitioning model was used to calculate the number of soil pore volume exchanges that would be required to reduce the chemical concentrations for the mean value in the area to background. Note that the mean detected concentrations shown in Table 1 generally are close to background. A description of the model is presented in Appendix A along with the chemical-specific and environmental parameters used in the calculations.

A second model was constructed to simulate groundwater flow in the vicinity of the THAN Site. This conceptual model was based on lithologic data from numerous borings at and near the THAN Site, along with information obtained from numerous domestic wells downgradient of the Site. A description of the model is included in Appendix A. The model was used to guide the development of groundwater extraction remediation options.

Three approaches to remediation were evaluated. The first approach looked at natural groundwater flow (remedial option 1). The costs associated with option 1 are generally confined to groundwater monitoring costs. Routine semi-annual groundwater monitoring costs are not included in the cost estimates presented. The second and third approaches involved pump and treat systems. The second approach (remedial option 2) involved two extraction wells at the distal end of each of the respective groundwater areas (in addition to two on or near-site extraction wells for Area 1). This minimized capital costs but increased operation and maintenance costs. Option 2 was considered the most reasonable extraction effort based on modeling results, the low levels of chemicals present, and concern for optimizing remediation by extracting only from the chemically-impacted water-bearing zone. The two distal extraction wells would also provide hydraulic control to limit the mobility of chemicals in groundwater. The calculated costs likely underestimate the actual costs.

A third approach was also considered that involved adding numerous additional extraction wells within the area of groundwater containing chemicals known to be associated with the Site. Increasing the total number of extraction wells to 36 for Area 1 and 24 for Area 2 was considered. This would increase capital costs but reduce operation and maintenance costs. While this option would result in reduced remediation times, it would not be feasible to implement because this option would require access to numerous parcels of private property to install the large number of extraction wells. In addition, the simplified partitioning model used in the TEFE may not accurately reflect the limitations in removing chemicals from groundwater, even using a large network of extraction wells. This third option was not considered further.

The results of the soil-water partitioning evaluation were used with information on the effect of groundwater extraction to calculate the time required to remediate groundwater in each of the areas to background levels. Background levels were taken to be less than the detection limits for all of the chemicals except chloroform. Twice the detection limit, or 1 ppb, was used for chloroform. (Appendix A). The calculated remediation times are shown in Table 3. In Area 1, for option 2 it was assumed that chloroform would be removed after 26 years. The annual treatment costs for remaining chemicals such as Dieldrin were reduced accordingly thereafter. For both groundwater areas, and Area 1 in particular, the required times for remediation are very long (e.g., over 100 years). The long remediation times require large quantities of groundwater to be extracted. The estimated volume of water that would be extracted in order to complete remediation in Area 1 is 110,000,000 gallons. In Area 2, the estimated volume of water required for remediation is 10,000,000 gallons.

The calculation of remediation times is based on soil-water partitioning only. The calculations do not account for other factors such as dispersion, diffusion, and biological degradation that may influence remediation time. It is difficult to determine the relative significance of these other factors. It is unlikely that dispersion and diffusion will have a major influence on a relatively immobile chemical such as Dieldrin. Although degradation of all of the chemicals is slow, it may have a noticeable influence on concentrations over the long remediation times calculated. Table 3 shows the difference between the time required for natural groundwater flow and the time required for active remediation. The active remediation contemplated in option 2 only reduces the remediation time for option 1 by approximately ten percent.

The estimated costs for remediating groundwater are also shown in Table 3. These costs do not incorporate the present worth of money. By dividing the estimated costs by the estimated amount of chemical in the area (assuming 100 percent removal), the unit cost of chemical removal can be calculated. The results are shown in Table 3 for the two remedial options. Costs for Area 1 are shown for individual chemicals. These costs are not additive. The hypothetical remediation system would be designed and operated for the presence of Dieldrin. Dieldrin is the chemical that would drive the remediation because it is more preferentially bound to soil than the other chemicals. Table 4 provides a summary of the remediation information for the two areas: Area 1 based on the removal of Dieldrin, and Area 2 based on the removal of chloroform.

In Area 1, where the maximum concentration of chloroform detected in the June 1996 sampling event was 36 ppb, the estimated cost of remediation is $17 million for remedial option 2. Because the estimated amount of Dieldrin that would be removed is one pound, the cost per pound of Dieldrin removed is also $17 million. Comparison costs are discussed below in Section 4.2.2. Attenuation factors, such as biodegradation, may reduce the overall remediation time required for option 2.

In Area 2, where the maximum concentration of chloroform detected in the June 1996 sampling event was 22 ppb, the estimated cost of remediation is $1 million for remedial option 2. Notably, it would cost $1 million to remediate the chloroform in this area over a period of 13 years, whereas natural attenuation would accomplish the same result in 15 years (only 2 more years) for the relatively nominal cost of monitoring. Because approximately 5 pounds of chloroform would be removed, the estimated cost per pound of chloroform removed is $240,000.

4.2.2 Incremental Cost Comparisons

4.2.2.1 Comparison of Remediation Options

The evaluation of economic feasibility is based on a comparison of the incremental costs with the incremental benefits to be obtained. One way to evaluate the incremental costs of the pump and treat options is to compare them with option 1, which relies on natural groundwater flow and natural attenuation of the chemicals of concem. Option 1 would entail groundwater monitoring costs, but these costs are common to the other options as well. The costs and remediation times shown in Table 4 indicate that option 1 would yield essentially the same benefits (in terms of remediation time) as option 2.

4.2.2.2 Comparison with Other Site Remediation Costs

Another way to evaluate costs and associated benefits is to consider the actions taken by THAN to fund extension of the City Water System to all residents with domestic wells affected by chemicals known to be associated with the Site. The cost to THAN for these actions was approximately $1.3 million. The benefit was a substantial incremental reduction in human health risks, from the risks of exposure to groundwater at the levels discussed below in Section 6.3.7 to essentially zero risk. The estimated costs for remediating Area 1 to background chemical levels range from $11 million to $17 million. For Area 2, the estimated costs range from $1 million to $2.8 million. There is essentially no associated public health benefit to be obtained from these actions. There would be little or no reduction in the risk of human exposure because the groundwater currently is not used for domestic purposes. While there would be a reduction in chemical mass in groundwater, the groundwater would remain unsuitable for domestic purposes, because of the regional presence of DBCP and 1,2,3-TCP.

4.2.2.3 Comparison with Remediation Costs at Other Sites

The State Water Resources Control Board's (SWRCB) Functional Equivalent Document for the containment zone policy (SWRCB Resolution No. 92-49) discusses costs per mass of chemical removed at example sites (SWRCB 1996). Two Superfund examples discussed are San Jose's IBM and Fairchild sites. At the IBM site, the unit cost of volatile organic compound removal using groundwater extraction and treatment during a five-year study period was $12,000 per pound. At the Fairchild site, the unit cost of VOC removal using pump and treat was $9,000 per pound. At other sites evaluated in California, the costs ranged from $4,800 to $89,000 per pound of chemical removed. The report states that "these kinds of costs may be particularly difficult to justify as reasonable at a site that has little adverse impact to human health, water quality, or the environment." Because of the connection to the City Water Supply system, there is currently little adverse impact to human health or the environment from the THAN Site-related chemicals in groundwater.

The Final Feasibility Study Report for the Fresno Sanitary Landfill (Camp Dresser & McKee 1996) includes a discussion of the technical and economic infeasibility of reaching background levels in groundwater. The same limitations of pump and treat technology for removing chemicals in groundwater to low levels were discussed. The time periods for restoration of the aquifers to background levels ranged from 148 to 310 years, with a total cost for remediating tetrachloroethene of $69 million. Costs per pound of chemical removed were not explicitly presented, but are expected to be quite high. In this case, the

U.S. EPA agreed that cleanup goals should be set at MCLs and not background. This decision included using the MCL of 100 ppb for total trihalomethanes as the limit for chloroform.

4.3 Conclusion Regarding the Technical and Economic Feasibility of Achieving Background Levels

It is unlikely that pump and treat technologies can achieve background levels in a reasonable time. Also, given the small amounts of chemicals that would be removed by the pump and treat option, the unit costs per pound of chemical removed are extremely high when compared to the human health and environmental benefits obtained. When considering costs relative to risk reduction benefits, the high costs are not justified on the basis of reduced risks. By way of comparison, prior actions by THAN to provide alternative domestic water supplies to affected nearby residents have produced significant benefits at substantially less cost. For these reasons, we conclude that it is technologically and economically infeasible to seek to achieve background levels of chemicals in groundwater in the vicinity of the THAN Site.

5 WATER QUALITY OBJECTIVES AND CUMULATIVE RISK ANALYSIS

5.1 Basin Plan Water Quality Objectives

According to the Basin Plan, groundwater may not contain chemical constituents in concentrations that "adversely affect beneficial uses" (RWQCB 1995, Section III-7). The regional board is directed to consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines developed by a number of agencies and organizations. The regional board must evaluate the specific numeric criteria to determine whether they are relevant and appropriate to the situation at hand, and whether the numeric criteria should be used in determining compliance with the narrative objective (RWQCB 1995 Section IV-22). Reference is made to relevant levels established by state and federal health authorities to determine whether the effects are reasonable.

Both federal and state authorities have established a preferential hierarchy for relevant numeric criteria. The SWRCB looks first to the chemical-specific MCL as the relevant standard. When no such standard exists, the SWRCB then looks to relevant health-related and water quality levels. (See, *e.g.*, *In re Santa Clara County et al.*, SWRCB Order No. WQ 86-8, May 5, 1986). Similarly, EPA has adopted this approach for Superfund sites in the Fresno area. At the FMC Corp. Superfund site, MCLs were ranked first, followed by action levels, health-based levels, and quantification limits. MCLs were to be applied when they existed; each of the subsequent standards was to be applied if a superior standard did not exist. The approach developed by the SWRCB and by EPA indicates that, at the THAN Site, the relevant numeric standard for chloroform levels in the groundwater is the 100 ppb drinking water standard.

The MCLs available for other Site-related chemicals are shown in Table 1.

5.2 Cumulative Risk Analysis

As noted above, the NCP generally establishes MCLs (and non-zero MCLGs) as the chemical-specific ARARs to be used in the cleanup of groundwater that is a potential source of drinking water, because MCLs are the enforceable standard under the Safe Drinking Water Act and are protective of human health. In cases involving multiple contaminants or exposure pathways, however, where attainment of chemical-specific ARARs will result in cumulative risk in excess of 10^{-4}, other factors may be considered. Acceptable exposure levels for carcinogens are generally in the 10^{-4} to 10^{-6} risk range, with the 10^{-6} risk level used as a point of departure for determining remediation goals when ARARs are not sufficiently protective because multiple contaminants or exposure pathways are present.

Similarly, the Basin Plan addresses cumulative risk by requiring an evaluation of the concentrations that do not pose a significant risk to human health or the environment, considering risks from all carcinogenic constituents to be additive (in the absence of scientifically valid data to the contrary).

The MCL relevant to chloroform in groundwater in the vicinity of the Site is 100 ppb. This concentration corresponds to the 10^{-4} risk level for chloroform. Where no multiple contaminants or exposure pathways are present, 100 ppb is the appropriate chloroform remedial goal under the NCP and the Basin Plan. Subject to a technical and economic feasibility evaluation, DTSC proposed a concentration of 48 ppb as the maximum concentration allowed for chloroform, based on a cumulative risk of 10^{-4} for all of the Site-related chemicals, assuming that chemicals other than chloroform were present at the PFRGs.

In order to comply with the NCP and the Basin Plan and to meet the 10^{-4} cumulative risk goal proposed by DTSC, THAN proposes to 1) set the PFRG for chloroform and other individual Site-related chemicals at a health-based risk level of 10^{-4} or the MCL, whichever is lower (see Table 5), and 2) set a cumulative risk limit of 10^{-4} in groundwater samples from compliance wells where more than one chemical of concern is present. A technical and economic feasibility evaluation supporting this approach is presented in Section 6.

The 10^{-4} risk level is protective of human health, particularly because there is no withdrawal of groundwater for domestic use due to THAN's provision of alternative water supplies. Furthermore, until the regional DBCP contamination problem is addressed, the groundwater in the vicinity of the Site is unsuitable for drinking water purposes without treatment for DBCP. The average DBCP concentration in groundwater samples from wells not affected by the Site and clearly affected by regional conditions ranged from 1.9 μg/l to 8.4 μg/l (RI Report, Section 7). Using these values, the range of calculated excess lifetime cancer risk from residential use of water due to the known regional presence of DBCP in groundwater is approximately 4×10^{-5} to 2×10^{-4}. There may also be a similar risk due to the regional presence of 1,2,3-TCP, but because background concentrations of 1,2,3-TCP have not been well characterized, the associated risks have not been calculated. THAN's proposed remedial approach addresses chemical-specific and cumulative risk appropriately, but it must be noted that there is no actual risk posed because there is no actual exposure to the groundwater.

The practical effect of this approach is that, if only one chemical is detected at a compliance point, the comparison with the individual 10^{-4} risk level or MCL (whichever is lower) is all that is necessary. If more than one chemical of concern is detected, not only must the individual chemical concentration be no greater than 10^{-4} risk level or the MCL, but the sum of the potential health risks associated with each chemical must be less than 10^{-4}.

If a chemical of concern other than chloroform is detected, the groundwater sample will not meet the criteria in step 1 because the MCL is equal to the detection limit. (The exception to this is Dieldrin, but in this cases the 10^{-4} risk level is only slightly above the detection limit.) If chloroform were present in a groundwater sample, and no other chemicals of concern were detected, 100 ppb would be used as the cleanup level for chloroform. However, if the sample also contained all of the other chemicals of concern at their detection limits, then the chloroform concentration could be no greater than 80 ppb without exceeding the cumulative risk limit. If 1,2,3-TCP, which is considered a regional pollutant, were included at it's detection limit, then the chloroform concentration could be no greater than 48 ppb without exceeding the cumulative risk limit. This calculation using 1,2,3-TCP corresponds to the evaluation performed by DTSC.

The advantage of this two-step evaluation is that it achieves both individual and cumulative risk levels for all the Site-related chemicals at all points of compliance, based on the actual chemistry of the groundwater. The points of compliance would be established during remedial design.

6 FEASIBILITY EVALUATION TO ESTABLISH FINAL REMEDIATION GOALS

As discussed in Section 4, it is technologically and economically infeasible to achieve background levels for Site-related chemicals. Therefore, cleanup levels should be set between background concentrations and concentrations that meet applicable water quality objectives and do not pose a significant risk to human health and the environment, at the lowest concentrations that are technologically and economically achievable.

For two of the chemicals evaluated (carbon tetrachloride and 1,2-DCA), the background levels evaluated in Section 4 and the MCLs discussed in Section 5 are the detection limits. For these chemicals, the conclusion that it is technologically and economically infeasible to achieve background levels also applies to the MCLs. Levels higher than MCLs cannot be proposed as PFRGs without an ARAR waiver.

For two other chemicals (chloroform and Dieldrin), the health-based levels presented in Section 5 are above the detection limits, and the following evaluation in this section is presented in support of the PFRGs for these chemicals.

Finally, two chemicals (DBCP and 1,2,3-TCP) are known or suspected regional pollutants in the Fresno area. For these chemicals, a non-numeric goal has been established by DTSC, and a feasibility evaluation is not required.

6.1 Technological Feasibility

As discussed in Section 4, it is technologically infeasible to restore groundwater in the vicinity of the THAN Site to background levels with current technology in reasonable time frames (i.e., decades). Because of the low concentrations of Site-related chemicals in groundwater, it is expected that health-based levels above detection limits cannot be met in a reasonable time using pump and treat technology. However, pump and treat technology will likely provide hydraulic control which will limit the mobility of chemicals in groundwater. Hydraulic control with natural attenuation will result in the reduction of chemical concentrations in groundwater.

The maximum chloroform concentration detected in groundwater samples during the June 1996 sampling event was 36 ppb. It would appear that this concentration, which is below the MCL of 100 ppb, could be met. For Dieldrin, the mean detected concentration in June 1996 was 0.1 ppb, which is below the health-based level of 0.3 ppb. The maximum concentration of Dieldrin was 0.32 ppb, just above the health-based level. However, it would be inappropriate to set a PFRG for either chloroform or Dieldrin based on the maximum or mean concentration observed because the concentrations that may be observed in the future cannot be predicted.

It is possible that chloroform concentrations greater than 100 ppb will be detected in the future. For example, if the A zone is resaturated, then it may cause increased concentrations of chloroform downgradient of the Site. If this should occur, it may be feasible to achieve the limit of 100 ppb using pump and treat technology, but it is not certain. In addition, it is not possible to determine with confidence a chloroform concentration below 100 ppb that would be technically achievable in a reasonable time. Similarly, we cannot be certain that Dieldrin concentrations will not increase to a level above 0.3 ppb. It is not possible to determine with confidence a Dieldrin concentration below 0.3 ppb that would be technically achievable in a reasonable time. More importantly, the cost of achieving the limit will be high, as discussed in the next section.

The routine groundwater monitoring program will provide information on whether an event such as resaturation of the A zone occurs. Section 10 of the draft RAP describes the remediation measures to be taken if such an event does occur in the future.

DBCP is a known regional pollutant. Because movement of DBCP from upgradient sources would make a remediation evaluation meaningless, one was not performed. Based on initial indications, 1,2,3-TCP is also a regional pollutant, and therefore a numeric goal has not been proposed. If there are upgradient sources of 1,2,3-TCP, then a remediation evaluation would also be meaningless. However, if 1,2,3-TCP were found to be strictly site-related with no upgradient sources, and if a health-based level of 0.2 ppb were used, then it may be feasible to achieve the level within a reasonable time. Given the assumption used in the model, it would take approximately 17 years to reduce 1,2,3-TCP concentrations in groundwater from a mean of 0.9 ppb to 0.2 ppb.

6.2 Economic Feasibility

In Section 4.2, the high absolute costs and high unit costs of removing chemicals from groundwater to background levels were discussed. The costs of remediating the two chemicals with health-based levels above background levels (detection limits) are discussed here.

For chloroform, the highest concentration detected in Area 1 was 36 ppb, and the highest concentration detected in Area 2 was 22 ppb. These concentrations are below the MCL of 100 ppb. For Dieldrin in Area 1, the mean concentration was 0.1 ppb, which is below the health-based level of 0.3 ppb. However, future maximum or mean concentrations of chemicals cannot be predicted. It is possible that chloroform concentrations greater than 100 ppb will be detected in the future. Likewise, it is possible that Dieldrin concentrations greater than 0.3 ppb will be detected in the future (the June 1996 maximum concentration was 0.32 ppb). If health-based levels are exceeded, there will be a cost associated with achieving these levels that cannot be estimated at this time. Nevertheless, because of the capital costs involved, a minimum cost can be estimated. In Area 1, the estimated capital costs are $250,000 for option 2. This corresponds to a minimum unit cost of $250,000 per pound of Dieldrin and $16,000 per pound of chloroform for option 2. In Area 2, the estimated capital costs are $140,000 for option 2. This corresponds to a minimum unit cost of $28,000 per pound of chloroform for option 2. Compared with past costs or unit costs at other sites, the costs for remediation of chloroform and Dieldrin are unreasonable.

The costs of reaching health-based limits are high relative to the comparison levels presented in Section 4.2.2. The costs are also high in relation to the benefit to be obtained. There would be little or no reduction in human health risk because there is no exposure to chemicals of concern in groundwater. While chemical mass may be reduced, the groundwater would remain unsuitable for domestic use because of the regional presence of DBCP in excess of its drinking water standard, and the regional presence of 1,2,3-TCP. For these reasons, we conclude that it is economically infeasible to remediate to a level below the health-based levels developed in Section 5.

6.3 Section 2550.4(d) Factors

The Tulare Lake Basin Plan states that the factors to be considered in the establishment of cleanup levels greater than background are given in Title 23, California Code of Regulations, Section 2550.4(d). These factors are summarized below. A more detailed discussion for each factor is presented in Appendix B.

6.3.1 Physical and Chemical Characteristics of the Waste

Section 3 of the draft RAP includes a summary of the types of chemicals present at the Site (Kennedy/Jenks 1994). Chemicals handled at the Site by the Site's owners and operators included agricultural chemicals (*i.e.,* pesticides), various raw materials used in agricultural chemical formulation, quality assurance laboratory chemicals, and solvents.

Most of the chemicals of concern in groundwater, such as chloroform, are halogenated alkanes. Halogenated alkanes typically are relatively mobile and persistent in the environment. The most persistent chemical is Dieldrin, an organochlorine pesticide. The chemical characteristics of the chemicals associated with the THAN Site make them difficult to remediate.

6.3.2 Hydrogeological Characteristics of the Facility and Surrounding Land

The hydrogeological characteristics of the Site are summarized in Section 4 of the draft RAP.

Domestic well logs reviewed during the remedial investigation (Kennedy/Jenks 1993) indicate that the screened depths of domestic wells in the Site vicinity vary from about 96 to 170 feet.

The lithology encountered during the remedial investigation (RI) consists of heterogeneous mixtures of sand, silt, gravel and occasional lenses of clay. Lithologic units of sand and gravel represent zones of high permeability and the most significant water-bearing zones. The water-bearing zones that were sampled during the RI are identified as A, B, C, and D. Semi-confined permeable subunits encountered in each water-bearing zone are designated with numbers increasing with depth in a given zone (A1, B0, B1, B2, C0, C1, and D1). Subunits extend across the Site as interfingered layers of greater and lesser permeable materials, which may allow flow to occur between subunits within a water-bearing zone.

Subunits and water-bearing zones investigated during the RI appear to be in hydraulic communication, with preferential horizontal flow paths dominating groundwater movement (Kennedy/Jenks 1993).

The water-bearing zone of most interest with regard to the presence of chemicals is the B zone. Chemicals in this region of silty sand and sand will partition between the soil and groundwater, and the chemicals in groundwater will exhibit movement. Because the A zone is currently unsaturated, it consists of approximately 60 feet of vadose zone soils overlying the B zone.

6.3.3 Quantity of Groundwater and Direction of Groundwater Flow

On the basis of Fresno Irrigation District records and information gathered during the RI, regional and local groundwater movement is from the northeast to the southwest. The water-producing zones of interest are present in the upper 200 feet of the alluvium (Kennedy/Jenks 1993).

The estimate for the volume of groundwater that would be removed to meet background levels is 110,000,000 gallons in Area 1 (to remediate Dieldrin) and 10,000,000 gallons in Area 2. The basis for these estimates is provided in Appendix A.

6.3.4 Proximity and Withdrawal Rates of Groundwater Users

THAN has provided alternative water supplies to the Temperance-Kutner Elementary School and all residents in the vicinity of the Site with domestic wells affected by chemicals known to be associated with the Site. These alternative supplies include the provision of bottled water (or replacement filters) beginning in 1984 and the extension of the City Water System in 1988-1989 at THAN's expense. There is, therefore, no withdrawal of groundwater for domestic use in the affected area. However, groundwater in the vicinity of the Site is still being used for other purposes such as irrigation. The estimated withdrawal rates for irrigation in the vicinity of the Site have not been determined.

The public supply well nearest to the Site, PS 102, is located approximately 2,800 feet south-southwest of the distal end of Area 2. PS 102 is screened below 250 feet, 90 feet below the known vertical extent of Site-related chemicals in groundwater. A 40-foot clay layer of low permeability separates the water-bearing zones. Samples of groundwater from PS 102 are regularly collected and analyzed for the possible presence of chemicals known to be associated with the Site. The regional contaminant DBCP has been detected, but chemicals associated with the Site have not been detected (Kennedy/Jenks 1994).

6.3.5 Current and Potential Future Users of Groundwater in the Area

Groundwater in the vicinity of the Site is designated by the EPA as a sole source drinking water aquifer (EPA 1993) and as suitable for municipal, domestic, agricultural, and industrial water supply by the RWQCB under the Central Valley Region Water Quality Control Plan for the Tulare Lake Basin (RWQCB 1995). Although the groundwater has been classified as a source of drinking water, the regional presence of DBCP at levels above drinking water standards renders the groundwater unacceptable for drinking water purposes.

Groundwater in the Site vicinity historically has been used for domestic and municipal supplies. It is THAN's understanding that domestic wells that are or were formerly included in the domestic well sampling program and affected by chemicals known to be associated with the Site are not used for domestic purposes, although they may be used for irrigation. Because of the regional presence of DBCP, if chemicals associated with the Site were removed, the groundwater would remain unsuitable for domestic use without treatment for DBCP.

6.3.6 Existing Quality of Groundwater

In addition to the potential impacts of chemicals associated with the Site, regulations require consideration of "existing quality of groundwater, including other sources of contamination or pollution and their cumulative impact on groundwater quality." General discussions of groundwater quality are included in the Feasibility Study, Section 4 (SEACOR 1993) and the Site risk assessment (Environ 1996). DBCP is the primary additional chemical of interest in Fresno area groundwater. The regional use and presence of DBCP was discussed in Section 4.2.4.5 of the draft RAP (Kennedy/Jenks 1994) and is discussed here.

In the Fresno area, DBCP has been detected at elevated concentrations in groundwater as a result of its regional application to crops. DBCP was present at concentrations higher than those detected regionally in some samples collected prior to 1987 from shallow, onsite A zone monitoring wells. Maximum concentrations of DBCP detected in groundwater samples from onsite B zone and all offsite monitoring wells are well within the regional DBCP concentration range reported in literature and measured during the RI.

Studies described in the draft RAP and in Appendix B document that, in addition to being associated with the THAN Site, DBCP is a regional groundwater pollutant in the Fresno area, including areas adjacent to the Site. Consequently, even if THAN were able to remediate Site-related chemicals to their respective PFRGs, the groundwater still could not be used for domestic purposes because of the regional presence of DBCP at levels above drinking water standards.

An initial study has indicated that 1,2,3-TCP is also a regional pollutant in the Fresno area, similar to DBCP. The background concentration of 1,2,3-TCP has not been well characterized, and a drinking water standard has not been established for the chemical. However, indications are that 1,2,3-TCP may be present at concentrations that would result in an unacceptable health risk if groundwater were to be consumed.

6.3.7 Potential for Health Risks

A human health and ecological risk assessment was performed for the Site in July 1993, and finalized in January 1996 (Environ 1996). The initial results of the risk assessment were summarized in Section 5 of the draft RAP. Because significant response actions had already been completed by THAN at the Site, the risk assessment considered potential risks to public health and the environment assuming that no further action is taken. Since 1984, THAN has provided alternative water supplies to all residents in the vicinity of the Site with domestic wells affected by chemicals known to be associated with the Site. The hypothetical exposure scenarios evaluated in the risk assessment conservatively did not consider the provision of such alternative water supplies for the purpose of calculating the risks associated with potential exposure to groundwater. The calculated risk would be significantly reduced if these alternative water supplies were taken into account.

An exposure assessment was performed in which both hypothetical current and future land-use scenarios were evaluated. For groundwater, the relevant potentially exposed populations included were onsite and offsite workers and residents. The primary exposure pathways evaluated for groundwater included ingestion, dermal contact, and inhalation of vapors from showering. Exposure from the use of groundwater in a swimming pool was also considered.

As discussed above, DBCP has been shown to be a regional pollutant. For this evaluation, potential risks excluding the contribution from DBCP will be discussed first, followed by potential risks including DBCP.

Using a lognormal basis for evaluating the data (and assuming use of groundwater), cumulative risks combining ingestion, bathing, and swimming ranged from $1x10^{-4}$ for future onsite adult residents to $2x10^{-6}$ for future offsite child residents. HI values calculated for the three groundwater exposure scenarios were less than 1. Combined hazards considering ingestion, bathing, and swimming were also less than 1. Including DBCP, the cumulative risks ranged from $4x10^{-4}$ for future onsite adult residents to $2x10^{-5}$ for current offsite child residents. The calculated HI values were less than 1. DBCP accounted for approximately 50 percent of the total calculated risk and total calculated HI.

Using a normal basis for evaluating the data, cumulative risks combining ingestion, bathing, and swimming ranged from $5x10^{-4}$ for future onsite adult residents to $3x10^{-6}$ for future offsite child residents. The HI values that were greater than 1 were for future onsite residents (adults and children) and onsite workers (long-term). These scenarios of course also had combined hazards (ingestion, bathing, and swimming) greater than 1. The calculated HI values (including cumulative) for other exposure scenarios were less than 1. Including DBCP, the cumulative risks ranged from $3x10^{-3}$ for future onsite adult residents to $4x10^{-5}$ for current offsite child residents. The calculated HI values were greater than 1. DBCP accounted for over 50 percent of the total calculated risk and total calculated HI.

Because THAN funded the connection to the Fresno City Water Supply system in 1988, none of the evaluated current or future groundwater exposure scenarios will likely occur.

6.3.8 Potential for Damage to Wildlife, Crops, Vegetation, and Physical Structures

An ecological evaluation was included along with the human health risk assessment (Environ 1993). The results were also summarized in Section 5 of the preliminary draft RAP (Kennedy/Jenks 1994). The presence of chemicals in groundwater at concentrations up to MCLs will not adversely affect wildlife, crops, vegetation, or physical structures.

6.3.9 Persistence and Permanence of the Potential Adverse Effects

If active pump and treat remediation is implemented, the concentrations will persist above background for the periods of time shown in Table 3. Without active remediation, chemical concentrations will decline slowly by natural attenuation. The potential for human health risk from exposure to drinking water will continue as long as the chemical concentrations in groundwater are above PFRGs. However, as stated above, groundwater in the vicinity of the THAN Site is not used as a source of drinking water because THAN has provided alternative water supplies. This condition will apply in the future. Therefore, although the potential for human exposure exists and will persist, actual domestic exposure to groundwater is not occurring.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Concentrations of chemicals remaining in groundwater are very low, and because of chemical partitioning, it will take a long time to reduce the concentrations further. The costs per pound of chemical removed by active remediation from groundwater downgradient of the THAN Site are extremely high. The values are inordinately high when compared with remediation at other sites, including other Superfund sites in Fresno and elsewhere. Groundwater in the vicinity of the Site is not being used for domestic purposes, so any reduction in potential health risks by reducing chemical concentrations in groundwater is hypothetical. The past response efforts by THAN to connect nearby residents to the Fresno City Water Supply system have reduced potential risks from exposure to groundwater for domestic purposes to essentially zero. Further efforts to reduce chemical concentrations in groundwater would have a negligible benefit in risk reduction.

In addition, the beneficial use of groundwater will not be altered following remediation of chemicals associated with the Site because of the regional presence of DBCP in excess of drinking water standards.

Finally, active remediation results in only minor reductions in the time required for remediation compared with natural groundwater flow and natural attenuation of chemical concentrations. The negligible health benefits, lack of change in beneficial use, and the long time required for remediation do not justify the costs of remediation. We conclude that remediating groundwater in the vicinity of the THAN Site to background (non-detect) levels is technologically and economically infeasible for the Site-related chemicals of concern.

7.2 Proposed FRGs

In Section 5.2, THAN proposed a general approach for establishing cumulative no significant risk levels. Because it was shown in Section 6 that it was technologically and economically infeasible to set goals less than the 10^{-4} risk level, this approach can also be used to establish PFRGs. The two step approach is to:

1. Set individual chemical PFRGs based on a risk level of 10^{-4} or the MCL, whichever is lower.

2. Set a cumulative risk limit of 10^{-4} in groundwater samples from compliance wells where more than one chemical of concern is present.

If only one chemical is detected at a compliance point, the comparison with the individual PFRG is all that is necessary. Individual PFRGs are shown in Table 4. If more than one chemical of concern is detected, not only must the individual chemical concentration be less than the PFRG, but the sum of the potential health risks associated with each chemical must be no greater than 10^{-4}. THAN proposes a 10^{-4} risk level as protective of human health because there is essentially no exposure to chemical in groundwater due to THAN's prior response actions.

The 10^{-4} risk level for chloroform is 100 ppb, which also happens to be the MCL for total trihalomethanes. If chloroform were present, and no other chemicals of interest were detected, 100 ppb would be used as the cleanup level for chloroform. However, if the sample also contained all of the other chemicals of concern at their detection limits, then the chloroform concentration could be no greater than 80 ppb without exceeding the cumulative risk limit. This is equivalent to the evaluation performed by DTSC, if the regional pollutants DBCP and 1,2,3-TCP are excluded. The advantage of the two-step evaluation is that it achieves both individual and cumulative risk levels for all Site-related chemicals of concern at all points of compliance based on the actual chemistry of the groundwater.

An appropriate statistical test will be used to evaluate compliance with PFRGs. The statistical test will be proposed to DTSC for approval. The choice of the tests will take into account the following factors:

- Choice of compliance wells.
- Use of non-parametric statistical tests when the PFRG is the detection limit or close to the detection limit.
- Use of transformed data (e.g., lognormal) if appropriate.
- Application of the 95% UCL to the cumulative risk (and not individual constituents).
- Rounding of cumulative risk values.
- Excluding 1,2,3-TCP (and DBCP) in the cumulative risk calculations.

Details of the statistical methodology and how the statistical tests will be applied will be presented in the remedial design report.

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TABLES

TABLE 1

Characteristics of Affected Groundwater

THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	Maximum Conc.[a] (ppb)	Mean Conc.[b] (ppb)	Background [c] (ppb)	MCL[d] (ppb)
Area 1				
Carbon tetrachloride	1.5	0.9	0.5	0.5
Chloroform	36	19	1.0	100[e]
1,2-Dichloroethane	2.3	1	0.5	0.5
Dieldrin	0.32	0.1	0.05	NA[f]
1,2,3-Trichloropropane	1.9	0.9	0.05	NA[g]
Area 2				
Chloroform	22	9	1.0	100[e]

Notes:

(a) Maximum concentration detected during June 1996 sampling event.
(b) Arithmetic mean of concentrations detected in offsite groundwater containing chemicals known to be associated with the Site.
(c) Set at the detection limit for all chemicals except chloroform, which was set at the 10^{-6} risk level (equivalent to twice the detection limit).
(d) More stringent of California or federal Maximum Contaminant Level.
(e) MCL for total trihalomethanes.
(f) MCL not available. California Action Level is 0.05 ppb.
(g) MCL not available.

TABLE 2

Summary of Other Site Remediation Efforts
THAN Site, Eastern Fresno County, California
K/J 844083.82

Site[a]	Date Started	Chemical	Cleanup Goal (ppb)	Initial Conc.[b] (ppb)	Asymp. Conc.[c] (ppb)	Time to Asymp. (years)
Black & Decker, New York	1988	TCE	5	7,900	30	1.7
Fairchild Semiconductor, San Jose, California	1982	TCA	200	11,000	1,000	0.1
General Mills, Minnesota	1985	TCE	27	1,200	100	0.5
Harris Corporation, Florida	1984	Total VOCs	NA	6,000	1,100	3.8
IBM, New Jersey	1978	TCA	NA	200	30	6
Occidental Chemical, Lathrop, California	1982	DBCP	NA	4,200	20	6
Ponders Corner, Washington	1984	PCE	NA	500	50	1
Sylvester/Gibson Road, New Hampshire	1981	Toluene	2,900	17,000	10,000	0.7
Tyson's Dump, Pennsylvania	1988	1,2,3-TCP	NA	340,000	50,000	2
Ville Mercler, Canada	1983	1,2-DCA	NA	11,500	1,000	0.7

<u>Notes:</u>

(a) Source: EPA 1992, Doty and Travis 1991.
(b) Concentration at beginning of remediation.
(c) Asymptotic concentration.

TABLE 3

Results of Economic Feasibility Evaluation
THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	Estimated Amount of Chemical in Area[a] (lbs)	Calculated Time Required to Achieve Background[b] (years)		Estimated Remediation Cost[e] ($)		Estimated Cost Per Pound[f] ($/lb)	
		Option 1[c]	Option 2[d]	Option 1[c]	Option 2[d]	Option 1[c]	Option 2[d]
Area 1[g]							
Carbon Tetrachloride	0.3	3	2.1	—	490,000	—	1,600,000
Chloroform	16	30	26	—	3,300,000	—	210,000
1,2-Dichloroethane	0.5	4.5	4	—	720,000	—	1,400,000
Dieldrin	1	160	140	—	17,000,000	—	17,000,000
1,2,3-Trichloropropane	0.7	36	32	—	3,900,000	—	5,600,000
Area 2(h)							
Chloroform	5	15	13	—	1,000,000	—	240,000

Notes:

(a) Calculated using the calculated mass in 1 cubic foot of soil and the assumed volume of groundwater.
(b) Estimated time required to reduce chemical concentration from mean to background.
(c) No further action. Estimated attenuation by soil pore volume exchanges without extraction of groundwater (natural groundwater flow). Does not consider diffusion, dispersion, or biodegradation.
(d) Assumes two extraction wells onsite, and two extraction wells offsite for Area 1 and two extraction wells at distal end of Area 2.
(e) Estimated cost = (estimated annual costs x estimated years required for remediation) + capital costs. Does not take into account present worth of money.
(f) Cost divided by calculated amount of chemical in area, assuming 100 percent removal.
(g) Based on removal of Dieldrin, the chemical requiring the greatest time to reach background. Approximately 110,000,000 gallons of groundwater would need to be extracted.
(h) Approximately 10,000,000 gallons of groundwater would need to be extracted.

TABLE 4

Summary of Economic Feasibility Evaluation
THAN Site, Eastern Fresno County, California
K/J 844083.82

Area	Calculated Time to Background (yrs)		Est. Remediation Cost ($)		Estimated Cost per Pound ($/lb)	
	Option 1	Option 2	Option 1	Option 2	Option 1	Option 2
Area 1 (based on Dieldrin)	160	140	–	17 mill	–	17 mill
Area 2 (based on chloroform)	15	13	–	1 mill	–	0.24 mill

Notes:

(a) Based on the removal of the chemical noted, requiring the greatest time to reach background. See Table 3 for details.

TABLE 5

Health-Based Levels and Proposed FRGs

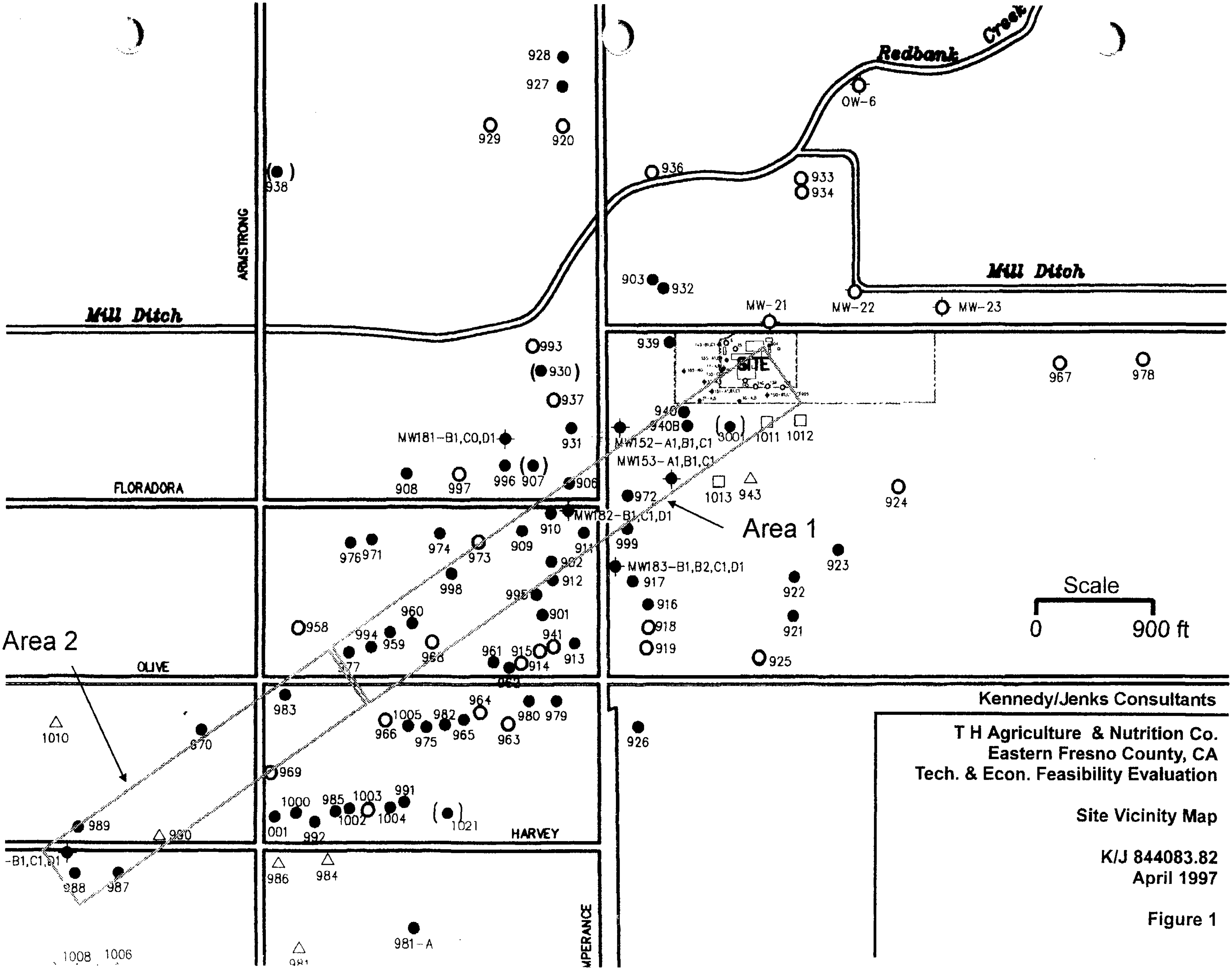
THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	Health-Based Level[a] (10^{-6} Risk) (ppb)	Health-Based Level[b] (10^{-4} Risk) (ppb)	Detection Limit (ppb)	MCL[c] (ppb)	THAN Proposed FRG[d] (ppb)
Carbon Tetrachloride	0.17[e]	20	0.5	0.5	0.5
Chloroform	0.98	100	0.5	100	100
1,2-DCA	0.47	50	0.5	0.5	0.5
Dieldrin	0.003	0.3	0.05	NA[f]	0.3
1,2,3-TCP	0.0016[e]	0.2	0.05	NA[g]	NN[h]
DBCP	0.048[e]	5	0.01	0.2	NN[i]

Notes:

(a) From Multipathway Health Risk Assessment (Environ 1996) unless otherwise noted.
(b) Rounded to one significant digit.
(c) California or federal maximum contaminant level (MCL), whichever is more stringent.
(d) 10^{-4} risk level or MCL, whichever is more stringent.
(e) From U.S. EPA Region IX, Preliminary Remediation Goals (PRGs), 1 August 1996.
(f) MCL not available. California Action Level is 0.05 ppb.
(g) MCL not available. 1,2,3-TCP is not regulated.
(h) Nonnumeric - Because 1,2,3-TCP has been detected in groundwater clearly unaffected by site-related activities, a numeric remediation goal has been deferred by DTSC. If 1,2,3-TCP were found to be strictly site-related, then using the criteria applied to site-related chemicals, a health-based level of 0.2 ppb would be established.
(i) Nonnumeric - Due to regional DBCP levels, satisfactory attenuation of DBCP will be based on mass of DBCP attenuated by the remedy and an evaluation of its background levels at the time the other remediation goals have been met.

