Record of Decision

Fruit Avenue Plume Site
Albuquerque, New Mexico

CERCLIS # NMD986668911

September 2001

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
SUPERFUND DIVISION

PART 1

DECLARATION - Fruit Avenue Plume Site

DECLARATION
FRUIT AVENUE PLUME SITE
RECORD OF DECISION

SITE NAME AND LOCATION

Fruit Avenue Plume Site
Albuquerque, New Mexico
NMD986668911

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Fruit Avenue Plume Site (hereinafter, the "Site"), in Albuquerque, New Mexico, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA), ("CERCLA"), 42 U.S.C. § 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et. seq., as amended. This decision is based on the Administrative Record for the Site.

The State of New Mexico concurs on the selected remedy.

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF THE REMEDY

The major components of the Selected Remedy, Soil Vapor Extraction plus Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component, consist of:

- Soil Vapor Extraction of contaminants from soil located on the source area property,

- Remediation of contamination Hot Spots in the shallow and intermediate ground water that underlies the source area property by injecting either a bioremediation additive or a chemical oxidant into the subsurface in order to degrade the contaminants of concern in place,

- C Extraction and treatment of contaminated shallow, intermediate, and deep zone ground water by using a pump and treat system consisting of air stripping and granulated activated carbon, and by re-injecting a portion of the treated water,

- C Placement of a restrictive covenant on the source property requiring that the asphalt cap remain on the source property until remediation goals for the soil are met,

- C Implementation of ground water use restrictions until remediation goals for ground water are met, and

- C Annual ground water monitoring to assess the extent of contamination and risks to human health.

The Site contamination will be addressed as one operable unit through the remedy selected in this ROD. This response action will treat the principal threat wastes (the tetrachloroethene and trichloroethene in ground water) and the low-level, but significant, threat wastes (the tetrachloroethene and trichloroethene in soils that may act to re-contaminate ground water).

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. The remedy also satisfies the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is protective of human health and the environment as required by CERCLA Section 121, 42 U.S.C. § 9621.

ROD CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision (ROD). Additional information can be found in the Administrative Record file for the Site.

- Chemicals of concern (COCs) and their respective concentrations;
- Baseline risk represented by the COCs;
- Remediation goals established for COCs and the basis for these goals;

- How source materials constituting principal threats are addressed;
- Current and reasonably-anticipated future land use assumptions, and current and potential future beneficial uses of ground water used in the Baseline Risk Assessment and ROD;
- Potential land and ground water use that will be available at the Site as a result of the selected remedy;
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected; and
- Key factors that led to selection of the remedy.

Myron O. Knudson

Myron O. Knudson, P.E., Director
Superfund Division
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9-27-01
Date

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PART 2

DECISION SUMMARY - Fruit Avenue Plume Site

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Acronyms

AEHD	City of Albuquerque Environmental Health Department
ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency For Toxic Substances And Disease Registry
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CTE	Central Tendency Exposure
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	U. S. Environmental Protection Agency
FS	Feasibility Study
HI	Hazard Index
HQ	Hazard Quotient
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
NCP	National Contingency Plan (40 CFR Part 300)
ND	Not Detected
NMED	New Mexico Environment Department
NPL	National Priorities List
PA	Preliminary Assessment
PCE	Tetrachloroethene
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record Of Decision
Site	Fruit Avenue Plume Superfund Site
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
TCE	Trichloroethene
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1.0 Site Name, Location, and Description

The Site (CERCLIS No. NMD986668911) is located in the downtown area of Albuquerque, New Mexico. Prior to being named the Fruit Avenue Plume Site, the Site was occupied by Elite Cleaners, and earlier, the Albuquerque Industrial Center. The Site coordinates are Latitude 35° 5' 21" North, and Longitude 106° 38' 40" West in Township 10N, Range 3E.

The Site is defined on the National Priorities List as a chlorinated solvent ground water plume beneath downtown Albuquerque. Data collected in all previous investigations of the Site indicate that chlorinated solvent contamination affects only the ground water; no surface parcels above the area of the plume are affected by the Site. Based on this data, the U. S. Environmental Protection Agency (EPA) has determined that the development and other uses of land above the plume does not present a risk from Site-related contamination. Untreated Site ground water should not be used for drinking, bathing, ingestion, or any other uses where individuals can come into dermal contact with the water, inhale the water, or ingest the water.

The area of the Site where the concentration of chlorinated solvent contamination exceeds the Federal drinking water standards is currently bounded by Lomas Boulevard to the north, Sixth Street to the west, Tijeras Avenue to the south, and Elm Street to the east. Ground water contamination at concentrations below the regulatory standards exists east of Elm Street to at least Cedar Street (Figure 1).

The City of Albuquerque Land Use Map indicates that the primary use of the land within the investigation area is commercial service, commercial retail, industrial and manufacturing, wholesale and warehousing, and public/institutional, with a limited number of private residences. Ground water beneath the Site is part of the sole source of drinking water for the City of Albuquerque. Currently, no potable water supply wells are impacted by the Site ground water contamination; however, if the plume expands far enough, it could contaminate municipal drinking water supply wells in the future. There is presently limited non-potable use of the ground water by downtown businesses.

The EPA is the lead agency for Site activity, with support from the New Mexico Environment Department (NMED). The City of Albuquerque Environmental Health Department (AEHD) and the City's Public Works Department also provided input. The National Superfund Electronic Database Identification Number for the Site is NMD986668911.

2.0 Site History, Investigations, and Enforcement Activities

2.1 Site Operational History

The Sunshine Laundry, located at 514 Third Street, was owned and operated by Mr. Bernard Parker from 1924 to 1958. In about 1940, Mr. Parker built the Elite Cleaners facility at 510 Third Street, directly adjacent, to the north, of the Sunshine Laundry building. He operated a dry-cleaning service at the Elite Cleaners from about 1940 until 1972. Sanborne Fire Insurance maps show locations of solvent tanks at the Sunshine Laundry and Elite Cleaners locations, as well as several water tanks and a pumphouse for the supply well on the southeast corner of the Sunshine Laundry building.

Mr. Parker indicated that the Elite Cleaners facility used a Stoddard solvent cleaning process; therefore, no chlorinated solvents were used. However, two underground storage tanks (USTs) (300-and 1,500-gallon [gal.] capacities) were removed by the City of Albuquerque in 1989, and soils surrounding the larger tank were contaminated with chlorinated solvents.

American Linen Corporation purchased the Sunshine Laundry 510 Third Street property from Mr. Parker in 1958. American Linen Corporation conducted water wash laundry operations at the 510 Third Street property from 1958 to 1973. American Linen Corporation has stated that it did not conduct dry-cleaning operations at the former Sunshine Laundry property, and there is no evidence that it did.

An automobile body shop and an automobile sales and services operation were located adjacent to the north and northeast, respectively, of the former Elite Cleaners/Sunshine Laundry property as early as 1946, according to Sanborn Fire Insurance maps. No information is available regarding the total number of years of operation or regarding any chemical use or waste disposal practices at these facilities.

In 1972, the City of Albuquerque Urban Renewal Agency acquired the former Elite Cleaners/Sunshine Laundry property and several surrounding city blocks as part of an Urban Redevelopment Plan. Contractors were hired to demolish buildings within the redevelopment area.

In 1973, two city blocks, including the former Elite Cleaners/Sunshine Laundry/American Linen properties, were sold to Security Realty Corporation and A.B.C. Development Company, as a general partnership. The former Elite Cleaners and American Linen properties were graded and blacktopped as part of the parking lot construction for the United New Mexico Bank. The two city blocks were combined into a single block as a result of the construction.

Security Realty Corporation acquired A.B.C. Development Company's 50-percent interest in the city block in 1976. In 1978, the entire city block was sold to Sierra Vista Partnership, and the United New Mexico Bank leased the building and several parking spaces. The United New Mexico Bank purchased the building and northern portion of the parking lot in 1991, while the United New Mexico Real Estate, Inc., a subsidiary of United New Mexico Financial Corporation, entered into a surface lease with Sierra Vista Partnership for most of the parking lot south of the bank building (the former Elite Cleaners/Sunshine Laundry and American Linen properties).

Sierra Vista Partnership deeded the bank parking lot to MC&C Investment, Ltd., Company on July 22, 1994. The United New Mexico Bank was acquired by the Norwest Bank of New Mexico, N.A., on October 3, 1994. Norwest Bank was purchased by Wells Fargo Bank of New Mexico, N.A., on January 19, 1999. The former Elite Cleaners/Sunshine Laundry property is currently part of the Wells Fargo Bank parking lot.

2.2 Summary of Previous Investigations

In April 1989, the City of Albuquerque conducted routine sampling of the Coca-Cola Bottling Plant (Coca-Cola) supply well, located at 205 Marquette Avenue NE. Analytical results showed concentrations of the chlorinated solvents tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE). The TCE concentrations were above the Federal maximum contaminant level (MCL) allowed in drinking water for this compound. The City of Albuquerque recommended Coca-Cola stop using its supply well because the MCL for TCE was exceeded; Coca-Cola switched to using municipal water for its potable and non-potable operations in 1989.

TCE, PCE, and DCE are chemicals known as chlorinated solvents, which are primarily used as de-greasing agents, and are classified as dense non-aqueous phase liquids (DNAPLs). DNAPLs are denser than water and will sink. They can exist as a free-phase in water, adsorb onto sediments, and/or dissolve into the water. The Federal MCLs for TCE and PCE in drinking water are 5 micrograms per liter (µg/L) for each. The MCL for cis-1,2-DCE is 70 µg/L, and the MCL for trans-1,2-DCE is 100 µg/L.

Several investigations were conducted in the downtown Albuquerque area following the discovery of contamination in the Coca-Cola well. In 1989, the City of Albuquerque identified public supply wells, industrial wells, and monitoring wells in the downtown Albuquerque area in an effort to determine the source(s) of contamination observed in the Coca-Cola well. During its review, the City of Albuquerque discovered chlorinated solvent contamination in ground water underlying two facilities within 2,500 feet of the Coca-Cola supply well (monitor well at the Convention Center, and monitor/industrial wells at the Lomas Center), however, the source(s) of the contamination was not determined.

Also in 1989, NMED completed a Preliminary Assessment (PA) which identified a total of five potential sources of the ground water contamination in the vicinity of the Coca-Cola well. These five potential sources include the following:

- Excelsior Cleaners (currently American Linen) located between Roma and Marquette Avenues, and First and Second Streets;
- Former Albuquerque Bus Terminal located on the southeast corner of Marquette Avenue and Second Street (currently the site of the Convention Center).

C Wyandotte Chemicals formerly at Tijeras Avenue and First Street (currently the site of the Springer Plaza Office Complex);

C Former Elite Cleaners at 514 Third Street (currently a parking lot leased by Wells Fargo Bank);

C Lomas Center at the southeast corner of Lomas Boulevard and Broadway Avenue (former location of Sno-White (Rutledge) Linen and a gasoline station); currently a McDonald's restaurant.

In 1998, NMED investigated these five potential source areas during the Background Investigation, and the Remedial Investigation. Except for the former Elite Cleaners property, no soil, vapor, or ground water data linked any of the potential source areas to the Fruit Avenue Plume contamination. The NMED has concluded that the property housing the former Elite Cleaners and Sunshine Laundry facilities is the primary source of soil and ground water contamination.

In November 1989, the City of Albuquerque removed the underground storage tanks (USTs) at the former Elite Cleaners/Sunshine Laundry property. A 300 gallon tank and a 1,500 gallon tank were removed from the property, and soil sampling showed PCE and TCE contamination as high as 3 milligrams per kilogram (mg/kg) and 0.5 mg/kg, respectively from the surface to at least 24 feet below ground surface (bgs). Although the tanks appeared to be intact during removal, contaminated soils around the tanks and extensive soil staining indicated a release of contaminants was associated with the former Elite Cleaners/Sunshine Laundry property.

The NMED submitted a Screening Site Inspection (SSI) report to the EPA on October 15, 1990. The SSI included the installation of four monitor wells on the former Elite Cleaners/Sunshine Laundry property (SFMW-1 through SFMW-4). Three of these wells found ground water contaminated with TCE at levels exceeding the MCL.

In 1993, NMED conducted an Expanded Site Inspection (ESI) for the Fruit Avenue Plume. The ESI included the installation of two soil borings and three monitor wells (SFMW-5, 6, and 7) on or near the former Elite Cleaners/Sunshine Laundry property. Soil and ground water analytical data gathered during the ESI indicated that waste sources at the former Elite Cleaners/Sunshine Laundry property contributed to observed contamination in the shallow zone, and that contamination was present in ground water collected from greater depths.

At about the same time that NMED was conducting the 1993 ESI, Wells Fargo Bank, which currently leases the parking lot that used to be the former Elite Cleaners/Sunshine Laundry property, hired Dames & Moore to conduct a Phase II Hydrogeologic Investigation. The Dames & Moore investigation consisted of a historical site review, sampling of existing wells, drilling of seven soil borings, and completion of 16 monitoring wells (DM-1 through DM-13(D2)). Soil sampling results showed the presence of Stoddard solvent, diesel and oil range hydrocarbons, and low levels of PCE, TCE, and 1,2-DCE in the vicinity of the two former underground storage tanks on site. The primary chlorinated solvent ground water contaminant was TCE, with the highest concentration (72 :g/L) detected in monitor well DM-12, located west, and up-gradient of the former Elite

Cleaners/Sunshine Laundry property.