FIGURES



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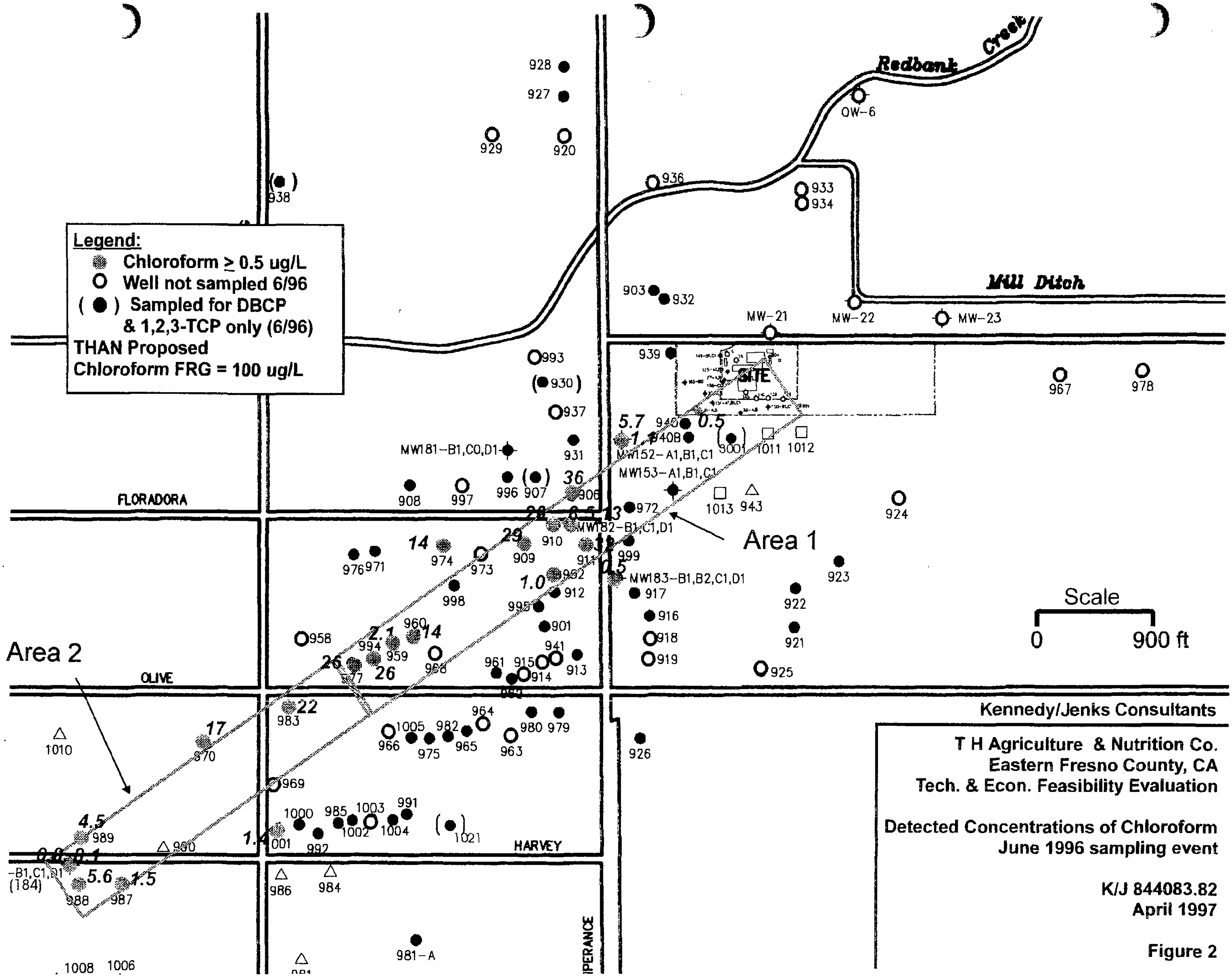
Tech. & Econ. Feasibility Evaluation

Site Vicinity Map

K/J 844083.82
April 1997

Figure 1



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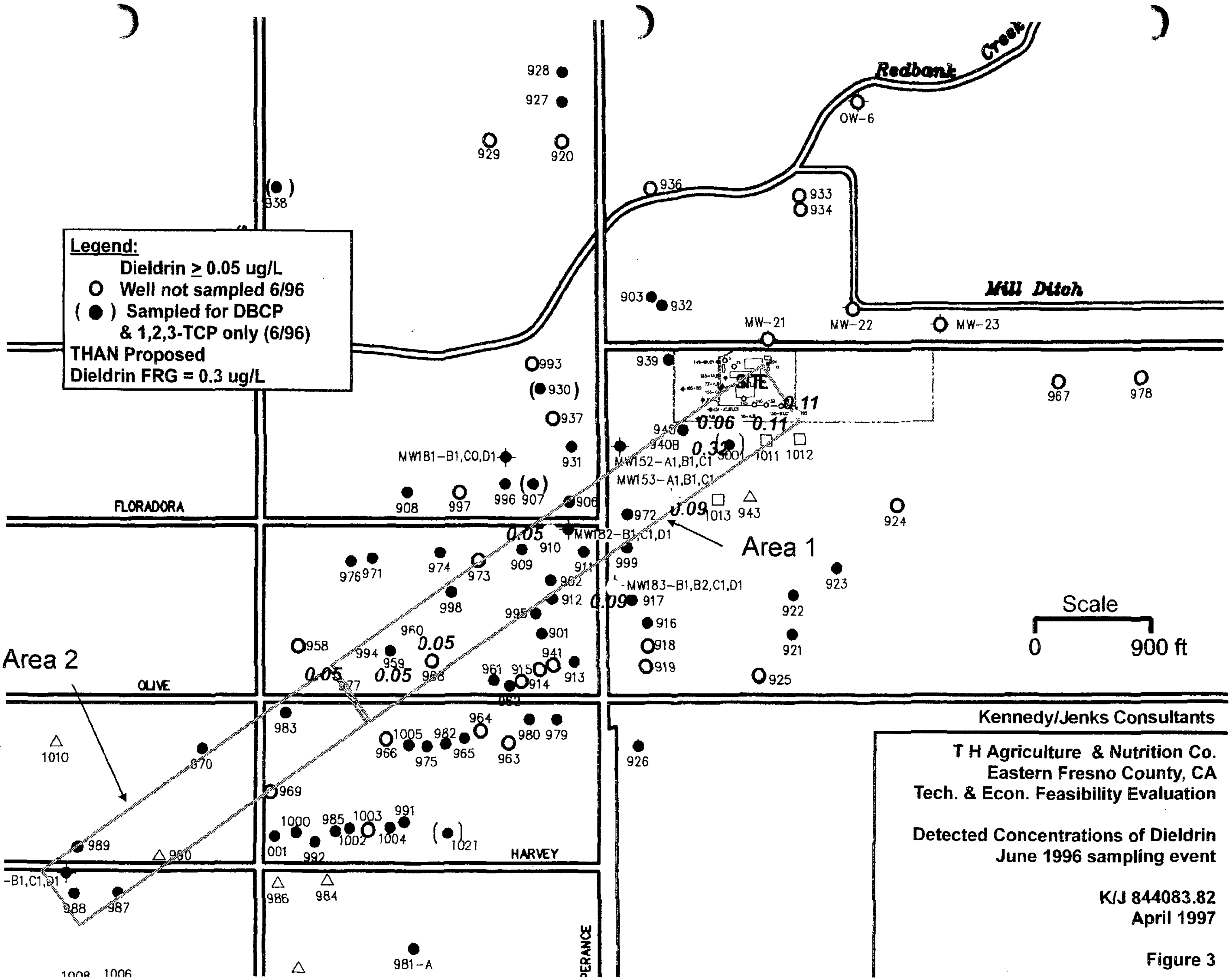
Detected Concentrations of Chloroform
June 1996 sampling event

K/J 844083.82
April 1997

Figure 2



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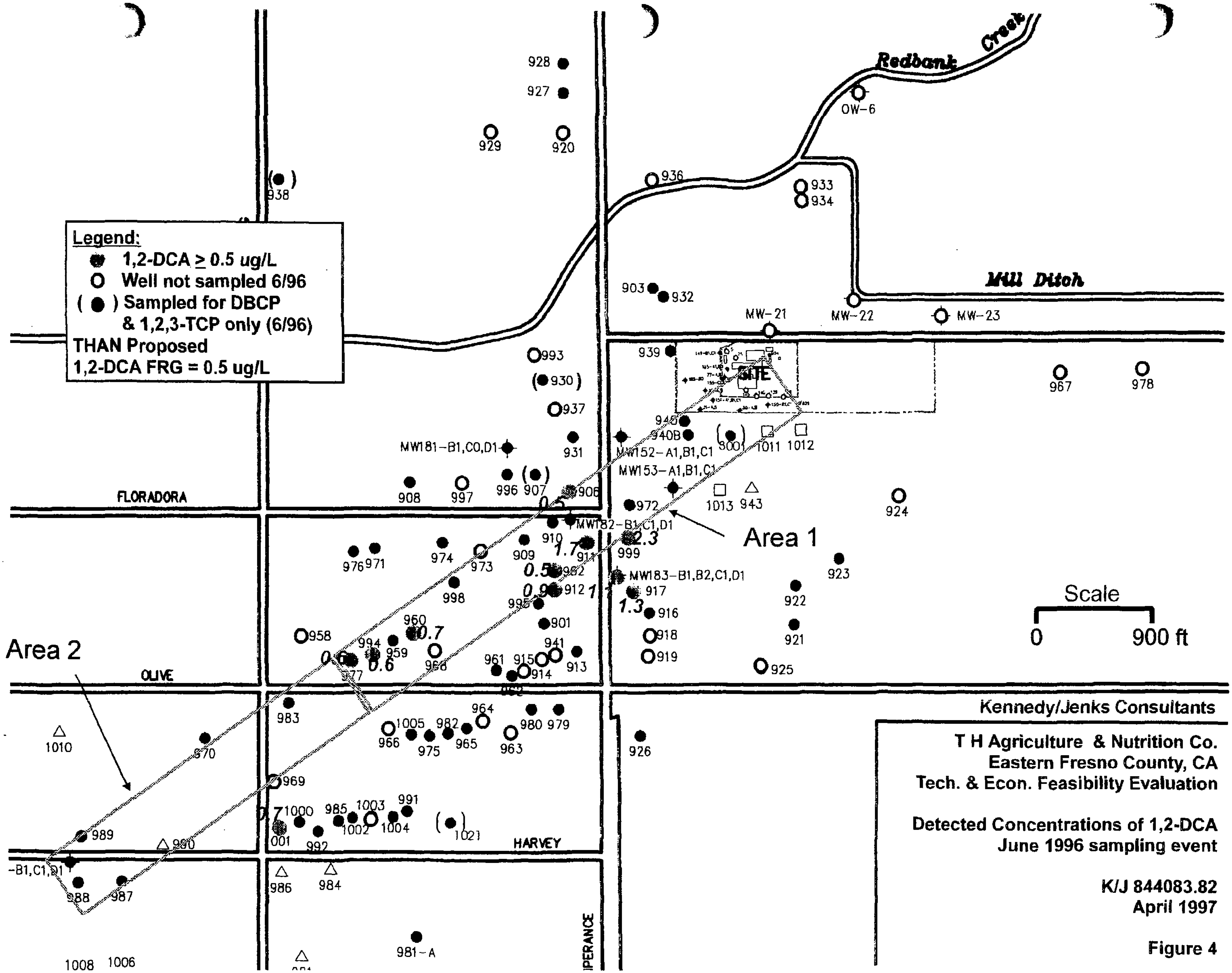
Detected Concentrations of Dieldrin
June 1996 sampling event

K/J 844083.82
April 1997

Figure 3



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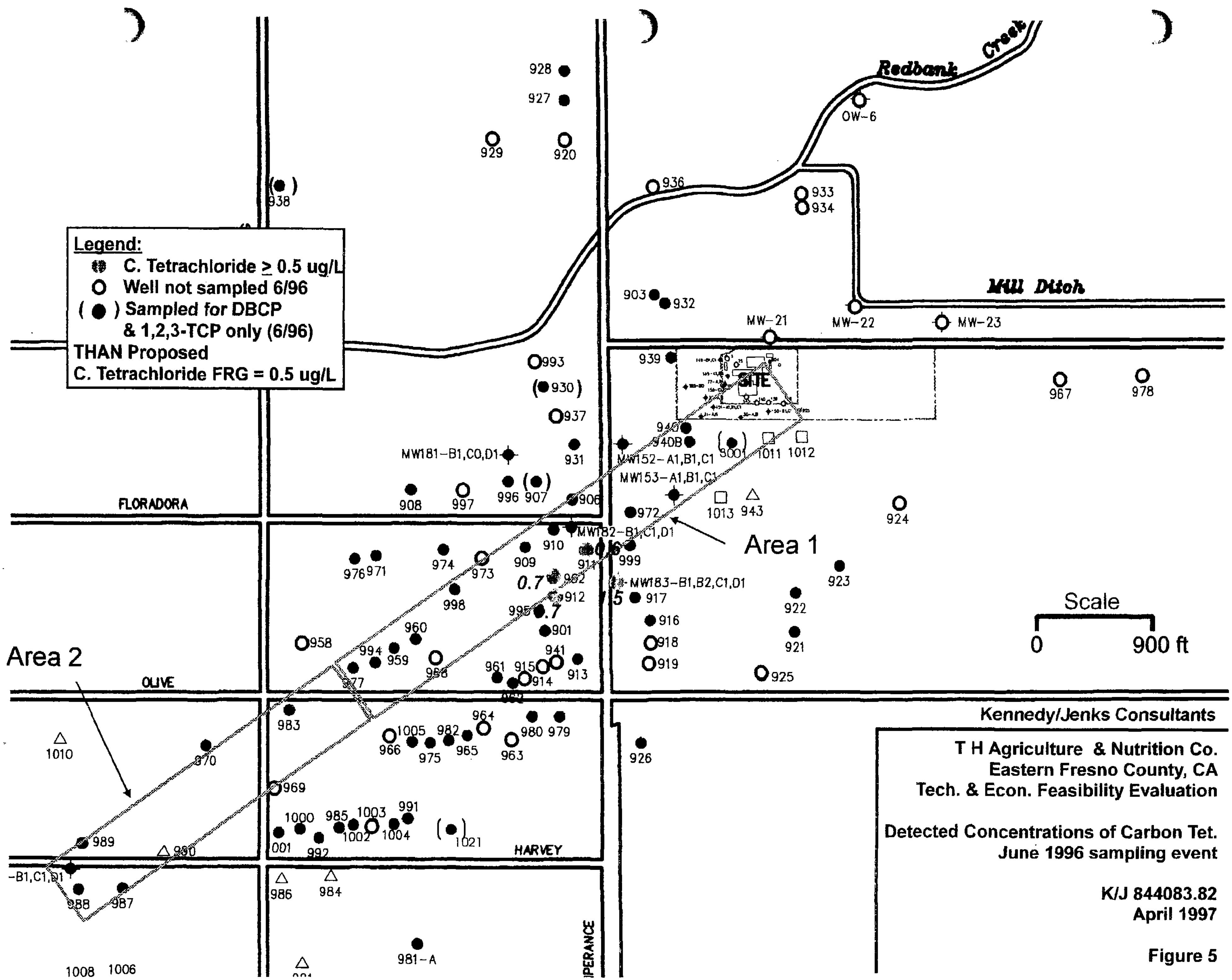
Detected Concentrations of 1,2-DCA
June 1996 sampling event

K/J 844083.82
April 1997

Figure 4


Legend:
C. Tetrachloride ≥ 0.5 ug/L
Well not sampled 6/96
(●) Sampled for DBCP & 1,2,3-TCP only (6/96)
THAN Proposed
C. Tetrachloride FRG = 0.5 ug/L
Redbank Creek
Mill Ditch
FLORADORA
OLIVE
HARVEY
SITE
Area 1
Area 2
Scale
0
900 ft
OW-6
MW-21
MW-22
MW-23
MW181-B1,C0,D1
MW152-A1,B1,C1
MW153-A1,B1,C1
MW182-B1,C1,D1
MW183-B1,B2,C1,D1
0.7
0.7
15
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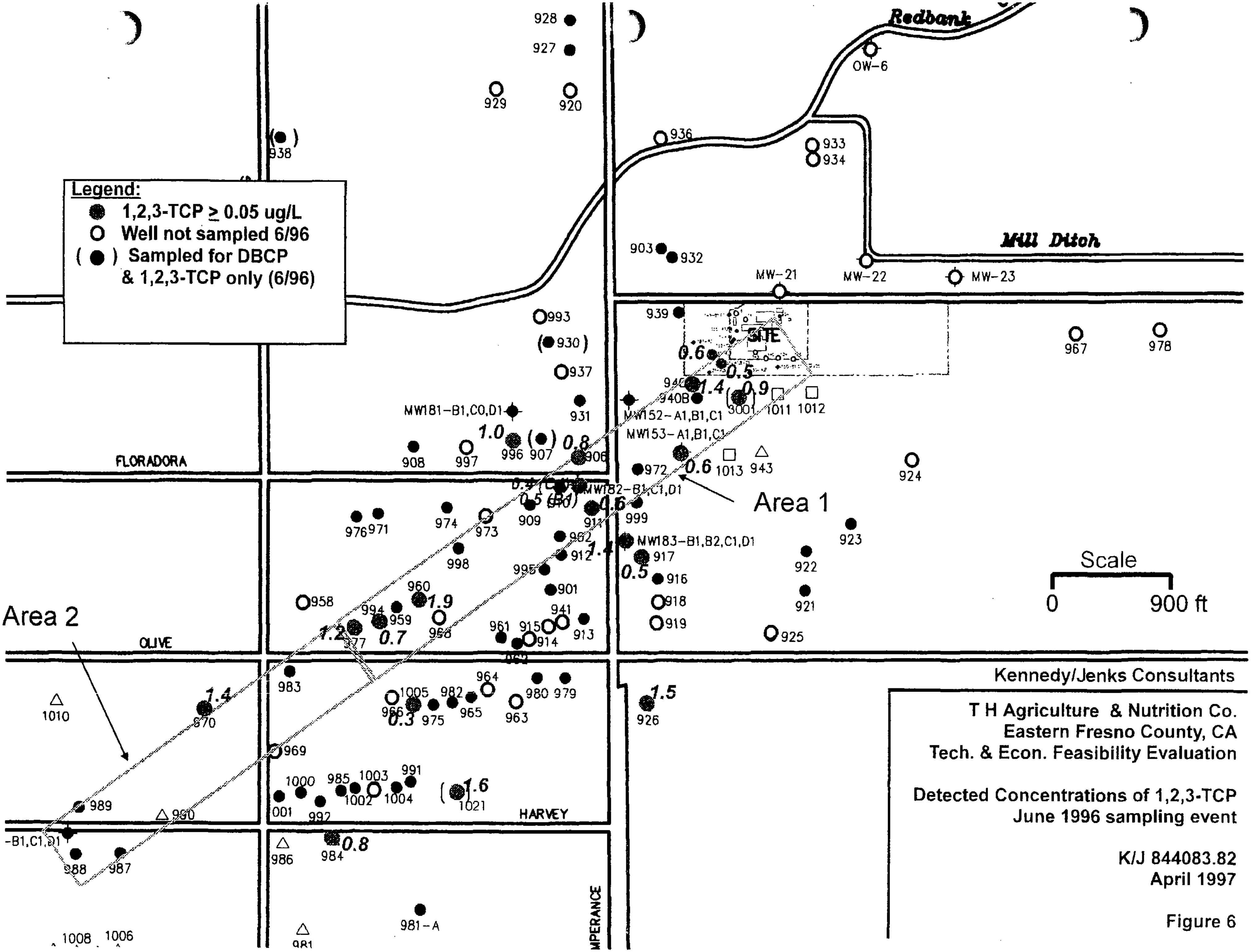
Tech. & Econ. Feasibility Evaluation
Detected Concentrations of Carbon Tet.
June 1996 sampling event
K/J 844083.82
April 1997
Figure 5



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Detected Concentrations of 1,2,3-TCP
June 1996 sampling event

K/J 844083.82
April 1997

Figure 6

APPENDIX A

DOCUMENTATION OF TECHNICAL AND ECONOMIC EVALUATION

APPENDIX A

Documentation of Technical and Economic Evaluation

THAN Site, Eastern Fresno County, California

INTRODUCTION

This appendix provides details on the technical and economic evaluation of achieving DTSC's background concentrations for chloroform and other chemicals related to the THAN Site. The appendix is organized into three sections. The first section discusses the concept of chemical partitioning and develops the formulas needed to calculate the number of soil pore volume exchanges required to reach background concentrations in groundwater given current chemical concentrations. The second section summarizes the chemical transport model. The last section provides estimates of the extent of chemical affected areas, and presents the cost evaluations for the use of pump and treat technology to reach background concentrations.

CHEMICAL PARTITIONING AND CALCULATION OF REQUIRED PORE VOLUME EXCHANGES

In the evaluation of groundwater remediation, it is important to have an estimate of the number of soil pore volumes of water that need to be removed to reduce the chemical concentration in groundwater to below the cleanup goal based on chemical partitioning between soil and groundwater. A simple, but conservative, model was developed to calculate the number of pore volume exchanges required to reduce chemical concentrations from current levels to below background.

Basic Concepts

A basic principle for understanding the mobility of a chemical in a soil/water system is that the chemical will distribute itself between the stationary soil (particulate) phase and the mobile aqueous phase. Chemicals that are partitioned predominantly in the aqueous phase will move more readily with groundwater, while chemicals that preferentially reside on the stationary soil particles will be retarded in their movement with groundwater. If an organic chemical is present at low concentrations in water and soil, the chemical concentrations in soil (C_s in μg/kg) and in water (C_w in μg/l) at equilibrium are often related by the simple expression:

$$K_d = C_s / C_w$$

K_d is called the soil/water partition coefficient of the chemical in site soil, and is a measure of the sorption potential of the chemical on soil. The assumption that C_s / C_w is a constant may not hold at high chemical concentrations.

K_d is generally not directly measured, but can be approximated using the soil/water partition coefficient normalized for organic carbon fraction (K_{oc}) and the fraction of organic carbon in site soil (f_{oc}).

$$K_d = K_{oc} \times f_{oc}$$

Values of K_{oc} were provided in the Remedial Investigation (RI) report for most chemicals. The values are summarized in Table A-1. Measured Site values of f_{oc} ranged from 0.002 to 0.006. The more conservative value (i.e., the value that would result in the greatest partitioning to soil) of 0.002 was used in the analysis presented in this appendix. If the value of 0.006 were used, calculated required pore volume exchanges would be three times higher.

Mechanisms other than organic carbon partitioning can contribute to the sorption of chemicals to soils. These include partitioning of chemicals between water and mineral soil surfaces in which the surface area and surface activity of the soil particles influence the partitioning coefficient. For example, clays show greater sorptive properties than do sands because of the larger surface areas of the clay materials compared to sands. However, the quantitative understanding of partitioning of organic chemicals between water and mineral surfaces is not well developed. As a general rule, it appears that at f_{oc} values of less than approximately 0.001, the use of a K_{oc} f_{oc} term to estimate K_d values begins to fail. For the purposes of this study, the K_{oc} f_{oc} term will be used, and not a related term for clay matter ($K_{cm}f_{cm}$).

Model

For simplicity, partitioning calculations were based on a hypothetical 1 ft^3 block of saturated soil. This assumption does not affect the pore volume turnover calculation. The simple assumption is that the water in the pore space of this soil block is removed along with the dissolved portion of the chemical, and replaced with water containing no detectable chemicals. The chemical remaining on soil particles within the block then reaches a new equilibrium partition between soil and water. This process is iterated, partitioning chemical from soil to water and removing the water, until the calculated water concentration is below the background concentration.

Given a value for C_w, such as a mean concentration of the chemical in groundwater, C_s can be calculated at time zero using K_d.

$$C_s = C_w \times K_d$$

The hypothetical mass of chemical in soil and groundwater is also calculated. The mass in soil is the product of the concentration and the amount of soil:

$$M_s = C_s \times D \times V \times CV1$$

where:
M_s = mass of chemical in soil (µg)
C_s = concentration of chemical in soil (µg/kg)
D = density of soil (assumed to be 100 lb/ft^3)
V = volume of soil (1 ft^3)
CV1 = conversion factor (0.4536 kg/lb)

The hypothetical mass of chemical in water is the product of the concentration and the amount of water:

$$M_w = C_w \times n \times V \times CV2$$

where:
M_w = mass of chemical in water (µg)
C_w = concentration of chemical in water (µg/l)
n = effective soil porosity (assumed to be 0.35)
V = volume (1 ft^3)
CV2 = conversion factor (28.32 L/ft^3)

After one pore volume exchange (time = 1), the mass of chemical in the system is reduced by M_w. The new total mass (TM) of the system (equal to the old M_s) is then distributed into a new M_w and new M_s.

$$TM^{t=1} = M_w^{t=1} + M_s^{t=1}$$

Substituting from above,

$$TM^{t=1} = (C_w^{t=1} \times n \times V \times CV2) + (C_s^{t=1} \times D \times V \times CV1)$$

Substituting $C_w \times K_d$ for C_s gives

$$TM^{t=1} = (C_w^{t=1} \times n \times V \times CV2) + (C_w^{t=1} \times K_d \times D \times V \times CV1)$$

$$= C_w^{t=1} \times [(n \times V \times CV2) + (K_d \times D \times V \times CV1)]$$

Solving for C_w:

$$C_w^{t=1} = TM^{t=1} / [(n \times V \times CV2) + (K_d \times D \times V \times CV1)]$$

After the first pore volume exchange (t=1), the total mass $TM^{t=1}$ is equal to the initial total mass, $TM^{t=0}$ minus the initial mass in water, $M_W^{t=0}$,

$$TM^{t=1} = TM^{t=0} - M_w^{t=0}$$

The concentration in water after the first pore volume exchange is therefore:

$$C_w^{t=1} = [TM^{t=0} - M_w^{t=0}] / [(n \times V \times CV2) + (K_d \times D \times V \times CV1)]$$

$$= \frac{C_w^{t=0} \times [(n \times V \times CV2) + (K_d \times D \times V \times CV1)] - (C_w^{t=0} \times n \times V \times CV2)}{[(n \times V \times CV2) + (K_d \times D \times V \times CV1)]}$$

$$= C_w^{t=0} \times \frac{K_d \times D \times V \times CV1}{(n \times V \times CV2) + (K_d \times D \times V \times CV1)}$$

This can be generalized to calculate the concentration in water at time m:

$$C_w^{t=m} = C_w^{t=0} \times \left[\frac{K_d \times D \times V \times CV1}{(n \times V \times CV2) + (K_d \times D \times V \times CV1)}\right]^m$$

To simplify the equation, define A as the chemical-specific factor in the power function:

$$A = \frac{K_d \times D \times V \times CV1}{(n \times V \times CV2) + (K_d \times D \times V \times CV1)}$$

Substituting this term, the equation becomes:

$$C_w^{t=m} = C_w^{t=0} \times A^m$$

This equation can be solved to find m, the number of pore volume exchanges required to reach a concentration in groundwater equal to background starting from the initial concentration.

$$\log(\text{background}) = \log(C_w^{t=0}) + m \times \log(A)$$

$$m = \frac{\log(\text{background}) - \log(C_w^{t=0})}{\log(A)}$$

The chemicals associated with the Site of primary concern in offsite groundwater are carbon tetrachloride, chloroform, 1,2-dichloroethane, dieldrin, and 1,2,3-trichloropropane. These chemicals have been detected in groundwater samples at concentrations of concern. Table A-2 shows the calculated values of m based on the calculated mean concentrations of chemicals detected in recent groundwater samples, and the respective background concentrations shown in Table A-1. The next step is to evaluate the time required to remove the required pore volumes under no further action and other scenarios. The next section discusses the volume of water impacted by the chemicals of primary interest.

GROUNDWATER MODELING

A model was constructed to simulate groundwater flow under and downgradient of the Site. Two separate parameter estimation calibrations (sub-models) have been made based on data obtained from pumping tests conducted in two monitoring wells (151-B1 and 182-B1). The pumping test data and model results indicate a hydraulic transmissivity (and conductivity) three to four times greater in the vicinity of monitoring well 182-B1 than 151-B1. Both sub-models use the same overall stratigraphic conceptual model, and are constructed as laterally homogeneous models.

Conceptual Model

The conceptual model is based on lithologic data from numerous borings at and near the Site, along with information obtained from numerous domestic wells downgradient. The groundwater flow regime has been characterized in past reports including the THAN Phase II/III Investigation Report (K/J 1991), and the THAN Remedial Investigation Report (K/J 1993).

An interpretation of available logs indicates that there are up to seven general water bearing zones, between ground surface and approximately 215 ft below ground surface (bgs), separated by leaky aquitards. The groundwater bearing zones encountered above 215 ft bgs have been designated as the A, B0, B1, B2, C0, C1, and D1 zones (from shallowest to deepest). The A zone has been dewatered since the late 1980s. The primary zone of concern, with regard to chemically affected groundwater and this model, is the B1 zone which occurs at approximately 80 ft bgs and is modeled as being eight feet thick. The land surface slopes approximately 15 feet over 1¼ miles (0.2%) in a downgradient direction. This surface is modeled as horizontal.

There is generally good stratigraphic correlation between water-bearing zones throughout the area investigated during the RI. There are thickness changes of the zones over the study area and two zones (B0 and C0) are apparently laterally discontinuous. The leaky aquitards are primarily composed of compacted silts, and sands with some clay present. The aquitard material was generally described as dry to moist during drilling activities.

Based on the results of two pumping tests performed in October 1994 (monitoring wells 151-B1 and 182-B1) there is hydraulic connection between the B1 (approximately 80 ft bgs) zone and the C1 zone (approximately 145 feet bgs). The C1 zone is modeled as being 13 feet thick. This connection is assumed to occur primarily through discontinuity in the B1-C1 aquitard, based on the relative lack of pore moisture encountered in core samples. Deeper zones were not monitored during the pumping test.

Computer Code Description

The model was constructed using the Visual MODFLOW package developed and distributed by Waterloo Hydrologic Software, Inc. (WHS) of Waterloo, Ontario, Canada. The package uses the computer code from the USGS, developed MODFLOW Groundwater Model as a base, with WHS developed pre- and post-processors. The USGS particle-tracking software MODPATH and the USEPA fate and transport model MT3D are incorporated into the overall package.

Visual MODFLOW has four numerical groundwater flow solvers built in. The groundwater model described here was primarily developed using the Waterloo Hydrogeologic Software Solver (WHSS) for Visual MODFLOW. Visual MODFLOW default WHSS parameters were used including: a maximum number of 50 outer iterations and 500 inner iterations; head change criterion for convergence of 0.01 feet; residual criterion for convergence of 0.01 feet; a damping factor for outer iterations of one; a relative residual criterion of one; and a factorization level of one. For the transient model calibrations, two 24-hour stress periods (pump on, pump off) were used to simulate the pumping tests. Ten time steps with a multiplier of 1.2 were incorporated into each stress period.

Model Construction

The model incorporates thirteen layers including seven porous (water-bearing) zones separated by six leaky aquitards. Upgradient and downgradient boundaries are represented in the model as constant head boundaries. Cross gradient boundaries are no flow cells. Boundaries are of sufficient distance from areas of interest so as not to be affected by induced stress (e.g. pumping). Water-bearing zone and aquitard thicknesses are estimated averages of the zone thickness over the model area as interpreted from the Phase II/III cross sections.

Two separate grid configurations and parameter estimations were made. These sub-models were calibrated to Fall 1994 steady state conditions and two 24-hour B1 zone pumping tests conducted in October 1994. One sub-model was configured to calibrate to the pumping test conducted at monitoring well 151 and the second sub-model was configured to calibrate to the pumping test conducted at monitoring well 182. All layers are considered homogeneous and isotropic for the purposes of the simulation.

The monitoring well 151 model configuration contains a total of 70 columns, 55 rows and 13 layers for a total of 50,050 grid nodes. The monitoring well 182 model contains a total of 44 columns, 45 rows, and 13 layers for a total of 25,740 grid nodes. The monitoring well 151 grid has more nodes to allow incorporation of additional pumping wells into the model framework. Grid spacing ranges from 500 feet by 500 feet at the edges of the model domain to 5 feet by 5 feet around specific areas of interest such as pumping wells. Grid spacing increases are designed such that grid node sizes are increased by not more than 1.5 times the adjacent node size.

Initial transmissivity and storativity values were based on averages of 34 slug tests conducted in the spring of 1990, the two pumping tests conducted in October 1994, empirical published values for soil types, and geological knowledge of the area. Primary vertical hydraulic connectivity through the aquitards is considered to be through fractures or cracks in the compacted silty material, and is treated in the model as higher vertical conductivities than published data would indicate.

Infiltration recharge was not included in the model. Precipitation in the area is less than fourteen inches per year. There is an irrigation ditch (Mill Ditch) that occurs on the edge of the modeled area. Data from numerous years of groundwater monitoring indicate a relatively stable gradient without significant impact from this ditch. There are numerous domestic wells in the modeled area. Pumping from these wells is not considered significant; these wells have been used for small area irrigation purposes only, since 1989. Upgradient and downgradient constant head boundaries have been estimated from Fall 1994 pieziometric surface maps.

Model Calibration

Each sub-model was initially calibrated to steady state conditions using water level measurements obtained from monitoring wells and domestic wells made in the third quarter 1994. Parameter estimation refinement was accomplished by using the initial steady state calibration results in two separate transient calibrations, one for each of the two B1 zone aquifer tests conducted in October 1994. Parameter estimations from the transient calibrations were then input into the steady state model to check for agreement. A mass balance was calculated for each model run. This process was iterated until modeled hydraulic heads in both the transient and steady state model runs were within one-third of one foot variance from measured heads and the mass balance was within 0.5 percent. The two sub-models, for monitoring wells 151-B1 and 182-B1, utilize modeled hydraulic conductivities in the B1 zone of 28 feet per day and 105 feet per day respectively. In both sub-models, the specific storage of the B1 zone is modeled as $1X10^{-5}$, and porosity is modeled as 35 percent.

Model results were incorporated into the calculations of cost estimates presented in the next section.

COST ESTIMATES

The economic feasibility evaluation contemplated the remediation of two areas in groundwater: Area 1, which extends approximately 4,050 feet southwest of the Site; and Area 2, which extends 2,700 feet southwest of the distal end of Area 1. The chemical areas, shown on

Figure 1, were delineated based on detected chemical concentrations in samples collected during the June 1996 sampling event. Area 1 was established based on the furthest downgradient presence of Dieldrin and most of the other chemicals. Area 2 contains primarily chloroform, but 1,2,3-TCP and DBCP are also present in part of this area.

For the purposes of this evaluation, the subsurface volumes corresponding to the two areas were modeled as rectangles, with a length corresponding to the distance in groundwater that chemicals were detected, a width equal to the expected influence of two extraction wells (based on modeling results, the estimated radius of influence of an extraction well would be 125 feet), and a depth equal to the estimated thickness of the targeted water bearing zone. For Area 1, the dimensions were 4,050 ft. x 500 ft. x 15 ft. For Area 2, the dimensions were 2,700 ft. x 500 ft. x 15 ft. These parameters were established in order to evaluate remediation costs conservatively, so that the feasibility evaluation would not overstate remediation costs in the balancing of incremental costs against incremental benefit.

The arithmetic mean concentration of detected chemical concentrations in groundwater was used with chemical partitioning information to determine the average mass of chemical in a cubic foot of chemically affected soil and groundwater in the area. Combining unit mass information with the total volume of the area allowed an estimate to be made of the total mass of chemical in the area. The results are shown in Table A-2.

For Dieldrin in Area 1, taking into account non-detect values was considered. Although the area appears to be well delineated, approximately one half of the monitoring well samples did not contain measurable concentrations of Dieldrin. An arithmetic mean using data from all the wells in Area 1, assuming that Dieldrin was present in non-detect wells at one-half its detection limit, resulted in a mean concentration (0.06 ppb) very near the detection limit of 0.05 ppb. While this might be interpreted to indicate that background has almost been met, the mean of all data may be a low representative value for Dieldrin in the area. The maximum concentration is also not representative, and would overestimate the amount of Dieldrin in the area. The arithmetic mean of detected concentrations was chosen as representative of groundwater requiring remediation. For chloroform in Area 2, the issue of non-detect values did not arise because all well samples contained detected amounts of chloroform.

Three approaches to remediation were evaluated. The first approach looked at natural groundwater flow (remedial option 1). The second and third approaches involve groundwater extraction and treatment with liquid phase activated carbon.

The second approach (remedial option 2) involved two extraction wells at the distal end of the respective areas (in addition to two onsite or nearsite extraction wells for Area 1). For Area 1, the assumption was that there would be two extraction wells onsite or nearsite, and two extraction wells near well 977. For Area 2, the assumption was that there would be two extraction wells near the monitoring well 184 cluster. This minimized capital costs but increased operation and maintenance costs. Option 2 was considered the most reasonable extraction effort based on modeling results, the low levels of chemicals present, and concern for optimizing remediation by extracting only from the chemically-impacted water bearing zone. Two distal extraction wells would also provide hydraulic control to limit the mobility of chemicals in groundwater. Extracted groundwater was assumed to require treatment. The calculated costs likely provide an underestimate of the actual costs.

A third approach that involved adding numerous additional extraction wells within the groundwater areas was also considered. Increasing the total number of extraction wells to 36 for Area 1 and 24 for Area 2 was considered. This would increase capital costs but reduce operation and maintenance costs. While this option would result in reduced remediation times, it would not be feasible to implement because this option would require access to numerous parcels of private property to install the large number of extraction wells. In addition, the simplified partitioning model used in the TEFE may not accurately reflect the limitations in removing chemicals from groundwater, even using a large network of extraction wells. This third option was not considered further.

Natural interstitial groundwater velocities were estimated to range from 0.3 feet/day to 1.6 feet/day. The value selected for the calculation was 0.75 feet/day, which was considered a reasonable groundwater flow velocity that likely would not underestimate the true groundwater velocity. A faster groundwater flow rate would allow remediation to occur sooner, and therefore reduce remediation costs. At a flow rate of 0.75 feet/day, it would hypothetically take groundwater approximately 15 years to travel the length of Area 1, and approximately an additional 10 years for Area 2. By combining this information with the information on the number of pore volumes required to be removed to reduce the chemical concentration from the mean to the background, the hypothetical time required for remediation can be estimated. The results are shown in Table A-2. For Area 1, the chemical that would take the longest time to achieve background is Dieldrin. Table A-3 shows the difference between the time required for natural attenuation and active remediation for the chemicals of interest.

Simulated times are based on soil-water partitioning only. They do not include other factors such as dispersion, diffusion, and biological degradation that may be occurring. It is difficult to determine the relative significance of these other factors. It is unlikely that dispersion and diffusion would have a major influence on a relatively immobile chemical such as Dieldrin. Although degradation of the chemicals is slow, it may have a noticeable influence on concentrations over the remediation times calculated.

Costs for installation of the two groundwater extraction and treatment systems were based on internal cost estimates performed in 1996 for various treatment and extraction scenarios. Costs considered included:

- Startup compliance
- Installation of extraction well systems
- Activated carbon treatment system
- Discharge system
- Operation and maintenance costs excluding carbon
- Activated carbon changeout costs

Treated water was assumed to be conveyed by pipelines to the Fresno Irrigation District canals.

The estimated costs for the simulated groundwater remediation scenarios are shown in Table A-3. These costs do not incorporate the present worth of money. By dividing the estimated costs by the estimated amount of chemical in the area (assuming 100 percent removal), the unit cost of chemical removal can be estimated. The results are shown in Table A-3 for the two remedial options. For completeness, costs for Area 1 are shown for individual chemicals. These costs are not additive. The hypothetical remediation system would be designed and operated for the presence of Dieldrin, the chemical that would drive the remediation because it is more preferentially bound to soil than the other chemicals.

In Area 1, for remedial option 2, the estimated cost of remediation is $17 million, and since the estimated amount of Dieldrin that would be removed is one pound, the cost per pound of Dieldrin removed is also $17 million.

In Area 2, for remedial option 2, the estimated cost of remediation is $1 million. Because approximately 5 pounds of chloroform would be removed, the estimated cost per pound of chloroform removed is $240,000.

TABLE A-1

Chemical Parameters
THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	K_{oc} [(a)]	K_d [(b)]
Carbon Tetrachloride	110[(c)]	0.22
Chloroform	34	0.068
1,2-Dichloroethane	33	0.066
Dieldrin	1,700	3.4
1,2,3-Trichloropropane	51[(c)]	0.10

Notes:

(a) Partition coefficient normalized for organic carbon. Values taken from remedial investigation (RI) report (K/J 1993) unless otherwise noted.
(b) Partition coefficient calculated from K_{oc} x f_{oc}, where f_{oc} is the fraction of organic carbon in soil, assumed to be 0.002.
(c) Value unavailable in RI report. Taken from U.S. EPA Region IX's Preliminary Remediation Goals (PRGs), August 1996.

TABLE A-2

Characteristics of Affected Groundwater
THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	Mean Conc.[a] (ppb)	Background[b] (ppb)	Amount of Chemical in Groundwater Area[c] (lb)	Calculated Number of Pore Volumes Required[d]	Calculated Time Required for Remediation[e] (years)
Area 1					
Carbon Tetrachloride	0.9	0.5	0.3	0.9	13
Chloroform	19	1.0	16	2	29
1,2-Dichloroethane	1	0.5	0.5	0.5	7
Dieldrin	0.1	0.05	1	11	160
1,2,3-Trichloropropane	0.9	0.05	0.7	4.7	68
Area 2					
Chloroform	9	1.0	5	1.5	15

Notes:

(a) Arithmetic mean of concentrations detected in groundwater area.
(b) FRGs proposed by DTSC in letter to THAN dated 6 March 1997.
(c) Calculated using the calculated mass in 1 cubic foot of soil and the assumed volume of impacted soil in the groundwater area.
(d) Number of pore volume exchanges required to reduce chemical concentrations from mean to background.
(e) Calculated using soil-water partitioning model and groundwater flow model assuming natural attenuation. See Appendix A.

TABLE A-3

Results of Economic Feasibility Evaluation
THAN Site, Eastern Fresno County, California
K/J 844083.82

Chemical	Estimated Amount of Chemical in Area[a] (lbs)	Calculated Time Required to Achieve Background[b] (years)		Estimated Remediation Cost[e] ($)		Estimated Cost Per Pound[f] ($/lb)	
		Option 1[c]	Option 2[d]	Option 1[c]	Option 2[d]	Option 1[c]	Option 2[d]
Area 1[g]							
Carbon Tetrachloride	0.3	3	2.1	—	490,000	—	1,600,000
Chloroform	16	30	26	—	3,300,000	—	210,000
1,2-Dichloroethane	0.5	4.5	4	—	720,000	—	1,400,000
Dieldrin	1	160	140	—	17,000,000	—	17,000,000
1,2,3-Trichloropropane	0.7	36	32	—	3,900,000	—	5,600,000
Area 2(h)							
Chloroform	5	15	13	—	1,000,000	—	240,000

Notes:

(a) Calculated using the calculated mass in 1 cubic foot of soil and the assumed volume of groundwater.
(b) Estimated time required to reduce chemical concentration from mean to background.
(c) No further action. Estimated attenuation by soil pore volume exchanges without extraction of groundwater (natural groundwater flow). Does not consider diffusion, dispersion, or biodegradation.
(d) Assumes two extraction wells onsite, and two extraction wells offsite for Area 1 and two extraction wells at distal end of Area 2.
(e) Estimated cost = (estimated annual costs x estimated years required for remediation) + capital costs. Does not take into account present worth of money.
(f) Cost divided by calculated amount of chemical in area, assuming 100 percent removal.
(g) Based on removal of Dieldrin, the chemical requiring the greatest time to reach background. Approximately 110,000,000 gallons of groundwater would need to be extracted.
(h) Approximately 10,000,000 gallons of groundwater would need to be extracted.

APPENDIX B

EVALUATION OF SECTION 2550.4(d) ELEMENTS

APPENDIX B

Evaluation of Section 2550.4(D) Elements

THAN Site, Eastern Fresno County, California

The Tulare Lake Basin Plan states that the factors to be considered in the establishment of cleanup levels greater than background are given in Title 23, California Code of Regulations, Section 2550.4(d). These factors were summarized in Section 6.3. A more detailed discussion for each factor is presented in this appendix.

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE WASTE

Section 3 of the draft RAP includes a summary of the types of chemicals present at the Site (Kennedy/Jenks 1994). Chemicals handled at the Site by the Site's owners and operators included agricultural chemicals (i.e., pesticides), various raw materials used in agricultural chemical formulation, quality assurance laboratory chemicals, and solvents.

Most of the chemicals of concern in groundwater are halogenated alkanes. One of these is carbon tetrachloride. Typical of other halogenated alkanes, carbon tetrachloride is relatively mobile and persistent in the environment.

Chloroform was used in the quality assurance laboratory. Chloroform, also called trichloromethane, is one of the trihalomethanes. Chloroform is highly volatile. It is also highly soluble in water. Because it does not partition strongly to soil, it is very mobile in groundwater. Degradation of chloroform in the environment is slow. However, it does not accumulate in plants and animals.

1,2-Dichloroethane (1,2-DCA) is a relatively volatile chemical. It is highly soluble in water, and would be expected to move quickly to groundwater. Transformation of 1,2-DCA is expected to be slow.

Dieldrin is a persistent organochlorine pesticide. Retardation of Dieldrin mobility in groundwater by sorption to organic matter and clay is likely. Transformation of Dieldrin is a slow process.

1,2,3-Trichloropropane (1,2,3-TCP) is a pesticide similar to 1,2-dibromo-3-chloropropane (DBCP), which had greater general use after DBCP was banned. It is a relatively volatile chemical. 1,2,3-TCP is not as soluble as some of the other compounds, but because of its expected low sorption, it may be considered mobile in groundwater.

In summary, many of the chemicals present are relatively mobile in groundwater. The chemical that is most highly sorbed to soils, and is also the most persistent, is Dieldrin.

HYDROGEOLOGICAL CHARACTERISTICS OF THE FACILITY AND SURROUNDING LAND

The hydrogeological characteristics of the Site are summarized in Section 4 of the draft RAP.

The Site is within the eastern portion of the San Joaquin Valley, about ten miles from the westernmost foothills of the Sierra Nevada Mountains. The San Joaquin Valley is a geomorphic province consisting predominantly of alluvial fans and plains, lacustrine and marsh deposits, flood basin deposits and sand dunes. The Fresno region of the San Joaquin Valley is underlain by a basement complex of metamorphic and igneous rocks. Consolidated marine and continental sedimentary rocks of Cretaceous and Tertiary age consisting mainly of sandstone, siltstone and shale overlie the basement complex. The most important water-bearing geologic unit for water supply is the older alluvium, which consists of layers and lenses of variable-sized sediments. The Site is situated atop Quaternary older alluvium (Kennedy/Jenks 1993).

During the course of the remedial investigation, over 200 soil borings were drilled at and near the Site to investigate surface and subsurface conditions from depths of one to two hundred and fifty feet. Surface and shallow subsurface soil samples from one to three feet deep were collected from grid areas in the unpaved areas of the Site. The lithology encountered during drilling consists of heterogeneous mixtures of sand, silt, gravel and occasional lenses of clay. Sandy silt comprises roughly 50 percent of the lithology encountered in the first 200 feet below ground surface. A loose silty sand layer is found at the ground surface and extends to depths between 4 to 9 feet across the Site and vicinity. This soil is coarse in texture and contains low percentages of clay and organic matter.

Lithologic logs for 202 borings of various depths dating from December 1982 to September 1991 are presented in Appendix K of the RI report (Kennedy/Jenks 1993). Electric (geophysical) and lithologic logs of the borings were used to construct two generalized geologic cross sections presented in the RI Report (Figures 4-5 and 4-6 of the RI report, Kennedy/Jenks 1993). Domestic well logs reviewed during the RI indicate that the screened depths of domestic wells in the Site vicinity vary from about 96 to 170 feet.

The lithology encountered during the RI consists of heterogeneous mixtures of sand, silt, gravel and occasional lenses of clay. Lithologic units of sand and gravel represent zones of high permeability and the most significant water-bearing zones. The water-bearing zones that were sampled during the RI are identified as A, B, C, and D. Semi-confined permeable subunits encountered in each water-bearing zone are designated with numbers increasing with depth in a given zone (A1, B0, B1, B2, C0, C1, and D1). Subunits extend across the Site as interfingered layers of greater and lesser permeable materials, which may allow flow to occur between subunits within a water-bearing zone. Permeable water-bearing zones were encountered at the following depths:

- In the A zone, clayey gravels and sands were encountered between depths of 15 and 45 feet below ground surface (bgs) in subunit A1. The A zone is not currently saturated but was historically saturated and became dry during the summer of 1987 due to climatic conditions.
- In the B zone, silty sand and sand were encountered between depths of 58 and 78 feet bgs in subunit B0. Silty sand and sand were encountered between depths of 70 and 102 feet bgs in subunit B1. Silty sand and sand were encountered between depths of 99 and 115 feet bgs in subunit B2. The permeable subunits within the B zone are not continuous across the Site and are separated from one another by silt or clayey silt.
- In the C zone, silty sand and sand were encountered between depths of 116 and 144 feet bgs in subunit C0. Silty sand, sand and silty gravel were encountered between depths of 140 and 184 feet bgs in the C1 subunit. The permeable C zone layers are not continuous across the Site and are separated from one another by less

permeable silt or clayey silt layers. The subunits within the C zone are separated from the B zone by approximately 20 feet of less permeable soils.

- In the D zone, silty sand, sand and gravel were encountered between depths of 172 and 232 feet bgs in the D1 subunit. The permeable subunit of the D zone is separated from the C zone by approximately 15 feet of less permeable soils.

Subunits and water-bearing zones investigated during the RI appear to be in hydraulic communication, with preferential horizontal flow paths dominating groundwater movement (Kennedy/Jenks 1993).

The vadose zone is the zone of soil overlying a regional water table. The near-surface soils are characterized as excessively drained, rapidly permeable, having low water-holding capacity and susceptible to wind erosion. The soils are coarse textured and are composed of well-sorted sands overlying an unrelated older eroded alluvial deposit (Kennedy/Jenks 1993).

In some locations beneath the surface layer, a dense, discontinuous hardpan layer has been encountered. Hardpan describes a semiconsolidated (compressed), uncemented soil layer. At the Site, the hardpan consists of silty soil. Where present, this hardpan layer occurs at an approximate depth of 4 feet in the northern and eastern part of the Site and dips to 9 feet in the southern and western part of the Site. The existence of shallow hardpan was established in a 1986 seismic refraction survey (RI Report, Appendix I, Kennedy/Jenks 1993). Hardpan was confirmed in some locations, but the continuity of the hardpan could not be established. Hardpans at greater depths were not investigated in this survey.

The zone of currently unsaturated alluvial deposits extends from the surface to a depth of approximately 50 feet. The alluvium is composed of braided stream deposits and consists of angular to sub-rounded sand, occasional gravel, and cobbles interlayered with lenses of silt and some clay. The porosity of this unit varies between 30 and 40 percent (Kennedy/Jenks 1993).

Deeper sediments encountered during the RI are generally similar to those near the ground surface with relatively sandy stream channel deposits interlayered with partially indurated fine-grained overbank deposits. Clay or silt layers at least 20 feet thick were encountered at the termination of the 250 foot deep borings.

In summary, the water-bearing zone of most interest with regard to the presence of chemicals is the B zone. Chemicals in this region of silty sand and sand will partition between the soil and groundwater, with the chemicals in groundwater able to move. Because the A zone is currently unsaturated, it consists of approximately 60 feet of vadose zone soils overlying the B zone.

QUANTITY OF GROUNDWATER AND DIRECTION OF GROUNDWATER FLOW

On the basis of Fresno Irrigation District records and information gathered during the RI, regional and local groundwater movement is from the northeast to the southwest. The water-producing zones of interest are present in the upper 200 feet of the alluvium (Kennedy/Jenks 1993).

The estimate for the volume of groundwater that would be removed to meet the PFRGs is presented in Table 1 of the main text. The basis for the estimates is provided in Appendix A.

PROXIMITY AND WITHDRAWAL RATES OF GROUNDWATER USERS

THAN has provided alternative water supplies to the Temperance-Kutner Elementary School and all residents in the vicinity of the Site with domestic wells affected by chemicals known to be associated with the Site. These alternative supplies include the provision of bottled water (or replacement filters) beginning in 1984 and the extension of the City Water System in 1988-1989 at THAN's expense. There is, therefore, no withdrawal of groundwater for domestic use in the affected area. However, groundwater in the vicinity of the Site is still being used for other purposes such as irrigation. The estimated withdrawal rates for irrigation in the vicinity of the Site have not been determined.

The public supply well nearest to the Site, PS 102, is located approximately 2,800 feet south-southwest of the distal end of Area 2. PS 102 is screened below 250 feet, 90 feet below the known vertical extent of Site-related chemicals in groundwater. A 40-foot clay layer of low permeability separates the water-bearing zones. Samples of groundwater from PS 102 are regularly collected and analyzed for the possible presence of chemicals known to be associated with the Site. The regional contaminant DBCP has been detected, but chemicals associated with the Site have not been detected (Kennedy/Jenks 1994).

CURRENT AND POTENTIAL FUTURE USERS OF GROUNDWATER IN THE AREA

Groundwater in the vicinity of the Site is designated by the EPA as a sole source drinking water aquifer (EPA 1993) and as suitable for municipal, domestic, agricultural, and industrial water supply by the RWQCB under the Central Valley Region Water Quality Control Plan for the Tulare Lake Basin (RWQCB 1995). Although the groundwater has been classified as a source of drinking water, the regional presence of DBCP at levels above drinking water standards renders the groundwater unacceptable for drinking water purposes without prior treatment.

Groundwater in the Site vicinity historically has been used for domestic and municipal supplies. It is THAN's understanding that domestic wells that are or were formerly included in the domestic well sampling program and affected by chemicals known to be associated with the Site are not used for domestic purposes, although they may be used for irrigation. Because of the regional presence of DBCP, if chemicals associated with the Site were removed, the groundwater would remain unsuitable for domestic use without treatment for DBCP.

EXISTING QUALITY OF GROUNDWATER.

In addition to the potential impacts of chemicals associated with the Site, regulations require consideration of "existing quality of groundwater, including other sources of contamination or pollution and their cumulative impact on groundwater quality." General discussions of groundwater quality are included in the Feasibility Study, Section 4 (Seacor 1993) and the Site risk assessment (Environ 1993). DBCP is the primary additional chemical of interest in Fresno area groundwater. The regional use and presence of DBCP was discussed in Section 4.2.4.5 of the draft RAP (Kennedy/Jenks 1994) and is discussed here.

In the Fresno area, DBCP has been detected at elevated concentrations in groundwater as a result of its regional application to crops. DBCP was present at concentrations higher than those detected regionally in some samples collected prior to 1987 from shallow, onsite A zone monitoring wells. Maximum concentrations of DBCP detected in groundwater samples from onsite B zone and all offsite monitoring wells are well within the regional DBCP concentration range reported in literature and measured during the RI.

The rate of migration of DBCP is estimated to be similar to that of chloroform, based on mobility factors (Kennedy/Jenks 1993). The direction of migration is assumed to be in the same direction as for other chemicals known to be associated with the Site (i.e., to the southwest). However, due to regional concentrations of DBCP detected in groundwater samples, the direction of migration cannot be determined solely from a review of the analytical data collected for DBCP during the RI.

Several studies have been made on the occurrence and distribution of DBCP in groundwater in California and Fresno County. California Department of Food and Agriculture (CDFA) reported that DBCP was detected at concentrations of less than 1 mg/kg in agricultural soils to which DBCP had been applied in Southeastern Fresno County (Kennedy/Jenks 1993). DBCP was detected in samples from 1,280 of the 3,016 wells sampled by the CDFA in the Fresno, Merced and Modesto areas between 1975 and 1988 (Kennedy/Jenks 1993). Detected concentrations of DBCP in those wells ranged from 0.1 to 10.5 µg/l (Kennedy/Jenks 1993).

A 1984 State Water Resources Control Board (SWRCB) study documented the occurrence of DBCP in groundwater state-wide. Local and state well sampling programs reported that approximately 41 percent of all well water tested in Fresno County in 1984 contained DBCP (Kennedy/Jenks 1993).

Schmidt evaluated the distribution of DBCP in groundwater in southeast Fresno County in 1984 (Kennedy/Jenks 1993, Appendix E). The study focused on an approximate 0.5 square mile area south and southeast of Fresno. The Site is located approximately 0.13 miles northeast of Schmidt's study area. Concentrations of DBCP reportedly ranged from approximately 0.1 to 5 µg/l. In approximately half of the wells within Schmidt's study area, shallow groundwater was observed to contain more than 1.0 µg/l of DBCP. Schmidt concluded that the presence of DBCP in well water "corresponded fairly closely to the locations of present or former vineyards." Relatively low or undetected DBCP concentrations were present in groundwater beneath urbanized areas and lands not heavily developed as vineyards. Schmidt found that DBCP concentrations exceeding 0.1 µg/l are primarily present in groundwater less than 250 feet below the ground surface (Kennedy/Jenks 1993).

THAN collected and analyzed samples of groundwater from domestic wells in the area of the city of Selma (Wells 944 through 957) to provide additional information on regional DBCP concentrations in an area clearly unaffected by the Site. The concentration values of detected DBCP ranged from less than 0.01 to 8.9 µg/l, with an average value of 2.3 µg/l (Kennedy/Jenks 1993).

These studies document that, in addition to being associated with the THAN Site, DBCP is a regional groundwater pollutant in the Fresno area, including areas adjacent to the Site. Consequently, even if THAN were able to remediate Site-related chemicals to their respective PFRGs, the groundwater still could not be used for domestic purposes without prior treatment because of the regional presence of DBCP at levels above drinking water standards.

An initial study has indicated that 1,2,3-TCP is also a regional pollutant in the Fresno area, similar to DBCP. The background concentration of 1,2,3-TCP has not been well characterized, and a drinking water standard has not been established for the chemical. However, indications are that 1,2,3-TCP may be present at concentrations that would result in an unacceptable health risk if groundwater were to be consumed.

POTENTIAL FOR HEALTH RISKS

Description of Risk Assessment

A human health and ecological risk assessment was performed for the Site in July 1993, and finalized in January 1996 (Environ 1996). The initial results of the risk assessment were summarized in Section 5 of the draft RAP. Because significant response actions have already been completed by THAN at the Site, the risk assessment considered potential risks to public health and the environment assuming that no further action is taken. Since 1984, THAN has provided alternative water supplies to all residents in the vicinity of the Site with domestic wells affected by chemicals known to be associated with the Site. The hypothetical exposure scenarios evaluated in the risk assessment conservatively did not consider the provision of such alternative water supplies for the purpose of calculating the risks associated with potential exposure to groundwater. The calculated risk would be significantly reduced if these alternative water supplies were taken into account.

An exposure assessment was performed in which both hypothetical current and future land-use scenarios were evaluated. For groundwater, the relevant potentially exposed populations were:

- Onsite workers
- Onsite residents
- Offsite workers
- Offsite residents

The primary exposure pathways evaluated for groundwater included:

- Ingestion
- Dermal contact
- Inhalation of vapors from showering

The risk assessment contained calculations of the public health risks which could result from exposure to groundwater containing 1) chemicals known to be associated with the Site, and 2) DBCP, a regional groundwater pollutant, also known to be associated with the Site. For this evaluation, potential risks excluding the contribution from DBCP will be discussed first. Total risk including DBCP will be discussed separately.

A recent study has indicated that 1,2,3-TCP is also a regional pollutant in the Fresno area, similar to DBCP. However, this information was not available at the time the risk assessment was performed. Also, at the time the risk assessment was performed, the carcinogenic potency of 1,2,3-TCP had not been adequately quantified. For these reasons, the risks associated with 1,2,3-TCP in groundwater as presented in the risk assessment may not be considered accurate based on the information available now. A specific discussion of the risks associated with 1,2,3-TCP is not presented in this section

As discussed in the risk assessment report, because of the uncertainty associated with the statistical distribution of the soil and groundwater data, there is a resulting uncertainty associated with the representation of the chemical concentrations to which a person could potentially be exposed. According to the EPA (1989b), the exposure concentration of a chemical is "the average concentration contacted at the exposure point or points over the exposure period." Scientific debate exists as to whether arithmetic or geometric mean concentrations provide the best representation of environmental concentrations. EPA Region IX guidelines (EPA 1989b) allow for the use of geometric mean concentrations, provided that data were collected in an unbiased fashion and appropriate statistical analyses indicate that the data are best described by a lognormal distribution. After performing statistical analyses of soil data for selected chemicals, the 95 percent upper confidence limit (UCL) of the geometric mean was selected in the risk assessment as the exposure point concentrations most appropriate for estimating the reasonable maximum exposure. However, in order to quantitatively depict the effect this uncertainty has on the hypothetical risks posed by the Site, the risk assessment also calculated risk based on an exposure concentration equal to the 95 percent UCL of the arithmetic mean. These exposure concentrations were then used to calculate potential health risks for several hypothetical current and future land-use scenarios.

Risk Characterization is the final step of a risk assessment. It is defined as the combination of the exposure and toxicity assessments to produce an estimate of risk and a characterization of uncertainties in the estimated risk. An estimate of the potential cancer risk associated with exposure to a carcinogen (i.e., the incremental probability that an individual will develop cancer over a lifetime of exposure to that carcinogen) was obtained by multiplying the projected chronic daily intake (CDI) of the carcinogen by the chemical-specific cancer slope factor (CSF). A separate estimated cancer risk for each potential exposure pathway was calculated by summing the chemical-specific risks for the multiple chemicals associated with that exposure pathway. The estimated risks for hypothetical exposure pathways relevant to a potentially exposed population were then summed to estimate the overall multi-chemical, multi-pathway risks for each potentially exposed population.

To assess the noncarcinogenic effects of chemicals, the estimated CDI of a chemical was compared with that chemical's reference dose (RfD) or reference concentration (RfC). The resulting ratio, referred to as the Hazard Quotient (HQ), assumes that there is a level of exposure (i.e., RfD) below which adverse health effects are not expected to occur. If the exposure level (E) exceeds this threshold (i.e., if E/RfD exceeds unity), there may be concern for potential noncancer effects. As a rule, the greater the value of E/RfD above unity, the greater the level of concern. To assess the total noncarcinogenic risk associated with a potential exposure pathway, the HQ of each chemical was summed to provide a value called the Hazard Index (HI) for each exposure pathway. The estimated HIs for hypothetical exposure pathways relevant to a potentially exposed population were then summed to estimate the overall multi-chemical, multi-pathway HI for each potentially exposed population.

Results Based on Lognormal Distribution - Excluding DBCP

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated risks ranging from 1×10^{-6} to 1×10^{-5} for an offsite resident child and adult, respectively. Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from 1×10^{-6} for an offsite resident child to 7×10^{-5} for an onsite resident adult.

Under the current land-use scenarios, the estimated risks for showering with groundwater range from 1×10^{-6} for an offsite resident child to 1×10^{-5} for an offsite resident adult. For the future land-use scenarios, estimated risks range from 1×10^{-6} for an offsite resident child to 7×10^{-5} for an onsite resident adult.

Under the current scenarios, the estimated cancer risks for swimming one day per week for 30 years in a pool filled with groundwater are 3×10^{-8} for a child and 2×10^{-7} for an adult, who is assumed to be exposed for more years than a child. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are 2×10^{-7} and 3×10^{-6}, and those estimated for children are approximately ten-fold lower.

Cumulative risks combining ingestion, bathing, and swimming ranged from 1×10^{-4} for future onsite adult residents to 2×10^{-6} for future offsite child residents.

HI values calculated for the three groundwater exposure scenarios were less than 1. Combined hazards considering ingestion, bathing, and swimming were also less than 1.

Results Based on Normal Distribution - Excluding DBCP

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated risks ranging from 1×10^{-6} to 1×10^{-5} for an offsite resident child and adult, respectively. Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from 1×10^{-6} for an offsite resident child to 4×10^{-4} for an onsite resident adult.

Under the current land-use scenarios, the estimated risks for showering with groundwater range from 2×10^{-6} for an offsite resident child to 2×10^{-5} for an offsite resident adult. For the future land-use scenarios, estimated risks range from 2×10^{-6} for an offsite resident child to 1×10^{-4} for an onsite resident adult.

Under the current scenarios, the estimated cancer risks for swimming one day per week for 30 years in a pool filled with groundwater are 4×10^{-8} for a child and 3×10^{-7} for an adult, who is assumed to be exposed for more years than a child. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are 3×10^{-7} and 2×10^{-5}, and those estimated for children are approximately ten-fold lower.

Cumulative risks combining ingestion, bathing, and swimming ranged from 5×10^{-4} for future onsite adult residents to 3×10^{-6} for future offsite child residents.

The HI values that were greater than 1 were for future onsite residents (adults and children) and onsite workers (long-term). These scenarios of course also had combined hazards (ingestion, bathing, and swimming) greater than 1. The calculated HI values (including cumulative) for other exposure scenarios were less than 1.

Results Based on Lognormal Distribution - Including DBCP

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated risks ranging from 8×10^{-6} to 8×10^{-5} for an offsite resident child and adult, respectively. Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from 1×10^{-5} for an offsite resident child to 2×10^{-4} for an onsite resident adult. In all cases, DBCP accounts for over 50 percent of the calculated risk.

Under the current land-use scenarios, the estimated risks for showering with groundwater range from $8x10^{-6}$ for an offsite resident child to $8x10^{-5}$ for an offsite resident adult. For the future land-use scenarios, estimated risks range from $1x10^{-5}$ for an offsite resident child to $2x10^{-4}$ for an onsite resident adult. In all cases, DBCP contributes over 50 percent of the calculated risk.

Under the current scenarios, the estimated cancer risks for swimming in a pool filled with groundwater are $2x10^{-7}$ for a child and $2x10^{-6}$ for an adult, assuming an exposure of one day per week for 6 years and 30 years, respectively. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are $2x10^{-6}$ and $4x10^{-6}$, and those estimated for children are approximately ten-fold lower. For both the current scenario and the future scenario, DBCP accounts for approximately 50 percent of the total calculated risk from swimming.

Cumulative risks combining ingestion, bathing, and swimming ranged from $4x10^{-4}$ for future onsite adult residents to $2x10^{-5}$ for current offsite child residents.

HI values calculated for the three groundwater exposure scenarios were less than 1, except for the potential future onsite residents. As was true for cancer risks, DBCP is the chemical that contributes the most to the HI values. In all cases, for both adults and children, DBCP accounts for over 50 percent of the total calculated HI.

Results Based on Normal Distribution - Including DBCP

The use of groundwater as a source of drinking water under the current land-use scenarios has estimated risks ranging from $2x10^{-5}$ to $2x10^{-4}$ for an offsite resident child and adult, respectively. Under the future land-use scenarios, the estimated risks associated with ingestion of groundwater range from $3x10^{-5}$ for an offsite resident child to $1x10^{-3}$ for an onsite resident adult. In all cases, DBCP accounts for at least 50 percent of the calculated risk.

Under the current land-use scenarios, the estimated risks for showering with groundwater range from $2x10^{-5}$ for an offsite resident child to $2x10^{-4}$ for an offsite resident adult. For the future land-use scenarios, estimated risks range from $3x10^{-5}$ for an offsite resident child to $2x10^{-3}$ for an onsite resident adult. In all cases, DBCP contributes at least 75 percent of the calculated risk.

Under the current scenarios, the estimated cancer risks for swimming in a pool filled with groundwater are $6x10^{-7}$ for a child and $5x10^{-6}$ for an adult, assuming an exposure of one day per week for 6 years and 30 years, respectively. Under the future scenarios, risks estimated for adults for exposure to chemicals as a result of swimming are $6x10^{-6}$ and $4x10^{-5}$, and those estimated for children are approximately ten-fold lower. For both the current scenario and the future scenario, DBCP accounts for at least 50 percent of the total calculated risk from swimming.

Cumulative risks combining ingestion, bathing, and swimming ranged from $3x10^{-3}$ for future onsite adult residents to $4x10^{-5}$ for current offsite child residents.

The HI values that were greater than 1 were for the following scenarios for both ingestion and bathing: current offsite child resident, future onsite worker long-term, future onsite adult resident, future onsite child resident, future offsite child resident. These scenarios of course also had combined hazards (ingestion, bathing, and swimming) greater than 1. As was true for cancer risks, DBCP is the chemical that contributes the most to the HI values. In all cases, for both adults and children, DBCP accounts for over 50 percent of the total calculated HI. The calculated HI values (including cumulative) for other exposure scenarios were less than 1.

It is important to keep in mind the fact that the risk estimates presented in risk assessment report are upper-bound estimates based on assumptions that are selected with the intention of assuring that actual risks are not underestimated. The risk assessment was performed according to regulatory guidelines which are not intended to be interpreted in terms of personal risk. At best, these guidelines produce upper-bound estimates of incremental individual risk. One should also keep in mind the fact that the incidence of cancer in the United States is one in four or 250,000 in a million (USDHHS 1991).

POTENTIAL FOR DAMAGE TO WILDLIFE, CROPS, VEGETATION, AND PHYSICAL STRUCTURES

An ecological evaluation was included along with the human health risk assessment (Environ 1993). The results were also summarized in Section 5 of the draft RAP (Kennedy/Jenks 1994). The presence of chemicals in groundwater at concentrations up to MCLs will not adversely affect wildlife, crops, vegetation, or physical structures.

PERSISTENCE AND PERMANENCE OF THE POTENTIAL ADVERSE EFFECTS

If active pump and treat remediation is implemented, the concentrations will persist above background for the periods of time shown in Table 3 of the main text. Without active remediation, chemical concentrations will decline slowly by natural attenuation. The potential for human health risk from exposure to drinking water will continue as long as the chemical concentrations in groundwater are above PFRGs. However, as stated above, groundwater is not being used as a source of drinking water because THAN has provided alternative supplies. This condition will apply in the future. Therefore, although the potential for human exposure exists and will persist, actual domestic exposure to groundwater is not occurring.

APPENDIX C

STATEMENT OF REASONS

Department of Toxic Substances Control

Edwin F. Lowry, Director
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Winston H. Hickox
Secretary for
Environmental
Protection

Gray Davis
Governor

STATEMENT OF REASONS
T H AGRICULTURE & NUTRITION, L.L.C. SITE
REMEDIAL ACTION PLAN
June 1999

INTRODUCTION

Effective January 1, 1999, Chapter 6.8 of Division 20 of the Health and Safety Code (H&SC) was repealed by operation of law. (See Health and Safety Code section 25395.) In order to ensure the continuing jurisdiction of the Department of Toxic Substances Control (DTSC) to address contaminated sites, emergency Corrective Action Regulations were filed. The Corrective Action Regulations allowed DTSC to continue site remediation work under the authorities of Chapter 6.5 of Division 20 of the H&SC. At the beginning of the new legislative session, efforts were undertaken to re-enact Chapter 6.8 through Senate Bill 47. The legislature subsequently approved Senate Bill 47, which was then signed into law by the Governor on May 26, 1999.

Development of the Draft Remedial Action Plan for the T H Agriculture & Nutrition, L.L.C. Site began well before the repeal of Chapter 6.8. However, Chapter 6.8 was no longer in existence at the time that the Draft Remedial Action Plan was moving toward finalization. Therefore, DTSC decided to finalize a Draft Remedial Action Plan for the THAN Site in a format consistent with both the requirements of Chapter 6.8 and the Corrective Action Regulations. This Statement of Reasons and the associated preliminary Nonbinding Allocation of Responsibility (NBAR) were prepared accordingly.

On May 14, 1999, the thirty-day public review and comment period was initiated for the Draft Remedial Action Plan. During the comment period, Senate Bill 47 was signed into law by the Governor (May 26, 1999). This re-enacted Chapter 6.8 of the Health and Safety Code retroactively with respect to the associated authorities under which the T H Agriculture & Nutrition, L.L.C. Site is being remediated.

The NBAR for the THAN Site was originally prepared and transmitted to THAN on December 7, 1994. It is DTSC's understanding that the court has adjudicated a cost recovery case involving various potentially responsible parties since the NBAR was prepared. The NBAR included in the below Statement of Reasons is the same NBAR that was transmitted on December 7, 1994 and does not take the findings of the court into consideration. The NBAR is included in this Statement of Reasons for completeness in accordance with the requirements of Chapter 6.8 of the H&SC. The decision of the court supersedes the NBAR.

STATEMENT OF REASONS

Pursuant to California Health and Safety Code (HSC), Section 25356.1(d), the California Environmental Protection Agency (CalEPA), DTSC has prepared this Statement of Reasons as part of the Remedial Action Plan (RAP) for the T H Agriculture & Nutrition, L.L.C. Site at 7183 East McKinley Avenue, Fresno, Fresno County, California.

The RAP presents a summary of the Remedial Investigation (RI) to address agricultural chemicals, volatile organic compounds (VOCs), and heavy metals that have been detected in soil and groundwater at the T H Agriculture & Nutrition, L.L.C. Site. The RAP summarizes results of a Multipathway Health Risk Assessment (MHRA) performed to determine the potential risks to public health and the environment associated with the agricultural chemicals and VOCs found in Site soil and/or groundwater samples (including: dieldrin, toxaphene, DDT, DDD, DDE, Lindane, DBCP, Dinoseb, xylenes, ethly benzene, 1,2-dichloroethane (1,2-DCA), 1,2,3-trichloropropane, and chloroform). The RAP also provides a discussion of the feasible remedial alternatives that were evaluated in the Feasibility Study (FS). The RAP recommends a remedial alternative that will meet the objectives of protecting public health and the environment. The RAP proposes remediation of soil by capping (as a final step to augment the previously conducted excavation and off-site disposal and soil vapor extraction interim measures) and remediation of groundwater through the implementation of monitored natural attenuation which includes contingent groundwater extraction and/or treatment as a remedy component. Further protection of public health is provided by the continuation of the previously provided alternative water supply and implementation of institutional controls (i.e. land use controls).

DTSC believes that the attached RAP complies with the law as specified in California Health and Safety Code, Section 25356.1. Section 25356.1(e) requires that RAPs

> "shall include a statement of reasons setting forth the basis for the removal and remedial actions selected." The statement of reasons "shall also include an evaluation of the consistency of the removal and remedial actions proposed by the plan with the federal regulations and factors specified in subdivision (d)..."

Subdivision (d) specifies six factors against which the remedial alternatives in the RAP must be evaluated. The proposed remedial action is consistent with the National Oil and Hazardous Substances Contingency Plan (the National Contingency Plan [NCP]), the federal Superfund regulations. The RAP has addressed all of these factors in detail. A brief summary of each factor follows. The Statement of Reasons also includes the preliminary NBAR as required by HSC section 25356.1(e).

1. Health and Safety Risks - Section 25356.1(d)(1)

The chemicals of concern in soil identified at this site are:

Acetone	Dacthal	DDE
Arsenic	DBCP	DDT
Chloroform	DDD	1,2-Dichloroethane

Dieldrin	Malathion	Toxaphene
Diphenamid	Methyl Parathion	Trifluralin
Ethion	Parathion	Xylenes
Ethylbenzene	PCNB	
Lindane	Phosalone	

The chemicals of concern in groundwater identified at this site are:

Carbon Tetrachloride	1,2-Dichloroethane	1,2,3-Trichloropropane
Chloroform	Dieldrin	DBCP

The MHRA evaluated potential exposures to impacted soil and groundwater for current and future on-site workers (long-term), current and future off-site workers (long-term), future on-site workers (short-term, intrusive of soil), current off-site residents (adult), current off-site residents (child), future on-site residents, future off-site residents, and future on-site trespassers.

The exposure pathways that were evaluated include: for soil - ingestion, dermal contact, and inhalation of vapors and particulates; for groundwater - ingestion, dermal contact and inhalation of vapors from showering.

Risks were evaluated assuming various exposure scenarios for both soil and groundwater. Risks were then summed across all exposure pathways for each hypothetically exposed population.

Cancer risks resulting from exposure to soil ranged from 4×10^{-3} for a hypothetical future onsite resident to 5×10^{-5} for both current and future hypothetical offsite resident children based upon an assumed normal distribution of contaminants. No adverse noncancer health effects are expected under the current and future exposure scenarios for exposure of offsite populations to soil, since all calculated hazard indexes (HI) are less than one. Under current and future land-use scenarios, the HI values calculated for all onsite populations exceeded 1. The chemicals contributing to the HI values above 1 were DDT, DDE, DDD, Dieldrin, and arsenic.

Cancer risks resulting from exposure to groundwater ranged from 3×10^{-3} for future onsite adult residents to 4×10^{-5} for current offsite child residents again assuming a normal distribution of contaminants. The HI values exceeded 1 for the following hypothetical exposed populations: current and future offsite child residents; future onsite child residents; future onsite adult residents; and future onsite workers (long-term).

DBCP, a chemical found in regional groundwater at concentrations that are not significantly different from those found downgradient of the THAN Site, contributes greater than 50% of both the combined cancer and noncancer risks identified above.

It should be noted that the risks identified above were calculated without considering any risk reduction that is afforded by the provision of alternative water supplies to impacted residents downgradient of the Site. If these alternative water supplies were taken into consideration, the calculated risks from exposure to groundwater would be significantly reduced.

2. Beneficial Uses of the Site Resources - Section 23536.1(d)(2)

The potential beneficial use of the site land includes future use as an industrial/commercial facility. Residential housing is not considered a potential beneficial use of site land. Deed restrictions will be implemented to ensure that residential housing, or uses involving sensitive populations (e.g. schools, hospitals), do not occur on the property in the future. Groundwater found beneath the Site is currently used for agricultural purposes. This use will likely continue.

3. Effect of the Remedial Action on Groundwater Resources

Available technologies were evaluated to meet the remedial action objectives for soil and for groundwater which has been impacted by Site chemicals. A variety of scientific engineering approaches and technologies were considered. The remedial action objectives for soil at the site are to reduce direct human exposure to impacted soil, and to limit the movement of chemicals from soil to groundwater. The remedial action objectives for groundwater include: the containment of chemicals found in groundwater in excess of remediation goals within the currently impacted plume area; the reduction of contaminant concentrations within the currently impacted plume area; and the containment of any future releases of chemicals from Site soils to groundwater at or near the Site property boundary.

As a result of the previously implemented alternative water supply program, impacted groundwater downgradient of the site is primarily used for agricultural and domestic irrigation purposes.

The proposed alternative for remediation of soil at the site, capping, will result in the reduced potential for human exposure to impacted soil and will minimize the potential for movement of chemicals from soil to groundwater. The proposed alternative will reduce chemical concentrations in groundwater within the existing plume area through natural attenuation processes. It also provides for the containment of groundwater containing contaminants in excess of remediation goals within the existing plume area and containment of any newly released chemicals from soil to groundwater at or near the Site property boundary. In addition, the proposed remedial alternative provides for the continued provision of alternative water supplies to impacted residents in accordance with the existing Contingency Plan for Alternative Drinking Water Supply.

4. Site-Specific Characteristics - Section 25356.1(d)(4)

Chemicals in soil and groundwater beneath the site have been extensively characterized. The potential for the continued migration of chemicals already present in groundwater exists. However, due to the previous implementation of interim remedial measures and existing natural attenuation processes, it does not appear that concentrations exceeding remediation goals are spreading beyond the existing plume area. Previously implemented interim remedial measures along with a falling water table have essentially resulted in the elimination of any on-going release of contaminants from Site soils to groundwater. The selected remedial alternative for remediation of on-site soils will reduce the potential for future migration of contaminants from Site soils to groundwater by minimizing rainwater infiltration through impacted vadose zone soils into groundwater.

Site-specific soil/hydrogeological conditions which may affect contaminant movement include the elevation of groundwater in relation to impacted soils, and the infiltration of groundwater through impacted vadose zone soils to groundwater. By eliminating infiltration of rainwater, the selected remedial alternative will eliminate a pathway for transfer of chemicals from soil to groundwater.

5. Cost-Effectiveness of Alternative Remedial Action Measures - Section 25356.1(d)(5)

The proposed remedial action alternative, capping, access restrictions, and land use controls for soil, along with natural attenuation and contingent extraction and/or treatment for groundwater, was the most cost-effective alternative identified to meet the required cleanup objectives.

6. Potential Environmental Impacts of Remedial Actions - Section 25356.1(d)(6)

All potential impacts will be mitigated under the proposed remedial alternative. The proposed remedial alternative will not create any significant environmental impacts. Because of this, a Negative Declaration has been adopted pursuant to the California Environmental Quality Act (CEQA) for the recommended remedial alternative. A Special Initial Study was completed for the THAN Site, which discussed potential environmental impacts of the recommended remedial alternative, as well as actions that will be taken to reduce or eliminate these potential environmental impacts during implementation. The CEQA Special Initial Study and proposed Negative Declaration were distributed under separate cover for a 30-day public comment period. The comment period has been completed. DTSC did not receive any comments on the proposed Negative Declaration.

7. Preliminary Nonbinding Allocation of Financial Responsibility - Section 25356.1(e)

The RAP must include a

> "nonbinding preliminary allocation of responsibility (NBAR) among all identifiable potentially responsible parties at a particular site, including those parties which may have been released, or may otherwise be immune, from liability..." (HSC Section 25356.1(e)).

The current NBAR for the THAN Site, as issued by DTSC, is presented on the next page.

PRELIMINARY NONBINDING ALLOCATION OF RESPONSIBILITY

Health and Safety Code (HSC) section 25356.1(e) requires the Department of Toxic Substances Control (DTSC) to prepare a preliminary nonbinding allocation of responsibility (the "NBAR") among all identifiable potentially responsible parties (PRPs). HSC section 25356.3(a) allows PRPs with an aggregate allocation in excess of 50% to convene an arbitration proceeding by submitting to binding arbitration before an arbitration panel. If PRPs with over 50% of the allocation convene arbitration, then any other PRP wishing to do so may also submit to binding arbitration.

The sole purpose of the NBAR is to establish which PRPs will have an aggregate allocation in excess of 50% and can therefore convene arbitration if they so choose. The NBAR, which is based on the evidence available to the DTSC, is not binding on anyone, including PRPs, DTSC, or the arbitration panel. If a panel is convened, its proceedings are de novo and do not constitute a review of the provisional allocation. The arbitration panel's allocation will be based on the panel's application of the criteria spelled out in HSC section 25356.3© to the evidence produced at the arbitration hearing. Once arbitration is convened, or waived, the NBAR has no further effect, in arbitration, litigation or any other proceeding, except that both the NBAR and the arbitration panel's allocation are admissible in a court of law, pursuant to HSC section 25356.7 for the sole purpose of showing the good faith of the parties who have discharged the arbitration panel's decision.

DTSC sets forth the following preliminary nonbinding allocation of responsibility for the contamination associated with activities at the T H Agriculture & Nutrition, L.L.C. Site at 7183 East McKinley Avenue, Fresno, Fresno County, California:

1.	T H Agriculture & Nutrition Company, Inc. (succeeded by T H Agriculture & Nutrition, L.L.C.) and North American Phillips Corporation, jointly	50%
2.	Olin Corporation	25%
3.	Ciba-Geigy Corporation	25%

APPENDIX D

ADMINISTRATIVE RECORD LIST

ADMINISTRATIVE RECORD LIST
T H Agriculture & Nutrition, L.L.C.
Remedial Action Plan
June 25, 1999

DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
2/3/81	CRWQCB	THCC	Letter regarding inspection report; request for submission of information concerning waste handling at site
2/23/81	THCC	CRWQCB	Letter regarding plant operations
3/27/81	DOHS	THCC	Letter regarding surface soil sampling
6/15/81	DOHS	THCC	Letter regarding Kleinfelder Proposal for Geotechnical Services
7/7/81	THCC	DOHS	Letter enclosing Kleinfelder Supplement Proposal of 7/3/81 (attached)
7/14/81	DOHS	THCC	Letter regarding 7/3/81 Kleinfelder Supplement Proposal
8/14/81	CRWQCB	THCC	Letter regarding off-site sampling and remedial action plan
8/31/81	THCC	CRWQCB	Letter requesting extension of time to submit sample analyses
9/16/81	CRWQCB	THCC	Letter regarding 8/31/81 request for extension of time for submittal of water and soil sample analyses
9/22/81	Kleinfelder	CRWQCB	Letter regarding sampling and analysis procedures in response to 8/14/81 letter from CRWQCB
10/14/81	CRWQCB	THAN	Letter regarding geotechnical study
10/28/81	CRWQCB	THAN	Letter regarding toxicological evaluation (evaluation attached)
11/3/81	DOHS	THCC	Letter requesting soil sampling report by 11/10/81
11/30/81	DOHS/HWMB	CRWQCB	Memo requesting that CRWQCB assume lead agency role in THAN site cleanup
12/7/81	CRWQCB	THAN	Letter regarding chemical waste study prepared by Kleinfelder

ADMINISTRATIVE RECORD LIST
T H Agriculture & Nutrition, L.L.C.
Remedial Action Plan
June 25, 1999

DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
1/21/82	THAN	CRWQCB	Letter submitting evaluations on plant site, as requested in Board letter of 1/4/82
10/5/82	Kleinfelder	DOHS	Letter responding to 9/1/82 DOHS memorandum "THAN - Proposed Cleanup Efforts"
2/14/83	Ciba-Geigy	DOHS	Follow up to "Abandoned Industrial Waste Disposal Site Survey"
2/28/83	CRWQCB	THAN	Letter requesting submission of Phase II-A and Phase II-B Assessments to CRWQCB by 5/1/83
3/22/83	Kleinfelder	Fresno County Department of Health	Letter regarding status report of THAN Phase II investigation
7/12/83	CRWQCB	THAN	Letter regarding Phase II-A and Phase II-B Proposals
7/26/83	Kleinfelder	CRWQCB	Letter regarding THAN soil analysis
8/26/83	CRWQCB	THAN	Letter regarding modified soil cleanup levels
9/27/83	CRWQCB	THAN	Letter regarding errors in CRWQCB memoranda of 8/26/83
10/18/83	CRWQCB	THAN	Letter summarizing agency findings and reviewing THAN's " Soil Investigation and Mitigation Plan"
11/9/83	Kleinfelder	CRWQCB	Letter regarding "Soil Investigation and Mitigation Plan" revised in response to agency letter of 10/18/83
12/30/83	McCutchen	CRWQCB	Letter regarding 1/6/84 meeting between agencies, THAN, Kleinfelder & Assoc. to discuss THAN/Kleinfelder proposals of 12/9/83 and 12/20/83

ADMINISTRATIVE RECORD LIST T H Agriculture & Nutrition, L.L.C. Remedial Action Plan June 25, 1999			
DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
1/9/84	Kleinfelder	CRWQCB	Letter regarding aerial photographs of THAN site
1/11/84	McCutchen	CRWQCB	Letter providing schedule for THAN's commencement and completion of further site investigation and remedial action tasks
2/3/84	CRWQCB	THAN	Letter regarding enclosed Cleanup and Abatement Order
2/3/84	CRWQCB	THAN	Cleanup and Abatement Order issued to THAN facility
5/21/84	McCutchen	DOHS	Letter requesting a meeting to discuss disposition of THAN stockpiled soils and final remedial action plans
6/6/84	McCutchen	CRWQCB	Letter regarding DOHS approval of replacement of soils removed from exploratory trenches
6/11/84	DOHS	McCutchen	Letter regarding continued site assessment at THAN
7/9/84	McCutchen	DOHS	Letter regarding 7/20/84 meeting at DOHS to discuss "Estimate of Mobility of Selected Pesticides in Soil"
7/11/84	McCutchen	CRWQCB	Letter regarding draft memoranda discussed at 6/25/84 meeting between THAN and CRWQCB ("Soils Investigation," "Estimate of Mobility of Selected Pesticides in Soil," "Revised Soil Exploration and Mitigation Program," "Mitigation Plan," "Analysis of Ground Water Data")
7/31/84	DOHS - Alternative Technology	DOHS- Northern Ca Section	Review memorandum regarding report entitled "Estimated Mobility of Selected Pesticides In Soil" prepared by Kennedy/Jenks Engineers

ADMINISTRATIVE RECORD LIST
T H Agriculture & Nutrition, L.L.C.
Remedial Action Plan
June 25, 1999

DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
7/31/84	DOHS - Alternative Technology	DOHS- Northern Ca Section	Internal memo addressing various aspects of site remediation
8/29/84	McCutchen	DOHS	Letter regarding 8/14/84 meeting regarding status of site mitigation
9/27/84	CRWQCB	McCutchen	Letter with staff comments on THAN documents submitted in compliance with Cleanup and Abatement Order
10/4/84	McCutchen	DOHS and CRWQCB	Letter regarding presentation by THAN of site investigation and mitigation status at 9/6/84 meeting
10/12/84	McCutchen	DOHS and CRWQCB	Letter regarding potential remedial action alternative
11/16/84	CRWQCB	McCutchen	Letter regarding "Interim Report, THAN Remedial Action Program" submitted 10/12/84 (Staff Report of 9/27/84 enclosed)
12/14/84	McCutchen	EPA/NPL Staff	Letter regarding extension of NPL analysis of THAN site
12/14/84	CRWQCB	McCutchen	Letter regarding "Ground Water Analyses for On-Site Wells" and "Ground Water Analyses for (area) Domestic Wells" submitted by THAN (Staff Report of 11/16/84 enclosed)
1/7/85	DOHS	THCC	Letter regarding inclusion of facility on State Priority Ranking List
1/8/85 (sic)	McCutchen	DOHS	Letter noting change in person receiving copy for Fresno County Health Dept. from Oberti to Leibold
1/30/85	DOHS		Order to Post Warning Signs

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
2/1/85	McCutchen	CRWQCB	Letter submitting THAN groundwater remedial action proposal
2/6/85	CRWQCB	McCutchen	Letter responding to letter of 2/1/85
2/12/85	McCutchen	CRWQCB	Letter enclosing Kennedy/Jenks "Concept Report: Proposed System for Groundwater Remediation at the THAN Site" and Kleinfelder & Assoc. "Preliminary Feasibility of Hydrodynamic Groundwater Containment at the THAN Site" in compliance with 2/3/84 CRWQCB Cleanup and Abatement Order and 3/21/84 amendment
2/20/85	EPA		Responses to McCutchen letter of 12/14/84
2/21/85	McCutchen	CRWQCB	Letter enclosing Kleinfelder "Analysis of Groundwater Data, THAN Site" in compliance with 2/3/84 CRWQCB Cleanup and Abatement Order
2/27/85	CRWQCB	McCutchen	Letter enclosing staff review of THAN site
3/11/85	McCutchen	EPA/NPL Staff	Letter regarding consideration of comments prior to final rule
3/29/85	DOHS	McCutchen	Summary of 3/26/85 meeting
4/9/85	McCutchen	DOHS	Letter regarding 3/26/85 meeting.
5/13/85	CRWQCB	McCutchen	Letter enclosing CRWQCB Notice of Public Hearing regarding THAN violations of Cleanup and Abatement Order of 2/3/84; Staff Report, Chronology and Tentative Order enclosed
5/28/85	DOHS		Determination of Imminent or Substantial Endangerment and Remedial Action Order