The NMED completed a comprehensive ground water sampling event in 1996. The primary volatile organic compounds (VOCs) detected in ground water included TCE, PCE, and 1,2-DCE as in previous investigations. TCE was detected in 17 of the 23 wells sampled, with the highest concentration of 58 : g/L detected in intermediate zone well DM-13(I), located in the source area vicinity (former Elite Cleaners/ Sunshine Laundry property). Six wells were sampled for semi-volatile organic compounds (SVOCs) and metals. In the six wells, no SVOCs or metals exceeded MCLs, except for manganese. The City of Albuquerque has high background manganese concentrations in ground water throughout the City, likely caused by septic system use. The ground water plume has not shown significant vertical or lateral movement since the 1993 sampling events.

In 1997, the Western Bank, located at the northeast corner of Marquette Avenue and Sixth Street (west of the former Elite Cleaners/Sunshine Laundry), hired Dames & Moore to conduct a limited phase II investigation of its property. Ground water sample results showed no detectable VOCs in the shallow zone wells, and trace levels of TCE, 1,2-DCE, and toluene in the intermediate zone wells.

In 1997 and 1998, NMED conducted a two-phase field investigation (hereinafter referred to as the Background Investigation) to determine the lateral and vertical extent of ground water contamination, and to determine whether other source areas besides the former Elite Cleaners/Sunshine Laundry property existed. The NMED installed 30 monitoring wells ranging in depth from 50 to 440 feet (SFMW-8 through SFMW-37) and six Geoprobe borings. TCE concentrations exceeding the MCL were detected in 22 of 65 wells sampled, with the highest concentration of TCE (86 : g/L) detected in monitoring well DM-13(I). PCE concentrations exceeded the MCL in two of the 65 wells sampled. VOC concentrations in the shallow and intermediate zones appeared to center on the former Elite Cleaners/Sunshine Laundry property.

In 1999, NMED performed a Remedial Investigation which included the installation of six additional wells (SFMW-38 through SFMW-42, and the McDonald's Well), and one year of quarterly ground water sampling. Ground water sampling data showed that the highest concentrations of TCE were still centered near the former Elite Cleaners/Sunshine Laundry property (monitoring wells SFMW-19 and DM-13(I) had 90 : g/L and 69 : g/L TCE, respectively). Ground water data also showed that TCE contamination above the MCL of 5 : g/L extended in the deep portion of the aquifer to a depth of at least 544 feet below ground surface, and had migrated east as far as Elm Street. The NMED oversaw the sealing of the Coca-Cola production well in September of 1999. The NMED also witnessed the plugging and abandonment of the Rutledge Linen production well in June 2000.

Numerous underground storage tank investigations for petroleum contamination are on-going in the downtown Albuquerque area. Six are located in the vicinity of the Fruit Avenue Plume site, and include the following:

C Fur & Hide site located at 700-720 First Street (FH-MW series monitor wells);

- First State Bank/Lobo Engine shop site north of Lomas on First Street (one monitor well named FSB-1);
- Maloof Distributing Company site at 523 Commercial Street NE (SPSC-MW series wells);
- Lomas Center site at 300 Lomas Boulevard (formerly Fina gas station and Sno-White/Rutledge Linen facility) at the southeast corner of Lomas Boulevard and Broadway Avenue (F-MW and CDM series monitor wells);
- Atomic gas station (currently Chevron) at 400 Lomas Boulevard, southeast corner of Lomas and Arno Street (A-MW series monitor wells); and
- Southwest Distributing Company site at the northwest corner of Lomas Boulevard and Broadway Avenue.

The petroleum hydrocarbon contamination associated with the USTs is being addressed under the NMED Underground Storage Tank Bureau (USTB) regulatory program, and is not considered part of the Fruit Avenue Plume site release. The USTB is responsible for overseeing the remediation of the USTs.

2.3 Previous Response Actions

No CERCLA cleanups have occurred at this Site. However, as noted in Section 2.2, the City of Albuquerque removed two underground storage tanks along with immediately adjacent contaminated soils, from the former Elite Cleaners/Sunshine Laundry property in 1989.

2.4 Potentially Responsible Parties

The EPA has conducted a search for potentially responsible parties (PRPs) responsible for the contamination at the Fruit Avenue Plume Site. No viable PRPs have been identified at this time.

3.0 Community Participation

Throughout the investigative process, the EPA and NMED have held open houses and informal meetings with community leaders and area residents to seek public input. In addition, the City of Albuquerque has played an extensive role in the decision-making at the Site. The NMED developed a Community Relations Plan in March 2000.

A public information repository is located at the Albuquerque Public Library, Main Branch, located at 510 Copper Avenue NW in downtown Albuquerque. The repository contains copies of all reports generated for the Site since 1989, and the Administrative Record.

The City of Albuquerque has been involved with the Site since the Coca-Cola production well was closed in 1989. During the early 1990s, NMED, City of Albuquerque, and the EPA investigated various sources of contamination and have monitored wells in the area. On November 7, 1996, a meeting was held between EPA, NMED, and the City to discuss activities planned for the Site.

On October 8, 1998, a Background Investigation informational meeting was held with the EPA, NMED, and City of Albuquerque. This meeting updated the attendees on findings made in the Background Investigation Report for the Site. On October 14, 1998, another meeting was held with NMED, EPA, and City of Albuquerque. During the October 14, 1998, meeting, the City representatives asked NMED and EPA to develop a communication strategy that would reassure the local business community. EPA and NMED agreed to develop such a strategy. The strategy developed focused on the use of "comfort letters" – letters that are written to allay the concerns of potential land purchasers, and on-site community members.

On November 24, 1998, a meeting was held with the Downtown Action Committee (DAC). The DAC is Albuquerque Mayor Jim Baca's redevelopment team. The DAC is composed of business leaders, property owners, lenders, and investors.

On June 10, 1999, a meeting was held with representatives from the City of Albuquerque, EPA, NMED, DAC, Mayor Jim Baca's office, the City of Albuquerque City Attorney's Office, and Duke Engineering & Services to notify participants that the Site was in the process of being proposed to the NPL.

On July 21, 1999, NMED, the City of Albuquerque, and the EPA held a meeting with local landowners and lenders to notify them that the Site was in the process of being proposed to the NPL. Questions were answered regarding liability concerns, and regarding the use of private land for remediation purposes at the Site. The opportunity for landowners and lenders to request comfort letters from the State and the EPA was provided.

A Site Summary Fact Sheet was developed in July 1999 for the Site and mailed to approximately 800 addresses (all addresses within 0.5-mile of the Site).

On July 23, 1999, the *Albuquerque Journal* and Channel 7 television ran news stories about the Site discussing the general location of the plume and its contaminants. On August 3, 1999, at his request, NMED and the City of Albuquerque made a presentation concerning the Site to Ken Sanchez, Bernalillo County Commissioner.

The NMED, the EPA, and the City of Albuquerque jointly conducted a public Open House on February 7, 2000, to discuss the placement of the Site on the National Priorities List (NPL), current activities, and future plans for the Site. Mailers printed in both English and Spanish were sent to approximately 800 addresses (all addresses within 0.5-mile of the Site), and were hand-delivered to public housing units along Arno Street and to downtown businesses. Eight neighborhood associations were notified of the meeting. The meeting notice was also posted in the two Albuquerque newspapers. NMED provided a Spanish interpreter for the meeting.

The NMED assisted the Agency for Toxic Substances and Disease Registry (ATDSR) in conducting a public Open House on July 12, 2000, to discuss public health concerns. The NMED contacted neighborhood association leaders, businesses, concerned citizens on the mailing list, and former Coca-Cola employees. A notice was also placed in the *Albuquerque Journal*.

On June 19, 2001, the EPA and the NMED held a public informational meeting to discuss the results of the Remedial Investigation and Feasibility Study, and to describe the Proposed Plan of Action. A Site Fact Sheet summarizing the Proposed Plan was mailed shortly after this Open House. On July 2, 2001, the EPA published a notice and brief analysis of the Proposed Plan in the *Albuquerque Journal* and the *Albuquerque Tribune*.

On June 29, 2001, the EPA made the Administrative Record available for public review at the EPA's offices in Dallas, TX; at NMED's offices in Santa Fe, NM; and at the Site repository located at the Albuquerque Downtown Library branch.

From June 29, 2001 to July 30, 2001, the EPA held a 30-day public comment period to accept public comment on the Remedial Investigation, on the alternatives presented in the Feasibility Study and the Proposed Plan, and on the supporting analysis and information located in the Site repository.

On July 17, 2001, the EPA and the NMED held a public meeting to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting is included in the Administrative Record for this Site. The oral comments received during this meeting, and the written comments received during the 30-day comment period, along with the EPA responses to these comments, are included in the Responsiveness Summary, Appendix A of this ROD.

4.0 Scope and Role of Response Action

The EPA expects that the Site contamination will be addressed as one operable unit through the remedy selected in this Record of Decision (ROD). (An operable unit is a discrete action that comprises an incremental step toward comprehensively addressing Site contamination.) That is, the response action, detailed in this ROD, will address both the principal threat wastes (the TCE- and PCE-contaminated ground water) and the low-level, but significant, threat wastes (the PCE- and TCE-contaminated soils).

5.0 Site Characteristics

5.1 Physical Site Characteristics

The Fruit Avenue Plume Site is located in the central portion of the Albuquerque Basin. The basin is one of the largest of the south-trending series of grabens that form the Rio Grande Rift. The basin is filled with up to 10,000 feet of unconsolidated to loosely consolidated gravel, sand, silt, and clay. The Site elevation varies from 4,950 feet above mean sea level to 5,005 feet above mean sea level, and slopes from the east down toward the river (Rio Grande) to the west. The Rio Grande is located just over one mile west-southwest of the Site.

The climate in the Site vicinity is semi-arid and characterized by sunny days and low humidity. The average annual total precipitation is 8.69 inches. Temperatures vary from an average of 90.0 degrees Fahrenheit in the summer months, to an average of 49.4 degrees Fahrenheit in the winter months.

5.2 Site Hydrogeology

Ground water beneath the former Elite Cleaners/Sunshine Laundry property is encountered at about 38 feet below the ground surface (bgs). Ground water velocity is estimated to be approximately 0.43 feet/day. Ground water flow direction in all the aquifer zones is to the east.

For the purposes of delineating vertical extent of contamination, NMED defined ground water (aquifer) zones based on depth bgs. The aquifer zones are based primarily on depths of existing monitoring and water supply wells. These aquifer zones are:

- **Shallow (S)** - wells with screen midpoint elevations at 4,894 feet above mean sea level (amsl) or higher; these shallow wells are typically completed across the water table at about 40 feet bgs.

- **Intermediate (I)** - wells with screen midpoint elevations between 4,894 and 4,834 feet amsl (roughly 60 to 120 feet deep);

- **Deep (D)** - wells having screen midpoint elevations at or below 4,834 feet amsl (generally completed below 120 feet).

An additional definition in describing the contamination in the aquifer is a "**hot spot**." For the purposes of the Fruit Avenue Plume Site, a hot spot is defined as an area having ground water contamination with relatively high concentrations (at least one order of magnitude[1] above MCLs) observed consistently (during at least three sampling periods) in at least two wells located within 200 feet of each other. The known source area (former Elite Cleaners/Sunshine Laundry property) is a

[1] An order of magnitude is a multiple of ten.

hot spot. The hot spot area used for costing purposes in the Feasibility Study is in the shallow and intermediate zones which underlie the former Elite Cleaners/Sunshine Laundry property.

5.3 Nature and Extent of Contamination

Subsurface Soils

Constituents detected in soil at the former Elite Cleaners/Sunshine Laundry facilities included VOCs, SVOCs, and metals/inorganics. The concentration of SVOCs and metals detected in soil were below pre-screening levels for risk to human health and, thus, were not considered further in the risk assessment. Pre-screening levels are concentrations that pose no unacceptable risk.

The VOCs were also detected in the subsurface soil. The concentrations of these compounds were also below the pre-screening levels for risk to human health; however, PCE and TCE concentrations in soil were found at concentrations high enough to impact the environment (ground water) potentially leading to ground water contamination that exceeds MCLs. Therefore, the contaminants of concern (COCs) for soil at the Site are identified as PCE and TCE.

The area of subsurface soil contamination is located on the former Elite Cleaners/Sunshine Laundry property, beneath and near the two former UST locations. This area of subsurface soil contamination covers an area of approximately 15,400 square feet (ft^2), and affects about 20,000 cubic yards of soil. In 1989, during excavation of the two USTs, heavy soil staining was observed to a depth of about 10 feet bgs on the west wall of the southern excavation pit (1,500 gallon tank). Stained soils *within* the excavation (up to approximately 10 feet bgs) were removed in 1989 for off-site disposal. Contaminated soils below 10 feet bgs were left on-site. Investigations show that PCE contamination extends from approximately the ground surface to the water table at 38 feet bgs. The highest concentrations of PCE (3.0 mg/kg) and TCE (0.5 mg/kg) were found in soil samples collected from 22 feet bgs in the former 1,500 gallon UST area (southern excavation). Low-levels of TCE and dichloroethene (DCE) were also detected in samples taken from within and near the two former tank excavation areas.