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
5/29/85	McCutchen	CRWQCB	Letter regarding Kennedy/Jenks "Concept Report: Proposed Interim Remedial Measure Program at the THAN Site" and DOHS Order to prepare remedial investigation/feasibility study documents for soil/groundwater remediation measures
6/13/85	McCutchen	DOHS	Letter requesting clarification of Remedial Action Order of 5/28/85 and extension of time
6/14/85	McCutchen	DOHS	Letter providing information required by DOHS Remedial Action Order
6/18/85	DOHS	Stinson, Mag & Fizell	Letter regarding THCC* request to be deleted from Remedial Action Order list of respondents
6/24/85	McCutchen	DOHS	Letter regarding 1981 company name change from THCC to THAN
6/28/85	DOHS		First Amendment of DOHS Remedial Action Order extending Order compliance deadline for Olin Corporation, Ciba-Geigy Corporation and THCC*
6/28/85	DOHS	McCutchen	Letter regarding DOHS 6/27/85 Amendment of Remedial Action Order
7/2/85	McCutchen	DOHS	Letter regarding petition for writ of mandate (enclosed) to remove North American Philips Corporation as Respondent to Order of 6/28/85
7/2/85	DOHS	McCutchen	Letter amending DOHS 6/27/85 Remedial Action Order to extend deadlines
7/10/85	McCutchen	DOHS	Letter providing submittals in accordance with DOHS Remedial Action Order
7/18/85	CRWQCB	McCutchen	Letter regarding issuance of enclosed Cleanup and Abatement Order. Cleanup and Abatement Order dated 7/17/85 (amends Order of 2/3/84)

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
7/19/85	DOHS	All respondents	Notice in 6/27/85 Remedial Action Order of extension of compliance deadlines
8/5/85	McCutchen	DOHS	Letter requesting deletion of THCC* from DOHS Remedial Action Order list of respondents. Enclosed: quitclaim deed (THCC to THAN) and title insurance guarantee of THAN as owner of record of described property
8/5/85	McCutchen	DOHS and CRWQCB	Letter providing submittals in accordance with Remedial Action Order
8/9/85	State Water Resources Control Board	McCutchen and Stinson, Mag & Fizzell	Letter dismissing THCC* as a responsible party from Cleanup and Abatement Order of 7/17/85
8/12/85	CRWQCB		Letter enclosing Amendment to Cleanup and Abatement Order of 7/17/85, dated 8/9/85
8/19/85	McCutchen	CRWQCB and DOHS	Letter enclosing Analysis of Drainage at THAN site in accordance with DOHS Remedial Action Order of 5/28/85, as amended, and by CRWQCB revised Cleanup and Abatement Order of 7/17/85 (see reports)
8/23/85	CRWQCB		Staff review of "Remedial Investigation and Interim Remedial Measure Documents" submitted by THAN. CRWQCB Staff review of 8/16/85 and DOHS memorandum of 7/19/85 attached
8/29/85	DOHS	McCutchen	Letter enclosing staff comments on the 7/10/85 Remedial Investigation and Interim Remedial Measure Documents Report (comments attached)

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
8/30/85	McCutchen	CRWQCB and DOHS	Letter enclosing Remedial Investigation and Interim Remedial Measure Documents in accordance with DOHS Remedial Action Order of 5/28/85, as amended, and by CRWQCB revised Cleanup and Abatement Order of 7/17/85 (see reports)
9/12/85	McCutchen	CRWQCB and DOHS	Letter regarding agency response to THAN submissions and agency cooperation in THAN's attempts to develop effective communication with local residents
9/30/85	McCutchen	DOHS	Letter providing quitclaim deed as recorded with the County of Fresno (quitclaim deed attached)
10/3/85	DOHS	McCutchen	Letter regarding necessity of receiving quitclaim deed before removing THCC from Remedial Action Order
10/3/85	DOHS	McCutchen	Letter requesting signed and recorded copy of quitclaim deed
10/5/85	Kleinfelder	Fresno County Environmental Health Department	Letter regarding analyses of domestic well water samples
10/7/85	McCutchen	DOHS	Letter in response to DOHS comments concerning the Remedial Investigation and Interim Remedial Measure Documents submitted by THAN July 10, 1985
10/7/85	McCutchen	DOHS	Letter responding to Department's memorandum of 8/13/85, enclosed in letter of 8/29/85, regarding Remedial Investigation and Interim Remedial Measure Documents submitted by THAN

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
10/16/85	CRWQCB	DOHS	Memorandum regarding staff analysis of "Remedial Investigation and Interim Remedial Measure Documents" and "On-site and Off-site Well Monitoring Data for Samples Collected 1/1/85 - 6/30/85"
10/28/85	State Water Resources Control Board	McCutchen	Letter regarding completion of petition for review of Cleanup and Abatement Order
10/31/85	CRWQCB	McCutchen	Letter enclosing 10/29/85 amendment to Cleanup and Abatement Order
11/4/85	DOHS	McCutchen	Letter enclosing staff comments on THAN's Community Relations Plan and "Remedial Investigation/Interim Remedial Measure Documents" of 8/8/85 and 9/3/85
11/5/85	EPA	DOHS and CRWQCB	Letter enclosing EPA comments on THAN's remedial activities at site in terms of EPA's requirements for a Remedial Investigation/Feasibility Study
11/21/85	DOHS	McCutchen	Letter transmitting EPA comments on THAN's "Remedial Investigation/Interim Remedial Measure" and "Groundwater Data" documents
11/25/85	Kleinfelder	DOHS	Letter regarding 12/6/85 meeting
11/25/85	McCutchen	DOHS	Letter requesting extension of due date for response to DOHS comments of 11/4/85 and 11/8/85 on "Remedial Investigation and Interim Remedial Measure Documents"
12/5/85	McCutchen	DOHS	Letter requesting extension of due date for response to DOHS comments of 8/2/85, 8/19/85, 9/3/85 on "Remedial Investigation and Interim Remedial Measure Documents" to 12/13/85

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12/9/85	McCutchen	DOHS	Letter summarizing meeting of 11/6/85
12/13/85	McCutchen	DOHS	Letter responding to DOHS letters of 11/4/85, 11/8/85 and enclosed memoranda of 9/25/85, 10/11/85 and two memoranda of 9/18/85
1/13/86	McCutchen	DOHS	Letter correcting Mr. Leibold's mailing address
1/20/86	McCutchen	DOHS	Letter regarding classification of groundwater extracted during groundwater remediation as hazardous waste
2/11/86	CRWQCB	McCutchen	Letter enclosing Public Notice for Tentative Waste Discharge Requirements and Negative Declaration & Proof of Posting form and noting requirements with respect to enclosures
3/13/86	EPA	McCutchen	Letter providing a preliminary determination that the groundwater beneath the THAN site is a regulated waste under Resource Conservation and Recovery Act (RCRA)
3/26/86	Kennedy/Jenks/Chilton	CRWQCB	Letter confirming March 6, 1986 and March 10, 1986 discussions regarding IRM and Tentative Waste Discharge Requirements
3/28/86	McCutchen	DOHS	Letter regarding THAN's understanding of its obligations under DOHS Remedial Action Order, Docket No. HSA 84/85-001
4/4/86	DOHS	McCutchen	Letter regarding IRM proposal and RI/FS workplans; enclosing staff memo commenting on THAN's "Response to Agency Comments Regarding Remedial Investigation and Interim Remedial Measure Documents" submitted to DOHS on 12/13/85

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4/14/86	CRWQCB	DOHS	Memorandum regarding "Final Report, Drainage System Exploration Program," enclosing comments on report
5/12/86	DOHS	McCutchen	Letter regarding Feasibility Study Work Plan as contained in the Remedial Investigation Report dated 9/3/85
5/12/86	McCutchen	DOHS	Letter in response to DOHS letter dated 4/4/86 regarding Remedial Investigation and Feasibility Study Work Plans and Proposed Interim Remedial Measures for Groundwater, and enclosing revised Remedial Investigation and Feasibility Study Work Plans for soil characterization and groundwater assessment (see reports)
5/16/86	McCutchen	EPA, DOHS and CRWQCB	Letter in response to EPA letter dated 3/13/86 regarding classification of groundwater to be extracted during proposed groundwater remediation
5/22/86	McCutchen	DOHS	Letter regarding draft of THAN newsletter submitted by THAN to DOHS on 2/22/86 in accordance with the community relations plan
6/16/86	McCutchen	DOHS	Letter in response to DOHS questions concerning the revised Groundwater Assessment Work Plan submitted 5/12/86
6/24/86	McCutchen	DOHS	Letter regarding approval status of work proposed in Remedial Investigation and Feasibility Study documents submitted to DOHS
7/8/86	DOHS	McCutchen	Letter regarding Revised Soil Characterization Workplan and Revised Groundwater Assessment Workplan

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8/5/86	DOHS	THAN	Letter regarding Groundwater Remedial Investigation Workplan, enclosing staff memorandum of 7/15/86 summarizing technical meeting between THAN representatives and DOHS staff
8/6/86	McCutchen	DOHS, CRWQCB, Fresno County Health Department and EPA	Letter informing agencies of THAN's appointment Wade W. Smith's as project manager for THAN site
8/12/86	McCutchen	DOHS	Letter regarding status of THAN document repository
8/12/86	McCutchen	DOHS	Letter enclosing copies of "THAN Community Newsletter," published by THAN in accordance with the community relations plan submitted by THAN to DOHS on 2/22/86
8/14/86	DOHS	Residents living near THAN site	Letter regarding THAN newsletter
8/15/86	THAN	DOHS	Letter in response to 8/5/86 letter regarding Groundwater Remedial Investigation Work Plan
9/18/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton monthly progress report dated 9/10/86, and requesting meeting to discuss the Groundwater Remedial Investigation Work Plan
9/22/86	DOHS	THAN	Letter regarding Groundwater Remedial Investigation Work Plan
10/2/86	DOHS	McCutchen	Letter enclosing draft revised remedial action order

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10/9/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton monthly progress report dated 10/8/86 and acknowledging receipt of 10/3/86 letter and draft revised remedial action order
10/17/86	McCutchen	DOHS	Letter regarding draft revised remedial action order
10/17/86	McCutchen	DOHS	Letter acknowledging receipt of the draft revised remedial action order and enclosing Kennedy/Jenks/Chilton comments on technical matters
10/29/86	McCutchen	DOHS	Letter enclosing preliminary hydrogeologic cross sections and Kennedy/Jenks/Chilton letter of explanation dated 10/24/86
11/7/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton reports regarding Water Surface Elevation Trend Plots for Monitoring Wells
11/8/86	DOHS	McCutchen	Letter enclosing staff comments on "Remedial Investigation/Interim Remedial Measure Documents" of 8/19/85
12/16/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton report regarding "Preliminary Ground Water Characterization: Summary of Data Assimilated to Date"
12/16/86	THAN	DOHS	Letter submitting "Revised Work Plans for Soil Characterization and Initial Phase of Groundwater Assessment"
1/5/87	Fresno County Department of Health	THAN	Letter regarding monitoring of Temperance-Kutner Elementary School well water
1/30/87	DOHS	THAN	Letter enclosing Preliminary Imminent and Substantial Endangerment Order, Docket No. HSA 87- and Proposed Stipulation Agreement

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2/20/87	THAN	DOHS	Letter enclosing Data Presented in Technical Meetings held December 1985 and July 1986
3/9/87	THAN	DOHS	Letter enclosing Work Plan for Phase I Groundwater Assessment dated 3/9/87
3/16/87	McCutchen	DOHS	Letter regarding meeting of 2/4/87 between THAN and DOHS concerning Imminent and Substantial Endangerment Order, Docket No. HSA 86/87-020 ED
4/23/87	CRWQCB	THAN	Letter transmitting comments regarding the "Preliminary Groundwater Characterization: Summary of Data Assimilated to Date" and the "Work Plan for Phase 1 of Ground Water Assessment"
4/27/87	THAN	DOHS	Letter enclosing Hazardous Waste Injection Well Statement
4/30/87	THAN	CRWQCB	Letter requesting a waiver of the Solid Waste Assessment Test Requirements
5/6/87	THAN	DOHS	Letter enclosing Quality Assurance Project Plan and Sampling and Analysis Plan, both dated 5/6/87
5/7/87	THAN	DOHS	Letter enclosing Draft Remedial Investigation/Feasibility Study Workplan dated 5/87
5/27/87	THAN	DOHS	Letter regarding deferred enforcement of Domestic Well Sampling Program, as set forth in Imminent or Substantial Endangerment Order, Docket No. HSA 86/87-020 ED., issued by DOHS on 1/23/87
6/8/87	THAN	CRWQCB	Letter regarding analytical protocol for groundwater sampling

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6/22/87	CRWQCB	THAN	Letter approving analytical protocol for groundwater sampling proposed by THAN in its June 6, 1987 letter
6/24/87	McCutchen	DOHS	Letter enclosing updated THAN community relations mailing list
7/1/87	THAN	CRWQCB	Letter regarding Solid Waste Assessment Test waiver request
7/9/87	CRWQCB	THAN	Letter enclosing comments on THAN's Draft Remedial Investigation/Feasibility Study Workplan
7/15/87	McCutchen	DOHS	Letter enclosing a draft of the second THAN Community newsletter for review and approval
8/20/87	McCutchen	DOHS	Letter requesting amendment of the Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED to reflect the replacement of Timothy Souther by James Wood of the CRWQCB and the new address for James Allen of DOHS
8/20/87	McCutchen	DOHS	Letter regarding community relations for the THAN site
8/27/87	THAN	DOHS	Letter regarding meeting between THAN and DOHS held on August 7, 1987 regarding target zones for Phase I intermediate and deep wells
8/28/87	THAN	DOHS	Letter enclosing the April 1987 Onsite Sampling report and the May 1987 Offsite Sampling report, both dated August 28, 1987
9/2/87	McCutchen	DOHS	Letter requesting a written designation by Dr. James T. Allen pursuant to Section V.1.2 of the Determination of Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
9/11/87	THAN	DOHS	Letter correcting THAN's letter to DOHS dated August 28, 1987
9/22/87	THAN	DOHS	Letter summarizing the progress and schedule for completion of Phase I Ground Water Investigation
9/30/87	THAN	DOHS	Letter enclosing updated schedule for completion of Phase I well installation and provisionally requesting extension of the deadline for completion of Phase I field work
10/7/87	CRWQCB	THAN	Letter approving THAN's Solid Waste Assessment Test Waiver request and enclosing a CRWQCB memorandum, dated October 7, 1987, providing its comments on the waiver request
11/18/87	THAN	DOHS	Letter enclosing a report entitled "Phase I Ground Water Assessment Summary, THAN Site, Eastern Fresno County," Volumes I, II, III, dated November 18, 1987
12/14/87	THAN	DOHS	Letter regarding December 2, 1987 meeting between THAN, DOHS and other interested Fresno City and County representatives
1/13/88	DOHS	THAN	Letter enclosing a summary of results from a recent sampling of private wells in the vicinity of the THAN site
1/14/88	DOHS	THAN	Letter enclosing comments from EPA and DOHS concerning THAN's RI/FS Workplan

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
1/21/88	THAN	DOHS	Letter summarizing and confirming matters discussed at the December 17, 1987 meeting between THAN, DOHS, EPA and other interested governmental agencies regarding THAN's Phase I Groundwater Investigation conducted in accordance with DOHS Imminent or Substantial Endangerment and Remedial Action Order HSA 86/87-202 ED
2/3/88	THAN	DOHS	Letter summarizing THAN's proposal to pay the costs of extending the existing Fresno domestic water system to certain households near the THAN site
2/4/88	McCutchen	CRWQCB	Letter regarding the Cleanup and Abatement Order issued by CRWQCB on July 17, 1985
2/5/88	THAN	DOHS	Letter regarding the Preliminary Endangerment Assessment/Public Health Evaluation under preparation by Metcalf & Eddy
2/5/88	DOHS	THAN	Letter regarding the organization of a community advisory committee for the THAN site
2/5/88	DOHS in Sacramento	DOHS in Fresno	Letter regarding the organization of a community advisory committee and the February 18, 1988 "Kickoff Meeting;" THAN Fact Sheet dated February 18, 1988, which was circulated at the meeting; summary of the meeting
2/5/88	THAN	DOHS	Letter summarizing and confirming matters discussed at the January 27, 1988 meeting between THAN, DOHS, CRWQCB and T-K Neighbors in Action regarding the overall strategy proposed for the remainder of the Remedial Investigation and the location of monitoring well clusters proposed in the December 17, 1987 meeting

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3/2/88	THAN	DOHS	Letter enclosing the proposed amendments to the DOHS Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED
3/3/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the March 16, 1988 THAN Community Advisory Committee Meeting; list of committee members; THAN Progress Report dated March 16, 1988, which was circulated at the meeting; summary of the meeting
3/4/88	CRWQCB	THAN	Letter enclosing comments on data submitted regarding Phase I drilling muds on the THAN site
3/9/88	Kennedy/Jenks/Chilton	DOHS	Letter enclosing proposed revisions to Appendix A to the DOHS Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED
3/11/88	Fresno County Department of Health	THAN	Letter discussing domestic well sampling protocol and enclosing "Water Well Disinfection Procedures" and a letter from Fresno County Department of Health to water well contractors, regarding well drilling near the THAN site
3/11/88	DOHS	THAN	Letter regarding site remediation and THAN's offer to fund an extension of the City of Fresno water distribution network
3/18/88	THAN	DOHS	Letter submitting the Remedial Investigation/Feasibility Study Workplan
4/11/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 20, 1988 THAN Community Advisory Committee Meeting; "Status Sheet: Redbank and Fancher Creeks Construction Project;" meeting agenda and THAN Fact Sheet dated April 20, 1988, which were circulated at the meeting

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4/14/88	THAN	DOHS	Letter regarding the Proposed Domestic Well Sampling Program
4/14/88	THAN	DOHS	Letter regarding a January 27, 1988 letter from T-K Neighbors in Action to DOHS
4/15/88	THAN	DOHS	Letter regarding the March 21, 1988 meeting between THAN, DOHS, Fresno County Health Department, and T-K Neighbors in Action regarding sampling of domestic wells by DOHS and the Fresno County Health Department
5/2/88	THAN	DOHS	Letter transmitting comments on the Draft Endangerment Assessment/Public Health Evaluation dated February 1988
5/13/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the May 25, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated May 25, 1988, which were circulated at the meeting; summary of the meeting
5/19/88	THAN	DOHS	Letter transmitting Dr. James L. Byard's comments on the Draft Endangerment Assessment/Public Health Evaluation dated February 1988
6/23/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the June 29, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated June 29, 1988, which were circulated at the meeting; summary of the meeting
6/29/88	CRWQCB	THAN	Letter formally rescinding the Board's Cleanup and Abatement Order issued to THAN on July 7, 1985

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7/20/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the July 27, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated July 27, 1988, which were circulated at the meeting; summary of the meeting
8/3/88	THAN	DOHS	Letter submitting revised report entitled "Quality Assurance Project Plan," dated July 27, 1988
8/26/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 31, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated August 31, 1988, which were circulated at the meeting; summary of the meeting
8/29/88	Fresno County Public Works and Development Services Department	THAN	Grading Work Voucher issued
8/29/88	THAN	Fresno County Public Works and Development Services Department	Letter submitting Grading Permit Application
8/30/88	THAN	Fresno County Public Works Department Water Division	Letter submitting revisions to Exhibits "A" and "C" attached to June 28, 1988 Agreement
9/1/88	McCutchen	DOHS	Letter regarding whether THAN's demolition and excavation activities are subject to the California Environmental Quality Act, Public Resources Code Sections 21000 - 21177 ("CEQA")

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
9/8/88	THAN	DOHS	Letter submitting the "Investigation-Derived Residuals Management Plan" ("the IDRMP"), dated September 8, 1988
9/21/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the September 28, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated September 28, 1988, which were circulated at the meeting; summary of the meeting
9/29/88	THAN	Fresno County Public Works Department	Letter submitting a revised project description for extension of the City of Fresno municipal water system
9/29/88	DOHS	McCutchen	Letter responding to McCutchen's September 1, 1988 letter to DOHS regarding whether THAN's demolition and excavation activities are subject to the California Environmental Quality Act, Public Resources Code Sections 21000 - 21177 ("CEQA")
10/20/88	DOHS	THAN	Letter regarding November 10, 1988 community meeting and enclosing THAN Community Advisory mailing list
10/26/88	THAN	DOHS	Letter enclosing the final versions of (1) the community letter regarding the availability of the Structures Demolition Plan and the November 10, 1988 community meeting, (2) the DOHS flyer announcing the community meeting; and (3) the THAN community advisory mailing list
11/1/88	DOHS		Notice of Intent to Adopt a Negative Declaration Pursuant to CEQA stating DOHS's intention to find that implementation of the Structures Demolition Plan will not have a significant effect on the environment and to adopt a Negative Declaration pursuant to the California Environmental Quality Act ("CEQA") for this project

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11/23/88	State of California Office of Planning and Research	DOHS	Letter acknowledging compliance with CEQA and stating that the state agency review period for the DOHS Notice of Intent to Adopt a Negative Declaration Pursuant to CEQA is closed and that no state agencies submitted comments on the document
11/28/88	DOHS		DOHS Notice of Determination stating that DOHS has approved the Structures Demolition Plan and has determined that the project will not have a significant effect on the environment, that a Negative Declaration was prepared pursuant to CEQA, and that mitigation measures were made a condition of the approval of the project
11/28/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the December 14, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated December 14, 1988, which were circulated at the meeting; summary of the meeting
1/12/89	THAN	EPA	Letter to demonstrate and certify that the requirements of 40 CFR § 268.8(a)(1) have been met by THAN with respect to offsite disposal of soil and debris wastes generated in conjunction with interim remedial measures taken at the site
1/13/89	THAN	DOHS	Letter transmitting a bound document containing the following reports relating to the structures demolition project: "Site Health and Safety Plan," "Air Monitoring Plan," "Dust and Vapor Control Workplan" and "Transportation Plan"
1/25/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the February 22, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated February 22, 1989, which were circulated at the meeting; summary of the meeting

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
2/22/89	THAN		Community Advisory Committee Meeting Summary
3/21/89	City Fresno Public Works Department		Internal memorandum describing a tentative schedule for the THAN municipal water system project
3/22/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the March 29, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated March 29, 1989, which were circulated at the meeting; summary of the meeting
3/24/89	City of Fresno Public Works Department	Property owners	Form letter describing the THAN municipal water system project and offering property owners the opportunity to request city water service connection
3/24/89	DOHS	TK Neighbors in Action	Letter discussing the February 28, 1989 meeting of TK Neighbors and a March 8, 1989 letter from TK Neighbors to DOHS
3/29/89	THAN Community Advisory Committee		Agenda for the March 29, 1989 meeting
4/5/89	THAN	DOHS	Letter summarizing THAN activities during 1988 and highlighting outstanding issues relating to the remedial investigation/feasibility study process
4/20/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 26, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated April 26, 1989, which were circulated at the meeting; summary of the meeting

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
5/2/89	DOHS	THAN	Letter which (1) describes DOHS's final comments on the March 1988 revision of the remedial investigation/feasibility study workplan, (2) transmits EPA's comments on the workplan, and (3) provides DOHS's conditional approval of the workplan
5/19/89	DOHS	THAN	Letter submitting comments on the July 1988 draft of the "Quality Assurance Project Plan"
6/6/89	DOHS	THAN	Letter providing conditional approval of the "Investigation - Derived Residuals Management Plan" for the THAN site
6/23/89	THAN	DOHS	Letter submitting THAN's response to a DOHS letter dated May 19, 1989 regarding the July 1988 draft of the "Quality Assurance Project Plan"
7/21/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 3, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated August 3, 1989, which were circulated at the meeting; summary of the meeting
8/2/89	CRWQCB	THAN	Letter providing information on the preparation of an Application for Waste Discharge Requirements letter received September 5, 1989
8/3/89	THAN	DOHS	Letter submitting proposed amendments to DOHS Order Docket No. HSA 86/87-020 ED
8/23/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 30, 1989 THAN Community Advisory Committee Meeting; meeting agenda which was circulated at the meeting; summary of the meeting

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8/24/89	THAN	DOHS	Letter submitting a sample letter that was sent to owners of wells in the vicinity of proposed Phase II/III groundwater monitoring well cluster locations
8/29/89	CRWQCB	THAN	Letter discussing groundwater remediation at the THAN site and enclosing an application for Waste Discharge Requirements and related materials
8/29/89	THAN	DOHS	Letter submitting materials relating to the June 1989 sampling of wells included in the domestic well sampling program and designated peripheral wells
9/25/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the September/October 1989 THAN Community Advisory Committee Meeting on October 4, 1989
9/27/89	DOHS	THAN Community Advisory Committee Members	Letter clarifying the date of the September/October 1989 THAN Community Advisory Committee meeting
10/4/89	DOHS	THAN Community Advisory Committee Members	Agenda for the October 4, 1989 meeting of the THAN Community Advisory Committee; THAN Fact Sheet dated October 4, 1989, which was circulated at the meeting; summary of the meeting
10/10/89	THAN	DOHS	Letter summarizing an August 30, 1989 meeting between THAN and DOHS; meeting attendance list
11/8/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the November 15, 1989 THAN Community Advisory Committee meeting; meeting agenda which was circulated at the meeting; summary of the meeting

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11/29/89	DOHS	THAN	Letter in response to a letter from THAN dated October 10, 1989 pertaining to an August 30, 1989 meeting between THAN and DOHS
12/14/89	THAN	DOHS	Letter regarding THAN's proposal to refine the analytical protocol used for the quarterly monitoring well sampling program
1/4/90	DOHS	THAN	Letter submitting memo from EPA on Technical Assistance Grant (TAG) insert that must be added to all NPL site fact sheets
1/10/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the January 17, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary
2/7/90	THAN	DOHS	Letter submitting memorandum prepared by Kennedy/Jenks/Chilton, dated January 11, 1990, summarizing technical action items relating to THAN's Phase II/III Groundwater Investigation Program
3/7/90	DOHS	THAN	Letter providing conditional approval of the Quality Assurance Project Plan and the December 14, 1989 proposed modification to the Monitoring Well Analytical Protocol
3/15/90	THAN	DOHS	Letter submitting materials relating to the December 1989 sampling of wells included in the domestic well sampling program and designated peripheral wells
3/23/90	DOHS	THAN	Letter submitting comments on THAN's Phase II/III Groundwater Investigation Technical Proposal, dated February 7, 1990

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
3/26/90	THAN	DOHS	Letter submitting recent modifications to proposed Amendment No. 2 to DOHS Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, including Appendix A, titled, "Domestic Well Sampling Program and Contingency Plan for Alternative Drinking Water Supply"
3/30/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 4, 1990 THAN Community Advisory Committee Meeting; meeting agenda; meeting summary
3/30/90	THAN	DOHS	Letter responding to DOHS comments on THAN's February 7, 1990 technical action item proposal outlining certain modifications to the RI/FS Workplan
4/9/90	THAN	DOHS	Letter submitting list of households that have been connected to the Fresno domestic water system; sample of notice letter sent to each household
4/11/90	THAN	City of Fresno Public Works Department	Letter submitting list of households that have been connected to the Fresno domestic water system; sample of notice letter sent to each household
4/13/90	THAN	DOHS	Letter regarding results of laboratory analyses performed on samples of residual drilling mud produced during drilling of exploratory borings for the Phase II/III Groundwater Investigation
4/24/90	THAN	CRWQCB	Letter regarding management of residuals generated during the Phase II/III Groundwater Investigation
5/4/90	THAN	City of Fresno Public Works Department	Letter regarding connection of additional households in THAN's Domestic Well Sampling Program to the Fresno domestic water system

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5/9/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the May 16, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 16, 1990, which was circulated at the meeting; meeting summary
5/15/90	THAN	DOHS	Letter proposing the continued sampling of three domestic wells located downgradient of the known chloroform plume pursuant to proposed Amendment No. 2 to DOHS Order, Docket No. HSA 86/87-020 ED
6/15/90	THAN	DOHS, CRWQCB, County Health Department and OES	Letter regarding a discharge of oil in orchard property owned by THAN, including attachment #1
6/22/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the June 27, 1990 THAN Community Advisory Committee meeting; THAN Fact Sheet dated June 27, 1990, which was circulated at the meeting; meeting summary
6/26/90	DOHS	THAN	Letter regarding continued sampling of certain domestic wells
7/7/90	THAN	DOHS	Letter submitting recently revised modifications to proposed Amendment No. 2 to DOHS Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, including Appendix A, title, "Domestic Well Sampling Program and Contingency Plan for Alternative Drinking Water Supply"
8/24/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 29, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated August 29, 1990, which was circulated at the meeting; meeting summary

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8/24/90	THAN	DOHS	Letter submitting an addendum to the March 1988 Remedial Investigation/Feasibility Study Workplan
8/30/90	THAN	DOHS	Letter submitting materials relating to the June 1990 sampling of certain domestic wells in the vicinity of the THAN site
10/18/90	THAN	Fresno County Air Pollution Control District	Letter submitting an application for a permit to construct and operate a soil vapor extraction pilot system at the THAN site
10/19/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the October 24, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda
10/22/90	THAN	DOHS	Letter submitting a revised THAN project schedule (Figure 39) for the March 1988 Remedial Investigation/Feasibility Study Workplan
11/15/90	DOHS	City of Fresno	Letter regarding concerns relating to the Fresno City water supply system, which have been expressed by residents who recently have been connected to that system
11/15/90	DOHS	City of Fresno	Letter regarding concerns relating to the Fresno City water supply system, which have been expressed by residents who recently have been connected to that system
11/28/90	Fresno County Air Pollution Control District	THAN	Letter regarding THAN's application for an Authority to Construct a soil vapor extraction system at the THAN site

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12/6/90	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter regarding proposed soil vapor extraction pilot system; monitoring schedule for soil vapor extraction pilot study; figure showing soil vapor extraction system schematic
12/18/90	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter submitting rating fee for soil vapor extraction pilot system permit application
1/25/91	DOHS	THAN and North American Philips Corporation	Letters transmitting a copy of "Amendment No. 2 to Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED," effective January 5, 1991
1/25/91	THAN	DOHS	Letter requesting an extension for submittal of Remedial Investigation Report and Baseline Risk Assessment Documents
1/28/91	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter submitting proposed modifications to the Authority to Construct issued to THAN for a soil vapor extraction pilot project
1/28/91	THAN	DOHS	Letter submitting a proposed Workplan for a Baseline Risk Assessment for the THAN site
2/4/91	DOHS	THAN	Letter transmitting background material regarding the Agency for Toxic Substances and Disease Registry ("ATSDR") Health Assessment Project for NPL sites
2/22/91	DOHS	THAN	Letter regarding remedial and removal action costs incurred during cleanup of the THAN site for the period of July 1984 through June 1989

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2/28/91	THAN	DOHS	Letter submitting materials relating to the December 1990 sampling of certain domestic wells in the vicinity of the THAN site
3/25/91	THAN	DOHS	Letter responding to DOHS letter dated February 22, 1991 regarding remedial and removal action costs for the THAN site
7/15/91	Air District		Permit to Operate issued on July 15, 1991 for a soil vapor extraction system at the THAN site
8/21/91	Kennedy/Jenks	Fresno County Air Pollution Control District [the Air District]	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
8/21/91	Kennedy/Jenks Consultants	Fresno County Air Pollution Control District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
8/22/91	THAN	DOHS	Letter submitting materials relating to the June 1991 sampling of certain domestic wells in the vicinity of the THAN site
8/26/91	Kennedy/Jenks	Fresno County Air Pollution Control District [the Air District]	Letter transmitting laboratory analysis report sheets for air samples collected on June 22, 1991 and July 19, 1991

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8/26/91	Kennedy/Jenks Consultants	Fresno County Air Pollution Control District	Letter transmitting laboratory analysis report sheets for air samples collected on June 22, 1991 and July 19, 1991
8/30/91	THAN	DOHS	Letter submitting a draft form letter, which offers to interview local government officials and elected representatives regarding the THAN site, and a list of proposed interviewees
8/30/91	THAN	DOHS	Letter submitting, for DOHS review and approval, a "working copy" of the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, as amended
9/5/91	Department	THAN	Memorandum enclosing a list of questions for community interviews
9/19/91	Kennedy/Jenks	Air District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
9/20/91	THAN	Mayor of the City of Fresno, Council-members for Districts 4 and 5 of the City of Fresno and officials of the City of Fresno Public Works Department	Letter offering to interview these individuals regarding any concerns they may have relating to the THAN site

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9/20/91	THAN	Department	Letter enclosing a form letter, which offers to interview local government officials and elected representatives regarding the THAN site, and the mailing list for the letter
10/7/91	Department	THAN	Letter modifying requirements for submittals set forth in Section V.I.2. of the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED
11/25/91	Department	THAN Community Advisory Committee Members	Letter announcing the December 4, 1991 THAN Community Advisory Committee meeting; THAN Fact Sheet dated December 4, 1991, which was circulated at the meeting; meeting summary
12/24/91	Kennedy/Jenks	Air District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
1/2/92	THAN	Department	Letter submitting "Draft Initial Screening and Process Options Summary Tables," dated January 2, 1992, prepared by Kennedy/Jenks
1/6/92	Department	THAN	Telecopier message transmitting the Department's notes on interviews of local government officials and locally elected representatives regarding the THAN site
1/9/92	Department	THAN	Letter providing (1) notice of sufficient data to prepare draft remedial investigation and feasibility study reports, and (2) approval of proposed project schedule submitted by THAN on August 30, 1991

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1/30/92	Department	THAN Community Advisory Committee Members	Letter announcing the February 5, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary
2/3/92	THAN	Department	Letter submitting "Treatability Study Objectives - Draft Technical Memorandum," dated February 3, 1992
2/6/92	THAN	Department and CRWQCB	Letter regarding (1) analytical results from September 1991 background soil sampling, (2) installation of three vapor extraction wells, and (3) proposed use of investigation derived residuals
2/28/92	THAN	Department	Letter submitting materials relating to the December 1991 sampling of certain domestic wells in the vicinity of the THAN site
3/5/92	Department	THAN Community Advisory Committee Members	Letter announcing the March 11, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated March 10, 1992, which was circulated at the meeting; meeting summary
5/7/92	Department	THAN Community Advisory Committee Members	Letter announcing the May 13, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 13, 1992, which was circulated at the meeting; meeting summary
6/16/92	Department	THAN	Letter approving proposed use of investigation derived residuals from the September 1991 background soil sampling and soil vapor extraction well installation

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
6/17/92	Department	THAN Community Advisory Committee Members	Letter announcing the June 24, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated June 24, 1992, which was circulated at the meeting; meeting summary
7/2/92	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of March through May 1992 for the Xylene Area Pilot Remediation System at the THAN site
7/8/92	THAN	Fresno County Health Department and the Department	Letter submitting a report, dated July 2, 1992, regarding removal of a 500-gallon underground storage tank from the THAN site
7/8/92	THAN	Fresno County Health Department and the Department	Letter submitting a report, dated July 2, 1992, regarding removal of a 500-gallon underground storage tank from the THAN site
7/24/92	Department	THAN Community Advisory Committee Members	Letter announcing the July 29, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated July 29, 1992, which was circulated at the meeting
8/3/92	Fresno County Health Department	THAN	Letter confirming completion of the site investigation and/or remedial action relating to removal of a 500-gallon underground storage tank from the THAN site
8/5/92	Department	THAN	Letter providing conditional approval of the "Public Participation - Community Relations Plan," dated January 1992
9/2/92	Department	THAN	Letter enclosing Department and EPA comments regarding the "Preliminary Draft Multipathway Health Risk Assessment," dated March 1992

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
9/18/92	THAN	Department	Letter submitting materials relating to the June 1992 sampling of certain domestic wells in the vicinity of the THAN site
9/28/92	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of June through August 1992 for the Xylene Area Pilot Remediation System at the THAN site
12/9/92	Department	THAN Community Advisory Committee Members	Summary of the December 9, 1992 THAN Community Advisory Committee Meeting, prepared by the Department; THAN Fact Sheet dated December 9, 1992, which was circulated at the meeting
12/11/92	Department	THAN	Letter enclosing EPA, CRWQCB and Department comments regarding the "Preliminary Draft Remedial Investigation Summary Report," dated March 30, 1992, and the "Preliminary Draft Feasibility Study," dated June 1, 1992
1/13/93	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of September through November 1992 for the Xylene Area Pilot Remediation System at the THAN site
1/21/93	Department	THAN Community Advisory Committee Members	Letter announcing the January 27, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated January 26, 1993, which was circulated at the meeting; meeting summary
1/21/93	Department	THAN	Letter transmitting the approval sheet, signed November 1992, for the "Public Participation - Community Relations Plan," dated January 1992, as revised in October 1992

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
1/26/93	Department	THAN	Facsimile transmission of a Department memorandum, dated January 26, 1993, regarding food chain pathway analysis in the risk assessment prepared by ENVIRON for the THAN site
1/31/93	THAN	Department	Letter submitting (1) "Response to Agency Comments - Revised Draft Remedial Investigation Summary Report," dated January 30, 1993 (see reports); (2) summary of responses to agency comments regarding the "Preliminary Draft Multipathway Health Risk Assessment" and corresponding proposed revisions to the text of that report (attached); (3) summary of responses to agency comments regarding the "Preliminary Draft Feasibility Study Report" (attached); and (4) revised draft "Feasibility Study Report," dated January 31, 1993 (see reports)
2/17/93	SEACOR	THAN	Letter (Department of Toxic Substances Control listed on cc list) transmitting the Laboratory Analytical Reports for Well Samples inadvertently omitted from the Third Quarter 1992 Groundwater Monitoring Report
2/23/93	SEACOR	Department	Letter transmitting Table 4-1 of the Preliminary Draft and Draft Feasibility Studies which was inadvertently omitted from both reports
3/3/93	THAN	Department	Letter submitting materials relating to the December 1993 sampling of certain domestic wells in the vicinity of the THAN site
3/25/93	Department	THAN Community Advisory Committee Members	Letter announcing the March 31, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated March 31, 1993, which was circulated at the meeting; meeting summary

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4/23/93	Department	THAN Community Advisory Committee Members	Letter announcing the April 28, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated April 28, 1993, which was circulated at the meeting; meeting summary
4/26/93	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of December 1992 through February 1993 for the Xylene Area Pilot Remediation System at the THAN site
4/27/93	Department	THAN	Letter providing conditional approval of the "Revised Draft Remedial Investigation Summary Report," dated January 30, 1993
5/13/93	ENVIRON	Department	Letter regarding revisions to the "Draft Multipathway Health Risk Assessment Report," prepared by ENVIRON for the THAN site
5/20/93	Department	THAN Community Advisory Committee Members	Letter announcing the May 26, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 25, 1993, which was circulated at the meeting; meeting summary
5/20/93	Department	THAN	Facsimile transmission of a mailing list prepared by the Department for the THAN site; a mandatory mailing list prepared by the Department for all site clean-up projects; and a summary regarding the remedy selection process for federal Superfund sites
6/11/93	THAN	Department	Letter submitting a revised Table 2-1 for the "Draft Feasibility Study Report," dated January 31, 1993
6/21/93	Department	THAN	Facsimile transmission of "THAN Site Final FS [Feasibility Study] Comments," prepared by the Department

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8/2/93	Kennedy/Jenks	Air District	Letter stating that the Xylene Area Pilot Remediation System at the THAN site will be shut down for a period of 60 to 90 days to evaluate the nature and extent of chemical concentrations remaining in the vadose zone
8/6/93	Department	THAN	Letter summarizing key performance objectives for soil and groundwater components of the preferred remedial alternative for the THAN site
8/19/93	Department	THAN Community Advisory Committee Members	Letter announcing the August 25, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated August 25, 1993, which was circulated at the meeting; meeting summary
9/16/93	THAN	Department	Letter submitting materials relating to the June 1993 sampling of certain domestic wells in the vicinity of the THAN site
10/21/93	THAN	Department	Letter requesting an extension for submittal of certain sections of the Draft Remedial Action Plan
11/10/93	Department	THAN Community Advisory Committee Members	Letter announcing the November 17, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated November 15, 1993, which was circulated at the meeting; meeting summary
1/20/94	Department		Notice stating that the January 26, 1994 THAN Community Advisory Committee meeting has been rescheduled for March 2, 1994
2/25/94	Department	THAN Community Advisory Committee Members	Letter announcing the March 2, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated March 2, 1994, which was circulated at the meeting; meeting summary

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3/4/94	THAN	Department	Letter submitting materials relating to the December 1993 sampling of certain domestic wells in the vicinity of the THAN site
6/3/94	Department	THAN Community Advisory Committee Members	Letter announcing the June 14, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated June 14, 1994, which was circulated at the meeting; meeting summary
8/12/94	THAN	Department	Letter submitting materials relating to the June 1994 sampling of certain domestic wells in the vicinity of the THAN site
9/00/94	Department	THAN Community Advisory Committee Members	Letter announcing that the September 14, 1994 THAN Community Advisory Committee meeting has been rescheduled for September 28, 1994
9/18/94	Kennedy/Jenks Consultants	CRWQCB	Letter regarding proposed aquifer testing in the vicinity of the THAN site
9/22/94	Department	THAN Community Advisory Committee Members	Letter announcing the September 28, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary; fact sheet dated September 28, 1994, which was circulated at the meeting
9/28/94	THAN	Department	Letter submitting "Calculation of Health Based Preliminary Remediation Goals," dated September 27, 1994, prepared by ENVIRON
10/7/94	Department	THAN	Letter enclosing Department and EPA comments regarding the "Preliminary Draft Remedial Action Plan"

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10/11/94	THAN	Department	Letter enclosing "Draft Response to Comments, THAN Site Risk Assessment," dated October 10, 1994
11/4/94	THAN	Department	Letter enclosing a list of households recently connected to the Fresno domestic water supply system and a sample of the "Notice Regarding Bottled Water" sent to each household on the list
11/14/94	THAN	Department	Letter enclosing preliminary responses to agency comments dated October 7, 1994 regarding the Preliminary Draft Remedial Action Plan
12/1/94	Department	THAN Community Advisory Committee Members	Letter announcing the December 13, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary; fact sheet dated December 13, 1994, which was circulated at the meeting
1/00/95	California Department of Health Services, Environmental Health Investigations Branch		"THAN Public Health Assessment, Exposure and Health Effects Fact Sheet"
1/9/95	THAN	California Department of Health Services	Letter providing comments on the "THAN Public Health Assessment, Exposure and Health Effects Fact Sheet"
1/25/95	Department	THAN Community Advisory Committee Members	Letter announcing the January 31, 1995 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated January 31, 1995, which was circulated at the meeting
2/27/95	THAN	Department	Letter submitting materials relating to the December 1994 sampling of certain domestic wells in the vicinity of the THAN site

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3/1/95	McCutchen	California Department of Health Services	Letter requesting to review and copy documents relating to the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc.," prepared by the California Department of Health Services
3/9/95	California Department of Health Services	McCutchen	Letter regarding arranging a time for McCutchen to review and copy documents relating to the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/10/95	THAN	California Department of Health Services	Letter providing supplemental comments regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/24/95	California Department of Health Services	McCutchen	Letter regarding files to be copied regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/31/95	Department	THAN	Letter enclosing Department comments on the "Draft Multipathway Health Risk Assessment" and the risk assessment and proposed remediation goals in the "Draft Remedial Action Plan"
4/3/95	McCutchen	California Department of Health Services	Letter stating that McCutchen has no further comments at this time regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
4/3/95	Department	THAN	Letter providing formal approval to change monitoring well sampling frequency from quarterly to semiannually, on an interim basis, pending adoption of a final remedial action groundwater monitoring program
6/8/95	THAN	Department	Letter submitting a letter, dated June 6, 1995, prepared by ENVIRON, responding to the Department's comments regarding the "Draft Multipathway Health Risk Assessment"

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6/30/95	THAN	Department	Letter submitting materials relating to the April 1995 sampling of certain domestic wells in the vicinity of the THAN site
7/14/95	SECOR	Department	Letter transmitting copies of laboratory reports from analysis of soil samples collected in the vicinity of Drainage System H by THAN in April 1994
9/27/95	THAN	Department	Letter submitting materials relating to the July 1995 sampling of certain domestic wells in the vicinity of the THAN site
10/27/95	THAN	Department	Letter enclosing "Workplan for Collection of Soil Samples Related to Shutdown of Soil Vapor Extraction Systems," dated October 24, 1995 (see reports)
12/21/95	Department	THAN	Letter approving the Draft Multipathway Health Risk Assessment, provided that THAN prepare a Final Multipathway Health Risk Assessment document that incorporates all agreed upon modifications and/or revisions identified in the attached memorandum from Office of Scientific Affairs
1/30/96	ENVIRON	Department	Letter submitting the final "Multipathway Health Risk Assessment for the THAN Site," dated January 31, 1996 (see reports)
1/31/96	THAN	Department	Letter submitting materials relating to the October 1995 sampling of certain domestic wells in the vicinity of the THAN site
3/19/96	Department	THAN	Letter approving the "Multipathway Health Risk Assessment for the THAN Site," dated January 31, 1996, as submitted by THAN, with the incorporation of this letter and attached memorandum from Office of Scientific Affairs

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
7/3/96	THAN	Department	Letter submitting materials relating to the April 1996 sampling of certain domestic wells in the vicinity of the THAN site
10/11/96	THAN	Department	Letter submitting materials relating to the 1996 second semiannual sampling of certain domestic wells in the vicinity of the THAN site
12/00/96	Department		Fact Sheet on "Draft Removal Action Workplan Available for Public Review"
12/19/96	Department	THAN	Letter enclosing a copy of the "Removal Site Evaluation Engineering Evaluation/Cost Analysis, and Workplan for Pesticide-Affected Soil Removal," dated October 4, 1996, which the Department has retitled "Draft Removal Action Workplan" and has approved for distribution for public review and comment
2/7/97	Department	THAN	Letter approving the THAN's "Removal Site Evaluation/Cost Analysis, and Workplan for Pesticide-Affected Soil Removal"
3/6/97	Department	THAN	Letter providing additional comments regarding the "Preliminary Draft Remedial Action Plan" and a list of proposed final remediation goals
3/28/97	THAN	Department	Letter requesting an extension to prepare a technical and economic evaluation of the proposed final remediation goals
4/30/97	THAN	Department	Letter enclosing "Technical and Economic Feasibility Evaluation," dated April 30, 1997, in support of the selection of final remediation goals for the THAN site (see reports)

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
8/4/97	THAN	Department	Letter submitting materials relating to the 1997 first semiannual sampling of certain domestic wells in the vicinity of the THAN site
10/3/97	Department	THAN	Letter providing comments regarding "Technical and Economic Feasibility Evaluation" submitted by THAN on April 30, 1997
3/6/98	THAN	Department	Letter submitting materials relating to the 1997 second semiannual sampling of certain domestic wells in the vicinity of the THAN site
3/10/98	Department	THAN	Letter regarding finalization of a Draft Remedial Action Plan for the THAN site
3/18/98	THAN	Department	Letter regarding deadline for submittal of a revised Draft Remedial Action Plan for the THAN site
6/19/98	THAN	Department	Letter regarding deadline for submittal of a Final Draft Remedial Action Plan for the THAN site
7/2/98	THAN	Department	Letter providing response to Agency comments regarding the Technical and Economic Feasibility Evaluation for the THAN site
7/2/98	THAN	Department	Letter providing response to Agency comments regarding the Draft Remedial Action Plan for the THAN site
9/8/98	THAN	Department	Letter submitting materials relating to the 1998 first semiannual sampling of certain domestic wells in the vicinity of the THAN site
11/11/98	THAN	Department	Letter submitting the"Groundwater Monitoring Report - First Semiannual Sampling of 1998" dated October 26, 1998, prepared by Chaney, Walton & McCall (see reports)

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
12/8/98	Department	THAN	Letter regarding jurisdictional consent agreement/consent order for the THAN site
12/18/98	THAN	Department	Letter providing response to Agency 12/8/98 letter regarding jurisdictional consent agreement/consent order for the THAN site
2/9/99	Department	THAN	Letter regarding finalization of a Draft Remedial Action Plan for the THAN Site.
3/5/99	THAN	Department	Letter regarding finalization of Draft Remedial Action Plan with attached 1) Response to DTSC Comments on the Draft RAP by Kennedy/Jenks Consultants; 2) Draft Fact Sheet; and 3) Draft Public Notice.
4/22/99	Department	THAN	Letter regarding review of Response to Comments dated 3/5/99 and transmitting Statement of Reasons and Preliminary Nonbinding Allocation of Responsibility.
4/23/99	THAN	Department	Letter transmitting Well water test results from the Second Semiannual Sampling of 1998.
6/28/99	DTSC	File/Interested Parties	Analysis of Public Comments Received on Draft Remedial Action Plan and Proposed Negative Declaration June 28, 1999

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DATE	TITLE	DESCRIPTION
10/30/81	Preliminary Report (Phase I Preliminary Report)*	Soil and water analytical results from borings 1-17 and wells 1-6; listing of chemicals known to have been formulated or processed between 1959-1981.
1/1/82	Phase II Assessment Program (Phase IIa Report)*	Summary of proposed work elements to further characterize the site.
01/28/82-09/30/82	Progress Reports #1-#9 for Phase II Assessment Program	
04/22/83	Report (2 volumes): Groundwater Results and Updated Report April 1983 (Report to Address RWQCB Concerns Expressed in Letter dated 02/28/83*	Reports to RWQCB re results in Phase II-A and Phase II-B Assessment Program.
11/23/83	Soil Mitigation Plan (Proposed Soil Excavation and Mitigation Program)*	Proposal for soil excavation and mitigation; information on handling of soils containing various chemical concentrations in soil.
01/84-04/84	Soils Investigation Report	Includes shallow soil sampling results for borings; includes physical testing results for borings 65 and 66 to a depth of 25 feet; includes sampling results in cistern area.
04/11/84	Report: Estimate of Mobility of Selected Pesticides in Soil	Summary and evaluation of various pesticides through 5 ft clean soil, with and without an impervious cap.
04/25/84	Revised Soil Exploration and Mitigation Program	Proposal for soil excavation and mitigation.

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DATE	TITLE	DESCRIPTION
04/25/84	Analysis of Groundwater Data	Presents monitoring results, contour data, data evaluation methods, high water table estimates and quality control data.
08/03/84	Interim Report - THAN Remedial Program	Summarizes the soils characterization data and remedial actions available or completed as of report date.
11/29/84	Status Report: THAN Remedial Program	Summarizes soils characterization, describes remedial activities completed in summer, describes various remedial program elements, summarizes air quality monitoring results.
02/08/85	Concept Report: Proposed System for Groundwater Remediation at the THAN Site	Conceptual description of proposed groundwater treatment system discharge system compatible with extraction system described in 02/12/85 Feasibility Assessment Report.
02/12/85	Feasibility Assessment of Hydrodynamic Groundwater Containment at the THAN Site, Fresno County, California	Describes hydrogeologic conditions at site, assesses feasibility of halting migration of organic constituents offsite, describes groundwater flow computer model.
02/19/85	Analysis of Groundwater Data, THAN Site, Fresno, California	Presents updated monitoring results, presents contour data, summarizes quality control procedures and data, evaluates groundwater quality.
05/1/85	Concept Report: Proposed Interim Remedial Measure Program at the THAN Site	Conceptual description of proposed interim remedial measures program.

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DATE	TITLE	DESCRIPTION
07/10/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides address inventory for drinking water wells, provides drinking water sampling program and contingency plan, provides bibliography of reports, provides rationale for termination of excavation activities, summarizes QA/QC procedures.
08/02/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides updated address inventory; past program for alternate drinking supply; interim groundwater remediation program engineering design; air monitoring and source control contingency plan; worker safety, community safety and contingency plans; partial list of pesticides and other substances handled at site; soil characterization work plan; groundwater assessment work plan.
08/19/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Analysis of drainage at the THAN site.
09/03/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides final address inventory community well inventory; information required for processing discharge requirements; community relations plan; and feasibility study work plan.
12/13/85	Response to Agency Comments Regarding Remedial Investigation, Interim Remedial Measure Documents	
02/1/86	Community Relations Plan	
2/12/86	Final Report: 2/12/86 Drainage System Exploration Program	Describes underground drainage systems investigation.

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DATE	TITLE	DESCRIPTION
04/03/86	Report: Groundwater Analyses for Wells; November Onsite Sampling	
04/03/86	Report: Groundwater Analyses for Wells; December Offsite Sampling	
05/1/86	Revised Soil Characterization Work Plan	
06/1/86	Water Resource Management Plan	A cooperative effort of the County of Fresno, the Fresno Irrigation District and the Fresno Metropolitan Flood Control District. Summarizes water quality throughout the Fresno area.
07/1/86	Kennedy/Jenks/Chilton Draft Feasibility Study, Tasks 1 and 2 THAN, Fresno County California submitted in accordance with DOHS Remedial Action order Docket No. HSA 84/85-001 and CRWQCB Cleanup and Abatement Order as reissued July 17, 1985	
11/10/86	Groundwater Analysis for Wells, April/May Onsite Sampling	
11/10/86	Groundwater Analyses for Wells, June Offsite Sampling	
12/16/86	Report: "Preliminary Groundwater Characterization: Summary of Data Assimilated to Date" Volumes one and two	Characterization of existing groundwater and hydrogeologic data.

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DATE	TITLE	DESCRIPTION
12/16/86	"Revised Work Plans for soil Characterization and Initial Phase of Groundwater Assessment"	
01/24/87	Groundwater Analyses for Wells July On-Site Sampling	
02/11/87	Groundwater Analyses for Wells October On-Site Sampling	
03/09/87	Work Plan for Phase I of Groundwater Assessment	Submitted in Accordance with DOHS Imminent and Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.9.
04/1/87	Groundwater Analyses for Wells December 1986 Off-Site Sampling	
05/1/87	Draft Remedial Investigation/Feasibility Study Workplan	Submitted to DOHS for comments in accordance with DOHS Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED.
05/06/87	Quality Assurance Project Plan	Plan for characterization of soil and groundwater quality in the vicinity of the THAN site. Submitted in accordance with DOHS Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.2.
05/06/87	Sampling and Analysis Plan	Describing the Sampling Protocol to be employed during Phase I field activities.
08/28/87	May 1987 Offsite Sampling Report	
08/28/87	April 1987 Onsite Sampling Report	

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DATE	TITLE	DESCRIPTION
11/18/87	Phase I Ground Water Assessment Summary Volumes I, II & III	Summarizes field activities and the hydrogeologic and water quality data collected during THAN's Phase I Ground Water Assessment. The Phase I Groundwater Assessment Summary report was submitted to DOHS in accordance with Section V.E.1. of DOHS Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, dated January 23, 1987, as amended May 8, 1987.
02/29/88	Draft Endangerment Assessment/Public Health Evaluation, prepared by Metcalf & Eddy on behalf of DOHS	
04/15/88	Groundwater Analysis for Wells December 1987 Domestic Well Sampling	
04/15/88	Groundwater Analysis for Wells November 1987	
05/18/88	Preliminary Soil Characterization Report Summary of Data Assimilated to Date	Summarizes chemical analyses performed on soil samples collected from the THAN site from 1981 to July 1987.
06/29/88	Groundwater Analyses January 1988 Onsite Monitoring Well Sampling	
07/27/88	Quality Assurance Project Plan	Revises draft report submitted on 05/06/87.
08/01/88	April 1988 Quarterly Groundwater Monitoring Well Sampling Report	

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DATE	TITLE	DESCRIPTION
09/08/88	Investigation-Derived Residuals Management Plan	Establishes appropriate procedures and protocol for the containment, sampling, and disposal of residuals expected to be generated during the THAN Site Remedial Investigation.
10/03/88	Draft Structures Demolition Plan	Describes the scope, schedule, engineering, and administrative controls proposed by THAN for the proposed structures demolition and soil excavation activities.
11/22/88	June 1988 Domestic Well Sampling Report	
12/05/88	Air Monitoring Plan	Describes the monitoring, sampling and analyses for airborne chemicals that will be conducted at the fenced perimeter of the THAN site during the demolition and excavation phases of the structures demolition project (note that this report is bound with the reports listed as item nos. 102, 103 and 104).
12/16/88	Site Health and Safety Plan	Establishes general health and safety protocol for Kennedy/Jenks/Chilton personnel at the THAN site (note that this report is bound with the reports listed as item nos. 100, 103 and 104).
12/22/88	Dust and Vapor Control Workplan	Describes dust/vapor control methods to be used during all work associated with asbestos removal, structures demolition, soil backfill/compaction, and transport loading at the THAN site (note that this report is bound with the reports listed as item nos. 100, 102 and 104).

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DATE	TITLE	DESCRIPTION
12/23/88	Transportation Plan	Describes procedures for safe and proper transportation of waste materials to CWM's Kettleman Hills Class I Treatment and Disposal Facility (note that this report is bound with the reports listed as item nos. 100, 102 and 103).
1/1/89	July 1988 Quarterly Groundwater Monitoring Well Sampling Report	
04/21/89	December 1988 Domestic Well Sampling Report	
06/26/89	October 1988 Quarterly Groundwater Monitoring Well Sampling Report	
06/30/89	January 1989 Quarterly Groundwater Monitoring Well Sampling Report	
08/31/89	June 1989 Quarterly Groundwater Monitoring Well Sampling Report	
08/31/89	June 1989 Domestic Well Sampling Report	
12/22/89	September 1989 Quarterly Groundwater Monitoring Well Sampling Report	
04/1/90	December 1989 Domestic Well Sampling Report	
04/1/90	December 1989 Quarterly Groundwater Monitoring Well Sampling Report	

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DATE	TITLE	DESCRIPTION
05/23/90	March 1990 Quarterly Groundwater Monitoring Well Sampling Report	
10/1/90	Description of Soil Vapor Extraction Pilot System	
10/30/90	June 1990 Groundwater Sampling Report	
12/1/90	Draft Public Participation - Community Relations Plan	
12/17/90	September 1990 Groundwater Sampling Report	
03/1/91	December 1990 Groundwater Sampling Report	
05/24/91	March 1991 Groundwater Sampling Report	
08/30/91	June 1991 Groundwater Sampling Report	
11/01/91	Tabulated Soils Data, Laboratory Analysis Results	
11/27/91	September 1991 Groundwater Sampling Report	
01/1/92	Public Participation - Community Relations Plan	
03/17/92	Groundwater Monitoring Report - Fourth Quarter 1991	
07/09/92	Groundwater Monitoring Report - First Quarter 1992	
10/1/92	Public Participation - Community Relations Plan	
12/21/92	Groundwater Monitoring Report - Second Quarter 1992	

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DATE	TITLE	DESCRIPTION
01/05/93	Groundwater Monitoring Report - Third Quarter 1992	
01/30/93	Response to Agency Comments - Revised Draft Remedial Investigation Summary Report	
03/19/93	Groundwater Monitoring Report - Fourth Quarter 1992	
05/26/93	Groundwater Monitoring Report - First Quarter 1993	
05/28/93	Final Remedial Investigation Summary Report and Appendices (Volumes 1 - 8)	
06/30/93	Feasibility Study Report	
10/12/93	Groundwater Monitoring Report - Second Quarter 1993	
12/23/93	Groundwater Monitoring Report - Third Quarter 1993	
03/08/94	Groundwater Monitoring Report - Fourth Quarter 1993	
06/08/94	Groundwater Monitoring Report - First Quarter 1994	
09/27/94	Calculation of Health-Based Preliminary Remediation Goals	
10/06/94	Groundwater Monitoring Report - Second Quarter 1994	
10/10/94	Draft Response to Comments, THAN Site Risk Assessment	
12/15/94	Groundwater Monitoring Report - Third Quarter 1994	

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DATE	TITLE	DESCRIPTION
01/1/95	Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc.	
04/10/95	Groundwater Monitoring Report - Fourth Quarter 1994	
10/23/95	Groundwater Monitoring Report - First Semiannual Sampling of 1995	
01/31/96	Multipathway Health Risk Assessment for the THAN Site	
04/03/96	Groundwater Monitoring Report - Second Semiannual Sampling of 1995	
08/19/96	Groundwater Monitoring Report, First Semiannual Sampling of 1996	
12/05/96	Groundwater Monitoring Report, Second Semiannual Sampling of 1996	
04/30/97	Technical and Economic Feasibility Evaluation	
07/31/97	First Semiannual Sampling of 1997, Groundwater Monitoring Report	
05/13/98	Groundwater Monitoring Report - Second Semiannual Sampling of 1997	
10/26/98	First Semiannual Sampling of 1998, Groundwater Monitoring Report	

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DATE	TITLE	DESCRIPTION
4/29/99	California Environmental Quality Act - Special Initial Study, Draft Negative Declaration and Draft DeMinimis Impact Finding	
5/3/99	Draft Remedial Action Plan	
5/26/99	Transcript of Public Meeting	
6/30/99	California Environmental Quality Act - Special Initial Study, Negative Declaration, DeMinimis Impact Finding, Negative Declaration Approval, Notice of Determination/Certificate of Fee Exemption and Notice of Determination Filing Checklist	

APPENDIX D

ADMINISTRATIVE RECORD LIST

ACRONYMS AND ABBREVIATIONS USED IN ADMINISTRATIVE RECORD LIST - MAY 5, 1999

Air District	San Joaquin Valley Unified Air Pollution Control District/Fresno Zone (formerly known as the Fresno County Air Pollution Control District)
CRWQCB	California Regional Water Quality Control Board, Central Valley Region
Department	California Environmental Protection Agency, Department of Toxic Substances Control (formerly known as California Department of Health Services, Toxic Substances Control Program or "DOHS")
DOHS	California Department of Health Services, Toxic Substances Control Program (now known as California Environmental Protection Agency, Department of Toxic Substances Control or the "Department")
EHS	Environmental Health System (Division of DOHS)
EPA	U.S. Environmental Protection Agency
Kennedy/Jenks	Kennedy/Jenks Consultants (formerly known as Kennedy/Jenks/Chilton)
Kleinfelder	J.H. Kleinfelder & Associates
McCutchen	McCutchen, Doyle, Brown & Enersen
NPL	National Priorities List
THAN	T H Agriculture & Nutrition, L.L.C. (formerly known as T H Agriculture & Nutrition Company, Inc. and prior to that THCC)
THCC	Thompson-Hayward Chemical Company (now known as THAN)
THCC*	Thompson-Hayward Chemical Company (formed in 1981)

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
2/3/81	CRWQCB	THCC	Letter regarding inspection report; request for submission of information concerning waste handling at site
2/23/81	THCC	CRWQCB	Letter regarding plant operations
3/27/81	DOHS	THCC	Letter regarding surface soil sampling
6/15/81	DOHS	THCC	Letter regarding Kleinfelder Proposal for Geotechnical Services
7/7/81	THCC	DOHS	Letter enclosing Kleinfelder Supplement Proposal of 7/3/81 (attached)
7/14/81	DOHS	THCC	Letter regarding 7/3/81 Kleinfelder Supplement Proposal
8/14/81	CRWQCB	THCC	Letter regarding off-site sampling and remedial action plan
8/31/81	THCC	CRWQCB	Letter requesting extension of time to submit sample analyses
9/16/81	CRWQCB	THCC	Letter regarding 8/31/81 request for extension of time for submittal of water and soil sample analyses
9/22/81	Kleinfelder	CRWQCB	Letter regarding sampling and analysis procedures in response to 8/14/81 letter from CRWQCB
10/14/81	CRWQCB	THAN	Letter regarding geotechnical study
10/28/81	CRWQCB	THAN	Letter regarding toxicological evaluation (evaluation attached)
11/3/81	DOHS	THCC	Letter requesting soil sampling report by 11/10/81

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
11/30/81	DOHS/HWMB	CRWQCB	Memo requesting that CRWQCB assume lead agency role in THAN site cleanup
12/7/81	CRWQCB	THAN	Letter regarding chemical waste study prepared by Kleinfelder
1/21/82	THAN	CRWQCB	Letter submitting evaluations on plant site, as requested in Board letter of 1/4/82
10/5/82	Kleinfelder	DOHS	Letter responding to 9/1/82 DOHS memorandum "THAN - Proposed Cleanup Efforts"
2/14/83	Ciba-Geigy	DOHS	Follow up to "Abandoned Industrial Waste Disposal Site Survey"
2/28/83	CRWQCB	THAN	Letter requesting submission of Phase II-A and Phase II-B Assessments to CRWQCB by 5/1/83
3/22/83	Kleinfelder	Fresno County Department of Health	Letter regarding status report of THAN Phase II investigation
7/12/83	CRWQCB	THAN	Letter regarding Phase II-A and Phase II-B Proposals
7/26/83	Kleinfelder	CRWQCB	Letter regarding THAN soil analysis
8/26/83	CRWQCB	THAN	Letter regarding modified soil cleanup levels
9/27/83	CRWQCB	THAN	Letter regarding errors in CRWQCB memoranda of 8/26/83
10/18/83	CRWQCB	THAN	Letter summarizing agency findings and reviewing THAN's " Soil Investigation and Mitigation Plan"
11/9/83	Kleinfelder	CRWQCB	Letter regarding "Soil Investigation and Mitigation Plan" revised in response to

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			agency letter of 10/18/83
12/30/83	McCutchen	CRWQCB	Letter regarding 1/6/84 meeting between agencies, THAN, Kleinfelder & Assoc. to discuss THAN/Kleinfelder proposals of 12/9/83 and 12/20/83
1/9/84	Kleinfelder	CRWQCB	Letter regarding aerial photographs of THAN site
1/11/84	McCutchen	CRWQCB	Letter providing schedule for THAN's commencement and completion of further site investigation and remedial action tasks
2/3/84	CRWQCB	THAN	Letter regarding enclosed Cleanup and Abatement Order
2/3/84	CRWQCB	THAN	Cleanup and Abatement Order issued to THAN facility
5/21/84	McCutchen	DOHS	Letter requesting a meeting to discuss disposition of THAN stockpiled soils and final remedial action plans
6/6/84	McCutchen	CRWQCB	Letter regarding DOHS approval of replacement of soils removed from exploratory trenches
6/11/84	DOHS	McCutchen	Letter regarding continued site assessment at THAN
7/9/84	McCutchen	DOHS	Letter regarding 7/20/84 meeting at DOHS to discuss "Estimate of Mobility of Selected Pesticides in Soil"
7/11/84	McCutchen	CRWQCB	Letter regarding draft memoranda discussed at 6/25/84 meeting between THAN and CRWQCB ("Soils Investigation," "Estimate of Mobility of Selected Pesticides in Soil," "Revised Soil Exploration and Mitigation Program,"

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
			"Mitigation Plan," "Analysis of Ground Water Data")
7/31/84	DOHS - Alternative Technology	DOHS- Northern Ca Section	Review memorandum regarding report entitled "Estimated Mobility of Selected Pesticides In Soil" prepared by Kennedy/Jenks Engineers
7/31/84	DOHS - Alternative Technology	DOHS- Northern Ca Section	Internal memo addressing various aspects of site remediation
8/29/84	McCutchen	DOHS	Letter regarding 8/14/84 meeting regarding status of site mitigation
9/27/84	CRWQCB	McCutchen	Letter with staff comments on THAN documents submitted in compliance with Cleanup and Abatement Order
10/4/84	McCutchen	DOHS and CRWQCB	Letter regarding presentation by THAN of site investigation and mitigation status at 9/6/84 meeting
10/12/84	McCutchen	DOHS and CRWQCB	Letter regarding potential remedial action alternative
11/16/84	CRWQCB	McCutchen	Letter regarding "Interim Report, THAN Remedial Action Program" submitted 10/12/84 (Staff Report of 9/27/84 enclosed)
12/14/84	McCutchen	EPA/NPL Staff	Letter regarding extension of NPL analysis of THAN site
12/14/84	CRWQCB	McCutchen	Letter regarding "Ground Water Analyses for On-Site Wells" and "Ground Water Analyses for (area) Domestic Wells" submitted by THAN (Staff Report of 11/16/84 enclosed)
1/7/85	DOHS	THCC	Letter regarding inclusion of facility on State Priority Ranking List

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
1/8/85 (sic)	McCutchen	DOHS	Letter noting change in person receiving copy for Fresno County Health Dept. from Oberti to Leibold
1/30/85	DOHS		Order to Post Warning Signs
2/1/85	McCutchen	CRWQCB	Letter submitting THAN groundwater remedial action proposal
2/6/85	CRWQCB	McCutchen	Letter responding to letter of 2/1/85
2/12/85	McCutchen	CRWQCB	Letter enclosing Kennedy/Jenks "Concept Report: Proposed System for Groundwater Remediation at the THAN Site" and Kleinfelder & Assoc. "Preliminary Feasibility of Hydrodynamic Groundwater Containment at the THAN Site" in compliance with 2/3/84 CRWQCB Cleanup and Abatement Order and 3/21/84 amendment
2/20/85	EPA		Responses to McCutchen letter of 12/14/84
2/21/85	McCutchen	CRWQCB	Letter enclosing Kleinfelder "Analysis of Groundwater Data, THAN Site" in compliance with 2/3/84 CRWQCB Cleanup and Abatement Order
2/27/85	CRWQCB	McCutchen	Letter enclosing staff review of THAN site
3/11/85	McCutchen	EPA/NPL Staff	Letter regarding consideration of comments prior to final rule
3/29/85	DOHS	McCutchen	Summary of 3/26/85 meeting
4/9/85	McCutchen	DOHS	Letter regarding 3/26/85 meeting.
			Letter enclosing CRWQCB Notice of Public Hearing regarding THAN violations

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
5/13/85	CRWQCB	McCutchen	of Cleanup and Abatement Order of 2/3/84; Staff Report, Chronology and Tentative Order enclosed
5/28/85	DOHS		Determination of Imminent or Substantial Endangerment and Remedial Action Order
5/29/85	McCutchen	CRWQCB	Letter regarding Kennedy/Jenks "Concept Report: Proposed Interim Remedial Measure Program at the THAN Site" and DOHS Order to prepare remedial investigation/feasibility study documents for soil/groundwater remediation measures
6/13/85	McCutchen	DOHS	Letter requesting clarification of Remedial Action Order of 5/28/85 and extension of time
6/14/85	McCutchen	DOHS	Letter providing information required by DOHS Remedial Action Order
6/18/85	DOHS	Stinson, Mag & Fizell	Letter regarding THCC* request to be deleted from Remedial Action Order list of respondents
6/24/85	McCutchen	DOHS	Letter regarding 1981 company name change from THCC to THAN
6/28/85	DOHS		First Amendment of DOHS Remedial Action Order extending Order compliance deadline for Olin Corporation, Ciba-Geigy Corporation and THCC*
6/28/85	DOHS	McCutchen	Letter regarding DOHS 6/27/85 Amendment of Remedial Action Order
7/2/85	McCutchen	DOHS	Letter regarding petition for writ of mandate (enclosed) to remove North American Philips Corporation as Respondent to Order of 6/28/85

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DATE	AUTHOR	RECEIVER	SUBJECT/"TITLE" OF DOCUMENT
7/2/85	DOHS	McCutchen	Letter amending DOHS 6/27/85 Remedial Action Order to extend deadlines
7/10/85	McCutchen	DOHS	Letter providing submittals in accordance with DOHS Remedial Action Order
7/18/85	CRWQCB	McCutchen	Letter regarding issuance of enclosed Cleanup and Abatement Order. Cleanup and Abatement Order dated 7/17/85 (amends Order of 2/3/84)
7/19/85	DOHS	All respondents	Notice in 6/27/85 Remedial Action Order of extension of compliance deadlines
8/5/85	McCutchen	DOHS	Letter requesting deletion of THCC* from DOHS Remedial Action Order list of respondents. Enclosed: quitclaim deed (THCC to THAN) and title insurance guarantee of THAN as owner of record of described property
8/5/85	McCutchen	DOHS and CRWQCB	Letter providing submittals in accordance with Remedial Action Order
8/9/85	State Water Resources Control Board	McCutchen and Stinson, Mag & Fizzell	Letter dismissing THCC* as a responsible party from Cleanup and Abatement Order of 7/17/85
8/12/85	CRWQCB		Letter enclosing Amendment to Cleanup and Abatement Order of 7/17/85, dated 8/9/85
8/19/85	McCutchen	CRWQCB and DOHS	Letter enclosing Analysis of Drainage at THAN site in accordance with DOHS Remedial Action Order of 5/28/85, as amended, and by CRWQCB revised Cleanup and Abatement Order of 7/17/85 (see reports)
8/23/85	CRWQCB		Staff review of "Remedial Investigation and Interim Remedial Measure Documents" submitted by THAN. CRWQCB Staff review of 8/16/85 and

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			DOHS memorandum of 7/19/85 attached
8/29/85	DOHS	McCutchen	Letter enclosing staff comments on the 7/10/85 Remedial Investigation and Interim Remedial Measure Documents Report (comments attached)
8/30/85	McCutchen	CRWQCB and DOHS	Letter enclosing Remedial Investigation and Interim Remedial Measure Documents in accordance with DOHS Remedial Action Order of 5/28/85, as amended, and by CRWQCB revised Cleanup and Abatement Order of 7/17/85 (see reports)
9/12/85	McCutchen	CRWQCB and DOHS	Letter regarding agency response to THAN submissions and agency cooperation in THAN's attempts to develop effective communication with local residents
9/30/85	McCutchen	DOHS	Letter providing quitclaim deed as recorded with the County of Fresno (quitclaim deed attached)
10/3/85	DOHS	McCutchen	Letter regarding necessity of receiving quitclaim deed before removing THCC from Remedial Action Order
10/3/85	DOHS	McCutchen	Letter requesting signed and recorded copy of quitclaim deed
10/5/85	Kleinfelder	Fresno County Environmental Health Department	Letter regarding analyses of domestic well water samples
10/7/85	McCutchen	DOHS	Letter in response to DOHS comments concerning the Remedial Investigation and Interim Remedial Measure Documents submitted by THAN July 10, 1985

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10/7/85	McCutchen	DOHS	Letter responding to Department's memorandum of 8/13/85, enclosed in letter of 8/29/85, regarding Remedial Investigation and Interim Remedial Measure Documents submitted by THAN
10/16/85	CRWQCB	DOHS	Memorandum regarding staff analysis of "Remedial Investigation and Interim Remedial Measure Documents" and "On-site and Off-site Well Monitoring Data for Samples Collected 1/1/85 - 6/30/85"
10/28/85	State Water Resources Control Board	McCutchen	Letter regarding completion of petition for review of Cleanup and Abatement Order
10/31/85	CRWQCB	McCutchen	Letter enclosing 10/29/85 amendment to Cleanup and Abatement Order
11/4/85	DOHS	McCutchen	Letter enclosing staff comments on THAN's Community Relations Plan and "Remedial Investigation/Interim Remedial Measure Documents" of 8/8/85 and 9/3/85
11/5/85	EPA	DOHS and CRWQCB	Letter enclosing EPA comments on THAN's remedial activities at site in terms of EPA's requirements for a Remedial Investigation/Feasibility Study
11/21/85	DOHS	McCutchen	Letter transmitting EPA comments on THAN's "Remedial Investigation/Interim Remedial Measure" and "Groundwater Data" documents
11/25/85	Kleinfelder	DOHS	Letter regarding 12/6/85 meeting
11/25/85	McCutchen	DOHS	Letter requesting extension of due date for response to DOHS comments of 11/4/85 and 11/8/85 on "Remedial Investigation and Interim Remedial Measure

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			Documents"
12/5/85	McCutchen	DOHS	Letter requesting extension of due date for response to DOHS comments of 8/2/85, 8/19/85, 9/3/85 on "Remedial Investigation and Interim Remedial Measure Documents" to 12/13/85
12/9/85	McCutchen	DOHS	Letter summarizing meeting of 11/6/85
12/13/85	McCutchen	DOHS	Letter responding to DOHS letters of 11/4/85, 11/8/85 and enclosed memoranda of 9/25/85, 10/11/85 and two memoranda of 9/18/85
1/13/86	McCutchen	DOHS	Letter correcting Mr. Leibold's mailing address
1/20/86	McCutchen	DOHS	Letter regarding classification of groundwater extracted during groundwater remediation as hazardous waste
2/11/86	CRWQCB	McCutchen	Letter enclosing Public Notice for Tentative Waste Discharge Requirements and Negative Declaration & Proof of Posting form and noting requirements with respect to enclosures
3/13/86	EPA	McCutchen	Letter providing a preliminary determination that the groundwater beneath the THAN site is a regulated waste under Resource Conservation and Recovery Act (RCRA)
3/26/86	Kennedy/Jenks/Chilton	CRWQCB	Letter confirming March 6, 1986 and March 10, 1986 discussions regarding IRM and Tentative Waste Discharge Requirements
3/28/86	McCutchen	DOHS	Letter regarding THAN's understanding of its obligations under DOHS Remedial

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			Action Order, Docket No. HSA 84/85-001
4/4/86	DOHS	McCutchen	Letter regarding IRM proposal and RI/FS workplans; enclosing staff memo commenting on THAN's "Response to Agency Comments Regarding Remedial Investigation and Interim Remedial Measure Documents" submitted to DOHS on 12/13/85
4/14/86	CRWQCB	DOHS	Memorandum regarding "Final Report, Drainage System Exploration Program," enclosing comments on report
5/12/86	DOHS	McCutchen	Letter regarding Feasibility Study Work Plan as contained in the Remedial Investigation Report dated 9/3/85
5/12/86	McCutchen	DOHS	Letter in response to DOHS letter dated 4/4/86 regarding Remedial Investigation and Feasibility Study Work Plans and Proposed Interim Remedial Measures for Groundwater, and enclosing revised Remedial Investigation and Feasibility Study Work Plans for soil characterization and groundwater assessment (see reports)
5/16/86	McCutchen	EPA, DOHS and CRWQCB	Letter in response to EPA letter dated 3/13/86 regarding classification of groundwater to be extracted during proposed groundwater remediation
5/22/86	McCutchen	DOHS	Letter regarding draft of THAN newsletter submitted by THAN to DOHS on 2/22/86 in accordance with the community relations plan
6/16/86	McCutchen	DOHS	Letter in response to DOHS questions concerning the revised Groundwater Assessment Work Plan submitted 5/12/86
			Letter regarding approval status of work proposed in Remedial Investigation and

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6/24/86	McCutchen	DOHS	Feasibility Study documents submitted to DOHS
7/8/86	DOHS	McCutchen	Letter regarding Revised Soil Characterization Workplan and Revised Groundwater Assessment Workplan
8/5/86	DOHS	THAN	Letter regarding Groundwater Remedial Investigation Workplan, enclosing staff memorandum of 7/15/86 summarizing technical meeting between THAN representatives and DOHS staff
8/6/86	McCutchen	DOHS, CRWQCB, Fresno County Health Department and EPA	Letter informing agencies of THAN's appointment Wade W. Smith's as project manager for THAN site
8/12/86	McCutchen	DOHS	Letter regarding status of THAN document repository
8/12/86	McCutchen	DOHS	Letter enclosing copies of "THAN Community Newsletter," published by THAN in accordance with the community relations plan submitted by THAN to DOHS on 2/22/86
8/14/86	DOHS	Residents living near THAN site	Letter regarding THAN newsletter
8/15/86	THAN	DOHS	Letter in response to 8/5/86 letter regarding Groundwater Remedial Investigation Work Plan
9/18/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton monthly progress report dated 9/10/86, and requesting meeting to discuss the Groundwater Remedial Investigation Work

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			Plan
9/22/86	DOHS	THAN	Letter regarding Groundwater Remedial Investigation Work Plan
10/2/86	DOHS	McCutchen	Letter enclosing draft revised remedial action order
10/9/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton monthly progress report dated 10/8/86 and acknowledging receipt of 10/3/86 letter and draft revised remedial action order
10/17/86	McCutchen	DOHS	Letter regarding draft revised remedial action order
10/17/86	McCutchen	DOHS	Letter acknowledging receipt of the draft revised remedial action order and enclosing Kennedy/Jenks/Chilton comments on technical matters
10/29/86	McCutchen	DOHS	Letter enclosing preliminary hydrogeologic cross sections and Kennedy/Jenks/Chilton letter of explanation dated 10/24/86
11/7/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton reports regarding Water Surface Elevation Trend Plots for Monitoring Wells
11/8/86	DOHS	McCutchen	Letter enclosing staff comments on "Remedial Investigation/Interim Remedial Measure Documents" of 8/19/85
12/16/86	THAN	DOHS	Letter enclosing Kennedy/Jenks/Chilton report regarding "Preliminary Ground Water Characterization: Summary of Data Assimilated to Date"
12/16/86	THAN	DOHS	Letter submitting "Revised Work Plans for Soil Characterization and Initial Phase

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			of Groundwater Assessment"
1/5/87	Fresno County Department of Health	THAN	Letter regarding monitoring of Temperance-Kutner Elementary School well water
1/30/87	DOHS	THAN	Letter enclosing Preliminary Imminent and Substantial Endangerment Order, Docket No. HSA 87- and Proposed Stipulation Agreement
2/20/87	THAN	DOHS	Letter enclosing Data Presented in Technical Meetings held December 1985 and July 1986
3/9/87	THAN	DOHS	Letter enclosing Work Plan for Phase I Groundwater Assessment dated 3/9/87
3/16/87	McCutchen	DOHS	Letter regarding meeting of 2/4/87 between THAN and DOHS concerning Imminent and Substantial Endangerment Order, Docket No. HSA 86/87-020 ED
4/23/87	CRWQCB	THAN	Letter transmitting comments regarding the "Preliminary Groundwater Characterization: Summary of Data Assimilated to Date" and the "Work Plan for Phase 1 of Ground Water Assessment"
4/27/87	THAN	DOHS	Letter enclosing Hazardous Waste Injection Well Statement
4/30/87	THAN	CRWQCB	Letter requesting a waiver of the Solid Waste Assessment Test Requirements
5/6/87	THAN	DOHS	Letter enclosing Quality Assurance Project Plan and Sampling and Analysis Plan, both dated 5/6/87
5/7/87	THAN	DOHS	Letter enclosing Draft Remedial Investigation/Feasibility Study Workplan dated

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			5/87
5/27/87	THAN	DOHS	Letter regarding deferred enforcement of Domestic Well Sampling Program, as set forth in Imminent or Substantial Endangerment Order, Docket No. HSA 86/87-020 ED., issued by DOHS on 1/23/87
6/8/87	THAN	CRWQCB	Letter regarding analytical protocol for groundwater sampling
6/22/87	CRWQCB	THAN	Letter approving analytical protocol for groundwater sampling proposed by THAN in its June 6, 1987 letter
6/24/87	McCutchen	DOHS	Letter enclosing updated THAN community relations mailing list
7/1/87	THAN	CRWQCB	Letter regarding Solid Waste Assessment Test waiver request
7/9/87	CRWQCB	THAN	Letter enclosing comments on THAN's Draft Remedial Investigation/Feasibility Study Workplan
7/15/87	McCutchen	DOHS	Letter enclosing a draft of the second THAN Community newsletter for review and approval
8/20/87	McCutchen	DOHS	Letter requesting amendment of the Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED to reflect the replacement of Timothy Souther by James Wood of the CRWQCB and the new address for James Allen of DOHS
8/20/87	McCutchen	DOHS	Letter regarding community relations for the THAN site

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8/27/87	THAN	DOHS	Letter regarding meeting between THAN and DOHS held on August 7, 1987 regarding target zones for Phase I intermediate and deep wells
8/28/87	THAN	DOHS	Letter enclosing the April 1987 Onsite Sampling report and the May 1987 Offsite Sampling report, both dated August 28, 1987
9/2/87	McCutchen	DOHS	Letter requesting a written designation by Dr. James T. Allen pursuant to Section V.1.2 of the Determination of Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED
9/11/87	THAN	DOHS	Letter correcting THAN's letter to DOHS dated August 28, 1987
9/22/87	THAN	DOHS	Letter summarizing the progress and schedule for completion of Phase I Ground Water Investigation
9/30/87	THAN	DOHS	Letter enclosing updated schedule for completion of Phase I well installation and provisionally requesting extension of the deadline for completion of Phase I field work
10/7/87	CRWQCB	THAN	Letter approving THAN's Solid Waste Assessment Test Waiver request and enclosing a CRWQCB memorandum, dated October 7, 1987, providing its comments on the waiver request
11/18/87	THAN	DOHS	Letter enclosing a report entitled "Phase I Ground Water Assessment Summary, THAN Site, Eastern Fresno County," Volumes I, II, III, dated November 18, 1987
			Letter regarding December 2, 1987 meeting between THAN, DOHS and other

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12/14/87	THAN	DOHS	interested Fresno City and County representatives
1/13/88	DOHS	THAN	Letter enclosing a summary of results from a recent sampling of private wells in the vicinity of the THAN site
1/14/88	DOHS	THAN	Letter enclosing comments from EPA and DOHS concerning THAN's RI/FS Workplan
1/21/88	THAN	DOHS	Letter summarizing and confirming matters discussed at the December 17, 1987 meeting between THAN, DOHS, EPA and other interested governmental agencies regarding THAN's Phase I Groundwater Investigation conducted in accordance with DOHS Imminent or Substantial Endangerment and Remedial Action Order HSA 86/87-202 ED
2/3/88	THAN	DOHS	Letter summarizing THAN's proposal to pay the costs of extending the existing Fresno domestic water system to certain households near the THAN site
2/4/88	McCutchen	CRWQCB	Letter regarding the Cleanup and Abatement Order issued by CRWQCB on July 17, 1985
2/5/88	THAN	DOHS	Letter regarding the Preliminary Endangerment Assessment/Public Health Evaluation under preparation by Metcalf & Eddy
2/5/88	DOHS	THAN	Letter regarding the organization of a community advisory committee for the THAN site
2/5/88	DOHS in Sacramento	DOHS in Fresno	Letter regarding the organization of a community advisory committee and the February 18, 1988 "Kickoff Meeting;" THAN Fact Sheet dated February 18,

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			1988, which was circulated at the meeting; summary of the meeting
2/5/88	THAN	DOHS	Letter summarizing and confirming matters discussed at the January 27, 1988 meeting between THAN, DOHS, CRWQCB and T-K Neighbors in Action regarding the overall strategy proposed for the remainder of the Remedial Investigation and the location of monitoring well clusters proposed in the December 17, 1987 meeting
3/2/88	THAN	DOHS	Letter enclosing the proposed amendments to the DOHS Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED
3/3/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the March 16, 1988 THAN Community Advisory Committee Meeting; list of committee members; THAN Progress Report dated March 16, 1988, which was circulated at the meeting; summary of the meeting
3/4/88	CRWQCB	THAN	Letter enclosing comments on data submitted regarding Phase I drilling muds on the THAN site
3/9/88	Kennedy/Jenks/Chilton	DOHS	Letter enclosing proposed revisions to Appendix A to the DOHS Imminent or Substantial Endangerment and Remedial Action Order Docket No. HSA 86/87-020 ED
3/11/88	Fresno County Department of Health	THAN	Letter discussing domestic well sampling protocol and enclosing "Water Well Disinfection Procedures" and a letter from Fresno County Department of Health to water well contractors, regarding well drilling near the THAN site
3/11/88	DOHS	THAN	Letter regarding site remediation and THAN's offer to fund an extension of the

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			City of Fresno water distribution network
3/18/88	THAN	DOHS	Letter submitting the Remedial Investigation/Feasibility Study Workplan
4/11/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 20, 1988 THAN Community Advisory Committee Meeting; "Status Sheet: Redbank and Fancher Creeks Construction Project;" meeting agenda and THAN Fact Sheet dated April 20, 1988, which were circulated at the meeting
4/14/88	THAN	DOHS	Letter regarding the Proposed Domestic Well Sampling Program
4/14/88	THAN	DOHS	Letter regarding a January 27, 1988 letter from T-K Neighbors in Action to DOHS
4/15/88	THAN	DOHS	Letter regarding the March 21, 1988 meeting between THAN, DOHS, Fresno County Health Department, and T-K Neighbors in Action regarding sampling of domestic wells by DOHS and the Fresno County Health Department
5/2/88	THAN	DOHS	Letter transmitting comments on the Draft Endangerment Assessment/Public Health Evaluation dated February 1988
5/13/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the May 25, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated May 25, 1988, which were circulated at the meeting; summary of the meeting
5/19/88	THAN	DOHS	Letter transmitting Dr. James L. Byard's comments on the Draft Endangerment Assessment/Public Health Evaluation dated February 1988

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6/23/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the June 29, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated June 29, 1988, which were circulated at the meeting; summary of the meeting
6/29/88	CRWQCB	THAN	Letter formally rescinding the Board's Cleanup and Abatement Order issued to THAN on July 7, 1985
7/20/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the July 27, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated July 27, 1988, which were circulated at the meeting; summary of the meeting
8/3/88	THAN	DOHS	Letter submitting revised report entitled "Quality Assurance Project Plan," dated July 27, 1988
8/26/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 31, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated August 31, 1988, which were circulated at the meeting; summary of the meeting
8/29/88	Fresno County Public Works and Development Services Department	THAN	Grading Work Voucher issued
8/29/88	THAN	Fresno County Public Works and Development Services Department	Letter submitting Grading Permit Application