Ground Water

Constituents detected in ground water at the Site included VOCs, SVOCs, and metals. The SVOCs and metals in ground water were not further investigated and were not included in the risk assessment because they were detected either at very low frequency, were determined to be unrelated to the Site release, or did not exceed pre-screening concentration levels for risk to human health. Of the VOCs in ground water, PCE, TCE, cis-1, 2-DCE, and trans-1, 2-DCE were determined to be COCs.

TCE, PCE, and DCE are chemicals known as chlorinated solvents, which are primarily used as de-greasing agents, and are classified as dense non-aqueous phase liquids (DNAPLs). DNAPLs are denser than water and will sink. They can exist as a free-phase in water, adsorb onto finer-grained sediments, and/or dissolve into the water. No free-phase DNAPLs have been found at the site. The Federal maximum contaminant levels (MCL) for TCE and PCE in drinking water are 5 µg/L for each. The MCLs for cis- and trans-1,2-DCE are 70 : g/L and 100 : g/L, respectively.

Ground water contaminated with dissolved-phase DNAPLs is concentrated in the vicinity of the former Elite Cleaners/Sunshine Laundry property (Figure 2). From there, the existing plume extends for more than 3,675 feet down-gradient (east-southeast). Contamination in ground water extends to a depth of more than 544 feet below ground surface (Figure 3). The total volume of contaminated ground water is estimated to be 320,000,000 gallons.

For the purposes of the Fruit Avenue Plume Site, the EPA and NMED have divided the ground water contamination into three water-bearing (aquifer) zones, shallow, intermediate, and deep (see Section 3.3). The shallow zone ground water contamination appears to be emanating from the former location of the Elite Cleaners/Sunshine Laundry property, between Third and Second Streets, north of Roma Avenue. Concentrations of TCE in the shallow ground water zone are as high as 6 : g/L. Concentrations of PCE in the shallow ground water have been detected at concentrations up to 15 : g/L; however, PCE has not been observed above 5 : g/L since 1997. There is also an area at the southwest corner of Lomas Boulevard and First Street at which the concentration of TCE in the shallow ground water has been measured at 6 : g/L (Figure 2).

The contamination in the intermediate zone is more widespread and contains higher concentrations of TCE than the contamination in the shallow zone, but also appears to be primarily centered on the former Elite Cleaners/Sunshine Laundry property. Concentrations of TCE in the intermediate ground water zone have been observed as high as 90 : g/L (Figure 2).

Deep zone contamination is not present below the shallow and intermediate zone centers (former Elite Cleaners/Sunshine Laundry property); however, contamination is present in the deep zone, down-gradient (east) of the center of these shallower zones, beginning at the former Coca-Cola well. TCE contamination detected at concentrations as high as 42 : g/L is present in the deep zone ground water down-gradient of the Coca-Cola well (Figures 2 and 3). Deep ground water contamination at concentrations above the MCL has been documented in the St. Joseph's Hospital well and the eastern extent of deep zone contamination above MCLs has been delineated as far as Elm Street. TCE contamination at concentrations below MCLs extends well beyond Elm Street, at least as far as the Presbyterian Hospital.

5.4 Conceptual Site Model

The EPA has developed a Site conceptual site model based on information obtained during previous investigations and during the Remedial Investigation. This conceptual Site model represents the migration routes of contaminants. A graphical depiction of the conceptual model is provided in Figure 4.

A primary release of solvents (PCE and TCE) occurred from tanks and/or sumps, and was possibly released directly down an on-site well, at the former Elite Cleaners/Sunshine Laundry property. The primary release from and around the tanks/sumps contaminated the underlying soil, which in turn may have acted as a secondary source to contaminate the "shallow zone" ground water. Although the former Elite Cleaners/Sunshine Laundry property was the primary origin of contamination, the Site is in a commercial area, and there could have been other contributing sources. Based on available data, there does not appear to be an exposure route for direct ingestion of soil or inhalation of volatiles from soil because the depth of contamination is approximately 10 to 35 feet bgs, and the area is covered with asphalt. The contaminated soil may pose a risk to ground water. The concentrations of TCE and PCE in the shallow ground water zone have exceeded MCLs.

The "intermediate zone" ground water has probably been impacted from a well conduit at the former Sunshine Laundry facility. Concentrations of TCE in ground water exceed the MCL and extend laterally from the former Elite Cleaners/Sunshine Laundry property. The westward spread is thought to have been due to the natural southwesterly gradient of the ground water underlying the Site prior to the development of extensive ground water pumping in the area. The eastward spread of contaminated ground water resulted from hydraulic gradients established by historical and existing private, industrial, and municipal supply wells.

The "deep zone" ground water has been impacted via vertical migration of contaminated ground water from the intermediate zone. This vertical migration was enhanced by the pumping of the Coca-Cola well and/or by direct migration down the Coca-Cola wellbore. The deep ground water zone also might have been impacted by vertical migration through wells at the former Ice Plant/Southeast Public Service Company facility and at the former Rutledge Linen facility. The concentration of TCE in the deep ground water exceeds MCLs. Migration of contaminated ground water in the deep zone has continued in an easterly direction with impacts observed at the St. Joseph's Hospital well and at the Presbyterian Hospital Well. The City of Albuquerque municipal supply wells are down-gradient and within the apparent flow path of the deep zone contamination.

Human receptors could be exposed in the future to the contaminated shallow, intermediate and deep zone ground water by the ingestion, inhalation, and dermal contact exposure route through City of Albuquerque or private wells completed in the impacted ground water plume. However, no human receptors are currently being exposed because the water from the contaminated private wells is being used as non-potable water, and because the municipal wells are not yet contaminated at concentration levels that exceed MCLs.

Surface water exposure pathways or air exposure pathways have not been identified for human or ecological receptors.

6.0 Current and Anticipated Future Land and Ground Water Use

Today, the area above the Site is fully developed with commercial businesses, buildings, streets, pavement, and some residential properties. Data obtained from the Bernalillo County Tax Assessors Office indicate that approximately 700 residences are located within a half-mile radius of the site and approximately 44,000 residences are located within a four-mile radius of the site.

An estimated 8,000 to 12,000 employees work in the commercial/industrial/government facilities located within the investigation area, which is area bounded by Lomas Boulevard to the north, 6th Street to the west, Tijeras Avenue to the south, and Elm Street to the east. The majority of the work conducted by these employees at their respective facilities takes place during the daytime. Some of the industrial facilities located in the investigation area operate in the evenings.

Future Site land use is anticipated to be similar to current land use. Because of the ongoing revitalization effort in downtown Albuquerque, future growth of the commercial sector within the plume boundary should continue and will dominate the area land use.

Contaminated ground water at the Site is not potable, but downtown businesses use it as non-potable water. The ground water beneath the City of Albuquerque is presently the sole source of drinking water for the City. A total of 91 municipal supply wells provide water to the City of Albuquerque. None are located within the current boundaries of the Fruit Avenue Plume Site. These supply wells service approximately 400,000 individuals. There are six municipal supply wells located within a one- to two-mile radius of the site. These wells service approximately 9,000 individuals. Twenty-three municipal wells are located within a two- to three-mile radius of the Site and service 20,000 individuals. Approximately 4,000 individuals are serviced by seven municipal wells that are located within a three- to four-mile radius of the Site.

Future use of the Site ground water could involve use of the water as drinking water in order to meet demand as the City of Albuquerque and the surrounding area continue to grow. In addition, because private and municipal supply wells are located directly down-gradient (east) of the Site contamination, migration of the plume could impact potable water wells in the future. Municipal supply wells Yale 1 and Yale 3 are within the path of ground water flow, and will likely be impacted by the Site contamination if remediation is not initiated.

7.0 Principal and Low-Level Threat Wastes

Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., concentration levels several orders of magnitude[2] above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a site, wherever practicable. Low-level threat wastes are those source materials that generally can be reliably contained and that contain contaminant concentrations not greatly above the acceptable levels. Examples of low-level threat wastes include non-mobile contaminated source material of low toxicity and low concentrations of low toxicity source material. Principal threat and low-level threat wastes associated with the Site are as follows:

Soil

Based on the information that the EPA has, PCE- and TCE-contaminated waste in soils at the Site is not a principal threat because concentrations of these contaminants of concern in the soil are not several orders of magnitude above levels that allow for unrestricted soil use and unlimited exposure, and because the toxicity is low. However, this material is a low-level, but significant threat because the concentrations of PCE and TCE in the soil are high enough to contaminate ground water, potentially leading to ground water contamination that exceeds MCLs.

Ground Water

The EPA considers TCE- and PCE-contaminated ground water at the Site to be the principal threat waste because contaminant concentrations are substantially above concentration levels that pose an unacceptable risk to human health, if humans were exposed to the ground water. Also, the TCE and PCE in ground water is a liquid that is mobile and cannot be reliably controlled in place. The contamination is in an aquifer that is the sole source of drinking water for the City of Albuquerque; however, the contamination has not yet reached any of the municipal supply wells (although it is moving towards the Yale well field). In short, if unaddressed, TCE and PCE will likely contaminate municipal supply wells for the City of Albuquerque.

[2] An order of magnitude is a multiple of ten.

8.0 Summary of Site Risks

8.1 Contaminants of Concern

The following compounds are considered to be COCs in both the soil and ground water at the Site:

- Tetrachloroethene (PCE);
- Trichloroethene (TCE);
- cis-1,2-dichloroethene (cis-1,2-DCE); and
- trans-1,2-dichloroethene (trans-1,2- DCE).

The COCs include TCE and PCE because these chemicals pose a carcinogenic risk to human health greater than 1 in 1,000,000 ($1 X 10^{-6}$), have a noncarcinogenic hazard index[3] (HI) greater than (>)1, and are found in Site ground water at concentrations that exceed MCLs (refer to Section 2.5.4 and the Baseline Risk Assessment in the RI for full explanation). Currently, cis-1,2-DCE and trans-1,2-DCE have been detected in Site ground water, but at concentrations that do not exceed non-zero MCLGs or MCLs, or that would otherwise pose a health risk. However, cis-1,2-DCE and trans-1,2-DCE are degradation products of TCE, and during remediation they could reach concentrations that exceed MCLs or result in an HI > 1. Therefore, cis-1,2-DCE and trans-1,2-DCE are also considered COCs at the Site.

Petroleum hydrocarbon constituents (benzene, toluene, ethyl benzene, and total xylenes [BTEX]) in ground water have also been observed at the Site. However, the boundaries of the BTEX plumes do not correspond with the outline of the chlorinated solvent plume, although there is some overlap between the plumes. The BTEX constituents in ground water are not considered COCs because they are unrelated to the Site release. These constituents are being addressed under State Underground Storage Tank Bureau regulatory authorities.

8.2 Potentially Exposed Populations

The Baseline Risk Assessment identified primary contaminant sources, contaminant release mechanisms, exposure pathways, and receptors for the COCs. Currently, the Site ground water is not used as drinking or bathing water and the contaminated soil at the site is covered by asphalt. Therefore, the scenarios that were used to calculate human exposure were developed based on future land use, as described in Section 6. In the risk assessment, exposures were calculated for adult and child residents who could be exposed through ingestion of and dermal exposure to ground water; inhalation of vapor from ground water when showering; and ingestion of homegrown vegetables or fruits grown using Site ground water. Table 1 summarizes the COCs and medium-specific exposure point concentrations used to calculate risk. Exposures were also calculated for industrial workers

[3] For an explanation of Hazard Index, see Section 8.3 (Toxicity Assessment).

(workers who worked in buildings on-site) who could be exposed through ingestion of ground water or dermal exposure through washing.

8.3 Toxicity Assessment

Site contaminants were assessed for carcinogenicity and for non-carcinogenic systemic toxicity. Table 2 summarizes the Site cancer toxicity data. Non-cancer toxicity data for the Site COCs is presented in Table 3.

The incremental upper bound lifetime cancer risk, presented in this ROD as the "carcinogenic risk," represents the additional site-related probability that an individual will develop cancer over a lifetime because of exposure to a certain chemical (i.e., a risk above the general nationwide lifetime risk of cancer). To protect human health, the EPA has set the target risk range for carcinogens at Superfund Sites from 1 in 10,000 to 1 in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}). A risk of 1 in 1,000,000 (1×10^{-6}) means that one person out of one million people could be expected to develop cancer as a result of a lifetime exposure to the site contaminants. Where the aggregate risk from COCs based on existing ARARs exceeds 1×10^{-6}, or where remediation goals are not determined by ARARs, the EPA uses the 1×10^{-6} as a point of departure for establishing preliminary remediation goals. This means that a cumulative risk level of 1×10^{-6} is used as the starting point (or initial "protectiveness" goal) for determining the most appropriate risk level that clean-up alternatives should be designed to attain. Factors related to exposure, uncertainty and technical limitations could justify modification of initial cleanup levels that are based on the 1×10^{-6} risk level.

For non-carcinogenic toxic chemicals, the toxicity assessment is based on the use of reference doses (RfDs) whenever available. A reference dose is the concentration of a chemical known to cause health problems. The estimated potential Site-related intake of a compound is compared to the RfDs in the form of a ratio, referred to as the hazard quotient (HQ). If the HQ is less than one, no adverse health effects are expected from potential exposure. When environmental contamination involves exposure to a variety or mixture of compounds, a hazard index (HI) is used to assess the potential adverse effects for this mixture of compounds. The HI represents a sum of the hazard quotients calculated for each individual compound. HI values that approach or exceed one generally represent an unacceptable health risk that requires remediation.

8.4 Human Health Risk Characterization

Risk estimates were calculated for future land use scenarios for hypothetical human receptors at the Site. Cancer risks were estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to the Site's carcinogenic contaminants. Toxicity risk estimates for noncarcinogenic toxic chemicals are presented for COCs where toxicity values were available. The potential for noncarcinogenic hazards due to potential exposures to chemicals was evaluated by calculating an HI for the COCs at the Site. Table 4, a risk characterization summary, shows the detailed calculation for both cancer and non-cancer risk.

The Baseline Risk Assessment organized the types of risk at the Site according to various exposure scenarios. Each exposure scenario specifies the type of human receptor (e.g., child resident, adult industrial worker), the exposure pathway (e.g., inhalation, ingestion) and the COC. If a contaminant or exposure scenario is found to produce a risk which will require a remedial action (based on either the carcinogenic risk or the HI) that contaminant or exposure scenario is said to "drive the risk" or "drive" the need for action. A remediation goal is set for site-related contaminants that drive risk. The following exposure scenarios are driving the need for action at the Site (all carcinogenic risks are based on Reasonable Maximum Exposure or RME):

Ground Water

Risk at the Site is driven by PCE and TCE contamination. The highest calculated carcinogenic risks at the Site, and those that are driving the risk at the Site, are from dermal absorption of ground water through bathing for adults and children. Both TCE and PCE pose cancer risks that are greater than the point of departure of 10^{-6}. As shown on Table 4, the cancer risks are:

Adults - PCE=4.05×10^{-5}
TCE=1.15×10^{-4}

Children - PCE=1.72×10^{-5}
TCE=4.86×10^{-5}

In addition, the hazard index for adults exposed to TCE through dermal absorption of ground water through bathing is 1.56 which is greater than 1 (Table 4).

Cancer risk to adults from ingestion of ground water through drinking is also greater than the point of departure at 1.10×10^{-5} (Table 4). All risks to industrial workers and all other risks to adults and children through the other exposure scenarios are in the order of magnitude of 10^{-6} to 10^{-8}, and therefore do not drive the risk at the site. Risks from cis-1,2-DCE and trans-1,2-DCE were several orders of magnitude below the HI of 1; however, for reasons explained in Section 8.1, these contaminants pose a risk to the ground water and, therefore, have remediation goals set for them.

8.5 Risk Assessment Uncertainty

Within the Superfund process, baseline quantitative risk assessments are performed in order to provide risk managers with a numerical representation of the severity of contamination present at a Site, as well as to provide an indication of the potential for adverse public health effects. There are many inherent and imposed uncertainties in the risk assessment methodologies. Uncertainties in the human health risk assessment include sampling data that may not fully characterize the contaminants at the Site, toxicity values that are extrapolated from animal or laboratory studies, and inhalation concentrations derived from a soil exposure model. These uncertainties could cause both overestimation and underestimation of risk. These uncertainties are further described in Sections 3.6 and 4.4 of the March 2001 Baseline Risk Assessment for the Site.

8.6 Ecological Risk Characterization

One of the first steps in performing an ecological risk assessment is evaluating whether or not there is a pathway of exposure for ecological receptors. At the Site, the EPA considered several factors in this evaluation: the urban setting of the Site; the developed nature of the Site (i.e., 95% of the Site is paved or covered with commercial establishments and residential buildings); and, the fact that currently, and in modeled future scenarios, the plume does not discharge to surface water. In addition, the EPA considered the input of the U.S. Department of the Interior (DOI) and the New Mexico Office of Natural Resource Trustees. Both the DOI and the New Mexico Office of Natural Trustees stated that there were no ecological exposure pathways at the Site. The EPA concluded that continuing with an ecological risk assessment was not appropriate for the Site because there was an incomplete exposure pathway to ecological receptors (see Section 3.2.3 of the Baseline Risk Assessment).

8.7 Basis for Action

The risks detailed in this chapter show a threat to future adult residents and workers, and child residents who could come into contact with Site ground water. It is the EPA's current judgment that the Selected Remedy identified in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

9.0 Remedial Action Objectives and Goals

9.1 Remedial Action Objectives

Under the provisions of the National Contingency Plan (NCP) (40 CFR Part 300), the lead agency involved in a Remedial Action (in this case, the lead agency is the EPA) is required to establish remedial action objectives (RAOs) for protecting human health and the environment. The RAOs specify the contaminants and media of concern, potential exposure pathways, and preliminary remediation goals (NCP, 1990). Remediation goals are concentrations of contaminants for each exposure route that are protective of human health and the environment.

Based on the Baseline Risk Assessment, the primary medium of concern at the Site is the ground water. The remedial action objectives (RAOs) for the Site are:

C Prevent human ingestion of, inhalation of, or dermal contact with ground water that contains concentrations of PCE above 5 : g/L, TCE above 5 : g/L, cis-1,2-DCE above 70 : g/L, and trans-1,2-DCE above 100 : g/L (these concentrations are the Maximum Contaminant Level Goals (MCLGs) set by the Clean Water Act (or are Maximum Contaminant Levels where MCLGs are set at zero)).

C Prevent human ingestion of, inhalation of, or dermal contact with concentrations of PCE and TCE in ground water, the source of which is contaminated soil with concentrations of PCE and TCE that exceed 0.027 mg/kg and 0.024 mg/kg respectively. That is, while the exposure route involves ground water as the medium of concern, the source of the PCE and TCE contamination in question is contaminated soil, even though that soil poses no direct risk to human health.

9.2 Basis for Selection of Remediation Goals

A Remediation Goal is the allowable concentration of a contaminant which may remain in a specific medium (such as soil or ground water) at a site after implementation of the ROD through the Remedial Action. For the Site ground water COCs (PCE, TCE, cis-1,2-DCE, and trans-1,2-DCE) the remediation goal is set at the ARARs, which are the MCLGs and MCLs as per Section 300.400(g)(2) of 40 CFR. Therefore the remediation goals for the Site COCs in ground water are:

Contaminant of Concern	Ground Water Remediation Goal
PCE	5 : g/L (MCL)
TCE	5 : g/L (MCL)
cis-1,2-DCE	70 : g/L (MCLG)
trans-1,2-DCE	100 : g/L (MCLG)

In addition to being above the ARARs, TCE and PCE posed a risk to human health that exceeds the EPA's point of departure (see Section 8.3). Setting the remediation goals to the MCLs reduces the risk from these compounds to acceptable levels. Although cis-1,2-DCE and trans-1,2-DCE were not detected above MCLs (ARARs) and did not therefore, show an unacceptable risk to human health in the Baseline Risk Assessment, a remediation goal has been set for these compounds because these compounds are breakdown products of TCE, and during remediation could reach concentrations that would exceed the MCLs (remediation goals).

Where no ARARs exist or where ARARs are not sufficiently protective, the NCP prescribes methods for selection of remediation goals. There are no chemical-specific ARARs for Site soil; consequently, remediation goals for soil were selected based on guidance outlining scientific methods to determine protective goals, according to NCP procedure. The remediation goal for soil at the Site was calculated using the EPA's *Soil Screening Guidance: Users Guide*, EPA Publication 9355.4-23. This guidance details the methodology through which a concentration in soil, protective of ground water, can be calculated. For this Site, the remediation goals for soils are 0.027 mg/kg of PCE, or less, and 0.024 mg/kg of TCE, or less. Site-specific data such as organic carbon content, soil porosity, and infiltration rates were used to calculate these remediation goals, as detailed in a March 2001 memorandum prepared by the NMED project manager, Birgit Landin, which is part of the Administrative Record for the Site. The remediation goals for PCE and TCE in soil are set at a level such that, if remediation goals are met, ground water cannot become impacted above the MCLs for these compounds through contaminant migration from soils. Therefore the remediation goals for the Site COCs in soil are:

Contaminant of Concern	Soil Remediation Goal
PCE	0.027 mg/kg
TCE	0.024 mg/kg

10.0 Description of Remedial Alternatives

This section summarizes the most comprehensive remedial alternatives for both the soil and the ground water developed during the Feasibility Study, plus the no-action alternative for each medium. These alternatives, along with other alternatives that are deemed less comprehensive, are analyzed in more detail in the Feasibility Study, which is part of the Administrative Record file. Alternatives S-3 - Soil Vapor Extraction, and G-5 - Hot Spot Treatment and Shallow, Intermediate, and Deep Zone restoration through pump and treat technology with a re-injection component are the two remedial action alternatives selected by EPA.

Soil Remedies:

- **Alternative S-1** - *No Further Action*
- **Alternative S-2** - *Institutional Controls*
- **Alternative S-3** - **The Selected Alternative** - *Soil Vapor Extraction*
- **Alternative S-4** - *Excavation and Off-Site Disposal*

Ground Water Remedies:

- **Alternative G-1** - *No Further Action*
- **Alternative G-2** - *Shallow, Intermediate, and Deep Zone Restoration Through Pump and Treat Technology with a Reinjection Component*
- **Alternative G-3** - *In-Situ Permeable Reactive Barrier in the Shallow and Intermediate Zones, and Deep Zone Restoration Through Pump and Treat Technology*
- **Alternative G-4** - *Point-of-Use Treatment*
- **Alternative G-5** - **The Selected Alternative** - *Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration Through Pump and Treat Technology with a Reinjection Component*

The Feasibility Study describes a total of 12 ground water alternatives, numbered GW-1 through GW-12. The Proposed Plan and the ROD detail the most comprehensive alternatives, plus the no-action alternative for each medium. The ground water alternatives presented in this ROD and their corresponding alternative numbers in the Feasibility Study are as follows:

10.1 Common Elements of Remedial Alternatives

Each of the remedial alternatives (other than Alternatives S-1 and G-1; No Action) evaluated as part of the detailed analysis has certain assumptions and aspects in common. These are called the common elements. Common elements which concern assumptions used in the Feasibility Study for S- and G- Alternatives 2, 3, 4, and 5 are:

- All costs were based on a 30-year project lifetime.

- All costs have a degree of accuracy of +50% to -30% pursuant to the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final" OSWER Directive 9355.3-01, October 1988, insofar as it is consistent with the NCP.

- All costs and implementation times are estimates which should be used as a basis for a comparative analysis of the alternatives only, and not as a determination of absolute costs which will be expended during the project. These costs will be recalculated in the Remedial Design.

- Net present value (also called present worth) costs are presented in this ROD so that the remedial action alternatives which have costs incurred in different time periods can be compared on the basis of a single cost figure for each alternative. Also, although some alternatives may take over 30 years to implement, a maximum cost period of 30 years is used for comparison purposes. Net present value cost, or present worth, is the amount of money that would have to be set aside at the inception of the Remedial Action in order to assure that funds will be available in the future to complete a given response action, assuming certain economic factors such as an interest rate and an inflation rate.

- Under the NCP, if a Remedial Action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site at concentrations that are above concentrations that allow for unlimited use and unrestricted exposure, the EPA must review the Remedial Action every five years. The five-year reviews are necessary at the Site because each remedial alternative evaluated allows hazardous substances to remain on-site in concentrations that restrict use. The EPA must conduct the reviews no less often than every five years after initiation of the Remedial Action in order to ensure that human health and the environment are being protected (See 42 U.S.C. Section 9621(c)). The EPA will conduct the statutory five-year reviews until ground water is restored to the MCLs.

- All ground water remediation alternatives (G-series alternatives) would meet ground water ARARs which are non-zero MCLGs, or MCLs where MCLGs are set at zero. There are no chemical-specific ARARs for soils.

- All soil remediation (S-series) alternatives would address the estimated volume of contaminated soil (20,000 cubic yards).

- All ground water remediation (G-series) alternatives would address the estimated volume of contaminated ground water (320,000,000 gallons).

- Institutional controls will be implemented during the response action in order to protect human health during the time before the remedial action has met the remediation goals. Despite the limitations associated with institutional controls, they will be implemented to the greatest extent possible to help minimize risk to human health and the environment during the implementation of the remedy.