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8/30/88	THAN	Fresno County Public Works Department Water Division	Letter submitting revisions to Exhibits "A" and "C" attached to June 28, 1988 Agreement
9/1/88	McCutchen	DOHS	Letter regarding whether THAN's demolition and excavation activities are subject to the California Environmental Quality Act, Public Resources Code Sections 21000 - 21177 ("CEQA")
9/8/88	THAN	DOHS	Letter submitting the "Investigation-Derived Residuals Management Plan" ("the IDRMP"), dated September 8, 1988
9/21/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the September 28, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated September 28, 1988, which were circulated at the meeting; summary of the meeting
9/29/88	THAN	Fresno County Public Works Department	Letter submitting a revised project description for extension of the City of Fresno municipal water system
9/29/88	DOHS	McCutchen	Letter responding to McCutchen's September 1, 1988 letter to DOHS regarding whether THAN's demolition and excavation activities are subject to the California Environmental Quality Act, Public Resources Code Sections 21000 - 21177 ("CEQA")
10/20/88	DOHS	THAN	Letter regarding November 10, 1988 community meeting and enclosing THAN Community Advisory mailing list
10/26/88	THAN	DOHS	Letter enclosing the final versions of (1) the community letter regarding the

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			availability of the Structures Demolition Plan and the November 10, 1988 community meeting, (2) the DOHS flyer announcing the community meeting; and (3) the THAN community advisory mailing list
11/1/88	DOHS		Notice of Intent to Adopt a Negative Declaration Pursuant to CEQA stating DOHS's intention to find that implementation of the Structures Demolition Plan will not have a significant effect on the environment and to adopt a Negative Declaration pursuant to the California Environmental Quality Act ("CEQA") for this project
11/23/88	State of California Office of Planning and Research	DOHS	Letter acknowledging compliance with CEQA and stating that the state agency review period for the DOHS Notice of Intent to Adopt a Negative Declaration Pursuant to CEQA is closed and that no state agencies submitted comments on the document
11/28/88	DOHS		DOHS Notice of Determination stating that DOHS has approved the Structures Demolition Plan and has determined that the project will not have a significant effect on the environment, that a Negative Declaration was prepared pursuant to CEQA, and that mitigation measures were made a condition of the approval of the project
11/28/88	DOHS	THAN Community Advisory Committee Members	Letter announcing the December 14, 1988 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated December 14, 1988, which were circulated at the meeting; summary of the meeting
1/12/89	THAN	EPA	Letter to demonstrate and certify that the requirements of 40 CFR § 268.8(a)(1) have been met by THAN with respect to offsite disposal of soil and debris wastes

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			generated in conjunction with interim remedial measures taken at the site
1/13/89	THAN	DOHS	Letter transmitting a bound document containing the following reports relating to the structures demolition project: "Site Health and Safety Plan," "Air Monitoring Plan," "Dust and Vapor Control Workplan" and "Transportation Plan"
1/25/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the February 22, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated February 22, 1989, which were circulated at the meeting; summary of the meeting
2/22/89	THAN		Community Advisory Committee Meeting Summary
3/21/89	City Fresno Public Works Department		Internal memorandum describing a tentative schedule for the THAN municipal water system project
3/22/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the March 29, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated March 29, 1989, which were circulated at the meeting; summary of the meeting
3/24/89	City of Fresno Public Works Department	Property owners	Form letter describing the THAN municipal water system project and offering property owners the opportunity to request city water service connection
3/24/89	DOHS	TK Neighbors in Action	Letter discussing the February 28, 1989 meeting of TK Neighbors and a March 8, 1989 letter from TK Neighbors to DOHS
3/29/89	THAN Community Advisory Committee		Agenda for the March 29, 1989 meeting

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4/5/89	THAN	DOHS	Letter summarizing THAN activities during 1988 and highlighting outstanding issues relating to the remedial investigation/feasibility study process
4/20/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 26, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated April 26, 1989, which were circulated at the meeting; summary of the meeting
5/2/89	DOHS	THAN	Letter which (1) describes DOHS's final comments on the March 1988 revision of the remedial investigation/feasibility study workplan, (2) transmits EPA's comments on the workplan, and (3) provides DOHS's conditional approval of the workplan
5/19/89	DOHS	THAN	Letter submitting comments on the July 1988 draft of the "Quality Assurance Project Plan"
6/6/89	DOHS	THAN	Letter providing conditional approval of the "Investigation - Derived Residuals Management Plan" for the THAN site
6/23/89	THAN	DOHS	Letter submitting THAN's response to a DOHS letter dated May 19, 1989 regarding the July 1988 draft of the "Quality Assurance Project Plan"
7/21/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 3, 1989 THAN Community Advisory Committee Meeting; meeting agenda and THAN Fact Sheet dated August 3, 1989, which were circulated at the meeting; summary of the meeting
8/2/89	CRWQCB	THAN	Letter providing information on the preparation of an Application for Waste Discharge Requirements letter received September 5, 1989

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8/3/89	THAN	DOHS	Letter submitting proposed amendments to DOHS Order Docket No. HSA 86/87-020 ED
8/23/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 30, 1989 THAN Community Advisory Committee Meeting; meeting agenda which was circulated at the meeting; summary of the meeting
8/24/89	THAN	DOHS	Letter submitting a sample letter that was sent to owners of wells in the vicinity of proposed Phase II/III groundwater monitoring well cluster locations
8/29/89	CRWQCB	THAN	Letter discussing groundwater remediation at the THAN site and enclosing an application for Waste Discharge Requirements and related materials
8/29/89	THAN	DOHS	Letter submitting materials relating to the June 1989 sampling of wells included in the domestic well sampling program and designated peripheral wells
9/25/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the September/October 1989 THAN Community Advisory Committee Meeting on October 4, 1989
9/27/89	DOHS	THAN Community Advisory Committee Members	Letter clarifying the date of the September/October 1989 THAN Community Advisory Committee meeting
10/4/89	DOHS	THAN Community Advisory Committee Members	Agenda for the October 4, 1989 meeting of the THAN Community Advisory Committee; THAN Fact Sheet dated October 4, 1989, which was circulated at the meeting; summary of the meeting

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10/10/89	THAN	DOHS	Letter summarizing an August 30, 1989 meeting between THAN and DOHS; meeting attendance list
11/8/89	DOHS	THAN Community Advisory Committee Members	Letter announcing the November 15, 1989 THAN Community Advisory Committee meeting; meeting agenda which was circulated at the meeting; summary of the meeting
11/29/89	DOHS	THAN	Letter in response to a letter from THAN dated October 10, 1989 pertaining to an August 30, 1989 meeting between THAN and DOHS
12/14/89	THAN	DOHS	Letter regarding THAN's proposal to refine the analytical protocol used for the quarterly monitoring well sampling program
1/4/90	DOHS	THAN	Letter submitting memo from EPA on Technical Assistance Grant (TAG) insert that must be added to all NPL site fact sheets
1/10/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the January 17, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary
2/7/90	THAN	DOHS	Letter submitting memorandum prepared by Kennedy/Jenks/Chilton, dated January 11, 1990, summarizing technical action items relating to THAN's Phase II/III Groundwater Investigation Program
3/7/90	DOHS	THAN	Letter providing conditional approval of the Quality Assurance Project Plan and the December 14, 1989 proposed modification to the Monitoring Well Analytical Protocol

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3/15/90	THAN	DOHS	Letter submitting materials relating to the December 1989 sampling of wells included in the domestic well sampling program and designated peripheral wells
3/23/90	DOHS	THAN	Letter submitting comments on THAN's Phase II/III Groundwater Investigation Technical Proposal, dated February 7, 1990
3/26/90	THAN	DOHS	Letter submitting recent modifications to proposed Amendment No. 2 to DOHS Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, including Appendix A, titled, "Domestic Well Sampling Program and Contingency Plan for Alternative Drinking Water Supply"
3/30/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the April 4, 1990 THAN Community Advisory Committee Meeting; meeting agenda; meeting summary
3/30/90	THAN	DOHS	Letter responding to DOHS comments on THAN's February 7, 1990 technical action item proposal outlining certain modifications to the RI/FS Workplan
4/9/90	THAN	DOHS	Letter submitting list of households that have been connected to the Fresno domestic water system; sample of notice letter sent to each household
4/11/90	THAN	City of Fresno Public Works Department	Letter submitting list of households that have been connected to the Fresno domestic water system; sample of notice letter sent to each household
4/13/90	THAN	DOHS	Letter regarding results of laboratory analyses performed on samples of residual drilling mud produced during drilling of exploratory borings for the Phase II/III Groundwater Investigation

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4/24/90	THAN	CRWQCB	Letter regarding management of residuals generated during the Phase II/III Groundwater Investigation
5/4/90	THAN	City of Fresno Public Works Department	Letter regarding connection of additional households in THAN's Domestic Well Sampling Program to the Fresno domestic water system
5/9/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the May 16, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 16, 1990, which was circulated at the meeting; meeting summary
5/15/90	THAN	DOHS	Letter proposing the continued sampling of three domestic wells located downgradient of the known chloroform plume pursuant to proposed Amendment No. 2 to DOHS Order, Docket No. HSA 86/87-020 ED
6/15/90	THAN	DOHS, CRWQCB, County Health Department and OES	Letter regarding a discharge of oil in orchard property owned by THAN, including attachment #1
6/22/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the June 27, 1990 THAN Community Advisory Committee meeting; THAN Fact Sheet dated June 27, 1990, which was circulated at the meeting; meeting summary
6/26/90	DOHS	THAN	Letter regarding continued sampling of certain domestic wells
7/7/90	THAN	DOHS	Letter submitting recently revised modifications to proposed Amendment No. 2 to DOHS Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, including Appendix A, title, "Domestic Well

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			Sampling Program and Contingency Plan for Alternative Drinking Water Supply"
8/24/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the August 29, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated August 29, 1990, which was circulated at the meeting; meeting summary
8/24/90	THAN	DOHS	Letter submitting an addendum to the March 1988 Remedial Investigation/Feasibility Study Workplan
8/30/90	THAN	DOHS	Letter submitting materials relating to the June 1990 sampling of certain domestic wells in the vicinity of the THAN site
10/18/90	THAN	Fresno County Air Pollution Control District	Letter submitting an application for a permit to construct and operate a soil vapor extraction pilot system at the THAN site
10/19/90	DOHS	THAN Community Advisory Committee Members	Letter announcing the October 24, 1990 THAN Community Advisory Committee meeting; tentative meeting agenda
10/22/90	THAN	DOHS	Letter submitting a revised THAN project schedule (Figure 39) for the March 1988 Remedial Investigation/Feasibility Study Workplan
11/15/90	DOHS	City of Fresno	Letter regarding concerns relating to the Fresno City water supply system, which have been expressed by residents who recently have been connected to that system
			Letter regarding concerns relating to the Fresno City water supply system, which

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11/15/90	DOHS	City of Fresno	have been expressed by residents who recently have been connected to that system
11/28/90	Fresno County Air Pollution Control District	THAN	Letter regarding THAN's application for an Authority to Construct a soil vapor extraction system at the THAN site
12/6/90	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter regarding proposed soil vapor extraction pilot system; monitoring schedule for soil vapor extraction pilot study; figure showing soil vapor extraction system schematic
12/18/90	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter submitting rating fee for soil vapor extraction pilot system permit application
1/25/91	DOHS	THAN and North American Philips Corporation	Letters transmitting a copy of "Amendment No. 2 to Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED," effective January 5, 1991
1/25/91	THAN	DOHS	Letter requesting an extension for submittal of Remedial Investigation Report and Baseline Risk Assessment Documents
1/28/91	Kennedy/Jenks/Chilton	Fresno County Air Pollution Control District	Letter submitting proposed modifications to the Authority to Construct issued to THAN for a soil vapor extraction pilot project
1/28/91	THAN	DOHS	Letter submitting a proposed Workplan for a Baseline Risk Assessment for the

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			THAN site
2/4/91	DOHS	THAN	Letter transmitting background material regarding the Agency for Toxic Substances and Disease Registry ("ATSDR") Health Assessment Project for NPL sites
2/22/91	DOHS	THAN	Letter regarding remedial and removal action costs incurred during cleanup of the THAN site for the period of July 1984 through June 1989
2/28/91	THAN	DOHS	Letter submitting materials relating to the December 1990 sampling of certain domestic wells in the vicinity of the THAN site
3/25/91	THAN	DOHS	Letter responding to DOHS letter dated February 22, 1991 regarding remedial and removal action costs for the THAN site
7/15/91	Air District		Permit to Operate issued on July 15, 1991 for a soil vapor extraction system at the THAN site
8/21/91	Kennedy/Jenks	Fresno County Air Pollution Control District [the Air District]	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
8/21/91	Kennedy/Jenks Consultants	Fresno County Air Pollution Control District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
			Letter submitting materials relating to the June 1991 sampling of certain

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8/22/91	THAN	DOHS	domestic wells in the vicinity of the THAN site
8/26/91	Kennedy/Jenks	Fresno County Air Pollution Control District [the Air District]	Letter transmitting laboratory analysis report sheets for air samples collected on June 22, 1991 and July 19, 1991
8/26/91	Kennedy/Jenks Consultants	Fresno County Air Pollution Control District	Letter transmitting laboratory analysis report sheets for air samples collected on June 22, 1991 and July 19, 1991
8/30/91	THAN	DOHS	Letter submitting a draft form letter, which offers to interview local government officials and elected representatives regarding the THAN site, and a list of proposed interviewees
8/30/91	THAN	DOHS	Letter submitting, for DOHS review and approval, a "working copy" of the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, as amended
9/5/91	Department	THAN	Memorandum enclosing a list of questions for community interviews
9/19/91	Kennedy/Jenks	Air District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
9/20/91	THAN	Mayor of the City of Fresno, Council-members for Districts	Letter offering to interview these individuals regarding any concerns they may have relating to the THAN site

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		4 and 5 of the City of Fresno and officials of the City of Fresno Public Works Department	
9/20/91	THAN	Department	Letter enclosing a form letter, which offers to interview local government officials and elected representatives regarding the THAN site, and the mailing list for the letter
10/7/91	Department	THAN	Letter modifying requirements for submittals set forth in Section V.I.2. of the Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED
11/25/91	Department	THAN Community Advisory Committee Members	Letter announcing the December 4, 1991 THAN Community Advisory Committee meeting; THAN Fact Sheet dated December 4, 1991, which was circulated at the meeting; meeting summary
12/24/91	Kennedy/Jenks	Air District	Letter summarizing operations and results to date for the Xylene Area Pilot Remediation System at the THAN site
1/2/92	THAN	Department	Letter submitting "Draft Initial Screening and Process Options Summary Tables," dated January 2, 1992, prepared by Kennedy/Jenks
1/6/92	Department	THAN	Telecopier message transmitting the Department's notes on interviews of local government officials and locally elected representatives regarding the THAN site

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1/9/92	Department	THAN	Letter providing (1) notice of sufficient data to prepare draft remedial investigation and feasibility study reports, and (2) approval of proposed project schedule submitted by THAN on August 30, 1991
1/30/92	Department	THAN Community Advisory Committee Members	Letter announcing the February 5, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary
2/3/92	THAN	Department	Letter submitting "Treatability Study Objectives - Draft Technical Memorandum," dated February 3, 1992
2/6/92	THAN	Department and CRWQCB	Letter regarding (1) analytical results from September 1991 background soil sampling, (2) installation of three vapor extraction wells, and (3) proposed use of investigation derived residuals
2/28/92	THAN	Department	Letter submitting materials relating to the December 1991 sampling of certain domestic wells in the vicinity of the THAN site
3/5/92	Department	THAN Community Advisory Committee Members	Letter announcing the March 11, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated March 10, 1992, which was circulated at the meeting; meeting summary
5/7/92	Department	THAN Community Advisory Committee Members	Letter announcing the May 13, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 13, 1992, which was circulated at the meeting; meeting summary
6/16/92	Department	THAN	Letter approving proposed use of investigation derived residuals from the

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			September 1991 background soil sampling and soil vapor extraction well installation
6/17/92	Department	THAN Community Advisory Committee Members	Letter announcing the June 24, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated June 24, 1992, which was circulated at the meeting; meeting summary
7/2/92	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of March through May 1992 for the Xylene Area Pilot Remediation System at the THAN site
7/8/92	THAN	Fresno County Health Department and the Department	Letter submitting a report, dated July 2, 1992, regarding removal of a 500-gallon underground storage tank from the THAN site
7/8/92	THAN	Fresno County Health Department and the Department	Letter submitting a report, dated July 2, 1992, regarding removal of a 500-gallon underground storage tank from the THAN site
7/24/92	Department	THAN Community Advisory Committee Members	Letter announcing the July 29, 1992 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated July 29, 1992, which was circulated at the meeting
8/3/92	Fresno County Health Department	THAN	Letter confirming completion of the site investigation and/or remedial action relating to removal of a 500-gallon underground storage tank from the THAN site
8/5/92	Department	THAN	Letter providing conditional approval of the "Public Participation - Community

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			Relations Plan," dated January 1992
9/2/92	Department	THAN	Letter enclosing Department and EPA comments regarding the "Preliminary Draft Multipathway Health Risk Assessment," dated March 1992
9/18/92	THAN	Department	Letter submitting materials relating to the June 1992 sampling of certain domestic wells in the vicinity of the THAN site
9/28/92	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of June through August 1992 for the Xylene Area Pilot Remediation System at the THAN site
12/9/92	Department	THAN Community Advisory Committee Members	Summary of the December 9, 1992 THAN Community Advisory Committee Meeting, prepared by the Department; THAN Fact Sheet dated December 9, 1992, which was circulated at the meeting
12/11/92	Department	THAN	Letter enclosing EPA, CRWQCB and Department comments regarding the "Preliminary Draft Remedial Investigation Summary Report," dated March 30, 1992, and the "Preliminary Draft Feasibility Study," dated June 1, 1992
1/13/93	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of September through November 1992 for the Xylene Area Pilot Remediation System at the THAN site
1/21/93	Department	THAN Community Advisory Committee Members	Letter announcing the January 27, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated January 26, 1993, which was circulated at the meeting; meeting summary
1/21/93	Department	THAN	Letter transmitting the approval sheet, signed November 1992, for the "Public Participation - Community Relations Plan," dated January 1992, as revised in

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			October 1992
1/26/93	Department	THAN	Facsimile transmission of a Department memorandum, dated January 26, 1993, regarding food chain pathway analysis in the risk assessment prepared by ENVIRON for the THAN site
1/31/93	THAN	Department	Letter submitting (1) "Response to Agency Comments - Revised Draft Remedial Investigation Summary Report," dated January 30, 1993 (see reports); (2) summary of responses to agency comments regarding the "Preliminary Draft Multipathway Health Risk Assessment" and corresponding proposed revisions to the text of that report (attached); (3) summary of responses to agency comments regarding the "Preliminary Draft Feasibility Study Report" (attached); and (4) revised draft "Feasibility Study Report," dated January 31, 1993 (see reports)
2/17/93	SEACOR	THAN	Letter (Department of Toxic Substances Control listed on cc list) transmitting the Laboratory Analytical Reports for Well Samples inadvertently omitted from the Third Quarter 1992 Groundwater Monitoring Report
2/23/93	SEACOR	Department	Letter transmitting Table 4-1 of the Preliminary Draft and Draft Feasibility Studies which was inadvertently omitted from both reports
3/3/93	THAN	Department	Letter submitting materials relating to the December 1993 sampling of certain domestic wells in the vicinity of the THAN site
3/25/93	Department	THAN Community Advisory Committee Members	Letter announcing the March 31, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated March 31, 1993, which was circulated at the meeting; meeting summary

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4/23/93	Department	THAN Community Advisory Committee Members	Letter announcing the April 28, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated April 28, 1993, which was circulated at the meeting; meeting summary
4/26/93	Kennedy/Jenks	Air District	Letter summarizing operations and results for the period of December 1992 through February 1993 for the Xylene Area Pilot Remediation System at the THAN site
4/27/93	Department	THAN	Letter providing conditional approval of the "Revised Draft Remedial Investigation Summary Report," dated January 30, 1993
5/13/93	ENVIRON	Department	Letter regarding revisions to the "Draft Multipathway Health Risk Assessment Report," prepared by ENVIRON for the THAN site
5/20/93	Department	THAN Community Advisory Committee Members	Letter announcing the May 26, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated May 25, 1993, which was circulated at the meeting; meeting summary
5/20/93	Department	THAN	Facsimile transmission of a mailing list prepared by the Department for the THAN site; a mandatory mailing list prepared by the Department for all site clean-up projects; and a summary regarding the remedy selection process for federal Superfund sites
6/11/93	THAN	Department	Letter submitting a revised Table 2-1 for the "Draft Feasibility Study Report," dated January 31, 1993
6/21/93	Department	THAN	Facsimile transmission of "THAN Site Final FS [Feasibility Study] Comments,"

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			prepared by the Department
8/2/93	Kennedy/Jenks	Air District	Letter stating that the Xylene Area Pilot Remediation System at the THAN site will be shut down for a period of 60 to 90 days to evaluate the nature and extent of chemical concentrations remaining in the vadose zone
8/6/93	Department	THAN	Letter summarizing key performance objectives for soil and groundwater components of the preferred remedial alternative for the THAN site
8/19/93	Department	THAN Community Advisory Committee Members	Letter announcing the August 25, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; THAN Fact Sheet dated August 25, 1993, which was circulated at the meeting; meeting summary
9/16/93	THAN	Department	Letter submitting materials relating to the June 1993 sampling of certain domestic wells in the vicinity of the THAN site
10/21/93	THAN	Department	Letter requesting an extension for submittal of certain sections of the Draft Remedial Action Plan
11/10/93	Department	THAN Community Advisory Committee Members	Letter announcing the November 17, 1993 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated November 15, 1993, which was circulated at the meeting; meeting summary
1/20/94	Department		Notice stating that the January 26, 1994 THAN Community Advisory Committee meeting has been rescheduled for March 2, 1994
2/25/94	Department	THAN Community Advisory Committee	Letter announcing the March 2, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated March 2, 1994, which was

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		Members	circulated at the meeting; meeting summary
3/4/94	THAN	Department	Letter submitting materials relating to the December 1993 sampling of certain domestic wells in the vicinity of the THAN site
6/3/94	Department	THAN Community Advisory Committee Members	Letter announcing the June 14, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated June 14, 1994, which was circulated at the meeting; meeting summary
8/12/94	THAN	Department	Letter submitting materials relating to the June 1994 sampling of certain domestic wells in the vicinity of the THAN site
9/00/94	Department	THAN Community Advisory Committee Members	Letter announcing that the September 14, 1994 THAN Community Advisory Committee meeting has been rescheduled for September 28, 1994
9/18/94	Kennedy/Jenks Consultants	CRWQCB	Letter regarding proposed aquifer testing in the vicinity of the THAN site
9/22/94	Department	THAN Community Advisory Committee Members	Letter announcing the September 28, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary; fact sheet dated September 28, 1994, which was circulated at the meeting
9/28/94	THAN	Department	Letter submitting "Calculation of Health Based Preliminary Remediation Goals," dated September 27, 1994, prepared by ENVIRON
10/7/94	Department	THAN	Letter enclosing Department and EPA comments regarding the "Preliminary

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10/11/94	THAN	Department	Letter enclosing "Draft Response to Comments, THAN Site Risk Assessment," dated October 10, 1994
11/4/94	THAN	Department	Letter enclosing a list of households recently connected to the Fresno domestic water supply system and a sample of the "Notice Regarding Bottled Water" sent to each household on the list
11/14/94	THAN	Department	Letter enclosing preliminary responses to agency comments dated October 7, 1994 regarding the Preliminary Draft Remedial Action Plan
12/1/94	Department	THAN Community Advisory Committee Members	Letter announcing the December 13, 1994 THAN Community Advisory Committee meeting; tentative meeting agenda; meeting summary; fact sheet dated December 13, 1994, which was circulated at the meeting
1/00/95	California Department of Health Services, Environmental Health Investigations Branch		"THAN Public Health Assessment, Exposure and Health Effects Fact Sheet"
1/9/95	THAN	California Department of Health Services	Letter providing comments on the "THAN Public Health Assessment, Exposure and Health Effects Fact Sheet"
1/25/95	Department	THAN Community Advisory Committee Members	Letter announcing the January 31, 1995 THAN Community Advisory Committee meeting; tentative meeting agenda; fact sheet dated January 31, 1995, which was circulated at the meeting

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2/27/95	THAN	Department	Letter submitting materials relating to the December 1994 sampling of certain domestic wells in the vicinity of the THAN site
3/1/95	McCutchen	California Department of Health Services	Letter requesting to review and copy documents relating to the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc.," prepared by the California Department of Health Services
3/9/95	California Department of Health Services	McCutchen	Letter regarding arranging a time for McCutchen to review and copy documents relating to the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/10/95	THAN	California Department of Health Services	Letter providing supplemental comments regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/24/95	California Department of Health Services	McCutchen	Letter regarding files to be copied regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
3/31/95	Department	THAN	Letter enclosing Department comments on the "Draft Multipathway Health Risk Assessment" and the risk assessment and proposed remediation goals in the "Draft Remedial Action Plan"
4/3/95	McCutchen	California Department of Health Services	Letter stating that McCutchen has no further comments at this time regarding the "Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc."
4/3/95	Department	THAN	Letter providing formal approval to change monitoring well sampling frequency from quarterly to semiannually, on an interim basis, pending adoption of a final remedial action groundwater monitoring program

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6/8/95	THAN	Department	Letter submitting a letter, dated June 6, 1995, prepared by ENVIRON, responding to the Department's comments regarding the "Draft Multipathway Health Risk Assessment"
6/30/95	THAN	Department	Letter submitting materials relating to the April 1995 sampling of certain domestic wells in the vicinity of the THAN site
7/14/95	SECOR	Department	Letter transmitting copies of laboratory reports from analysis of soil samples collected in the vicinity of Drainage System H by THAN in April 1994.
9/27/95	THAN	Department	Letter submitting materials relating to the July 1995 sampling of certain domestic wells in the vicinity of the THAN site
10/27/95	THAN	Department	Letter enclosing "Workplan for Collection of Soil Samples Related to Shutdown of Soil Vapor Extraction Systems," dated October 24, 1995 (see reports)
12/21/95	Department	THAN	Letter approving the Draft Multipathway Health Risk Assessment, provided that THAN prepare a Final Multipathway Health Risk Assessment document that incorporates all agreed upon modifications and/or revisions identified in the attached memorandum from Office of Scientific Affairs
1/30/96	ENVIRON	Department	Letter submitting the final "Multipathway Health Risk Assessment for the THAN Site," dated January 31, 1996 (see reports)
1/31/96	THAN	Department	Letter submitting materials relating to the October 1995 sampling of certain domestic wells in the vicinity of the THAN site
			Letter approving the "Multipathway Health Risk Assessment for the THAN

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3/19/96	Department	THAN	Site," dated January 31, 1996, as submitted by THAN, with the incorporation of this letter and attached memorandum from Office of Scientific Affairs
7/3/96	THAN	Department	Letter submitting materials relating to the April 1996 sampling of certain domestic wells in the vicinity of the THAN site
10/11/96	THAN	Department	Letter submitting materials relating to the 1996 second semiannual sampling of certain domestic wells in the vicinity of the THAN site
12/00/96	Department		Fact Sheet on "Draft Removal Action Workplan Available for Public Review"
12/19/96	Department	THAN	Letter enclosing a copy of the "Removal Site Evaluation Engineering Evaluation/Cost Analysis, and Workplan for Pesticide-Affected Soil Removal," dated October 4, 1996, which the Department has retitled "Draft Removal Action Workplan" and has approved for distribution for public review and comment
2/7/97	Department	THAN	Letter approving the THAN's "Removal Site Evaluation/Cost Analysis, and Workplan for Pesticide-Affected Soil Removal"
3/6/97	Department	THAN	Letter providing additional comments regarding the "Preliminary Draft Remedial Action Plan" and a list of proposed final remediation goals
3/28/97	THAN	Department	Letter requesting an extension to prepare a technical and economic evaluation of the proposed final remediation goals
4/30/97	THAN	Department	Letter enclosing "Technical and Economic Feasibility Evaluation," dated April 30, 1997, in support of the selection of final remediation goals for the THAN site

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			(see reports)
8/4/97	THAN	Department	Letter submitting materials relating to the 1997 first semiannual sampling of certain domestic wells in the vicinity of the THAN site
10/3/97	Department	THAN	Letter providing comments regarding "Technical and Economic Feasibility Evaluation" submitted by THAN on April 30, 1997
3/6/98	THAN	Department	Letter submitting materials relating to the 1997 second semiannual sampling of certain domestic wells in the vicinity of the THAN site
3/10/98	Department	THAN	Letter regarding finalization of a Draft Remedial Action Plan for the THAN site
3/18/98	THAN	Department	Letter regarding deadline for submittal of a revised Draft Remedial Action Plan for the THAN site
6/19/98	THAN	Department	Letter regarding deadline for submittal of a Final Draft Remedial Action Plan for the THAN site
7/2/98	THAN	Department	Letter providing response to Agency comments regarding the Technical and Economic Feasibility Evaluation for the THAN site
7/2/98	THAN	Department	Letter providing response to Agency comments regarding the Draft Remedial Action Plan for the THAN site
9/8/98	THAN	Department	Letter submitting materials relating to the 1998 first semiannual sampling of certain domestic wells in the vicinity of the THAN site

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11/11/98	THAN	Department	Letter submitting the"Groundwater Monitoring Report - First Semiannual Sampling of 1998" dated October 26, 1998, prepared by Chaney, Walton & McCall (see reports)
12/8/98	Department	THAN	Letter regarding jurisdictional consent agreement/consent order for the THAN site
12/18/98	THAN	Department	Letter providing response to Agency 12/8/98 letter regarding jurisdictional consent agreement/consent order for the THAN site
2/9/99	Department	THAN	Letter regarding finalization of a Draft Remedial Action Plan for the THAN Site.
3/5/99	THAN	Department	Letter regarding finalization of Draft Remedial Action Plan with attached 1) Response to DTSC Comments on the Draft RAP by Kennedy/Jenks Consultants; 2) Draft Fact Sheet; and 3) Draft Public Notice.
4/22/99	Department	THAN	Letter regarding review of Response to Comments dated 3/5/99 and transmitting Statement of Reasons and Preliminary Nonbinding Allocation of Responsibility.
4/23/99	THAN	Department	Letter transmitting Well water test results from the Second Semiannual Sampling of 1998.

ADMINISTRATIVE RECORD LIST - **REPORTS** Draft Remedial Action Plan T H Agriculture & Nutrition, L.L.C. May 5, 1999		
DATE	TITLE	DESCRIPTION
10/30/81	Preliminary Report (Phase I Preliminary Report)*	Soil and water analytical results from borings 1-17 and wells 1-6; listing of chemicals known to have been formulated or processed between 1959-1981.
1/1/82	Phase II Assessment Program (Phase IIa Report)*	Summary of proposed work elements to further characterize the site.
01/28/82-09/30/82	Progress Reports #1-#9 for Phase II Assessment Program	
04/22/83	Report (2 volumes): Groundwater Results and Updated Report April 1983 (Report to Address RWQCB Concerns Expressed in Letter dated 02/28/83*	Reports to RWQCB re results in Phase II-A and Phase II-B Assessment Program.
11/23/83	Soil Mitigation Plan (Proposed Soil Excavation and Mitigation Program)*	Proposal for soil excavation and mitigation; information on handling of soils containing various chemical concentrations in soil.
01/84-04/84	Soils Investigation Report	Includes shallow soil sampling results for borings; includes physical testing results for borings 65 and 66 to a depth of 25 feet; includes sampling results in cistern area.
04/11/84	Report: Estimate of Mobility of Selected Pesticides in Soil	Summary and evaluation of various pesticides through 5 ft clean soil, with and without an impervious cap.
04/25/84	Revised Soil Exploration and Mitigation Program	Proposal for soil excavation and mitigation.
04/25/84	Analysis of Groundwater Data	Presents monitoring results, contour data, data evaluation

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DATE	TITLE	DESCRIPTION
		methods, high water table estimates and quality control data.
08/03/84	Interim Report - THAN Remedial Program	Summarizes the soils characterization data and remedial actions available or completed as of report date.
11/29/84	Status Report: THAN Remedial Program	Summarizes soils characterization, describes remedial activities completed in summer, describes various remedial program elements, summarizes air quality monitoring results.
02/08/85	Concept Report: Proposed System for Groundwater Remediation at the THAN Site	Conceptual description of proposed groundwater treatment system discharge system compatible with extraction system described in 02/12/85 Feasibility Assessment Report.
02/12/85	Feasibility Assessment of Hydrodynamic Groundwater Containment at the THAN Site, Fresno County, California	Describes hydrogeologic conditions at site, assesses feasibility of halting migration of organic constituents offsite, describes groundwater flow computer model.
02/19/85	Analysis of Groundwater Data, THAN Site, Fresno, California	Presents updated monitoring results, presents contour data, summarizes quality control procedures and data, evaluates groundwater quality.
05/1/85	Concept Report: Proposed Interim Remedial Measure Program at the THAN Site	Conceptual description of proposed interim remedial measures program.
07/10/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides address inventory for drinking water wells, provides drinking water sampling program and contingency plan, provides bibliography of reports, provides rationale for termination of excavation activities, summarizes QA/QC procedures.

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DATE	TITLE	DESCRIPTION
08/02/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides updated address inventory; past program for alternate drinking supply; interim groundwater remediation program engineering design; air monitoring and source control contingency plan; worker safety, community safety and contingency plans; partial list of pesticides and other substances handled at site; soil characterization work plan; groundwater assessment work plan.
08/19/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Analysis of drainage at the THAN site.
09/03/85	Report: Remedial Investigation and Interim Remedial Measure Documents	Provides final address inventory community well inventory; information required for processing discharge requirements; community relations plan; and feasibility study work plan.
12/13/85	Response to Agency Comments Regarding Remedial Investigation, Interim Remedial Measure Documents	
02/1/86	Community Relations Plan	
2/12/86	Final Report: 2/12/86 Drainage System Exploration Program	Describes underground drainage systems investigation.
04/03/86	Report: Groundwater Analyses for Wells; November Onsite Sampling	
04/03/86	Report: Groundwater Analyses for Wells; December Offsite Sampling	
05/1/86	Revised Soil Characterization Work Plan	

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DATE	TITLE	DESCRIPTION
06/1/86	Water Resource Management Plan	A cooperative effort of the County of Fresno, the Fresno Irrigation District and the Fresno Metropolitan Flood Control District. Summarizes water quality throughout the Fresno area.
07/1/86	Kennedy/Jenks/Chilton Draft Feasibility Study, Tasks 1 and 2 THAN, Fresno County California submitted in accordance with DOHS Remedial Action order Docket No. HSA 84/85-001 and CRWQCB Cleanup and Abatement Order as reissued July 17, 1985	
11/10/86	Groundwater Analysis for Wells, April/May Onsite Sampling	
11/10/86	Groundwater Analyses for Wells, June Offsite Sampling	
12/16/86	Report: "Preliminary Groundwater Characterization: Summary of Data Assimilated to Date" Volumes one and two	Characterization of existing groundwater and hydrogeologic data.
12/16/86	"Revised Work Plans for soil Characterization and Initial Phase of Groundwater Assessment"	
01/24/87	Groundwater Analyses for Wells July On-Site Sampling	
02/11/87	Groundwater Analyses for Wells October On-Site Sampling	
03/09/87	Work Plan for Phase I of Groundwater Assessment	Submitted in Accordance with DOHS Imminent and Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.9.

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DATE	TITLE	DESCRIPTION
04/1/87	Groundwater Analyses for Wells December 1986 Off-Site Sampling	
05/1/87	Draft Remedial Investigation/Feasibility Study Workplan	Submitted to DOHS for comments in accordance with DOHS Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED.
05/06/87	Quality Assurance Project Plan	Plan for characterization of soil and groundwater quality in the vicinity of the THAN site. Submitted in accordance with DOHS Imminent or Substantial Endangerment Order Docket No. HSA 86/87-020 ED, Section V.D.2.
05/06/87	Sampling and Analysis Plan	Describing the Sampling Protocol to be employed during Phase I field activities.
08/28/87	May 1987 Offsite Sampling Report	
08/28/87	April 1987 Onsite Sampling Report	
11/18/87	Phase I Ground Water Assessment Summary Volumes I, II & III	Summarizes field activities and the hydrogeologic and water quality data collected during THAN's Phase I Ground Water Assessment. The Phase I Groundwater Assessment Summary report was submitted to DOHS in accordance with Section V.E.1. of DOHS Determination of Imminent or Substantial Endangerment and Remedial Action Order, Docket No. HSA 86/87-020 ED, dated January 23, 1987, as amended May 8, 1987.
02/29/88	Draft Endangerment Assessment/Public Health Evaluation,	

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DATE	TITLE	DESCRIPTION
	prepared by Metcalf & Eddy on behalf of DOHS	
04/15/88	Groundwater Analysis for Wells December 1987 Domestic Well Sampling	
04/15/88	Groundwater Analysis for Wells November 1987	
05/18/88	Preliminary Soil Characterization Report Summary of Data Assimilated to Date	Summarizes chemical analyses performed on soil samples collected from the THAN site from 1981 to July 1987.
06/29/88	Groundwater Analyses January 1988 Onsite Monitoring Well Sampling	
07/27/88	Quality Assurance Project Plan	Revises draft report submitted on 05/06/87.
08/01/88	April 1988 Quarterly Groundwater Monitoring Well Sampling Report	
09/08/88	Investigation-Derived Residuals Management Plan	Establishes appropriate procedures and protocol for the containment, sampling, and disposal of residuals expected to be generated during the THAN Site Remedial Investigation.
10/03/88	Draft Structures Demolition Plan	Describes the scope, schedule, engineering, and administrative controls proposed by THAN for the proposed structures demolition and soil excavation activities.
11/22/88	June 1988 Domestic Well Sampling Report	
12/05/88	Air Monitoring Plan	Describes the monitoring, sampling and analyses for airborne

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DATE	TITLE	DESCRIPTION
		chemicals that will be conducted at the fenced perimeter of the THAN site during the demolition and excavation phases of the structures demolition project (note that this report is bound with the reports listed as item nos. 102, 103 and 104).
12/16/88	Site Health and Safety Plan	Establishes general health and safety protocol for Kennedy/Jenks/Chilton personnel at the THAN site (note that this report is bound with the reports listed as item nos. 100, 103 and 104).
12/22/88	Dust and Vapor Control Workplan	Describes dust/vapor control methods to be used during all work associated with asbestos removal, structures demolition, soil backfill/compaction, and transport loading at the THAN site (note that this report is bound with the reports listed as item nos. 100, 102 and 104).
12/23/88	Transportation Plan	Describes procedures for safe and proper transportation of waste materials to CWM's Kettleman Hills Class I Treatment and Disposal Facility (note that this report is bound with the reports listed as item nos. 100, 102 and 103).
1/1/89	July 1988 Quarterly Groundwater Monitoring Well Sampling Report	
04/21/89	December 1988 Domestic Well Sampling Report	
06/26/89	October 1988 Quarterly Groundwater Monitoring Well Sampling Report	

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DATE	TITLE	DESCRIPTION
06/30/89	January 1989 Quarterly Groundwater Monitoring Well Sampling Report	
08/31/89	June 1989 Quarterly Groundwater Monitoring Well Sampling Report	
08/31/89	June 1989 Domestic Well Sampling Report	
12/22/89	September 1989 Quarterly Groundwater Monitoring Well Sampling Report	
04/1/90	December 1989 Domestic Well Sampling Report	
04/1/90	December 1989 Quarterly Groundwater Monitoring Well Sampling Report	
05/23/90	March 1990 Quarterly Groundwater Monitoring Well Sampling Report	
10/1/90	Description of Soil Vapor Extraction Pilot System	
10/30/90	June 1990 Groundwater Sampling Report	
12/1/90	Draft Public Participation - Community Relations Plan	
12/17/90	September 1990 Groundwater Sampling Report	
03/1/91	December 1990 Groundwater Sampling Report	

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DATE	TITLE	DESCRIPTION
05/24/91	March 1991 Groundwater Sampling Report	
08/30/91	June 1991 Groundwater Sampling Report	
11/01/91	Tabulated Soils Data, Laboratory Analysis Results	
11/27/91	September 1991 Groundwater Sampling Report	
01/1/92	Public Participation - Community Relations Plan	
03/17/92	Groundwater Monitoring Report - Fourth Quarter 1991	
07/09/92	Groundwater Monitoring Report - First Quarter 1992	
10/1/92	Public Participation - Community Relations Plan	
12/21/92	Groundwater Monitoring Report - Second Quarter 1992	
01/05/93	Groundwater Monitoring Report - Third Quarter 1992	
01/30/93	Response to Agency Comments - Revised Draft Remedial Investigation Summary Report	
03/19/93	Groundwater Monitoring Report - Fourth Quarter 1992	
05/26/93	Groundwater Monitoring Report - First Quarter 1993	
05/28/93	Final Remedial Investigation Summary Report and Appendices (Volumes 1 - 8)	

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DATE	TITLE	DESCRIPTION
06/30/93	Feasibility Study Report	
10/12/93	Groundwater Monitoring Report - Second Quarter 1993	
12/23/93	Groundwater Monitoring Report - Third Quarter 1993	
03/08/94	Groundwater Monitoring Report - Fourth Quarter 1993	
06/08/94	Groundwater Monitoring Report - First Quarter 1994	
09/27/94	Calculation of Health-Based Preliminary Remediation Goals	
10/06/94	Groundwater Monitoring Report - Second Quarter 1994	
10/10/94	Draft Response to Comments, THAN Site Risk Assessment	
12/15/94	Groundwater Monitoring Report - Third Quarter 1994	
01/1/95	Draft Public Health Assessment, T H Agriculture & Nutrition Company, Inc.	
04/10/95	Groundwater Monitoring Report - Fourth Quarter 1994	
10/23/95	Groundwater Monitoring Report - First Semiannual Sampling of 1995	
01/31/96	Multipathway Health Risk Assessment for the THAN Site	
04/03/96	Groundwater Monitoring Report - Second Semiannual Sampling of 1995	

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DATE	TITLE	DESCRIPTION
08/19/96	Groundwater Monitoring Report, First Semiannual Sampling of 1996	
12/05/96	Groundwater Monitoring Report, Second Semiannual Sampling of 1996	
04/30/97	Technical and Economic Feasibility Evaluation	
07/31/97	First Semiannual Sampling of 1997, Groundwater Monitoring Report	
05/13/98	Groundwater Monitoring Report - Second Semiannual Sampling of 1997	
07/02/98	Draft Remedial Action Plan	
10/26/98	First Semiannual Sampling of 1998, Groundwater Monitoring Report	
4/29/99	California Environmental Quality Act - Special Initial Study, Draft Negative Declaration and Draft DeMinimis Impact Finding	

APPENDIX E

RESPONSE TO PUBLIC COMMENTS

Department of Toxic Substances Control

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Winston H. Hickox
Secretary for
Environmental
Protection

Gray Davis
Governor

T H Agriculture & Nutrition, L.L.C. Site - Responsiveness Summary

Analysis of Public Comments Received on
Draft Remedial Action Plan and Proposed Negative Declaration
June 28, 1999

I. Introduction

Between May 14, 1999 and June 12, 1999, the California Department of Toxic Substances Control (Department) held a public comment period on the Draft Remedial Action Plan (RAP) and the Proposed Negative Declaration for the T H Agriculture & Nutrition, L.L.C. (THAN) Site, located in Fresno, Fresno County, California. The purpose of the comment period was to provide the public with an opportunity to review information regarding the project and to solicit public comments on the adequacy of the Draft RAP and appropriateness of the Negative Declaration.

Two residents of the area near the THAN Site contacted DTSC by telephone during the comment period. Both calls were made in response to the receipt of Fact Sheets by these residents, and consisted of questions regarding the Site status and purpose of the public meeting. In addition, several comments/questions were received verbally during the public meeting held at Temperance-Kutner Elementary School on May 26, 1999. No written comments or questions were received on the Draft RAP during the comment period. There were no comments or questions received in writing or verbally regarding the Proposed Negative Declaration.

II. Comments Received and DTSC Responses

A. Comments Received by telephone:

1. Comment/Question: An area resident called in response to receiving the Fact Sheet informing the community of the start of the comment period and the public meeting. He indicated that he and his in-laws were relatively new to the area and did not know anything about the THAN project. He was concerned about potential impacts to their property which is located approximately 1.25 miles southwest of the site within the area impacted by site chemicals.

   Response: The caller was provided with general information related to the proposed remedy for the site and the significance of the presence of contaminants in site soils and groundwater with respect to his residence and family. His residence is connected to the City Water System. He seemed to be satisfied with the information that he was given and indicated that he might attend the public meeting.

2. Comment/Question: A long time resident called to inquire as to the subject of the public meeting. He further indicated that he and his wife had been experiencing health problems and wondered whether this meeting would be about health problems in the community.

   Response: It was explained to the caller that the main topic of the meeting would be the proposal for final remedial actions at the site. It was further explained that the results of a risk assessment conducted for the site would be discussed but not in great detail. In addition, past efforts in the area of community health assessment were discussed, in particular, the Public Health Assessment prepared by the Agency for Toxic Substances and Disease Registry. A copy of the Public Health Assessment was sent to the caller for his information.