- In order to help protect the public from contaminated soil, it is EPA's and NMED's intention that a restrictive covenant will be placed on the property containing the soil. The covenant will call for the owner of the property that includes the contamination source to not disturb the asphalt cap covering the contaminated soil at the source property. It may not be possible for EPA or the State to effect this covenant because, under State law, a restrictive covenant must be put in place by the property owner. As a backup plan, the NMED intends to enter into an enforceable agreement with the property owner. The agreement would require the property owner to maintain the asphalt cap until the soil remediation goals have been met. The problem with such an agreement is that it is not transferable. That is, unlike a restrictive covenant, it will not transfer to a new property owner when the property changes hands.

- As part of the institutional controls for ground water, the New Mexico Office of the State Engineer (OSE) would issue an order to restrict use of the portion of the contaminated aquifer that is part of the Fruit Avenue Plume Site until remediation goals have been met. It should be noted that the OSE has verbally agreed to issue such an order; however, the order has not been issued to date. The OSE order would have limited usefulness because the order is not enforceable by the EPA or by NMED

- All alternatives include an operations and maintenance (O&M) component that involves annual ground water monitoring to assess the extent of contamination and the risks to human health.

- All alternatives would support the current and future anticipated land and ground water use at the Site - commercial, light industrial, and residential.

- Wherever practicable, the remediation system (treatment plant, extraction wells, re-injection wells, and associated piping) will be located in City of Albuquerque right-of-way. However, the actual locations will be determined in the Remedial Design phase.

- Wherever practicable, the treatment component of the ground water alternative should utilize presumptive technologies identified in EPA's ground water presumptive strategy, "*Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites*," October 1996, OSWER Directive Number 9283.1-12.

- EPA's soil presumptive strategy, "*Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils*," September 1993, OSWER Directive Number 9355.0-48FS was utilized during the RI/FS to determine appropriate technologies for soil remediation.

10.2 Alternatives S-1 and G-1 - *No Further Action*

Alternatives S-1 and G-1 are the baseline conditions against which other soil and ground water remedial alternatives are compared, as required by the NCP. Alternatives S-1 and G-1 would provide no further remedial action at the Site. Alternatives S-1 and G-1 would not address the human health risks identified in Section 4 of this document and, therefore, they do not protect human health. Alternatives S-1 and G-1 do not reduce contaminant toxicity, mobility, or volume and they are not effective or permanent remedies. Since these no action alternatives would leave hazardous substances on the Site, CERCLA requires the EPA to conduct a review of the Remedial Action every five years in order to assess risks to human health and the environment. Costs for conducting the five-year reviews are shown for Alternatives S-1 and G-1. Alternatives S-1 and G-1 are rejected, but are mentioned throughout the evaluation process for the purposes of comparison.

- Capital cost: $0
  Annual operation and maintenance (O&M): $0
  Present worth: $21,578

10.3 Alternative S-2 - Institutional Controls

The contaminated Site soils are currently covered by asphalt, which acts as a cap to limit both rain infiltration and mobilization of soil contaminants. Institutional control Alternative S-2 would call for a restrictive covenant to be placed on the property that contains the contaminated soil. The covenant would require the property owner to leave the asphalt undisturbed to protect human health and the environment from the contaminated soil at the source property (former Elite Cleaners/Sunshine Laundry). Annual O&M includes yearly inspections of the cap, and a review of the institutional controls. Costs for conducting five-year reviews are included in the present worth and total cost projections.

- Capital cost: $0
  Annual operation and maintenance (O&M): $2,000
  Present worth: $46,400
  Implementation time: Not applicable
  Total cost: $120,000

10.4 Alternative S-3 - The Selected Soil Alternative - *Soil Vapor Extraction*

The EPA has selected Alternative S-3, Soil vapor extraction (SVE) as its remedy for contaminated soil. SVE is an unsaturated (vadose) zone remediation technology that extracts soil gas containing contaminants from the subsurface and treats the contaminants aboveground. A below-ground piping network routes volatile organics from the soil gas through a regenerative blower located at the surface, followed by a vapor-phase granular-activated carbon (GAC) filter to remove contaminants from the soil gas. Operations and maintenance costs include the cost of running the soil vapor extraction system. O&M does not include annual ground water monitoring because the soil will be cleaned up within 2 to 5 years. Five-year reviews are not part of this alternative because the remedy will not result in unacceptable concentrations of hazardous substances remaining on-site in the soil.

- Capital cost: $160,000
  Annual operation and maintenance (O&M): $35,000
  Present worth: $223,280

Implementation time: 9 months
Time to reach remediation goals: 2 to 5 years
Total cost: $390,000

10.5 Alternative S-4 - *Excavation and Off-Site Disposal*

Alternative S-4 involves the physical removal of contaminated soil located in the two former UST locations on the former Elite Cleaners/Sunshine Laundry property. Under Alternative S-4, the excavated soil would have been disposed of off-site. Heavy equipment, such as backhoes and trenchers, would be utilized for this remedy. Contaminated soil would have been removed to the greatest depth practicable, assumed to be approximately 25 feet below the ground surface. Clean soil fill would have been used to backfill the excavated area. Operation and maintenance would not have been required for this alternative because the contaminated material would be removed.

- Capital cost: $540,000
  Annual operation and maintenance (O&M): $0
  Present worth: $540,000
  Implementation time: less than 1 year
  Total cost: $540,000

10.6 Alternative G-2 - *Shallow, Intermediate, and Deep Zone Restoration Through Pump and Treat Technology with a Reinjection Component*

Alternative G-2 is a "pump and treat" ground water remedy where contaminated ground water is pumped out of the ground through extraction wells and brought to the surface where it is treated. Under Alternative G-2, ground water would have been pumped out of the shallow, intermediate, and deep zones of the aquifer through a series of extraction wells. This extracted water would flow through below-ground piping to an above-ground treatment plant located within the Site boundaries. Once in the treatment plant, the extracted water would be directed through an air stripper to volatilize the contaminants. An air stripper typically includes a tower filled with material (trays or whiffle balls) that breaks the water into smaller droplets so that more surface area is created to mix with air. The contaminated water is pumped to the top of the air stripper tower and allowed to cascade down. Air under pressure is blown up through a tower and mixes with the water droplets. Mixing of the air and the cascading contaminated water droplets results in volatilization of the contaminants in the water. The vapor emissions from the air stripper pass through a granular activated carbon filter to clean the emissions prior to release into the atmosphere. The discharge water at the bottom of the air stripper would also go through a granular activated carbon filter to remove any remaining contaminants.

This alternative includes reinjecting a portion of the treated (cleaned) water back into the aquifer after treatment. The remediated water would be pumped back into the ground through injection wells placed at strategic locations (usually around the perimeter of the plume). This creates an underground treatment "cell" with the clean water flushing through the aquifer, pushing the contaminated water towards the extraction wells, and potentially lowering the time to reach remediation goals.

Based on the design used for costing purposes in the FS, this alternative would have taken 30 years or more to meet remediation goals, because source area contamination would not be directly remediated. This time could have been reduced if the source area contamination desorbs (contaminants come off the sediments they are adsorbed to) at a faster rate than currently modeled.

- Capital cost: $2,275,000
  Annual operation and maintenance (O&M): $255,000
  Present worth: $5,455,000
  Implementation time: 1 year
  Time to reach remediation goals: greater than 30 years
  Total cost: $9,967,000

10.7 Alternative G-3 - *In-Situ Permeable Reactive Barrier in the Shallow and Intermediate Zones, and Deep Zone Restoration Through Pump and Treat Technology*

Alternative G-3 includes the installation of a subsurface treatment barrier wall into the shallow and intermediate aquifer zones, coupled with a deep zone pump and treat system. The treatment barrier wall would have been comprised of over 60 closely-spaced injection wells forming a barrier along the down-gradient (eastern) edge of the shallow and intermediate zone ground water contaminant plume. An in-situ treatment material, such as a bioremediation enhancer or a chemical oxidant, would have been injected into the injection wells to form this treatment wall. The treatment wall would intercept contaminated ground water as it migrates down-gradient, and it would react with the contaminants to remediated them as they pass through the wall.

Pilot studies or bench-scale tests conducted during Remedial Design would have been performed to determine whether biodegradation or chemical oxidation would be used for the treatment wall. Biodegradation of organic compounds can proceed naturally in ground water or can be enhanced with the addition of food sources (substrate), electron acceptors/donors, or nutrients (known as biostimulation) and/or microbes (known as bioaugmentation) into the subsurface to accelerate the rate of natural biodegradation. The resident and/or introduced bacteria then degrade the contaminants in the ground water into harmless end products. Chemical oxidation processes involve oxidation-reduction (redox) reactions, which are essentially an exchange of electrons between chemical species. Strong oxidants attack contaminant organic molecules and the organic compounds are converted to carbon dioxide, water, and chloride ions, which are all relatively harmless.

Contaminants in the deep portion of the aquifer cannot be feasibly treated with a subsurface treatment wall due to the depth and wide-spread nature of the deep zone contamination. Therefore, under Alternative G-3, the deep zone ground water would have been remediated with a pump and treat system, as described in Alternative G-2, except treated water would not be reinjected into the aquifer as part of this alternative. Treated water would be disposed in a manner agreed to by the State and the City of Albuquerque. Disposal options include discharge to the sanitary sewer, discharge to the storm drain, or reuse. Under Alternative G-3, disposal of the treated water would have been determined during Remedial Design.

Operation and maintenance would have included yearly reinjection of reactive material into the treatment wall. Based on the design used for costing purposes in the FS, this alternative would have taken more than 30 years to meet remediation goals in all areas of the Site aquifer. This time could have been reduced based on a different design completed as part of the Remedial Design phase.

- Capital cost: $1,930,000
  Annual operation and maintenance (O&M): $835,000
  Present worth: $12,307,000
  Implementation time: 1 year
  Time to reach remediation goals: greater than 30 years
  Total cost: $27,022,000

10.8 Alternative G-4 - *Point-of-Use Treatment*

Alternative G-4, Point-of-Use-treatment, would have included the installation of activated carbon filters at water supply well heads. The ground water would be pumped through a wellhead treatment unit, tested to ensure that it meets standards (MCLs), and then piped into the water supply system for use. Because this remedy does not clean up the source of contamination, it would have been in operation for as long as contaminated ground water existed. The time to reach remediation goals is greater than 30 years. For costing purposes, wellhead treatment units for 8 known existing water supply wells within the ground water flow pathway of the Site plume have been calculated on a 30-year basis.

- Capital cost: $2,435,000
  Annual operation and maintenance (O&M): $360,000
  Present worth: $6,918,000
  Implementation time: less than 1 year
  Total cost: $13,277,000

10.9 Alternative G-5 - <u>The Selected Ground Water Alternative</u> - *Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration Through Pump and Treat Technology with a Re-injection Component*

The EPA has selected Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone restoration through pump and treat technology with a re-injection component as its remedy for ground water contamination. Alternative G-5 involves aggressive remediation of ground water contamination in "hot spot" areas (see Section 5.2 for hot spot definition). The hot spot used for costing purposes in the Feasibility Study is in the shallow and intermediate zones which underlie the former Elite Cleaners/Sunshine Laundry property. Identification of any additional hot spots requiring remediation would be performed during the Remedial Design.

Hot spot remediation will include injection of either a bioremediation additive, or a chemical oxidant (to be determined during Remedial Design) into the subsurface to degrade COCs in place.

Enhanced in-situ biodegradation involves the addition of food sources (substrate), electron acceptors/donors, or nutrients (known as biostimulation) and/or microbes (known as bioaugmentation) into the subsurface to accelerate the rate of natural biodegradation. The resident and/or introduced bacteria then degrade the contaminants in the ground water into harmless end products.

Chemical oxidation processes involve oxidation-reduction (redox) reactions, which are essentially an exchange of electrons between chemical species. Strong oxidants attack contaminant organic molecules and the organic compounds are converted to carbon dioxide, water, and chloride ions, which are all relatively harmless.

The remaining ground water contamination located outside of the hot spot will be remediated using a pump and treat system comprised of extraction and injection wells as described in Alternative G-2.

Because Alternative G-5 includes concentrated destruction of the contaminants at the source area, remediation will occur much faster than under other alternatives that do not directly address the source area. Computer modeling simulations show that this alternative is expected to reach remediation goals in less than 15 years in all zones of the aquifer, except for a relatively isolated area in the intermediate zone between Fourth Street and Third Street, near Roma Avenue. If it appears that this area near Fourth Street is not remediating in a timely fashion through pump and treat alone, an additional hot spot treatment may be considered for this area. Depending on the removal rate (rate that contaminants strip off the sediments onto which they are adsorbed) of contaminants in this area, complete remediation could take up to 30 years for this portion of the Site. To be conservative for costing purposes, operation and maintenance of the system is estimated for 30 years.

- Capital cost: $3,733,000
  Annual operation and maintenance (O&M): $255,000
  Present worth: $6,912,000
  Implementation time: 1.5 years
  Time to reach remediation goals: 15 years except for one area which could take 30 years
  Total cost: $11,425,000

Alternative Cost Estimate Table

Alternative Title	Proposed Plan Number	Capital Cost	Annual O&M Cost	Net Present Value	Total Cost	Years to Reach Remedial Goal
Soil - No Action	S-1	$0	$0	$21,578	$60,000	N/A
Institutional Controls	S-2	$0	$2,000	$46,400	$120,000	N/A

Alternative Cost Estimate Table

Alternative Title	Proposed Plan Number	Capital Cost	Annual O&M Cost	Net Present Value	Total Cost	Years to Reach Remedial Goal
The Selected Alternative Soil Vapor Extraction	S-3	$160,000	$35,000	$223,280	$390,000	2 to 5
Excavation and Off-Site Disposal	S-4	$540,000	$0	$540,000	$540,000	1
Ground water - No Action	G-1	$0	$0	$21,578	$60,000	N/A
Shallow, Intermediate, and Deep Zone Ground water Restoration Through Pump and Treat Technology with a Reinjection Component	G-2	$2,275,000	$255,000	$5,455,000	$9,967,000	>30
In-Situ Permeable Reactive Barrier in the Shallow and Intermediate Zones, and Deep Zone Ground water Restoration Through Pump and Treat Technology	G-3	$1,930,000	$835,000	$12,307,000	$27,022,000	>30
Point-of-Use Treatment	G-4	$2,435,000	$360,000	$6,918,000	$13,277,000	N/A
The Selected Alternative Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Ground water Restoration Through Pump and Treat Technology with a Reinjection Component	G-5	$3,732,120	$255,000	$6,912,000	$11,425,000	15

11.0 Comparative Analysis of Alternatives

The EPA uses nine NCP criteria to evaluate remedial alternatives for the cleanup of a release. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment, and compliance with ARARs. The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The modifying criteria are state acceptance and community acceptance. The following briefly describes the evaluation criteria:

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

The comparative analysis describes the strengths and weaknesses of the alternatives relative to one another with respect to each NCP criterion. The alternative(s) that performs the best overall in that category is discussed first, with the other alternatives discussed in order according to their relative success at satisfying the NCP criterion.

The alternatives intended to address the unsaturated zone soil (S-series) and ground water (G-series) were kept separate throughout the Feasibility Study evaluation, and that approach is continued in this section of the ROD.

11.1 Comparative Analysis of Unsaturated Zone Alternatives

Alternatives S-1, No Action, and S-2, Institutional Controls (such as placement of restrictive covenants to ensure that the asphalt overlying the contaminated soil continues to act as a barrier to surface infiltration) do not actively address the contaminated soil. Alternative S-3 provides in-situ treatment of contaminated soil by soil vapor extraction. Alternative S-4 provides ex-situ treatment of contaminated soil by excavation and off-site disposal. Table 5 provides a summary of the comparative analysis of soil alternatives.

11.1.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment draws on a combination of criteria, compliance with ARARs, short-term effectiveness, long-term effectiveness, and reduction in toxicity, mobility, and volume. The Baseline Risk Assessment concluded that soils do not pose a direct exposure risk to human health. However, the concentration of contaminants in the soil could continue to contaminate the ground water, leading to ground water contamination that exceeds the MCLs, therefore, soil remediation alternatives were considered. The soil alternatives are evaluated only in regard to their risk to the environment in this section. All the soil alternatives are protective of human health as far as direct human exposure to soil is concerned; however, soil contamination poses a threat to humans in that it could impact ground water which is subsequently used by humans.

Alternative S-3, the selected remedy, has the best overall protection of the environment because: 1) all of the initial PCE and TCE mass in soil along with the entire volume of contaminated soil will be treated by this alternative; consequently, this alternative is the most effective and permanent in the long term; and 2) of the two active soil remediation alternatives, Alternative S-3 is the most effective in the short term because the installation of the SVE system poses less short term risks and needs fewer engineering controls than the deep excavation required by Alternative S-4.

Alternative S-4 would only have addressed a portion of the contaminated soil at the Site, leaving a continuous low level risk to the environment (ground water). Although Alternative S-4 could involve off-site treatment, and although S-4 poses some long-term effectiveness, as a whole, S-4 is much less protective than Alternative S-3.

The passive alternatives, Alternatives S-1 (no action) and S-2 (institutional controls) would have offered no additional protection to the environment. Alternative S-2, although not fully protective, was retained for comparison purposes in this nine-criteria analysis because of the low number of implementable alternatives for Site soils.

11.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Because there are no chemical-specific ARARs for soil and because all the soil alternatives would meet location-specific and action-specific ARARs, all of the soil alternatives would comply with ARARs.

11.1.3 Long-term Effectiveness and Permanence

Alternatives S-3, SVE, has the greatest long-term effectiveness and permanence because the attainment of remediation goals protective of Site ground water is possible under this alternative and because no residual risk would remain. Alternative S-4, Excavation and Off-Site Disposal, would have been effective in reducing the concentration and mass of PCE in soil, and would have greatly reduced the contribution of contaminants from soil to ground water. Under Alternative S-4, however, a low level of contamination would not be excavated; consequently some residual risk would remain.

Alternatives S-1 and S-2 do not include treatment so contaminated soil that could potentially impact the ground water would be left in place, and residual risk to the environment (and indirectly to humans) would have remained. Although the soil contamination is not currently contaminating the ground water, the fact that the soil could potentially contribute to the ground water contamination means that alternatives S-1 and S-2 would have poor long-term effectiveness and permanence.

11.1.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative S-3, SVE, affects the greatest reduction in the volume of PCE- and TCE-contaminated soil in the vadose zone through treatment. Alternative S-3, SVE, would address the entire volume of the PCE- and TCE-contaminated soil (22,000 cubic yards) through treatment, and it would address 100% of the mass of contaminants, while Alternative S-4 would only remove soil in the areas of greatest impact (1,300 cy), which account for 85% of the mass of contaminants. Alternatives S-1 and S-2 do not involve active treatment, and would not have reduced the mass of PCE or the volume of PCE-contaminated soil. None of the soil remedial alternatives include recycling of hazardous substances.

Soils at the Site do not represent principal threats, rather, the contaminated soils are considered low-level threats. Alternatives S-3 and S-4 reduce inherent hazards posed by the low-level threat soils.

11.1.5 Short-term Effectiveness

A comparison of the alternatives with respect to the short-term effectiveness shows that all alternatives can be made to be protective of the community and workers during remedy implementation, although only two of the alternatives allow the soil to reach the remediation goal quickly.

Alternative S-3 poses some risk to on-site workers and the community because of the use of heavy equipment necessary to install the SVE system and due to the fact that the system would be installed in an active bank parking lot. These risks will only last for the short time it takes to install the system, and they would be greatly minimized through the use of engineering controls. Alternative S-3 is expected to meet RAOs for soil and to provide protection of the environment in approximately two years. No other alternatives would have been expected to completely meet the RAOs.

Alternative S-4, Excavation and Off-Site Disposal, would have posed a greater risk to on-site workers and to the community than does Alternative S-3 because S-4 includes the same risks to workers and the community from the work in the bank parking lot, along with additional risk from transportation of the PCE-contaminated soil. Although the use of engineering controls would greatly minimize the risks to the community and workers, S-4 still would have posed some risk.

11.1.6 Implementability

All of the alternatives are implementable with regard to technical feasibility, administrative feasibility, and availability of resources.

Alternative S-3, SVE, has been implemented at many sites in order to reduce the size and magnitude of soil gas plumes. Alternative S-3 requires installation of vapor extraction wells, and a surface treatment unit. S-3 is a reliable technology because of its mechanical simplicity, and, therefore, its technical feasibility is high. The administrative feasibility for S-3 is also high; however, implementation of this alternative would involve close coordination with the landowner and the City of Albuquerque because of the effects it will have in the downtown area. This alternative is implementable.

Like Alternative S-3, Alternative S-4, Excavation and Off-Site Disposal, has been implemented at many sites. The technical feasibility is high for excavation because there are no logistical problems in excavating the area containing the contaminated soil (no buildings or structures are in the way), but not as high as for SVE, because the great depth of the excavation under alternative S-4 (25 feet) would have required some specialized techniques like ramping or shoring. The administrative feasibility of alternative S-4 is the same as for Alternative S-3 because it involves the same area of the Site.

Alternative S-1, No Action, would have been technically and administratively feasible.

Alternative S-2, Institutional Controls, such as placement of restrictive covenants to ensure that the asphalt continues to act as a barrier to stormwater contacting the soil, have a low implementability. This is due to the fact that they generally cannot be put in place without the cooperation of the landowner.

11.1.7 Cost

The selected soil alternative, Alternative S-3, is also the alternative with the lowest capital cost, at \$160,000. Alternative S-4, Excavation and Off-Site Disposal, would have had a capital cost of \$540,000.

Alternatives S-1, No Action, and S-2, Institutional Controls, do not have capital costs associated with them, and have minor O&M costs (for reviewing institutional controls (S-2), and for conducting five-year review reports).

Alternative S-3 is estimated to last approximately 2 to 5 years with a total O&M cost of $70,000. Alternative S-4 will last approximately three to four weeks and will incur no annual O&M costs. No long-term monitoring strategies are planned for either alternative.

Alternative S-3 has a present worth of $223,280 whereas Alternative S-4 has a present worth of $540,000.

11.1.8 State Acceptance

The EPA and NMED have worked together in the investigation of the Site, and in developing this ROD. The State has expressed its support for soil Alternative S-3, the selected remedy. Soil Alternative S-4 may not have been technically feasible if the excavation depth is greater than anticipated, and it would have been very disruptive to the activities on the source property. The State and the City did not support Alternatives S-1 and S-2 because they do not use treatment as a permanent solution.

The NMED has documented its support for issuance of the Proposed Plan and the ROD outlining the Selected Remedy (S-3 Soil Vapor Extraction) in letters to the EPA dated May 25, 2001 and May 7, 2001, respectively. The NMED has agreed in principle to undertake the tasks which the ROD calls for it to take. The NMED, however, is an agency of a sovereign State, and NMED may at some future time decide not to continue these actions. If NMED should discontinue its actions, the EPA will then evaluate its options under the NCP and CERCLA to ensure that human health and the environment are protected.

11.1.9 Community Acceptance

In general, the public comment on the Proposed Plan was favorable and the EPA did not receive specific adverse comments on the proposed alternative. Significantly, the City of Albuquerque, which worked very closely with the EPA and NMED in the development of the proposed plan, has documented its support of the Selected Remedy (S-3 Soil Vapor Extraction). Most of the public comments were questions about implementation of the proposed alternative, or risk from the Site prior to completion of the remedial action. The responses to these comments are included in Appendix A, the Responsiveness Summary.

11.2 Comparative Analysis of Ground Water Alternatives

All of the alternatives except the no action alternative include institutional controls (ground water use restrictions put in place by the New Mexico State Engineer's Office) to help protect the community until the remediation goals are met.

Alternative G-1, No Action, would not have actively addressed the contaminated ground water plume.

Alternative G-2, Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component, would have treated all three ground water zones by extracting ground water, treating it at the surface in a treatment plant, and reinjecting a portion of the treated water back into the aquifer.

Alternative G-3 In-Situ Permeable Reactive Barrier and Deep Zone Restoration through Pump and Treat Technology, would have treated the shallow and intermediate zone ground water contamination as it migrates through a subsurface barrier that is filled with a reactive material to destroy the contaminants. The deep zone contamination would have been treated with a pump and treat technology.

Alternative G-4, Point-of-Use Treatment, would have included installation of pre-packaged surface treatment units onto existing potable water supply wells.

Alternative G-5, Hot Spot Remediation with Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Re-injection Component is the selected ground water remedy. Using Alternative G-5, EPA will treat a shallow and intermediate zone ground water contamination hot spot by injecting a reactive material into the aquifer to destroy contaminants near the source area. The remaining portions of the aquifer not directly treated with the hot spot remediation will be treated using pump and treat technology.

Table 6 summarizes the comparative analysis of the ground water alternatives.

11.2.1 Overall Protection of Human Health and the Environment

Alternative G-5 will provide the best overall protection of the environment because: 1) TCE concentrations in the intermediate zone areas showing the highest concentrations of contaminants (the "hot spots") will be reduced below the remediation goals, in turn causing the intermediate zone to be remediated in the shortest timeframe compared to the other alternatives; and 2) TCE concentrations in all the zones: the shallow, intermediate (other than the hot spot areas), and deep ground water zones will be reduced below remediation goals through treatment by pump and treat technology. The shortened time-frame at which the overall remediation will be accomplished is the main reason that Alternative G-5 is the G-series alternative that will provide the most overall protection of human health and the environment.

Alternatives G-2 and G-3 would have been the next most protective of human health and the environment because: 1) TCE concentrations in the intermediate ground water zone down-gradient from the area where the remedy would be employed are reduced below remediation goals by either in-situ treatment or by pump and treat technology; and 2) TCE concentrations in the deep ground water zone downgradient from the recovery wells would be reduced below remediation goals through treatment by pump and treat technology. Alternatives G-2 and G-3 would have treated the Site ground water contamination faster than all the other alternatives, except for Alternative G-5, because they would have reduced the concentrations of contaminants through treatment in two zones. However, G-2 and G-3 would not have actively addressed hot spots, and, therefore, would not reach remediation goals in a timely fashion.