B. Comments Received at the Public Meeting on May 26, 1999

1. Comment/Question: A comment was made that the Fact Sheet was overly technical and that the community couldn't understand it.

   Response: The process involved in preparing a fact sheet, including information that significant effort was expended by DTSC's public participation staff to make it understandable, was discussed. For future fact sheet efforts it was agreed that, at a minimum, a glossary would be provided to assist the reader in understanding the information presented.

2. Comment/Question: A comment was made that soil should be removed to a depth of about 18 inches from the area between the fence along the north side of the Site and East McKinley Avenue. It was further explained that when this area is plowed a strong odor occurs indicating that contamination is present.

   Another individual commented that all problem soil should be removed from the Site and hauled off for disposal. He indicated that the 24,000 cubic yards of contaminated soil previously removed from the Site was nothing and had solved nothing. It was further implied that additional removal and disposal should occur no matter what the volume of impacted soil and that on-site management of impacted soils was not an appropriate solution.

   Later in the meeting it was asked why in the first place the Site was not just capped instead of moving all those thousands of yards of soil? Then following a response that it was felt that it was best to remove those soils containing high concentrations of contaminants off Site leaving lower concentrations that are more suitable for capping, the following question was asked: "Then following that same logic why are they not going to move that soil outside the fence and put it over in Kerman, where it should be, instead of moving it underneath the cap?"

Response: The Remedial Action Plan includes provisions for the consolidation of impacted soils from the area lying between the northern Site fence and McKinley Ave. to the area inside the fence which is impacted by the same chemicals at similar concentrations. Since this area is not under THAN's control, it will be cleaned up to levels that will allow for unrestricted future land use. It is anticipated that soil from this area will be removed to a depth of approximately 12 to 18 inches. Confirmation samples will be required to demonstrate attainment of unrestricted land use cleanup levels.

Contaminated soil from this area will then be capped along with other contaminated Site soil in accordance with the requirements of a remedial design. A deed restriction will be placed on the Site property limiting its future use to industrial/commercial activities that do not involve sensitive populations (e.g. children). An Operation and Maintenance Plan will be required along with financial assurances to ensure that the integrity of the cap is maintained. In addition, it will be required that the fence and signs are maintained to limit access to the Site.

The removal of 24,000 cubic of highly contaminated soil was of significant value to the community, not strictly in terms of volume, but rather in terms of a reduction in the mass of chemicals present on-site and in terms of the significant reduction in concentrations present in Site soils. These past removal actions targeted the most contaminated soils found on-site. DDT was and is the organic chemical detected most frequently on-site. DDT was also the contaminant present at the highest maximum and average concentrations in Site soils. The removal actions previously conducted resulted in a reduction in the average concentration of DDT present in Site soils from 690 parts per million (ppm) to 73 ppm. In general, significant reductions in mass and concentration occurred for most contaminants of concern found in Site soil.

The soil located outside the fence contains DDT, DDD, and DDE (related compounds) at concentrations ranging from non-detect to approximately 75 ppm, well within the range of concentrations found in soils remaining within the fenced Site area. The consolidation of this soil to within the fenced Site area will not have any significant impact on the volume or concentration of soils contained under the cap.

Evaluation of the various remedial options for Site soils in accordance with the nine criteria contained in the National Contingency Plan has identified the proposed remedy as the preferred method for remediating Site soils. Implementation of the remedy proposed for Site soils, capping along with administrative controls as described above, eliminates any risk to public health and the environment by ensuring that future exposures to chemicals found in Site soils do not occur. The remedy eliminates the potential for direct contact with contaminated soil and the potential for inhalation of dust or vapor. The remedy also minimizes the potential for contaminants to move down through Site soils to groundwater.

3. Comment/Question: A series of questions were asked about the groundwater contamination plume and its potential impacts on wells in the Site vicinity and implications associated with the proposed remedy. These questions include:

What's happening to the plume of contamination that has been heading towards the city water system?

Is there any family that is in this plume area that is not connected to the city water system that should be right now?

If a well is contaminated later will something be done about it?

This last phase doesn't stop additional wells from being contaminated, does it?

Response: The groundwater contamination plume emanating from the THAN Site has been relatively stagnant over the last nine years. Chloroform concentrations have consistently been detected in monitoring well 184-C since its installation in 1990. The chloroform concentration in monitoring well 184-C climbed from approximately 1.0 part per billion (ppb) in June of 1990 to a maximum of 11.0 ppb in May of 1997. Over the last four semi-annual sampling events the chloroform concentration has remained steady at between 7.0 and 9.1 ppb. When this well was last sampled in December of 1998 it was found to contain 8.3 ppb chloroform. All of the reported detections of chloroform at this monitoring well cluster location have been well below the remediation goal for chloroform of 100.0 ppb.

Domestic wells located further down gradient from the site than the 184 monitoring well cluster have been monitored. No detections of any chemical other than DBCP have been reported for samples collected from these down gradient wells. Reported DBCP concentrations have been below 0.1 ppb.

In addition to an absence of significant migration of the groundwater plume, maximum contaminant concentrations within the plume have steadily decreased over time. The maximum chloroform concentration in the plume area down gradient of the Site has decreased from 160.0 ppb in 1990 to 26.0 ppb in December of 1998. Overall DBCP concentrations within the plume area have also fallen during this time frame.

The declining concentrations within the plume area, a lack of any significant increase in the area affected by Site chemicals and the absence of Site related chemicals in excess of remediation goals in on and near-site monitoring wells provides significant evidence that natural attenuation processes are acting upon the groundwater contaminant plume. To develop a greater understanding of the specific natural attenuation processes that are occurring, monitoring for various indicator constituents has been initiated. This will assist DTSC and THAN in determining the specific biological, chemical and physical mechanisms that are acting on groundwater contaminants to reduce their concentrations.

To DTSC's knowledge there are no residences that are not connected to the City Water System that should be under the requirements of THAN's approved Domestic Well Sampling Program and Contingency Plan for Alternative Drinking Water Supply (DWSP). DTSC will review the status of connections to the City Water System and/or other alternative water supply during the remedial design phase. DTSC will also evaluate and require appropriate revisions to the groundwater monitoring program and DWSP during the design phase.

Both the DWSP and the Remedial Action Plan include requirements for the provision of alternative water supply upon the confirmed detection of Site related chemicals, other than DBCP and 1,2,3-TCP, in a previously unaffected well. In addition, the presence of DBCP or 1,2,3-TCP may result in an offer of alternative water under certain conditions as further described in the DWSP and/or the RAP.

In addition to natural processes that have resulted in a lack of significant movement of contaminants in ground over the last several years, the RAP contains contingencies for active pumping for containment of contaminants exceeding remediation goals both on/near-site and off-site within the contaminant plume. This contingency in conjunction with the provisions of the DWSP provide significant protections for public health and the environment.

4. Comment/Question: A series of questions were asked by and in relationship to a property owner who purchased/built a home just to the west of the THAN Site along Temperance Avenue. Generally these questions focused on the fact that this resident was not allowed, by the county, to install a well to serve their new home and therefore they were forced to connect to the city water system. The property owner and a few others in attendance felt that THAN should pay for the connection of this home to the city water system.

It was suggested that the county's decision to not allow the drilling of a well was a result of the THAN groundwater contamination problem.

Another attendee indicated that he felt that the DBCP problem in the area was because of the THAN Site, even though DTSC and THAN claim that it is a regional problem, and therefore, her home should be connected to city water at no charge.

A comment was made regarding the potential for changes in the direction of groundwater flow and the need for testing wells to the west of the Site. Also, it was asked how often wells to the west of this residents home were tested.

Response: This issue does not specifically relate to the remedy as proposed in the Draft RAP. However, it does relate to the issue of on-going groundwater monitoring requirements and the DWSP. Both of these programs will be addressed during the remedial design phase and subsequently in relationship to the preparation of an Operation and Maintenance Plan for the Site.

The issue of whether THAN should be held responsible of paying the costs of connecting this residence to city water involves two separate questions. The first is whether THAN Site contaminants are present in groundwater under this property. Current information does not indicate that this is the case however, there was a comment made regarding the monitoring of wells more westerly of the Site to demonstrate that this is still true. DTSC agrees that it would be appropriate to review existing information and incorporate changes in the monitoring program to address this issue to the extent that the existing monitoring program does not adequately address the potential for significant contaminant movement in a westerly direction.

Preliminary review of historic and on-going monitoring of the area west of the Site has been completed. Monitoring wells 32-B and 185-B0 are located in the area directly between the Site and the residence of concern. These two wells are monitored on a regular basis. Domestic wells 930 and 937 are the closest wells to the west of the subject property.

Historically chloroform was detected in well 32-B on a regular basis between October of 1984 and June of 1990. Since June of 1992 the only chemicals detected in well 32-B have been 1,2,3-trichloropropane and DBCP. Over the last four semi-annual sampling events, 1,2,3-trichloropropane has been detected at concentrations less than 0.2 ppb and DBCP has not been detected at all.

Chloroform was detected in well 185-B0 in 1990 and 1991. Since March of 1993 no chemicals have been detected in this well.

Domestic well 930 was sampled on numerous occasions between 1982 and 1990. It has been sampled one time since 1990 (September 1996) the only chemical ever detected in this well is DBCP.

Domestic well 937 was sampled on a somewhat regular basis between 1982 and 1990. DBCP was regularly detected in this well. In addition, two chemicals, dieldrin and alpha-BCH were reportedly detected in this well in 1983 at concentrations of 0.004 and 0.001 respectively.

Domestic well 931 is located to the southwest of the subject property. Historically this well has been found to contain DBCP and chloroform on a somewhat regular basis, although the last detection of DBCP occurred in 1989. In addition, five other chemicals were reportedly detected in this well on a one time basis (different occasions) at low concentrations. In 1996 chloroform was estimated to be present ("J" qualified data) in well 931 at a concentration of 0.3 ppb. Based upon groundwater gradient information groundwater moving from the THAN Site to well 931 would potentially pass through the southeastern corner of the subject property.

The most recent groundwater sampling conducted for wells 32-B and 185-B0 seem to indicate that chemicals other than DBCP and 1,2,3-TCP are not present under the subject property however, the absence of more recent data from wells 937, 930 and 931 leave some question as to this finding. Therefore DTSC will request that THAN include this wells in at least a few future sampling events. Additionally the need for ongoing monitoring of these wells will be considered during the design phase review of the groundwater monitoring program.

The second issue related to connection of this residence to city water involves the specific reason that the county required this connection and the time frame under which this decision was made. DTSC will investigate this issue with the county and take appropriate follow-up action in the near future.

The issue of whether the DBCP that is present in the area is a strictly a THAN problem is addressed in the response to Comment 5 below.

5. Comment/Question: A diagram/map was displayed showing wells in the vicinity of the Site that have been tested and have had detections of DBCP in them. This resulted in a comment that it looks like all of the DBCP is coming from the plant.

In addition, a comment was made that you guys (meaning DTSC) and THAN have never taken responsibility for the DBCP contamination caused by the plant. This individual further stated that he believed, from the bottom of his heart, that DBCP contamination, in this area (THAN area), was created by THAN, period, exclamation point.

Response: The RAP identifies DBCP as a groundwater chemical of concern. The proposed remedy includes on-going sampling and analysis for DBCP as well as all other Site related contaminants. In addition, the RAP includes a non-numeric remediation goal for DBCP which must be addressed before the Site can be certified. These requirements were included to address THAN's contribution to the presence of DBCP in regional groundwater which is currently indistinguishable from background.

The diagram/map that was displayed during the public meeting included those wells in the vicinity of the THAN Site that have been sampled historically. It should be noted that since the presentation was focused on a ground water remedy for the area impacted by THAN chemicals near and down gradient of the Site the diagrams/maps presented also focused on this area. There is a significant volume of THAN data for outlying areas, including the Selma area, which indicates a substantial presence of DBCP. There is also significant data from other sources indicating that DBCP is not only present in the Fresno area but, throughout the San Joaquin Valley. Recent information sent by the City of Fresno Water Division to water customers indicates that in 1998 samples taken from 250 city wells, which are generally deeper than the wells monitored at the THAN Site, DBCP was present at a minimum concentration of 0.02 ppb a maximum concentration of 0.07 ppb and an average concentration of 0.043 ppb. This provides clear evidence of a pervasive presence of DBCP in groundwater throughout the Fresno area and not just in locations were THAN could be the "source".

Other sources of information regarding the presence of DBCP in soil and groundwater throughout the California and the Fresno area include:

> The California Department of Food and Agriculture (CDFA) reported that DBCP was detected at concentrations of less than 1 mg/Kg in agricultural soils to which DBCP had been applied in Southeastern Fresno County. DBCP was detected in groundwater samples from 1,280 of 3,016 wells sampled by the CDFA in the Fresno, Merced and Modesto areas between 1975 and 1988. Detected concentrations of DBCP in those wells ranged from 0.1 to 10.5 μg/l.
>
> A 1984 State Water Resources Control Board (SWRCB) study documented the occurrence of DBCP in groundwater statewide. Local and state well sampling programs reported that approximately 41 percent of all well water tested in Fresno County in 1984 contained DBCP.
>
> Dr. Ken Schmidt evaluated the distribution of DBCP in groundwater in southeast Fresno County in 1984. The study focused on an approximate 0.5 square mile area south and southeast of Fresno. The Site is located approximately 0.13 miles northeast of Dr. Schmidt's study area.

Concentrations of DBCP reportedly ranged from approximately 0.1 to 5 μg/l. In approximately half of the wells within Dr. Schmidt's study area, shallow groundwater was observed to contain more than 1.0 μg/l of DBCP. Dr. Schmidt concluded that the presence of DBCP in well water "corresponded fairly closely to the locations of present or former vineyards." Relatively low or undetected DBCP concentrations were present in groundwater beneath urbanized areas and lands not heavily developed as vineyards. Dr. Schmidt found that DBCP concentrations exceeding 0.1 μg/l are primarily present in groundwater less than 250 feet below the ground surface.

THAN collected and analyzed samples of groundwater from domestic wells in the area of the city of Selma (Wells 944 through 957) to provide additional information on regional DBCP concentrations in an area clearly unaffected by the Site. The concentration values of detected DBCP ranged from less than 0.01 to 8.9 μg/l, with an average value of 2.3 μg/l.

These studies along with Site specific information clearly document the presence of DBCP as a regional groundwater pollutant in California and in particular in the central San Joaquin Valley.

6. Comment/Question: A resident of the area commented that she had a problem with THAN testing the well water (her's and other's). She explained that she felt that there was a conflict of interest since the person that operates the lab used to work for THAN and got started in the business when THAN shut down their operation and sold her their laboratory equipment.

Response: All sampling and analysis is performed in accordance with a Quality Assurance Project Plan prepared for the Site which has been reviewed and approved by DTSC. The laboratories utilized by THAN have been certified by the State of California to conduct the analyses that are routinely preformed on THAN Groundwater samples. Under the sampling and analysis protocol samples collected by THAN are submitted to the laboratory as blind samples. Blind samples are identified to the laboratory only by number so that they do not know the source well.

Over the years DTSC has collected split samples (duplicate samples) which were analyzed by our own hazardous materials laboratory in addition to analysis by THAN's contract laboratories. There has been no indication of any laboratory problems on the basis of this split sampling or any other information reviewed by DTSC.

7. Comment/Question: A series of questions and comments pertaining to 1,2,3-trichloropropane were offered. They included the following.

Did THAN manufacture or formulate the substitute chemicals that were used after DBCP was outlawed?

When soil analyses were done on the Site, was 1,2,3-trichloropropane included in the soils analysis?

Where would information regarding whether 1,2,3-trichloropropane was actually looked for in soil be found?

Comment: The State of Hawaii has established an MCL for 1.2.3-trichloropropane at 0.8 parts per billion.

Response: According to the Site Chemical Inventory contained in the THAN Site Remedial Investigation report, DD Soil Fumigant was handled at the Site. This inventory list was prepared in response to Orders issued by DTSC and the Regional Water Quality Control Board which required that it be prepared. Additional information provided verbally by THAN is that DD Soil Fumigant was brought to the Site and resold in its original packaging. There is no information that DTSC is aware of that indicates that the substitute chemicals that were used after DBCP was outlawed were ever formulated on the THAN Site. Chemical "manufacturing" did not occur on the Site.

Based on DTSC's review of soil results tabulated in the Remedial Investigation/Feasibility Study Report, 1,2,3-trichloropropane was not a constituent included in the analytical protocol utilized for the Site. However the methods employed for analysis are capable under appropriate circumstances of identifying 1,2,3-trichloropropane. Further review of this data revealed that both cis and trans 1,3-dichloropropene were included in the analytical protocol along with 1,2-dichloropropane. The 1,3-dichloropropene isomers are the primary active ingredients in DD Soil Fumigant, 1,2-dichloropropane is identified as an inert ingredient and 1,2,3-trichloropropane is an impurity found in DD.

Based upon review of the soil data accumulated for the Site, over 450 samples were analyzed for both cis and trans 1,3-dichloropropene and 1,2-dichloropropane. None of these compounds were detected in any of these samples. Various literature sources list the concentration of 1,3-dichloropropenes in DD and Telone at around 92 to 94% with 1,2-dichloropropane accounting for < 2% of the 6 to 8 % inerts. DD mixtures are reported to contain between 0.4% and 7% by weight 1,2,3-trichloropropane. For this reason it is felt that the absence of detectable concentrations of cis and trans 1,3-dichloropropene and 1,2-dichloropropane in over 450 soil samples provides ample evidence that there is no significant on-site source of 1,2,3-trichloropropane at the THAN Site.

Soil data for the THAN Site can generally be located in Appendix G of the Remedial Investigation Report prepared for the Site in 1993. This report is available for review in the DTSC office and the document repository that the addresses listed below.

8. Comment/Question: A series of questions and comments were asked/made regarding a lawsuit that THAN filed and a resulting settlement. These questions/comments focused on an issue related to past efforts on the part of the community aimed at having THAN acquire the home and property of a resident living immediately adjacent to the western edge of THAN's property.

   Response: DTSC has committed to assisting the community in accessing available court records from the federal court in Fresno.

   The property acquisition issue is not directly linked to the process of review and finalization of a Remedial Action Plan for the Site. The residence in question was connected to the City Water System at THAN's expense in 1990 as it was located within the "buffer zone" identified for the water system extension project. Residences located within the buffer zone area were connected to the water system even though they didn't meet the criteria established to determine whether they had been impacted by THAN groundwater contaminants. These buffer zone wells were included to ensure that movement near the THAN plume boundary over time would not result in adverse health impacts in the community.

   There is no evidence suggesting any current impact to this residence. However, the Public Health Assessment prepared for the Site by the Agency for Toxic Substances and Disease Registry found that there may have been past exposures from air releases that occurred during the period which the plant operated.

   A few years ago DTSC became involved in the property acquisition issue as a result of regular community advisory committee meetings which were facilitated by DTSC in its Clovis office. Informal negotiations were initiated between THAN and the property owner however, these negotiations broke down. DTSC will look into whether the two parties are willing to re-institute these negotiations. Absent that possibility it appears that resolution will require legal negotiations involving legal representation for both sides.

9. Comment/Question: After the close of the meeting a member of the community asked for the name of the court case between THAN and other responsible parties and asked how he would go about obtaining a copy of the court's

decision. In addition, this party requested a copy of THAN's chemical inventory list.

Response: DTSC has agreed to arrange to have the court records returned to the Fresno District Court from the Federal Records Center so that they can be reviewed by the interested parties. In addition, a copy of THAN's chemical inventory list is will be sent to this individual.

Project records are available for review at:

Department of Toxic Substances Control
1515 Tollhouse Road
Clovis, California 93611
The Removal Action Workplan and selected information is also available for review at:

Fresno County Public Library
Sunnyside Branch
5562 East Kings Canyon Road
Fresno, CA 93727

ORIGINAL

PUBLIC HEARING

STATE OF CALIFORNIA

ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

In the matter of:

THE DRAFT REMEDIAL ACTION PLAN and PROPOSED NEGATIVE DECLARATION for T H AGRICULTURE and NUTRITION FACILITY, FRESNO.

Wednesday, May 26, 1999

7:00 p.m.

Held at:

Temperance-Kutner Elementary School
1448 North Armstrong Avenue
Fresno, California

Before Public Participation Specialist:

Randell Sturgeon
California Environmental Protection Agency
Department of Toxic Substances Control
Northern California Region
10151 Croydon Way, Suite 3
Sacramento, California 95827-2106
(916) 255-3649

Staff present:

Karen DiBiasio, Ph.D., Staff Toxicologist
Tom Kovak, Project Senior
California Environmental Protection Agency
Department of Toxic Substances Control
Human and Ecological Risk Division
400 P Street, Fourth Floor
Post Office Box 806
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Kevin Shaddy, Project Manager
California Environmental Protection Agency
Department of Toxic Substances Control
Clovis Office, File Room
1515 Tollhouse Road
Clovis, California 93612
(209) 297-3929

Speakers/From the Public:

Don Alison, Area Resident
Jerry Effron, Area Resident
Wanda Gardiner, Area Resident
Cindy Hoopes, Area Resident
Joyce Johnson, Area Resident
Alma Lavender, Area Resident
Gunter Redlin, Local Consulting Firm Employee
Wade Smith, THAN Site Project Manager

Reported by: George Palmer

Proceedings recorded by electronic sound recording; transcript produced by federally-approved transcription service.

I N D E X

Wednesday, May 26, 1999 7:10 o'clock p.m.

PROCEEDINGS

MR. STURGEON: Good evening. Just to make sure you are in the right place, this is a Public Meeting on the Remedial Action for T H Agricultural and Nutrition Facility. So I assume you are all in the right place.

This meeting is all part of the public comment period, which -- let's see, when did we start the public comment period?

MR. SHADDY: May 14th.

MR. STURGEON: 14th.

MR. SHADDY: 14th, May 14th.

MR. STURGEON: An important thing to know, the public comment period ends June 12th. So if you have comments or questions after tonight's meeting, you need to have that postmarked to us by June 12th. It doesn't have to get to us by June 12th, but it needs to be postmarked by June 12th.

I forgot to introduce myself. I'm Randy Sturgeon, Public Participation Specialist. I took the place of the last person that was here, Sue Sher. I don't know if any of you remember her. She retired and went to Virginia. And so I'm taking over this site.

Also I'm sure most of you know, if you got the fax sheet at least or have been involved with this site in the past, the information repository is located here at the Fresno County Library at the Sunnyside Branch on East Canyon Road. A copy of everything we are discussing tonight is in that repository.

I assume everybody knows Tom Kovak who's Project Senior on this.

What we're going to do is first Kevin will give a presentation, going over kind of the brief history and also, of course, going over what's going to be done now out at that site.

And after that point, we'll take questions and comments.

We have a court reporter taking down everything. So when we get to that point I'll have you raise your hand and I'll grab one of these wireless mics and come to you, and he can pick it up there so we have a transcript of the proceeding.

We will try to answer questions tonight if we can. If we can't, we're going to answer those in writing later. Any comments you submit we have to respond to in writing. Anyone who makes comments or anyone who puts their name on that sign-in sheet tonight will get a copy of the responses to all comments that were submitted to the public record. You'll get a copy of that mailed to you, I don't know how many weeks, after the comment period is over.

MR. SHADDY: We're going to try to push this fairly rapidly and get done by the end of June. So that's our goal. We may slip, but pretty close to that timeframe.

MR. STURGEON: June, mid-July you should have a copy of the response to comments sent to you.

So I'm going to turn things over to Kevin, who will give a presentation on the Remedial Action Plan.

MR. SHADDY: I need something to lean on, so I have to stand behind the podium. One of the things you need to let me know is if you can hear me okay. If you can't, I can pull the microphone up and use the public address system.

You know, in trying to come up with a relatively concise, short presentation for you on this was fairly difficult because we have in our file room and in the repository probably 60 or 70 feet of paper, if you were to lay it stacked up on end. And trying to boil that down into eight or ten overheads took a little bit of effort.

I'm not going to delve too deeply into the history because what we really want to get across to you tonight is a little bit about where we've come from, where we are currently, but quite a bit more about where we are heading, what we want to implement as the final remedy on this site to go with those actions that have already been taken in the past.

So I'm just going to start out and run through this relatively quickly until we get to some of the more interesting things that are going to occur out in the future.

Investigations of this site, the T H Agriculture and Nutrition site, started in 1981. At that time the Regional Water Quality Control Board was involved. The Department of Health Services, which ultimately became our Department, became more and more involved over a period of about three years until 1984 when we took over the Lead Agency responsibility for overseeing activities at the site.

In 1986 this site was added to the Federal Superfund list. At that time through discussions with U.S. EPA, because the project was already underway with state oversight, it was decided that the state would remain in lead capacity even though it was a Federal Superfund site on the National Priority List. So we've proceeded in that capacity as Lead Agency since then.

In 1987 the Department, and that's the Department of Toxics when I use that, issued an order to THAN requiring that they undertake what we call a remedial investigation which involves the collection of data, samples and other things to determine what chemicals are present in soils and groundwater that could potentially be released to the air. That investigation, which was a very extensive investigation, was completed in May of 1993.

In conjunction with that activity a Health Risk Assessment was initiated. And while it was essentially completed by 1993 that document was not finalized. There were minor changes that occurred, and it was ultimately finalized in 1996.

The results of the Health Risk Assessment were intended to quantify the risks to public health and the environment posed by the site. And they were used as feeders into the system to help develop remedial alternatives through the Feasibility Study process. A Feasibility Study was completed in June of '93 and submitted for the Department to review and comment upon.

Subsequent to that time -- and I think I left an item out in this, which is really what we're here to talk about today -- an Initial Draft Remedial Action Plan was submitted. That Draft Remedial Action Plan I think was -- the Initial Draft was submitted in 1994. There were several iterations of Department comments on that document and revisions by THAN until ultimately in 1997 the Department provided final comments on that document, with some input to THAN, related to proposed final remediation goals, the criteria we wanted to attain through the cleanup actions which would be implemented at the site, and also through an evaluation of those remediation goals and various laws that might apply to the cleanup of the site.

We gave THAN the opportunity to prepare a technical and economic feasibility evaluation aimed at addressing the technical feasibility of attaining those remediation goals, timeframes to do that, the expense of achieving those goals. As a result of that technical and economic feasibility evaluation an additional option for remediation of the site that hadn't been contemplated up until that time was developed.

Over the course of all of these activities, starting as early as 1984, through the identification of problem areas onsite, things that needed to be done in terms of remediation, multiple interim remedial activities were undertaken.

Now the first thing that was done was soil excavation. But I'm going to run through these just in the order they are here.

Provision for alternative drinking water supplies was initiated relatively early on and culminated ultimately in the provision of a city water system extension which was completed in 1990 to the area.

Excavation of soil and drainage systems occurred over a period of 1984 to 1997, the bulk of the work being done in 1984 when a landfill area was excavated, in 1989 when drainage systems were excavated onsite a loading dock where a railroad spur came into the site.

Also between the period of 1988 and 1993 there were a couple of soil vapor extraction systems where we actually pulled air from the soil that contained volatile chemicals, traded that air, and removed the chemicals. And also there were some tanks, piping and other things that were removed over the course of the site's history.

I'll delve a little bit more into the actual investigation of the site. During the course of the remedial investigation, as I stated, data was collected and analyzed. And as a result of that data -- well, I'll step back a little bit.

In the course of collecting data a large volume of information was amassed as a result of a large number of soil samples being collected, in excess of 1400, from the site property and nearby property.

Groundwater samples were collected from a large number of wells, both monitoring wells and domestic wells, in the area. More than 1800 samples had been collected by 1996. And since that time additional samples have been collected and we will continue to do so under the remedy being contemplated.

One of the things I thought maybe might be of interest is just to give you an idea of the extent or the grade to which the site was investigated in terms of soil. We talked about 1400 soil samples.

This is a drawing of the site boundaries, the dotted line representing the fence. And you can see that this is a paved area. With the exception of this paved area, all of the work areas were extremely well investigated. As a result of those investigations, excavations, soil removals in the form of interim remedial measures were conducted.

And the areas -- they're a little bit difficult to see -- but this is the old landfill area, drainage area, loading dock area. These dark lines, odd-shaped, are areas that were excavated on site. And those excavations included removals in the two, the 1984 and 1989 removals. A total of 24,000 cubic yards of soil were removed from the site. Along with that in excess of 5,000 tons of building debris were removed from the site. It's just the massive effort that was involved in those activities.

As a result of the investigations, collection of data, the next step was to take that data and evaluate the health and environmental risks posed by the presence of those chemicals. The Health Risk Assessment was prepared. It was determined that unacceptable risks were posed through groundwater ingestion, a potential for people near the site or on the site, to be exposed to contaminated soil and measures needed to be undertaken to remediate the site.

Remedial options were developed as part of the

Feasibility Study process. During the Feasibility Study or in the process of doing the Feasibility Study 11 different options were identified. And subsequently as a result of that technical and economic feasibility evaluation looking at groundwater a 12th objection was developed and fully evaluated.

I'm just going to put this up real quick and go through it. Under the National Contingency Plan, which are the federal regulations governing how Superfund sites are investigated and remediated, these are the nine evaluation criteria that are applied to remedial options.

The first two are the overall protection of human health in the environment and compliance with applicable or relevant and appropriate requirements, which are laws that apply to the things you're doing on the site or laws and regulations that are related. They don't necessarily apply legally but they're closely enough related that you choose to implement or use those on the site.

In terms of evaluating options, options have to be protective of human health in the environment. They have to attain those applicable or relevant and appropriate requirements.

Options that meet those two criteria are then evaluated through these next five evaluation criteria: long-term effectiveness and permanence, reduction of toxicity, mobility of volume through retreatment or recycling, short-term effectiveness, implementability and ultimately cost.

Options are brought forward. We do what we're doing with you, regulatory Agency's review. And you get to the last two criteria which are regulatory acceptance and community acceptance.

As a result of all those efforts, the Draft Remedial Action Plan which summarizes all of the work done up that date, identifies the various options that were evaluated and then presents what's being proposed as the final remedy for the site is generated. That's what our meeting tonight is about.

The Proposed Remedial Action Alternative for the site includes a soil component, a component for groundwater that is on or near the site, a component for groundwater that is away from the site out in the community, and then further engineering, administrative and institutional controls. And I'll describe each one of those in little more detail for you.

The soil component we are proposing includes the elements identified here, plus one that for some reason I have on my paper copy but it didn't make it on the overhead. So we've included soil vapor extraction, and put in parenthesis or brackets behind it, that that's been completed.

We've given THAN verbal approval to discontinue operation of that system because it's achieved its goal. It's removed the volatile chemicals from the soil to the extent that it can. As a result of the finalization of the RAP, we'll be formally approving the discontinuation of those systems.

The remedy for soil includes site capping. And the cap really has a couple of different purposes. The primary purpose being the elimination of potential for exposure to chemicals bound to soil particles or coming off soils in a volatile form but primarily soil particles.

If a person were to be present on the site, that would be critical, or present at the fence boundary, wind could blow dust, those kinds of things. So the cap is designed to eliminate exposures as a result of the presence of chemicals in soil. And it also is designed to minimize infiltration which could result in the movement of chemicals over time down to groundwater.

The cap will essentially cover the entire site but it will have different design features depending on the area of the site that it's on.

Some areas we're concerned about potential for migration. Other areas we just have chemical contaminants in shallow soils. Included in the soil remedy are land use restrictions. The site property, there will be a covenant recorded against the deed for the property that limits use to basically industrial, commercial, appropriate industrial or commercial activities. We don't want residences there. We don't want schools, hospitals, any kind of use that would bring a susceptible population to the site.

Access controls, primarily the fencing. Signs, indicating that hazardous substances are present and warning people to stay away.

And a final one that's not on the overhead, provisions for ongoing cap maintenance to ensure that it stays in good shape in perpetuity.

The groundwater component for onsite or near-site groundwater consists really of three primary elements. One is long-term monitoring. We're going to continue to monitor groundwater until it can be demonstrated that it's no longer necessary. And because there are chemicals that will be left in site soils this should go on again forever. In addition, we will be using monitored natural attenuation of low chemical concentrations.

Now you recall we talked earlier about the development of remediation goals just a little bit. And we can go into that a little more in a few minutes. On and near the siting groundwater we don't have any chemicals present that exceed any remediation goals currently. It's our hope that that remains true.

There are a few things that could occur that might result in an additional release of chemicals from soil to groundwater. One would be a dramatic rise in the groundwater table which, you know, in theory could occur. But the way things are going in terms of the use of groundwater and falling water table we're fairly stagnant in the area.

So we have to plan for things that may occur. So we've included contingencies in the event that a final remediation goal, which is this PFRG, were to show up in monitoring wells, on or near the site, a confirmed detection of some chemicals present above the remediation goal, then we would activate the contingency plan.

The offsite groundwater component consists of groundwater containment at compliance point if concentrations exceed remediation goal. "Compliance point" is kind of a strange term. What that really means is that we have an area where groundwater is currently impacted. Our goal is to ensure that the chemicals present in that groundwater that exceed remediation goals don't spread to areas outside that area that's already impacted.

In addition to that criteria we also over time, as a result of ongoing monitoring, will keep track of trends in chemical concentrations, movement of chemicals. And if we see that down the road we may have an exceedence, at that point, we would then implement a contingency plan.

Long-term groundwater monitoring is included and again monitored natural attenuation. And I'll go into that in quite a bit more detail, I think. I've got some figures to show you that will explain what's been going on in groundwater over the last eight or so years.

And lastly we've got the further engineering, administrative, institutional controls. These consist of things we can do that aren't directly related to the contaminants themselves. Continued provision of alternative water supply. That consists of either bottled water, provision of replacement of carbon for carbon filters, or connection to a city water system, or some other water system, depending on location of an impacted residence.

That continued provision of an alternative water supply is not predicated upon the exceedence of a remediation goal in a domestic well, a private well. It's predicated upon just the detection of a site specific chemical.

So if chloroform showed up and was confirmed to be present in someone's well, who didn't previously have it there, that confirmed presence of chloroform would trigger the offer to you of alternative water. And that's even though you don't exceed the remediation goal at that location.

We felt it was reasonable to provide that type of protection for residents that up to this point in time haven't been impacted. They are the kind of protections that have been given to residents that were impacted in the past.

In addition, there's a financial assurance mechanism that will require that THAN and the other respondents, or responsible parties, provide some mechanism that ensures that money will be available to implement, on a long-term basis, all of these elements of the remedy.

And finally under federal law there's a requirement that every five years the remedy be evaluated to ensure that it's still effective; it's doing its job.

In this particular case we will do those five-year reviews, but we will have ongoing evaluations occurring on a semiannual basis of the effectiveness of the groundwater remediation.

I think that's generally the framework. And I want to talk a little bit about how we got to this particular remedy. With respect to soils with the significant removal actions that occurred in 1984 and 1989 we've dramatically decreased concentrations that remain onsite. You know, 24,000 tons of soil were removed. The chemicals that remain there, some are relatively deep; some are very shallow.

They're relatively nonmobile chemicals. We're not seeing any appreciable movement or presence of chemicals in groundwater at the side boundary. We feel that the cap is a good final step, with the financial assurances, the deed restriction, and the O and M requirements included.

With respect to groundwater, I thought I might quickly go through a little bit on final remediation goals and some of the things that have been occurring in groundwater out in the vicinity of the site.

The light went out. Would we like to take a five-minute break? Because I have a spare bulb. I planned for this contingency. We have good contingency plans. But it will take about five minutes. I'm sure it's hot. Or I can just tell you what it says. Do you prefer the overhead?

MR. SHADDY: Do you want the overhead? Okay.

We'll go ahead and change the bulb out.

MR. STURGEON: While he's doing that -- when he's finished we'll start with questions and comments.

Each time the microphone comes to you I'll need you to state your name so the court reporter can get it and that we have an accurate transcript of who asked what or made what comment.

We have another person here whom I had forgotten to introduce. I was going to introduce during questions and answers. Karen DiBiasio.

DR. DiBIASIO: DiBiasio.

MR. STURGEON: DiBiasio -- I've got to keep working. I've had her at a couple of public meetings and still haven't got it right.

She's a Toxicologist with the Department of Toxic Substances Control. So her job will be to sort of talk more about health-related kinds of things.

Have you got it changed yet, Kevin?

MR. SHADDY: It's really hot, believe me.

MR. STURGEON: How many did not get the fax sheet in the mail? I know a couple of people said they did not get the fax sheet in the mail about a month ago.

Someone -- you said you didn't, right. Okay. And someone else, I think, did, too.

Make sure you're on the sign-up sheet so that you're on the mailing list. And take extra fax sheets or whatever to anyone you might know who would want to be on that mailing list and just have them send in the coupon. And I'll see to it they get materials.

MS. LAVENDER: You know, people couldn't understand that.

MR. STURGEON: Um-hum.

MS. LAVENDER: They don't deal with things like this, don't know all those abbreviations. So people were telling that they were trying to figure out half of it and having a terrible time.

MR. STURGEON: Okay.

MS. LAVENDER: They don't understand it. It's too technical.

MR. STURGEON: You should have seen it when it started.

MS. LAVENDER: Because you're dealing with things like that, but they don't.

MR. STURGEON: Um-hum.

MS. LAVENDER: Because they don't understand it.

MR. STURGEON: Okay.

MS. LAVENDER: And, yes, I have been to the meetings and things a lot, but I still didn't understand it.

MR. STURGEON: Okay.

MS. LAVENDER: It's just -- they are too technical.

MR. STURGEON: Okay. I'll take a look at that. Maybe we need to put a glossary with it.

MS. LAVENDER: I need one.

MR. STURGEON: Yes. Well, I'm not a technical person. And I'm the one who took -- and I wish you could have seen the first draft of this document. No one would have ever understood it. And I'm the one who rewrote it. And, you know, I'll try -- I'll look at your comments and see how I can simplify it. What I try to do, and sometimes fail, is I want to make it as simple as possible and yet make sure it still says what Kevin needs it to say. And sometimes I'm walking a bit of a tightrope there.

MS. LAVENDER: Well, people don't know what --

MR. STURGEON: Right.

MS. LAVENDER: -- it says because it doesn't make sense to anyone, and we need to know.

MR. STURGEON: So one thing we need to do is at least put a glossary for all the abbreviations in there. Okay.

Any other comments on the fax sheet while we're waiting for him, because I mean that's my job to write these. So I'll take anything that -- oh, you're ready?

Thank you.

MR. SHADDY: Good contingencies.

MR. STURGEON: Kevin is always prepared.

MR. SHADDY: I just want to go over in not too much detail. Now all of this detail is available in the Remedial Action Plan. It's available both in my office between 8:00 and 5:00 and in the Sunnyside Branch of the library. Now their hours are limited to 20 hours a week. But they have some hours that are different than ours. And they assured us, and THAN arranged to have somebody go in and reorganize things, but they assured us they'll keep that document readily available for you to walk in and take a look at it.

We also may have some other summary information. In fact, we may have some copies of the fax sheet, that was even more technical, that Randy had to pare down. If you wanted to look at it to get more details we might be able to come up with some copies of that for you also.

Over the course of time a significant number of chemicals were detected in groundwater. Now we, in various documents, report a fairly long list. But in the course of doing the investigation that list got pared down for a variety of factors. One is lots of chemicals were detected only at one time in one well out of 1000 samples collected. And so those chemicals were eliminated from any further consideration.

Other chemicals historically showed up in groundwater, but currently, over the last several years, are not there. So what we did is we identified those chemicals that were present currently in groundwater that were of significant concern and came down really to this list of six chemicals.

In order to develop remediation goals we took, for groundwater, numbers that were developed as a result of the work done on the Risk Assessment. We took preliminary remediation goals that U.S. EPA publishes for various chemicals.

And we took MCLs, which are maximum contaminant limits, which are enforceable drinking water standards, that would be applied to a drinking water system. We took those numbers, took the U.S. EPA remediation goal, and a health-based calculated remediation goal specific to the site, compared them, picked the one that was lower, and then compared it to the MCL.

If the MCL was as low as that health base number, or lower, we applied it. If there wasn't an MCL, we applied the health base number. It's a complicated process that took us a long time.

But ultimately what we came to, in terms of remediation goals for the various chemicals, with respect to carbon tetrachloride detection, the limit is .5. The proposed final remediation goal is .5.

MR. STURGEON: That's in parts per billion, right?

MR. SHADDY: This is parts per billion.

MR. STURGEON: Parts per billion, a shot glass in an Olympic swimming pool. One part per billion would be about a shot glass in an Olympic-sized swimming pool. So he's talking about -- was that half a part per billion,.5?

MR. SHADDY: Yes.

MR. STURGEON: Okay.

MR. SHADDY: That remediation goal for carbon tetrachloride was based on the MCL. It's an enforceable drinking standard. And I don't have an exact number, but I believe that's a one-in-one-million cancer risk level number.

Chloroform, again, MCL-based 100. That 100 -- step back one step.

EPA, for remediation purposes, has set a risk range that's acceptable for remediation of Superfund sites. That range is anywhere from a one-in-a-million cancer risk level to a one-in-10,000 cancer risk level. I think maybe --

MR. STURGEON: Well, actually, I can explain what that means. Okay, in any population a certain number of people are going to get cancer. He said one in a million. What that means is you're going to get one additional cancer than what you would have expected out of -- I think about one-fourth of the population is the normal expectation for cancer.

So you'd expect 250,000 out of a million. So what "one-in-a-million" means is 250,001 would get cancer if that was done, or could get cancer. It doesn't mean they will.

MR. SHADDY: Yes. And also you need to understand that in a development of those risk numbers it assumes various things about people's presence at a site: That you live there your entire life, that you're exposed to that chemical and that water at that concentration. To the extent you're drinking two liters of it a day for that entire 70-year period. It assumes that everybody weighs 154 pounds.

MR. STURGEON: It's a 24-hour-a-day exposure, too, isn't it?

MR. SHADDY: Right, it's just the volume. The exposure is that you're drinking too liters of water a day. But everybody's 154 pounds. People that weighed less would -- women and men may respond differently. It's just a hypothetical. And they have set those thresholds to allow us to have something to shoot for as goal in terms of remediation.

And in working through chloroform, set again at the MCL 100 parts per billion, 12 DCA. Another chemical at the MCL .5, dieldrin, was health-based. There is no MCL, the number is .3 parts per billion.

I didn't talk about DBCP. DBCP is regional groundwater pollutant, in addition to potentially being present in some quantity as result of THAN's operations. Historically there were elevated concentrations detected on or near site wells.

We did an extensive study, an evaluation of concentrations in groundwater, over a number of years, evaluated the data. We were not able to distinguish any statistically-different concentration of DBCP in the area, that THAN's chemicals have impacted, versus areas adjacent upgradient where DBCP is present as a result of its use on egg properties. And because of that, DBCP doesn't exceed background we've developed a nonnumeric remediation goal that's linked to an evaluation process that occurs once we've attained remediation goals for those chemicals where there is a numeric goal.

And that evaluation would include an evaluation of the mass that had been removed through the degradation processes, the concentrations versus the background concentrations.

Over time, as a result of a variety of factors in the laboratory, it was decided we needed to look a little more closely at 123 TCP, trichloral propane, a closely-related chemical to DBCP. It's actually present in a -- they call it an inert ingredient -- it's a contaminant in chemicals that have been put in use in place of DBCP.

In past sampling the laboratory methods being used weren't sensitive enough to get to very low detection limits. So it was decided to change methods. We used those much lower detection limits. And what it appears is that we have a significant presence in background groundwater of 123 TCP, as well as DBCP. We've establish a nonnumeric goal with kind of a question mark attached to it, at this point, for 123 trichloral propane, pending collection of additional data.

One of the things that we do know about 123 TCP is where we had a significant concentration of DBCP at one point in time in groundwater at or near the site, we never have had 123 TCP at concentrations that were similarly high.

This table identifies historic maximum concentrations. And that would be in sampling conducted any time in 1996 or prior. And that's this column. You can see the maximum detected for chloroform historically was 20,000 parts per billion in an onsite well.

The current maximum detected in the last couple of sampling rounds, 31 parts per billion. That's a really dramatic decrease.

Now some of the things that have contributed to that are the soil removals, soil vapor extraction that occurred, falling water table, some potentially naturally degradation processes, absorption. These are things we might put off and have a little more question and answer about this.

But I just wanted you to see the trend we've seen occurring in groundwater. And this trend is really what has contributed to, along with the background presence of DBCP and the technical impracticality of pumping groundwater and getting very, very low concentrations of chemicals out of groundwater as a result of pumping and treating, has contributed to our decision to go with a monitored natural attenuation remedy that includes various protections for public health and the environment on a long-term basis.

I think that's about it. And I think maybe I can stop with that, and we can go to question and answer.

MR. STURGEON: Okay.