Alternative G-4 would have been fully protective of human health at the point-of-use locations. However, the protectiveness of Alternative G-4 is reduced at locations other than point-of-use locations which must depend upon institutional controls to ensure that people do not come in contact with the ground water in the future. Alternative G-4 would not be protective of the ground water (part of the environment) because it does not actively treat the contaminant plume. Finally, Alternative G-4 would not have met NCP expectations that useable ground waters will be returned to their beneficial uses wherever practicable within a time-frame that is reasonable, given the particular circumstances of the Site.

Alternative G-1 is not protective of human health or the environment and therefore, it was not eligible for selection under the NCP (see 40 CFR §300.430(f)(1)(i)(A)).

11.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

All alternatives except Alternative G-1 would comply with chemical-specific ARARs because ground water would be treated until it is below the MCLs or the MCLGs. Alternative G-1 would not have met chemical-specific ARARs because no remedial actions are conducted at the Site under this alternative.

Alternative G-4 would meet ARARs upon treatment at the point-of-use; however, the plume area will not meet ARARs under G-4, and so implementation of this alternative would have required an ARARs waiver under 40 CFR § 300.430(f)(1)(C). Although this alternative would not meet ARARs at the Site as a whole, and must, therefore, be rejected, it was retained so that it could be compared to the other alternatives in the detailed analysis.

11.2.3 Long-term Effectiveness and Permanence

All of the alternatives that involve treatment, except Alternative G-4, would provide the same high degree of long-term effectiveness in that acceptable residual risk will remain once the remediation goals have been met, so no additional engineering or administrative controls will be necessary. Alternative G-4, Point-Of-Use Treatment, would not have been permanent because it would only have treated water that is used, so contamination at unacceptable concentrations would have remained in the aquifer and controls such as monitoring would have been needed indefinitely, making this alternative much less effective in the long-term. Alternative G-1 would not have been effective in the long-term because remediation goals would not have been met and residual risk would have remained for an indefinite period of time.

11.2.4 Reduction of Toxicity, Mobility, and Volume through Treatment

In this section, the alternatives are compared qualitatively based on their overall reduction of toxicity, mobility, and volume through treatment of the contaminants over the time period each alternative would take to reach the remediation goals. Note that in shorter time periods, based on the design scenario used for costing purposes in the FS, there are greater differences among the alternatives in their reduction of toxicity, mobility, and volume through treatment.

Amount of Hazardous Substances that will be Destroyed, Treated, or Recycled

Alternatives G-2, G-3, and G-5 (the selected alternative), treat the greatest amount of contaminant mass and volume because they treat all three zones of the aquifer.

Alternative G-4 would have only removed contamination when the ground water was used, so the mass and volume it would have treated cannot be determined at this time. However, this mass and volume would be much less than the amount treated by the other alternatives (G-2, G-3, and G-5) over any given time frame.

Alternative G-1 would have treated no contaminant mass or volume because this alternative does not include treatment.

None of the ground water remedial alternatives involve recycling of hazardous substances. All ground water alternatives (other than G-1) address the inherent hazards posed by the principal threat wastes at the Site, although G-4 only does so at the wellhead treatment unit.

Reduction in Toxicity

The Site alternatives that involve chemical or biological treatment of the ground water (G-3 and G-5) call for the reduction of the toxicity of the COCs through treatment. In anaerobic biodegradation, PCE and TCE break down to the less toxic DCE; DCE breaks down to vinyl chloride (VC), and eventually the VC breaks down to ethene, which is not toxic. If oxidation is used, the reduction occurs under aerobic conditions and the chlorinated ethene break down completely to carbon dioxide, chloride, and water (also non-toxic end products). There is a possibility that Alternatives G-3 and G-5 would use biological treatment (depending on results of pilot testing conducted as part of the Remedial Design). Biological treatment could produce VC in low concentrations in the aquifer that might not breakdown to non-toxic ethene, and, thus, the toxicity of the ground water could increase if biological treatment is used, caused by the greater toxicity of VC. Bench scale testing of the selected remedy during Remedial Design should determine the potential for VC production, and needed modifications to minimize its occurrence. However, Alternatives G-3 and G-5 would involve active pumping and treating and would, therefore, remove the VC along with the other COCs, thus any VC production would be localized and short-term. Compared to the greater risk reductions that would be gained by any of the ground water treatment alternatives, the slight risk of an increase in VC is not significant.

11.2.5 Short-term Effectiveness

A comparison of the alternatives with respect to short-term effectiveness indicates the following:

Short-term Risks that Might be Posed to the Community during Remedial Actions

The community would be protected from short term risks under all alternatives through the use of proper engineering controls, such as fencing the construction zone, posting warning signs, employing air strippers, reducing access to minimize the potential for injury or exposure, and monitoring of air emissions (i.e., vapor). Aside from Alternative G-1, Alternative G-4 would have required the least disruption and presented the fewest risks to the community because the treatment system used would most likely have been a packaged system that is already built and would have needed only to be hooked to the wellhead. Under Alternative G-3, annual re-application of the treatment substances to the aquifer could have resulted in significant disruptions to traffic and business and pose risks to the community.

Potential Impacts on Workers during Remedial Action

On-site workers would be protected under all of the alternatives through strict adherence to a health and safety plan, which would include protective measures, such as vapor monitoring in the breathing zone and the use of appropriate personal protective equipment.

There is a slightly higher, shorter-term risk to workers associated with Alternatives G-3 and G-5 (the selected remedy), if, after Remedial Design pilot tests, chemical oxidation is found to be the best reactive material to use for these alternatives. The reason for the higher risk is that there are greater potential health and safety risks associated with the handling of chemical oxidants compared to biological reactive agents.

Potential Environmental Impacts

Short-term and minor environmental impacts are associated with all of the active ground water alternatives. Alternative G-4 would have involved treatment primarily at locations that already withdraw ground water. Therefore, Alternative G-4 would have had less impact to the overall aquifer characteristics than the alternatives that involve ground water withdrawal at previously unimpacted areas, or in-situ treatment. Alternatives G-3 and G-5 (the selected remedy), which might include in-situ chemical oxidation, could have minor impacts on the aquifer geochemistry. Of the pump and treat alternatives, Alternative G-3 has the most significant environmental impacts because of the continuous extraction of contaminated ground water.

Alternative G-1 would have had no additional environmental impact because no active remediation would have taken place; however, contamination would remain in place and continue to impact the aquifer, making Alternative G-1 unacceptable.

Time until Protection is Achieved and Overall Short-Term Effectiveness

Alternative G-5 (the selected remedy) affords the highest degree of short-term effectiveness because this alternative will use a combination of in-situ treatment in the hot spots (at a minimum, in the suspected source area) and restoration in the shallow, intermediate, and deep zones through pump and treat technology, to achieve remediation goals in the shortest time-frame. Computer modeling shows that Alternative G-5 will reach MCLs in all zones of the aquifer within 15 years, except for a relatively isolated area of the intermediate zone located between Fourth Street and Third Street, near Roma Avenue. Depending on the removal rate of contaminants in this remaining area, remediation for the Site as a whole could take up to 30 years or more. If it appears that this area near Fourth Street is not remediating in a timely fashion through pump and treat alone, an additional hot spot treatment could be considered for this area.

Alternatives G-2 and G-3 would have offered a slightly lower degree of short-term effectiveness than Alternative G-5. Since G-2 and G-3 do not include the initial treatment of the hot spots, they take longer to achieve remediation goals than Alternative G-5. However, the short-term effectiveness of these alternatives is high because ground water within the capture zone of the pump and treat system will be immediately kept from migrating towards water supply wells, and will be actively treated right away.

Alternative G-4 would have had a low effectiveness in the short-term because this alternative meets remediation goals at the point-of-use location only and not in the entire aquifer. This means that under G-4, anyone who draws water from an untreated wellhead would have been at risk.

Alternative G-1 would not have been effective in the short term because this alternative represents a no-treatment scenario and the contamination would remain unaddressed.

11.2.6 Implementability

Administrative Feasibility

All the alternatives, with the exception of G-4, have high administrative feasibility. No administrative issues are significant enough to prevent the implementation of Alternatives G-1, G-2, G-3, and G-5 (the selected remedy). Alternative G-4, Point of Use Treatment, would have had the lowest administrative feasibility because the City of Albuquerque has discouraged consideration of point-of-use treatment on municipal supply wells, and the City has control over the logistical and administrative issues that would be involved with this type of treatment at municipal supply wells.

Technical Feasibility/Availability of Goods and Services

The alternatives that include ground water extraction and treatment, Alternatives G-2, G-3, and G-5 (the selected remedy), are highly technically feasible because these technologies are standard practice at many ground water sites. Goods and services, equipment, and materials are readily available.

The alternatives involving in-situ treatment (G-3 and G-5), are implementable from a technical standpoint. These technologies have been implemented at several sites with similar subsurface conditions. Two relatively moderate technical implementability issues for these alternatives are the depth of the contamination and the presence of clay layers and gravel/cobble zones. These subsurface materials may present technical challenges for the geoprobe or cone penetrometer, which is proposed for use in Alternatives G-3 and G-5, because the geoprobe or cone penetrometer may not be able to reach the depth required, or may have difficulty getting through clay and/or gravel/cobble layers to inject treatment fluids. Alternate injection methods, such as the use of hollow-stem auger drilling to install injection points, can be employed if the geoprobe or cone penetrometer proves not to be technically implementable. Services, equipment, and materials are readily available for these alternatives.

The alternative using chemical oxidation or bioremediation as the principal treatment in a barrier configuration, Alternative G-3, has significant technical implementability issues because use of chemical oxidation or bioremediation in barrier-type configurations for the depth and length proposed at the Site is an innovative application of this technology. A barrier of this length has not been installed in the field, and there was a distinct possibility that installation would not have succeeded at the Site. Services, equipment, and materials are available for Alternative G-3, though not as readily available as the previously mentioned, less innovative technologies.

Alternative G-1 would not have involved treatment, so an evaluation of technical implementability does not apply.

Overall Implementability

Alternatives G-2 and G-5 (the selected remedy) have the best overall implementability because they have high administrative and technical feasibility. Alternative G-3 has significant technical feasibility problems associated with the barrier treatment technology portion of the alternative, and, therefore, it has a lower implementability compared to the G-2 and G-5 Alternatives. Alternative G-4 has an extremely low administrative feasibility, which greatly offsets its high technical feasibility, making it low in implementability. Alternative G-1 does not involve treatment, so an evaluation of technical implementability is not applicable.

11.2.7 Cost

Capital Costs

The capital costs of the alternatives range from $0 for Alternative G-1, the no action alternative, to about $3.7 million (for Alternative G-5, the selected remedy). Alternative G-3 has a capital cost of about $1.9 million. Alternative G-2, at about $2.3 million capital costs, includes costs for equipment that would be used to reinject a portion of the treated water into the aquifer. Alternative G-4, Point-of-Use Treatment, has a moderate capital cost ($2.4 million) due to the need to install separate treatment units at each of the eight identified point-of-use locations. Alternative G-5, at about $3.7 million, has the highest capital costs because it uses two different treatment technologies (a pump and treat system that includes re-injection, and a hot spot injection system that would be used to destroy contaminants in the source area).

Operation and Maintenance Costs

Other than Alternative G-1, Alternatives G-2 and G-5 (the selected remedy) have the lowest annual O&M costs, $255,000. The O&M costs for these alternatives consist mainly of annual ground water monitoring and maintenance of the extraction and injection wells. The reactive barrier alternative, G-3, has the highest O&M costs, at almost $1 million, because it will require reinjection of treatment solution annually. Alternative G-4 has an annual O&M cost of $360,000. The cost of O&M for G-4 is due to the annual regeneration of the granular activated carbon filters which would be necessary because G-4 would produce a high flow rate through the treatment units.

Present Worth Cost

Net present value (or present worth) is defined in the common elements section of this ROD (see Section 10.1). The ground water alternative involving the pump and treat technology, but not in-situ treatment, Alternative G-2, has a present worth of $5.5 million. Alternative G-5 (the selected remedy), a combination alternative involving in-situ treatment and pump and treat technology, has a relatively moderate present worth value of $6.9 million. Alternative G-4 also has a relatively moderate present worth value of $6.9 million. Alternative G-3, the reactive barrier plus pump and treat technology alternative, has very high present worth values of more than $10,000,000 because of the costs of the annual injection of treatment material.

Total Project Cost

The total cost of the alternative over the life of the project is calculated by adding the capital costs to the projected O&M and five year review costs (inflation rates are not considered). O&M and five-year reviews are estimated for 30 years for all alternatives, although Alternative G-5, and to a lesser degree Alternative G-2, are likely to meet the remedial goals in less than 30 years. The total project cost for Alternative G-1, no action, is the lowest at $60,000. Of the Alternatives that involve active treatment, Alternative G-2 has the lowest total project cost at $10 million, followed closely by Alternative G-5 (the selected remedy) with a total project cost of $11.4 million. Alternative G-4 has a moderate total project cost at $13.3 million. Alternative G-3 has the highest total project cost at $27 million.