MR. SHADDY: I've got a lot of information, but it's going to get scattered now. And like I say boiling, you know, 30 feet of paper down to --

MS. LAVENDER: You're not going to talk about what's outside the fence, between the fence.

MR. SHADDY: Oh, okay. I can answer that question for you, Alma.

Alma's had concerns and raised concerns in the past about the presence of DDT and a couple of other chemicals in soils on the north side of the site between McKinley Avenue and their fence line.

The soil remedy that is proposed includes the consolidation of those materials that are contaminated inside the fence to be included with the soils onsite that are being capped. So those chemicals will be eliminated from that roadway area during the implementation of the final remedy.

MS. LAVENDER: I think you should talk about it.

MR. SHADDY: I think you should make that as a formal comment and get it on the record. I need you to give him your name and then make that comment.

MR. STURGEON: Yes, that should go in the transcript.

MS. LAVENDER: I'm Alma Lavender. And I live -- adjoin the chemical plant on the west side.

I think that that between the fence and the street on the north side should be taken down to about 18 inches deep at least because that dirt is stirred more than you think. It's stirred a lot more than you realize.

MR. STURGEON: Okay, I can respond. We will respond obviously in a formal fashion. But what we will do is we'll excavate and remove soils and incorporate some type of confirmation sampling to made sure that we get what we need to remove from that area as we're doing it. So after removing the soils, we'll go in and take soil samples to make sure that we've gotten what we need to get.

MS. LAVENDER: The reason that I suggest this is Mr. Obali (phonetic), that takes care of the place up there, he was plowing not so long ago when we were still having the rains. And it smelled to high heaven, while it was damp, when he was plowing out there.

Then recently, oh, about six days ago, or something like that, he was plowing and that dust stirs up until you couldn't even see his tractor. And not only that, but there's 18 wheelers come down that a lot any more. And each one of them just stirs up a whirlwind. And that dust just settles around the neighborhood.

MR. SHADDY: Yes. That's definitely an element of the final remedy for soils. And we will include some type of sampling to confirm we've adequately moved soils that are contaminated onto the site and consolidated them under the cap.

MS. LAVENDER: I know there's bound to be chemicals there because I've seen it many and many a time.

MR. SHADDY: Yes. We do have data from that area from samples that I actually personally collected. And we -- DDT is present, I think, about 10, maybe 20 times higher, in at least one sample, than the industrial remediation goal, in shallow soils.

It does dramatically drop as you go to -- I can't remember the exact depth that I sampled -- but 12 inches, 15 inches, something like that. And it drops off dramatically to where it's below industrial remediation criteria at that depth.

And we collected samples from three boring locations along the fence, spaced along the primarily the old railroad loading dock area, because that's where they had a lot of spillage and other things that were occurring.

MS. LAVENDER: Mr. Obali said that -- he says, "I almost have to plow it, or harrow it, or something because it's too large an area to just pull weeds out of it." He does pull the weeds inside the fence up to the oleanders. But that has rocks on it to where he can't do anything else. But this is outside where there's quite a lot of area there.

MR. SHADDY: Yes. We will definitely take care of that area.

MR. STURGEON: Any other, or the next person, question, comment?

Back here. Here you go, sir. And make sure you state your name for the record.

MR. ALISON: My name is Don Alison. I live at 8222 East McKinley.

This lady is saying that this stuff's been there for this long. And, okay, 18 inches is not going to do it. I don't understand if it's caused all this trouble after all this time why doesn't it get loaded up and taken out to Coalinga where it belongs?

MR. SHADDY: Okay. The excavation and removal of soils, I'll go back a little bit.

We removed approximately 24,000 cubic yards of soil from the site up to this point in time.

MR. ALISON: That's does not impress me. Okay? I haul dirt for a living. So 24,000 tons is nothing. Okay? I've watched them move a hundred thousand tons to build one overpass. All right? If this stuff's been there for that long -- they took out 24,000 tons, okay, and it's still there -- they have solved nothing.

MR. STURGEON: Was that tons or cubic yards?

MR. ALISON: Cubic yards.

MR. STURGEON: Cubic yards, okay.

MR. ALISON: Either way.

MR. SHADDY: I don't think I have a good table that I can use. But if you recall the drawing that I put up with soil samples on it.

MR. ALISON: Sir, what I'm saying is if the problem is still there it makes no difference if you took out 24,000 tons, 24 million tons. If the problem is still there, it has to be resolved.

MR. SHADDY: Okay. The removals that occurred targeted the soils that contained the highest concentrations of chemicals.

MR. ALISON: But the problem is still there.

MR. SHADDY: The problem that is associated with the site is one -- let me go back a little bit here.

The Superfund Program is designed to protect public health and the environment. There are two things that are necessary in order for you to have a public health risk. And one is you have to have the presence of the chemical. But, two, you have to have a complete exposure pathway that no one can come in contact with the chemical. Then there is no health risk.

MR. ALISON: Well, if the dust is rolling down the road, and is in touch with this lady, then there is something wrong.

MR. SHADDY: But that soil is going to be moved to the site and capped over so that there won't be any more dust production. There's a fence there. There are signs. The cap will be maintained so that you've eliminated the potential for dust, for surface runoff. We no longer see chemicals on or near the site in groundwater in any appreciable concentrations. They're gone because of the removals of the huge mass of chemicals that were present in those soils that were removed from the site.

MR. ALISON: We had two local organizations here telling me what's going on.

MR. SHADDY: We'll respond to your comment in writing.

MR. STURGEON: Next?

MR. EFFRON: My name is Jerry Effron. I live at 1628 North Temperance.

I'm the Co-chairman of TK Neighbors in Action. And that was the group that organized to try and find a healthy solution to the contamination that resulted from THAN's negligence, both the health problems and also getting people hooked up to the city water system.

The last time we met, which was several years ago -- and I have been out of the loop for one reason or another -- I was just told about this meeting two and a half weeks ago. But the last time we met we were told that there was a plume of contaminants heading towards the city water system that we were connected to, and that that's why they were going to do vapor extraction to remove some of these contaminants so it wouldn't reach the water supply to which we were connected.

Is that correct?

MR. SHADDY: In summary, yes.

MR. EFFRON: Okay. My question is: What's happening to that plume of contamination that's been heading towards the city water system, which we haven't heard anything about in two and a half years?

MR. SHADDY: Yes. The chemicals that are present in groundwater -- and I think maybe we could go back to that other table. You saw the dramatic decrease in concentrations present in groundwater. We haven't seen THAN chemicals in groundwater in wells downgradient of the -- I think a figure maybe that I have here that would help. Let me use one of the boards.

This one helps because it actually shows wells. Figure out what's the best way to deal with this. The site is here. These are monitoring well clusters. This is the monitoring well 184 cluster. Over the course of the last five or six years we have not seen any significant change in these numbers. The wells don't show up here. But there are additional wells that have been monitored, and we have seen no detections of any of those chemicals in these wells.

Part of the remedy that's proposed requires that chemicals that exceed the remediation goals, one, be contained within this area. Two is that if there's a presence of any chemical above the detection limit, that's confirmed in any wells out here, it would trigger provision of alternative water.

And in the very unlikely event that the city well were to become impacted -- and I'll go over why we think that's very unlikely, currently, Jerry.

There are contingencies to address any impact on that well that would result in wellhead treatment, blending. Something to ensure that you wouldn't be exposed to chemicals that had unacceptable concentrations there and that the city is satisfied that their well is not adversely impacted.

But because these concentrations -- and if you'll recall we had, at one point in time, 20,000-parts-per-billion chloroform present in groundwater. The maximum concentration we're seeing now is in this vicinity and it's 31-parts-per-billion. That's one-third of the maximum contaminant limit or the enforceable drinking water standard.

Other chemicals present in groundwater most notably might be eliminating the 123 TCP and DBCP which, because they're present everywhere -- and there's another drawing I might pull up -- 12 DCA is the chemical that is probably furthest from the site that exceeds the remediation goal. Now the remediation goal for 12 DCA is .5, half a part per billion. And it's present out in, I think, probably this vicinity. But it's back a ways from that well still.

But the goal of the contingency here is to ensure that chemicals that exceed the remediation goals don't go beyond this point, which is an area that has the city water system connected to it. And also if there's a little bit of spread where say a well -- to pick good example -- maybe up here. This well isn't currently impacted at all. No chemicals other than DBCP at very low concentrations. If chloroform were to show up in this well and confirmed to be present, that means a couple of sampling events where it's there, alternative water would be offered to those residents, even though we didn't exceed a remediation goal there.

So the idea is to contain this groundwater body, let natural processes -- and I think maybe natural attenuation is -- there are various things that go on with natural attenuation.

One is a phenomenon called absorption, which is chemicals in a mixture of soil and water have a preference to either attach to the soil or go with the water. And every chemical, a portion of it will stay with the soil and some of it go with the water. Some of these chemicals mostly want to stay with the water. Others of the chemicals that are in groundwater, like dieldrin, mostly want to stay with the soil. So dieldrin stayed very close to the site. It hasn't moved appreciably because it's bound up tightly with the soils. And you detect it, but it's --

You know, I do have some figures maybe that would help with this. Would you like me to pull them out?

There's some overheads that are in color that maybe would help explain this better.

MR. EFFRON: And, Kevin, the second part of my question; you may want to address this at the same time: Is there any family that is in this plume area that is not connected to the city water system that should be right now?

MR. SHADDY: Not that we're aware of. And that's a good comment. It's something that maybe we can incorporate and investigate a little bit as part of our design process to make sure that everybody that should be is. I think we've done that, but as another check, do that.

MS. LAVENDER: If it is contaminated later will something be done about it?

MR. EFFRON: Yes, that's what they're saying.

MR. STURGEON: Yes, the contingency says that if chemicals --

MR. STURGEON: Could you repeat that question because he didn't pick it up?

MS. LAVENDER: I asked if it was found to be contaminated later, would they -- the company do something about it?

MR. SHADDY: Yes. The domestic --

MS. LAVENDER: This doesn't stop -- this doesn't stop the water, in other words, if people find their water is contaminated? This last phase of it doesn't stop that now, does it?

MR. SHADDY: I'm not sure it is I -- what it includes of provisions that if a chemical -- a THAN-related chemical, other than DBCP, or 123 TCP, which are special circumstances, just a confirmed detection of a chemical in somebody's well, chloroform 12 DCA, dieldrin, triggers their -- the offer to them of alternative water.

And, you know, depending on where they're located, the form that that alternative water takes is dictated by the availability of community water, whether they have a filter system. And if they had a filter system, and it was detected, it would maybe result in THAN providing change out of carbon for their filter, those kinds of things.

DBCP and 123 TCP are also included in this, but they're not included strictly on the basis of just detecting the chemical. There would have to be an indication that the chemicals are showing up in their well and they're above background concentrations.

It's one of the toughest things we've had to deal with, with regard to this site, is the fact that we have these chemicals present in groundwater on a really wide area basis, DBCP, nitrates, and now 123 TCP, it appears.

And trying to distinguish, you know, in the case of DBCP, whether THAN had the release that occurred, and where it is, if it's there present at elevated concentrations or not, has been a problem.

Nitrates, we've never had an indication that THAN had any appreciable contribution to the presence of nitrates. That's primarily fertilizer and septic use. And 123 TCP, there's no historical information that would indicate any kind of release from THAN. And we've looked at some of the formulation records, and that kind of thing, also there.

But there are the provisions to provide those people with alternative water on a long-term basis. There's provisions to try to ensure that contaminates exceeding remediation goals stay where they are in this area that's impacted. And there are provisions to address the city well in the unlikely event that it were to become impacted.

MR. STURGEON: Before I go here, did he answer your second part?

Okay, and remember to state your name.

MS. JOHNSON: My name is Joyce Johnson. And I live at 1878 North Temperance. I'm your neighbor.

And I just bought my house and built a house there. And, of course, it's my first time here and I'm not sure what's going on. But are you telling us that the groundwater is okay now, or that you could do a well now, or it's still unsuitable to drill a well?

MR. SHADDY: Well, I can answer that really in two ways. In general the groundwater, in this area of Fresno County, is unsuitable for drinking purposes, the shallow water, due to the widespread presence of a couple of chemicals, DBCP in particular. In addition, there are some THAN-specific-related chemicals that exceed remediation goals present in groundwater in some isolated areas.

I've got some figures maybe that would help explain that a little bit.

MS. JOHNSON: Okay. The reason I asked my question is you're talking about these ulterior for people that move into the area. But I had -- I mean, they told me

$3200, flat out, to put -- hook up to the city water. So anybody that comes in, that is an option, the only option you have. You cannot drill a well because this county will not issue you a permit. And the person that moved in next to me had to pay $5200 to hook up to city water. So that's not really a very good option either.

MR. STURGEON: Now, in terms of --

MS. JOHNSON: You're talking a $2,000 increase in less than -- well, a little over a year. And that's a lot of money compared to drilling a well.

MR. STURGEON: Yes. There are two things that are going on. There are those properties and homes where you can't drill a well because the county won't let you. But your groundwater is not impacted by THAN chemicals, which means that THAN wouldn't be required to provide alternative water for you.

MS. JOHNSON: Why wouldn't they?

MR. STURGEON: Because they haven't impacted your groundwater.

MS. JOHNSON: They didn't come in and --

(Simultaneous talking.)

MR. STURGEON: No, no, no.

(Comments off the record.)

MR. SHADDY: There are others that lie along the water distribution system that had to buy there also at the time the system was installed.

MS. JOHNSON: (Not using microphone, inaudible.)

THE REPORTER: Randy, could you take the microphone to the people who are speaking?

MR. STURGEON: Who needed this next?

THE REPORTER: This person, here.

MR. STURGEON: Which one?

MR. SHADDY: Up here.

MS. JOHNSON: I'm sorry. I just mean that I was told -- first I was told that my house, being right in front of the chemical plant, that it would probably be included, which I didn't count on it. But I was told that, "Hey, everybody got their water here because it's the chemical plant's fault. You can't drill a well. You don't have the option."

Now you're saying the wells are better. The county says, "No, they're not." The county says, "There's no way were going to give you a permit."

So even though a well would be cheaper in the long run, and they said it would be beneficial to drill a well because it would help get rid of some of the contaminated water. Now I was told that, too. So I'm interested to find out what the real story is.

MR. SHADDY: Yes. Who's telling you these things? Is that the county or --

MS. JOHNSON: Well, the county told me that the water is so bad that they would not issue a permit to drill a well. That's what the county said.

MR. SHADDY: On the basis of the presence of --

MS. JOHNSON: They told --

MR. SHADDY: -- DBCP or --

MS. JOHNSON: -- they told -- they told me at the time, Mr. Summerfield, down at the -- where I had to get the water -- you know. And they couldn't even -- they had a hard time figuring out who gives you the permit to even get the water.

But they told me they would not issue me a permit for water because the groundwater is so bad. But they said it would be helpful if you could drill a well and get some of that bad water out of there.

Now the guy that bought the place next to me told me they refused to issue him a permit if he was going to drill a well. He had to buy the county water, city water hookup, for $5200 so that he could have water, because the groundwater was so bad he would not give him a permit.

MR. SHADDY: Yes. I really can't answer your question because there are people that are building right -- that have built recently right behind the site that have been able to drill wells. But they're not in a location where they can hook up to city water. But our department doesn't issue those permits. But we can look into it and find out what the county's position is on that issue.

MS. JOHNSON: Can you tell me where those people are that got to drill a well? Because I am right -- I'm right beside her. I'm actually fac- -- I'm on Temperance in front of the chemical plant.

MR. SHADDY: Wade, did you have something?

MR. STURGEON: And tell who you are.

MR. SMITH: Good evening, my name is Wade Smith, Project Manager for the THAN Site.

And I was just going to state that maybe it would be helpful to know exactly where you're located in proximity to the site?

MS. JOHNSON: Well, I think --

MR. SHADDY: We talked a little earlier, and I think that where you're located is right in this area along Temperance, south of McKinley?

MS. JOHNSON: I'm on the -- the three lots, and I'm the first one right --

MR. SHADDY: Yes. There aren't lots drawn in here on this map, but you're the south one in this area?

MS. JOHNSON: Right near the site by the ditch, where the ditch is.

MR. SHADDY: Okay. So she's right in this area.

MR. SMITH: Yes. And let me respon- --

MS. JOHNSON: Right in front of it.

MR. SMITH: Let me respond to one of the comments that I've heard just moments ago. In the event there is a well owner or user that is impacted by chemicals known to be associated with the site in the future, if feasible, your household will be connected to the city of Fresno water system at THAN's expense.

MS. JOHNSON: I already hooked it up to the city.

MR. SMITH: Correct. However, your well --

MS. JOHNSON: Do I get my money back?

MR. SMITH: Your well, to the best of our knowledge, you can -- maybe County Health has some -- well, I'm sorry. You don't have the well; is that correct?

MS. JOHNSON: No. I had to hook up to the city.

MR. SMITH: Okay.

MS. JOHNSON: I was not allowed to put -- drill a well.

MR. SMITH: That's based for the years of the investigation. And the determination of the direction of groundwater flow it was not anticipated that your well is impacted the THAN site. That's why the -- that's why those parcels, upon development, were not connected.

Water mains were made available in the street that would not otherwise be available unless THAN funded the water main extension. So any additional growth and development would be required to either install a well or connect to the city water system. And you're questioning the differences of cost, $2200 versus $5200. That is dependent upon the plumber that's contacted --

MS. JOHNSON: City.

MR. SMITH: -- to do --

MS. JOHNSON: City.

MR. SMITH: -- the job. Well, there is some permit fees.

MS. JOHNSON: Right.

MR. SMITH: But essentially the cost is associated with the plumbing.

MS. JOHNSON: Right. But I'm just wondering if that was the deal made because of the chemical company, why was it not included for anyone who had to build a house there and did not have the option to put a well in if the water was bad? How come it was not part of the deal? Because we don't have a choice. We had to go city.

MR. SMITH: Well, I can't speak for the county requirements. But I would assume that the county is trying to protect public health by putting in some type of ordinance preventing somebody installing a well perhaps incorrectly and exposing them to chemicals and concentrations of chemicals of concern.

MS. JOHNSON: He's just saying it's not that bad.

MR. SHADDY: Well, remember that you have two issues going on. One, what are the chemicals that are present as a result of this plant being present where it is. The other is the regional problem, which is a DBCP problem. The background concentrations of DBCP exceed the MCL, which means that if the city were to drill a shallow well and try to provide that water in their water system they would be exceeding a regulatory threshold. They would be in violation of the law. They would have to take some action. And so there's a background component in the area as a whole.

MR. STURGEON: There are chemicals there that aren't even associated with THAN. If THAN wasn't even there those chemicals would still be there.

MS. JOHNSON: Okay. But it still seems like they should have --

MR. STURGEON: And that's what the two issues are.

MS. JOHNSON: -- there should be something included with whatever they designed that the people that came into the area that did have those options should be taken care of.

MR. SHADDY: Yes. I think we'll have to research this a little bit.

MS. JOHNSON: Because I --

MR. SHADDY: But I believe that --

MS. JOHNSON: -- I debated it with the city for a long time on it.

MR. SHADDY: Yes. I believe that there were provisions included -- well --

MR. STURGEON: We're going to have see again --

MR. SHADDY: Yes. We'll have to explore with the county what their requirements actually are, and a few other things, in order to be able to adequately respond.

MS. JOHNSON: I would like to know that.

MR. STURGEON: And you'll get responded to in writing.

MS. JOHNSON: Okay.

MS. LAVENDER: They won't let me use my well, either. I have a well there that we had before, but they won't let me use it.

MS. JOHNSON: He's saying the water is better now.

MR. STURGEON: From the THAN camp.

MS. JOHNSON: Right.

MR. STURGEON: Yes.

MR. EFFRON: You know, Kevin, a lot of this boils down to the DBCP which, you know, we have been fighting you guys and THAN for what, 15 years?

I think, you know, we ought to bring this out to the rest of the people here about the -- about a couple of the wells that were right -- six feet from the plant that had concentrations of DBCP -- at what levels, Kevin? 80, 120?

MR. SHADDY: 81 --

MR. EFFRON: 81?

MR. SHADDY: -- was the maximum ever detected.

MR. EFFRON: Is that a pretty high level, would you say?

MR. SHADDY: Yes, that's a high level.

MR. EFFRON: Okay. But this DBCP is only a regional problem. It is not created, or caused, or helped, by chemical dumping at the plant. And we've been fighting you for 15 years. So here we have a lady, okay, who moved in the area. And I can understand that if she was allowed to build a well -- okay -- that there'd be no reason for her connect to the city water.

But I think shame on you and shame on THAN that this woman has to pay to hook up. She's in the plume area, okay? They're not allowing her to build a well. So she should be connected to the city water system at no charge.

MR. SHADDY: Based on the data we have, though, Jerry, she's not in the plume area.

MS. JOHNSON: I'm right in front of it.

MR. SHADDY: No, no, no. You're east of the site -- or west of the site, excuse me. The groundwater contamination plume goes to the southwest.

MS. JOHNSON: There's one of those blue things right on the -- on the side of my street, right in my property. It's right -- and the neighbor next to me -- Nick has it. Nick has one of those blue things. You come out and check. And his dust, when he plows, comes in my way, too. And there's orchards right behind me.

MR. SHADDY: Well, his dust doesn't have anything to do with the THAN site.

MS. JOHNSON: No, but I mean she was talking about the dust and all that.

MR. SHADDY: Yes.

MS. JOHNSON: Well, we get it, too, when he plows.

MR. SHADDY: Where you're located there's nothing in our data that would indicate that there's an impact on groundwater associated with the site in that location.

MS. LAVENDER: Well, there must be something.

MS. JOHNSON: Yes. Nick, the guy next to me, I can see the blue thing out in his --

MS. LAVENDER: Those blue things are the test wells.

MS. JOHNSON: Right. And it's right next to me. It's not in my property, but it's in the neighbor's, right beside me and behind me.

MR. SHADDY: Maybe it would help to look at some of these figures, and that might give you an idea.

MS. JOHNSON: Okay.

MR. SHADDY: Because chemicals that we know come from the site help us understand the direction that groundwater is moving. Groundwater elevations that are measured in monitoring wells help us understand the direction that groundwater is moving because groundwater flows a lot like water would flow across the top of a table. The way that it slopes is the direction that it flows.

But if you'll look at this, the green dots on this map -- this is the dieldrin detections in 1996. The green dots indicate wells where dieldrin has been detected. The black dots are wells that were tested, and it wasn't detected.

MR. STURGEON: It's very light, the very light dots are the green. It's the lighter dots. I know they're hard to see, the lighter circles. They're almost opaque.

MR. SHADDY: Okay, this is the more recent data. This is from the last four sampling events that were conducted. Again the green dots indicate the detection of dieldrin. An item that you also might look at is the concentrations that are being detected and the remediation goal that's been proposed, .3 parts per billion. There isn't a detection of dieldrin currently that exceeds that remediation goal.

But you notice that these wells are all here and these are all nondetect. I'm not sure -- you know, your property is in here somewhere, maybe back this way a little more. And that's true for essentially all of these chemicals that are good tracers for where groundwater is moving, from the site itself, where the chemicals that ended up in groundwater went.

Chloroform, which has historically been the most prevalent chemical found in groundwater, other than DBCP, out in that area. This is 1996. You see a lot of numbers in here, but you look backward. Remember the MCL, which resulted in the remediation goal for chloroform --

MR. EFFRON: Where is her property up there?

MR. SHADDY: -- is 100 parts per billion.

Here.

MS. JOHNSON: And Flora Dora?

MR. SHADDY: Source area -- Flora Dora is here.

MR. EFFRON: Where is the nearest detection of her -- to her property.

MR. SHADDY: Well, there's the monitoring well, this well. This was the historical source area that was remediated on the site. It may be better to look at the more recent data. Again this particular well at 5.7, more recent sampling events, it's declined. It's still there.

MR. STURGEON: And you don't have another detect -- where you had a detect on the previous chart, you don't have one there. It's kind of hard to tell the colors.

MR. SHADDY: Well, remember there's some variability in the wells that are sampled. Historically, a large number of well were sampled. The monitoring program has been modified as a result of this historical database that we have, what's been impacted, what hasn't. What we do is we monitor wells where we believe there could potentially be an impact as a result of movement.

MR. EFFRON: How far do you have to be out to be outside the plume? I mean, let's go back to that -- to the -- here. How far do you have to be out to be out? I mean, it looks like the chloroform is very, very close to her property.

MR. SHADDY: Now, see, one thing is it's easy to try to draw a straight line. It doesn't necessarily behave in a straight line. It has bulges and other things that occur. But groundwater flow generally is in this direction. We've got wells between the site -- and you see all these black dots, between the site and her property, that are all nondetect.

In order to get from here to here it has to go through these wells. From here to here this well, based on the data, I don't believe that it is impacted. And one of the things that obviously I can't tell you is that we've sampled a well on that property because there is no well there.

MR. STURGEON: We have a question back here. Remember to state your name.

MS. HOOPES: I'm Cindy Hoopes.

Kevin, could you put that map up again? Because if you are putting more wells out to the west side, there's more development out at the west side of the site now. And on the other map there looked like there was another place that you either tested or -- I don't know whether there's a detect there tested because you really can't tell from here, on the map. But if you have more wells coming up and more hookups coming in, isn't that going to shift the direction of the plume, you're going to have more pull?

If you're going to have more development and water pressure coming on the other end you may be pulling that plume out. And I'm wondering if, you know, how often are you testing the well at, say, west of the site and, say, west of her property?

Do you track what I --

MR. SHADDY: Yes.

MS. HOOPES: Okay.

MR. SHADDY: I follow you. And, yes, one of the things that these maps don't do is -- these are wells that are or have been tested at the time that the diagram is representative of. What I try to think of, if I have a figure that shows all the wells that have been tested at some point in time.

And I think this is an issue where we can look at what wells are present and maybe in one of those subsequent sampling let's think about an adjustment that might give some information, more west of the site, to fill a data gap that you think might be there. We can explore that a little bit.

But generally the wells that have been selected are based on trying to establish a perimeter where we have nondetects on the outside that would be, you know, the first well to detect, kind of situation. And then if that well -- the program calls for, once a well has a detection of the chemical, that a well downgradient of that well be added, if it's not already included in the sampling program. So there's kind of a protocol to shift things and other things.

One of the things that the final remedy does include will be, you know, a reevaluation of the monitoring program and adjustments as necessary, also. But it's something that we can look at as the potential for samplings of wells out a little more westward for that purpose.

MS. GARDINER: I have a question.

MR. STURGEON: A question back here. State your name, please.

MS. GARDINER: Wanda Gardiner. I'm Alma

Lavender's daughter.

It doesn't really matter -- you are splitting hairs here -- whether she's in the plume or not. She's affected by it because she's so close. The county is not allowing her to drill a well because she's affected by that area.

MR. SHADDY: That, like I state, I have to talk with the county and find out what their position is on this. I really don't know their official position and their reasoning.

MR. STURGEON: Okay. Other questions or comments, next person?

MR. SHADDY: Can I through up a couple of last little slides. This will help you understand the issue of DBCP versus other chemicals from the site.

This is the last four sampling events there for chloroform.

I can show you carbon tetrachloride which is a chemical included on our list. There's one detection of carbon tetrachloride above remediation goal.

The rest of the black dots are wells that were sampled and nondetected.

It shows you 12 DCA, another chemical that's site-related, last four sampling events. Three detections in all of that. Last four sampling events, DBCP, red dots.

Very few dots that are black on that map. And you saw whether the chemicals that we know are strictly related to the site are present, chloroform being the most prevalent in groundwater. You look at this map and you see DBCP and you sort of understand. It presented an extremely difficult task for us.

And, Jerry, one thing I want to respond to. There was an earlier comment, Jerry, that you had regarding we're ignoring DBCP. No, we're not. We have a nonnumeric remediation goal when we --

MR. EFFRON: I didn't say anything about an -- I never said the word, "ignore."

MR. SHADDY: Okay, excuse me.

We are looking at DBCP. It's still included in the program. Once we attain the remediation goals for the other chemicals, we'll reevaluate that situation and see if there's anything that sticks out in terms of presence of DBCP. We'll also track the massive DBCP that's been removed from the groundwater body by virtue of decreasing concentrations regionally. And that's one of the nice things that's been developed over time with respect to the data. We have a lot of data, not just for the THAN chemicals and wells in the plume, but a broad area. DBCP concentrations regionally are declining also.

MR. EFFRON: Kevin, if you look at that chart -- just look at that chart, okay? If you draw a line around the outskirts of the red dots, okay, which is the detected DBCP, now when I look at that it looks to me like all of that was created by the plant.

MR. SHADDY: So --

MS. JOHNSON: It sure does.

MR. SHADDY: -- this .3 --

MR. EFFRON: It sure does.

MR. SHADDY: -- this .34 parts per billion, which is across --

MR. EFFRON: Kevin, --

MR. SHADDY: -- the waterway --

MR. EFFRON: -- let's talk sense, Kevin.

MR. SHADDY: -- that recharges water --

MR. EFFRON: Let's talk about the ground, most of where the dots are. Don't take the dot that's furthest away from the rest of the dots. If you draw a line of the outskirts of most of the dots it sure seems to me -- and I'm just a common guy. I don't have your expertise, Kevin, -- but it sure seems that that DBCP is coming from somewhere. And it seems that it's coming from the plant site.

MR. SHADDY: Well, here is the thing to think about when you say that. We sample all those wells that are in here. And it looks like it's coming from the plant for a purpose. We don't sample all of the wells that are over here. And we don't sample all of the wells that are over here routinely because the plant hasn't had anything to do with those areas. If we did, it would look a lot like this.

MR. EFFRON: But you've got to understand. My comment is: I've been angry at you guys and THAN for 15 years because you guys and THAN have never taken responsibility for DBC contamination caused by the plant. And I firmly believe, from the bottom of my heart, that the DBC contamination, in this area, was created by THAN, period, exclamation point. And I'll go to my grave feeling the same way, no matter what you guys say.

MS. LAVENDER: And I will, too.

MR. EFFRON: And I want to go on record as saying that. Because if anybody ever reads this in the future I want them hopefully to be able prove me correct.

MR. STURGEON: Thank you.

MR. SHADDY: Jerry, I don't know what to say. We talked about this a lot. There is a known DBCP groundwater problem regionally. That's why the city sued Shell, Dow and other people. That's why other cities sued. It's a chemical that loves water. It was applied to roots. It stayed with the water. We don't find it in soil.

MR. EFFRON: How do you find a well with 80 parts per billion right next to a plant site --

MR. SHADDY: But, yes, if you read the RAP --

MR. EFFRON: That suddenly disappeared.

MR. SHADDY: -- if you read the RAP there's been responsibility taken for the fact that there were some historical releases from the site. We did include DBCP in the remediation. Ultimately we'll have to reevaluate it to see how many removals occurred as a result of natural --

MR. EFFRON: But it's a travesty to me that nobody's taken responsibility for it.

MR. SHADDY: Well, but what I'm saying, --

MR. EFFRON: That's what the travesty is.

MR. SHADDY: -- Jerry, is in the RAP they do take responsibility for some releases of DBCP.

MS. LAVENDER: This is Alma Lavender, again, that lives right west of the plant.

My well was tested by the County Health Department. And it was found to have 28-parts-per-billion of DBCP in it. That's when THAN took over. And that amount began to drop immediately as soon at they started testing the water. It's amazing how fast it disappeared.

MS. JOHNSON: Are you saying that THAN tested the water?

MS. LAVENDER: Not -- yeah, THAN tested the water.

MS. JOHNSON: Instead of the county?

MS. LAVENDER: Right. The county tested the water and found it there, but then THAN was turned over to test it.

MR. SHADDY: Yes. I have a copy of a map from a 1984 DBCP Study that was done in Eastern Fresno County. There are lots of wells that contained relatively high concentrations of DBCP.

MS. LAVENDER: I have problems with THAN testing the wells. And I have had all the time. I think it's time people had problems with it because after all this person that's testing the water was a person that worked up there. She was given all the equipment when they closed down and put in business down there. She tested the water. And I have news for you. My daughter went down there. She's a chemist, too. She went down there to see about getting a job. And she said, "I wouldn't work there because they're not testing it right."

MR. SHADDY: All I can tell you is that there was a Quality Assurance Plan that was developed. It was reviewed by our laboratory --

MS. LAVENDER: Well, did you ever see if it was carried through?

MR. SHADDY: It was reviewed by our laboratory personnel. The laboratory was reviewed by the Department of Health Services and received a certification for these analyses. I can't say anything more that. We --

MS. LAVENDER: The water sat there for quite some time before it was ever tested. That was not the way it was supposed to be done --

MR. SHADDY: I can't respond.

MS. LAVENDER: -- because she looked around and saw the dates on it.

MS. LAVENDER: There are certain protocols in the laboratory, and they're supposed to follow those protocols. They received this certification as a result of demonstrating how they handle samples and how they analyze samples. They have a quality assurance plan that --

MS. LAVENDER: That's a conflict of interest. I don't care what you say.

MR. STURGEON: Other questions or comments? Anyone else in here?

MS. GARDINER: This is Wander Gardiner again.

I want to readdress the moving of the soil outside the fence. Why in the first place was not the place just capped instead of moving all those thousands of yards of soil?

MR. SHADDY: That goes back to an earlier comment I had. The soils that were removed contained very high concentrations of chemicals. And I think that part of the reasoning was that it was best to remove those high concentrations from the site. Capping is a good remedy but it's more appropriate for the lower concentrations that are currently present.

MS. GARDINER: Then following that same logic why are they not going to move that soil outside the fence and put it over in Kerman, where it should be, instead of moving it underneath the cap?

MR. SHADDY: Well, we had historically, I believe, 25,000-parts-per-million DDT in soils that were removed from the site. That's soils in the street area. And those samples, collected by our Department and shipped to our laboratory, contained 54- --

MS. JOHNSON: It's still there.

MR. EFFRON: Well, it's still there and it's no different from what you took out. And it's still there -- it's there. It's got to be gotten out.

MR. SHADDY: All I can relate back to is that concentration plays a critical role in exposures.

MR. STURGEON: Any others?

MR. ALISON: All I'm saying is if the chemical is still there then it needs to be dealt with. It makes no difference how much you took out of there or when. If it's still there it needs to be taken out.

MS. LAVENDER: It was taken out from a different area than that.

MR. REDLIN: My name is Gunter Redlin. I work for a local consulting firm. I just have a general question about 123 trichloral propane. Did Thompson Hayward manufacture or formulate the substitute chemicals that were used after DBCP was outlawed?

MR. SHADDY: Okay. I'm going to answer, and I'm going to make sure that you get some clarification. My understanding is that they repackaged, onsite, some of those chemicals, but didn't formulate.

Now, Wade, is that accurate?

MR. SMITH: Based upon my research in historical records we have not formulated or repackaged any compound using 123 TCP. There were six drums of -- I think it was DD- -- one of the parent compounds, the tradename, that would have contained TCP. But those drums were essentially either brought in under consignment or shipped and received in the same day. So there was no --

MR. SHADDY: Okay, so there was no --

MR. SMITH: -- no manufacturing, --

MR. SHADDY: -- repackaging. It was just that they --

MR. SMITH: -- no formulation.

MR. SHADDY: -- came to the site and then left?

MR. SMITH: Correct.

MR. REDLIN: My second question is: When the soils analyses were done on the site, was 123 trichloral propane included in the soils analyses?

MR. SMITH: Off the top of my head I believe that it was included based on the analytical method. But I would have to go back and look at the database in order to be certain -- and be certain about -- but I don't recall any appreciable detections. If it had been it would have been included as a chemical of concern in soils. I don't believe it was.

MR. REDLIN: The last is just a comment. I'm working right now on similar problems in the Hawaiian Islands. And the state of Hawaii has established an MCL for 123 trichloral propane of.8 parts per billion. I don't know if you knew this or not.

MR. SHADDY: Okay.

MR. REDLIN: Because it's a problem over at the Islands.

MR. SHADDY: Yes. One of the things I didn't touch base on. We, right now, are proposing a nonnumerical 123 TCP pending that outcome of additional analytical data and studies. If it's shown that there's a THAN release that occurred and the chemical is present aboveground, we have a mechanism set up to establish a remediation goal for that chemical. And that remediation goal would be .2 parts per billion based on that protocol. So it would be below that MCL. But we believe it's background.

But we don't have the same kind of database that we have for DBCP because the detection limits were higher using prior methods. We've gone to lower detection limits. We're seeing more of it at low concentrations. So we'll continue to track that chemical. And if it ever appears that it's a chemical coming from the site, then we'll address it and apply the protocol that would establish that .2 PPB remediation goal.

MR. REDLIN: A last question: Where would I find where the 123 trichloral propane was actually looked for in the soils? Where would I find that information?

MR. SHADDY: Oh, that will be in the RIFS data tables. And, you know, I think I looked for it. I can't remember. That data table for soil is probably 60 pages long. But I'll go back and research it. If you want, you can give me a call at the office tomorrow. The phone number is in the fax sheet. And I can look it up for you. Probably if we were looking and had nondetects, we may have some statistics on top of, you know, just the raw information.

MR. STURGEON: Any others?

MS. LAVENDER: I have another question but it's on a different subject.

Yesterday was my youngest daughter's birthday. She was 41 years old. And when I came to home, from the hospital, with that tiny little baby there was so much chemicals in the air, until -- I had to close the windows, shut off the cooler, close the doors, because we couldn't breathe. And it was a day about like today. So I was really wondering what is going to happen to my little baby with all these chemicals? In other words, we have fought the chemicals for 41 years.

And now I have heard that THAN sued the other company that was there, who didn't bother us, for troubles that they caused at our house. And this has been -- I don't know just exactly when it was -- but it's been approximately two years ago. And never have they said a word to me about what they got. They were suing for damages for my house.

MR. SHADDY: Okay. I can't respond to that because we're, as a Department, not involved at all.

MS. LAVENDER: Kevin can.

MR. SHADDY: It's something you might take up with Wade --

MS. LAVENDER: I mean, Wade can.

MR. SHADDY: -- and discuss with him after the meeting.

MS. LAVENDER: No, now. Why was it done? I want other people to know.

MR. SMITH: Well, I think the earlier part of Kevin's presentation provided an overview of the remedial investigation, the amount of effort that was expended in evaluating the nature and extent of chemicals in soil and groundwater.

And, as Mrs. Lavender pointed out, there have been other owner-operators that preceded THAN that used a number of these same chemicals that were also released into the environment. THAN and the other responsible parties were not able to agree upon an allocation amongst ourselves and, as a result, to settle the allocation of issues of response cost, simply those costs incurred to evaluate the nature and extent of the problem. It was taken to the Federal Courthouse here in Fresno, and that allocation was decided. There has been no settlement. And then that's public record. That judgment is public record. There's no settlement. There was no identification of response costs associated with Mrs. Lavender's property.

MS. LAVENDER: It was stated, my property, individually.

MR. SMITH: What was stated, Ms. Lavender?

MS. LAVENDER: What I heard.

MR. SMITH: Well, I would refer you to the judgment that I'm sure is attainable at that county (sic) courthouse. There's no reference to any type of response costs associated with your household. I'll clarify that.

There were response costs associated with analyzing your well, collecting samples from your well, submitting them. But they're not itemized on a well-by-well basis.

I guess I'm just trying to give you a general overview of the category of cost, their operation and maintenance, monitoring cost, removal cost, remediation cost, cost of my consultants, reimbursing the costs of the Department of Health Services. There were approximately a million dollars that THAN and the other responsible parties have reimbursed the state. Those are the type of costs.

MS. LAVENDER: Don't you think the person that was harmed should have gotten something for it?

MR. SMITH: Ms. Lavender, as --

MS. LAVENDER: Instead of you getting the money?

MR. SMITH: Those costs that were subject to allocation were costs that were paid by THAN.

MS. LAVENDER: That isn't the way I understand it.

MR. SMITH: The costs that the --

MS. LAVENDER: It was when you were talking about buying my house and you -- yes -- with Kevin and them. You were willing to buy my house. But, no, when you got with me alone you weren't willing to do those things.

MR. SMITH: Ms. Lavender, we can have this discussion now in the public meeting, or we can have this discussion later, but --

MS. LAVENDER: It's right now. This is when it's supposed to be done.

MR. SMITH: That is -- that is --

MS. LAVENDER: I have waited long enough. This has been about two years.

(Comments out of microphone range.)

MR. SMITH: Well, it's fine. Let's talk about this. Mrs. Lavender contacted THAN. I've met with Mrs. Lavender. She provided me with a financial demand to purchase her property for a specific amount that I'll allow Mrs. Lavender to disclose if she would like to. I'll have the -- remain that confidential.

We said we were not looking to purchase property. If we were to consider the purchase of Mrs. Lavender's property, due to her unique circumstances, due to location of her house to the site, we would evaluate this, based upon fair market value. This would be a real estate issue. This would not be an issue about damages.

If Mrs. Lavender felt that she was damaged, if she was exposed to these chemicals, I informed Mrs. Lavender that she had remedies available to her. I did not want to advise her for any legal matters. I'm not an attorney. I didn't represent Mrs. Lavender. I suggested she consult with somebody. We discussed it with the Department and other members.

I believe I even had a conversation with Mr. Redlin some time ago about alternative means in evaluating fair market value.

After we had those initial conversations I no longer heard from Mrs. Lavender about this subject.

MS. LAVENDER: Because the attorney's letters were returned. Okay.

MR. SMITH: Right. Now that you mentioned that, I believe you did retain counsel, --

MS. LAVENDER: I did.

MR. SMITH: -- and counsel for THAN did respond to those.

MS. LAVENDER: No, THAN did not respond to him.

MR. SMITH: Well, we can only refer to the record, Mrs. Lavender.

MS. LAVENDER: Where did you hide them then after you wrote them? He didn't ever receive them.

MR. SMITH: Mrs. Lavender, I would suggest that you contact your counsel for THAN's response.

MS. LAVENDER: I don't think it's right for somebody to come in and mess up the neighborhood like THAN did and then sue for money for it and not even offer a penny of it to the harmed party. I think that's pretty low down, Wade.

MR. SHADDY: Can I speak to this a little bit?

MS. LAVENDER: Yes.

MR. SHADDY: That lawsuit was filed in Federal Court. A judge heard that case and made a decision. He heard all of the evidence and he decided how to allocate responsibility for the response costs on the site. That's what his job is. And the allocation, on the basis of the judge's determination, he deemed to be fair.

MS. LAVENDER: I don't think it was fair. THAN took advantage of a little person.

MR. SHADDY: Well, I think there's a difference in terms of that issue.

MR. SMITH: Well, I'd like to respond to that. I think that THAN and the other responsible parties, during the years that it was in operation, released chemicals to the environment. They --

MS. LAVENDER: That's an understatement even.

MR. SMITH: There is evidence that chemicals were land disposed of on THAN's property. At that time that was a legal method of disposal.

MS. LAVENDER: I'm not talking about that. I'm talking about what was in the air.

MR. SMITH: Oh, okay. Mrs. Lavender, I --

MS. LAVENDER: That was not legal.

MR. SMITH: I don't dispute that. There were releases of chemicals into the environment. And THAN, and now the other responsibly parties, are acting in a cooperative and responsible manner to investigate and remediate that site. To date -- I don't have the exact figure -- but I recall there's been $30 million in costs in investigation and remediation. And that will be ongoing.

MS. LAVENDER: THAN was the one that was responsible for almost all of it.

MR. SMITH: And we are required, by an order and by law, to provide financial assurances to continue with the ongoing implementation of the final remedy and ongoing operation and maintenance.

MS. LAVENDER: I don't think THAN has had to pay for what they've done; I definitely don't. I don't think anybody else does, either.

MR. STURGEON: Okay. Anything else before we close the meeting?

(No response.)

MR. STURGEON: Before I close I just want to remind you again of the June 12 -- it is June 12, correct?

MR. SHADDY: June 12th, yes.

MR. STURGEON: -- June 12th, the postmark date for any more comments. And if you have any more questions or comments, you can submit them in writing, or you can even call Kevin, his phone number is on the fax sheet, or you can call me. I'll accept them as well. And I will pass them on to Kevin.

So unless you have anything else, then that concludes the meeting this evening.

(No response.)

MR. STURGEON: I thank you for coming, really.

(The Public Hearing was adjourned at 8:54 p.m.)

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State of California)
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County of San Joaquin)

I, George Palmer, a Notary Public in and for the State of California, certify the foregoing is a true and correct transcript, to the best of my ability, of the above pages, of the electronic sound recording taken by me of the Public Hearing on the Draft Remedial Action Plan and Proposed Negative Declaration for T H Agriculture and Nutrition, LLC, held on Wednesday, May 26, 1999, in Fresno, California.

I also declare and certify under penalty of perjury that the aforementioned transcript was transcribed under my direction and that the foregoing pages constitute a true and accurate transcription of the Public Hearing.

I further certify I am neither counsel for nor related to any of the parties involved, and that I am not financially nor otherwise interested in the outcome of the action.

George Palmer

George Palmer
Palmer Reporting Services

Dated June 12, 1999