11.2.8 State Acceptance

The EPA and the NMED have worked together in the investigation of the Site and in developing this ROD. The State has expressed its support for Alternative G-5, the selected remedy. The State does not believe Alternative G-1, No Action, provides adequate protection of human health and the environment.

The NMED has documented its support for issuance of the Proposed Plan and the ROD outlining the Selected Remedy (G-5, Hot Spot Treatment with Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component) in a letter to the EPA dated May 25, 2001. The NMED has agreed in principle to undertake the tasks specified in the ROD. The NMED, however, is an agency of a sovereign State, and NMED could, at some future time, decide not to continue these actions. If NMED should discontinue its actions, the EPA will then evaluate its options under the NCP and CERCLA to ensure that human health and the environment are protected.

11.2.9 Community Acceptance

The City of Albuquerque has worked very closely with EPA and NMED in the investigation of the Site and in developing this ROD. The City of Albuquerque has expressed its support for Alternative G-5, the selected remedy. The City does not believe Alternative G-1, No Action, provides adequate protection of human health and the environment. Also, the City will not support Alternative G-4 Point-of-Use Treatment, as a stand-alone option for addressing the ground water contamination. The City of Albuquerque has documented its support for issuance of the Proposed Plan and the ROD outlining the Selected Remedy (G-5, Hot Spot Treatment with Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component) in a letter to the EPA dated May 7, 2001.

In general, the public comment on the Proposed Plan was favorable and the EPA did not receive specific adverse comments on the proposed alternative, G-5, which is now the selected remedy under this ROD. Most of the public comments were questions about implementation of the proposed alternative, or about risk posed by the Site prior to completion of the remedial action. The responses to these comments are included in Appendix A, the Responsiveness Summary.

12.0 The Selected Remedy

12.1 Summary of the Rationale for the Selected Remedy

Selected Soil Remedy

Alternative S-3, Soil Vapor Extraction, is the selected soil remediation alternative. Alternative S-3 is selected because it provides the best balance of tradeoffs among the other alternatives with respect to the nine criteria evaluated, and because S-3 will achieve substantial risk reduction by treating the entire volume of the source soil materials constituting a low-level, but significant threat at the Site. Alternative S-3 is the Selected Alternative because of its high level of protection of human health and the environment, because of its permanence, and because of its high level of overall reductions in the mass, volume, and toxicity of contaminants through treatment, compared to its relatively low costs.

Selected Ground Water Remedy

Overall, for remediation of the ground water, Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component, provides the best balance of tradeoffs among the alternatives with respect to the nine criteria evaluated. Alternative G-5 is the Selected Alternative because it offers the highest degree of protection of human health and the environment due to reduction of the mass and volume of contaminants in all three aquifer zones in the shortest timeframe. In addition, this alternative achieves this high degree of protectiveness and permanence for a present worth cost of about $6.9 million, which is in the middle of the range of the costs of all the alternatives. Alternative G-5 is implementable. Uncertainty associated with costs for treatment of the hot spot in the event that waste volume is greater than anticipated is a downside for the selected G-5 ground water remedy; however, G-5 costs are not expected to exceed those for the other remedies, even if additional hot spots are treated beyond those estimated.

12.2 Description of the Selected Remedy

The major components of the Selected Remedy, Soil Vapor Extraction (Alternative S-3) plus Hot Spot Treatment and Shallow, Intermediate, and deep Zone Restoration through Pump and Treat Technology with a Reinjection Component (Alternative G-5), include:

- Soil Vapor extraction of contaminated soil located on the source area property,
- Hot Spot remediation of shallow and intermediate ground water contamination beneath the source area property through the injection of either a bioremediation additive, or a chemical oxidant into the subsurface in order to degrade the contaminants of concern in place,

- C Extraction and remediation of contaminated shallow, intermediate, and deep zone ground water with a pump and treat system, coupled with a reinjection component of a portion of the treated water,

- C Implementation of a restrictive covenant on the source property in order to maintain the asphalt cap until remediation goals for the soil are met,

- C Implementation of ground water use restrictions until remediation goals for ground water are met, and

- C Annual ground water monitoring to assess the extent of contamination and risks to human health.

The Site contamination will be addressed as one operable unit through the remedy selected in this ROD. This response action will address the principal threat wastes (the PCE and TCE in ground water) and the low-level, but significant, threat wastes (the PCE and TCE in soils that could re-contaminate ground water).

The following detailed description of the Selected Remedy components is based on preliminary conceptual designs used in the Feasibility Study for costing purposes. Actual location of remedy components and design specifications (i.e., number of wells and injection points, size of piping, placement of treatment plant, etc.) will be determined during the Remedial Design phase, which will commence as soon as possible.

Soil Vapor Extraction

Soil vapor extraction (SVE) is a vadose zone remediation technology that extracts soil gas containing contaminants from the subsurface, and treats the contaminants above ground. The conceptual SVE design for vadose zone soil used for costing purposes in the Feasibility Study includes 12 vapor extraction wells installed on the former Elite Cleaners/ Sunshine Laundry property. Each well will be two inches in diameter, and will be constructed of Schedule 40 polyvinyl chloride (PVC). The wells will be screened from approximately 10 to 38 feet below grade in the unsaturated zone. Ground water in this area is encountered at approximately 38 feet below grade. An asphalt cover is present at the property, and the asphalt will minimize the effects of atmospheric air entering the vapor extraction wells. A piping network below ground will route soil gas from the extraction wells through a regenerative blower and then through a vapor-phase granular-activated carbon (GAC). A water knock-out will be connected to the blower unit to collect condensate from the soil gas stream. Effluent from the vapor-phase GAC will be discharged to the atmosphere. The total vapor flow rate is estimated approximately 500 cubic feet (ft^3) per minute (ft^3/min), or a little more than 40 ft^3/min per well.

Design of Alternative S-3 will take approximately three to six months. Procurements, mobilization, and installation will take another three months. Alternative S-3 is expected to operate for approximately two years to reach remedial action objectives.

Hot Spot Treatment

Alternative G-5 combines the use of a hot spot treatment technology and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component. Hot spot treatment will occur first, followed by pump and treat technology with a reinjection component. A final hot spot treatment approach - based on chemical oxidation or enhanced bioremediation- will be selected during pilot testing conducted as part of the Remedial Design phase. For costing purposes, hot spot enhanced bioremediation was selected to allow for a more conservative cost estimate.

Hot spot treatment will focus on TCE contamination in the southern portion of the Wells Fargo parking lot (former Elite Cleaners/Sunshine Laundry property). The dimensions of this treatment will be approximately 300 by 225 feet. The vertical depth interval that will be treated is approximately 50 to 106 feet bgs. A grid system will be set up to inject the treatment fluid evenly over the selected treatment zone. The treatment fluid will be injected into the subsurface through direct push technology, most likely a cone penetrometer (CPT) due to the depth of the treatment interval. For each temporary injection point, the CPT hydraulically will push a steel rod to the desired depth of 106 feet bgs. As the CPT is retrieved from the subsurface, the treatment fluid will be injected at regular intervals throughout the treatment zone of 50 to 106 feet bgs. When the CPT rod reaches approximately 50 feet bgs, the rod will be withdrawn from the subsurface, decontaminated, and used to install the next temporary injection point. This process will be repeated until all temporary injection points are installed. The injection process is estimated to last a total of approximately 35 to 80 days. It is assumed that two injection periods will be required to reduce TCE concentrations to below MCLs.

Extraction and Injection of Ground Water

The pump and treat technology portion of Alternative G-5 will consist of withdrawal of contaminated ground water from the shallow, intermediate, and deep zones with above ground treatment and reinjection of the treated water into the intermediate and deep zones. The proposed shallow and intermediate zone pump and treat system used for cost estimates in the Feasibility Study will consist of five extraction wells: two in the shallow zone near wells FHMW-1 and FHMW-4, and three in the intermediate zone. The purpose of the wells in the shallow zone will be primarily to prevent vertical and horizontal migration of any petroleum hydrocarbon (BTEX) plume in the vicinity of monitoring wells FHMW-4 and DM-9 and to remove ground water containing slightly elevated levels of TCE (6 μg/L) near well FHMW-4. One of the intermediate zone extraction wells will be placed near the corner of Roma Avenue and Third Street in the center of the intermediate zone contaminant plume, while the other two intermediate zone extraction wells will be placed along First Street to capture the downgradient edge of the intermediate zone plume.

All shallow and intermediate extraction wells will be constructed of 6-inch-diameter SCH 40 PVC casing installed in 12-inch-diameter boreholes. Shallow zone wells will be installed to a depth of approximately 60 feet and will be screened from approximately 40 to 60 feet bgs. Intermediate zone wells will be installed to a total depth of approximately 120 feet and will be screened between approximately 60 to 120 feet bgs. Four-inch electric submersible pumps be used to extract ground water from the aquifer. All piping from the extraction wells to the treatment building will be buried approximately 3 feet below grade with the use of a trenching machine.

The combined extraction rate for the two shallow zone wells will be 20 gallons per minute (gpm). Extraction rates for the individual intermediate zone wells will be 20 gpm for the well near Roma and Third Street, and 25 gpm each for the two wells along First Street, for a combined intermediate zone flow rate of 70 gpm.

The deep zone pump and treat technology will consist of three extraction wells. Two deep zone extraction wells will be installed along Broadway Avenue between Roma Avenue and Marquette Avenue. The remaining deep zone extraction well will be installed near the corner of Arno Street and Roma Avenue. The purpose of these wells will be to contain the deep ground water contaminant plume and prevent further downgradient migration in this zone. The extraction rate for each deep zone well will be 100 gpm, for a total combined flow of 300 gpm.

All deep zone extraction wells will be constructed of 10- or 12-inch-diameter casing installed in 16-inch-diameter boreholes. Boreholes will be installed by mud rotary methods. Deep zone wells will be installed to a total depth of approximately 550 feet bgs and will be screened between approximately 120 to 550 feet bgs. Six-inch electric submersible pumps will be used to extract ground water from the aquifer. All piping that extends from the extraction wells to the treatment building will be buried approximately 3 feet below grade with the use of a trenching machine.

Ground water reinjection will occur through 3 intermediate zone wells and 4 deep zone wells. The intermediate zone injection wells, screened between 60 and 120 feet bgs, will be installed along Fifth Street and the corner of Roma Avenue and John Street. The deep injection wells will be screened from 120 to 550 feet bgs, and will be installed along Edith Boulevard and between Second and Third Streets. Intermediate zone injection wells will have flow rates of between 20 and 30 gpm. Deep zone injection wells will have flow rates of between 50 and 75 gpm.

Extracted ground water from wells screened in the shallow, intermediate, and deep zones will be directed to an air stripper through underground piping. Prior to the air stripper, ground water will be pre-treated with a sequestrant to prevent fouling of the air stripper. Emissions from the air stripper will be treated by vapor-phase GAC prior to discharge to the atmosphere. Liquid-phase effluent from the air stripper will be polished by liquid-phase GAC. A portion of the discharge from this option will be reinjected into the aquifer through the previously mentioned injection wells. The remainder of the discharge from the above ground water treatment system will be disposed, probably to the City of Albuquerque storm water system. A final selection of the discharge option will be made during the design phase, and other discharge alternatives, such as reuse, will also be considered.

Design of Alternative G-5, including planning, numerical modeling, and pilot/laboratory testing, is expected to take approximately 6 months. Procurement, mobilization, and installation will take another 3 to 6 months. The pump and treat technology will be in operation for at least 15 years.

Institutional Controls

To protect ground water from continuing to be contaminated by the soil at the source property, NMED intends to enter into an enforceable agreement with the property owner and leasee to ensure the asphalt cap is maintained until remediation goals for the soil are met. The asphalt parking lot acts as a cap to retard the infiltration of rainwater from washing contaminants down from the soil into the ground water. Wells Fargo Bank management has already stated that they intend to keep the parking lot intact for the next several years. The only foreseeable disturbance of the asphalt cap at this time is for installation of the soil vapor extraction system and for the hot spot treatment planned as part of this ROD. These disturbances to the asphalt cap will be temporary, and will be patched upon placement of the remediation system components.

To protect human health from the existing ground water contamination, a ground water use restriction will be implemented. NMED will request the New Mexico Office of the State Engineer (OSE) to issue a restrictive order for the portion of the contaminated aquifer (currently defined as Lomas Boulevard to the north, Sixth Street to the west, Tijeras Avenue/Dr. Martin Luther King Avenue to the south, and Elm Street to the east). The OSE would be responsible for issuing the order and enforcing the restriction. The ground water use restriction is only applicable to new requests for water well permits; the restrictive use order cannot be enforced against existing water well permit holders. The ground water use restriction will be in place until remediation goals for the ground water are met.

Annual Ground Water Monitoring

Ground water monitoring from site-wide monitoring wells will be conducted annually to track the location of the plume, monitor the performance of the remediation system, and to ensure protection of human health. Ground water monitoring will include water level measurements and ground water sampling for VOCs in order to observe the direction and rate of contaminant migration. An estimated 30 wells could be necessary to adequately characterize and monitor the ground water contamination.

12.3 Summary of the Estimated Remedy Costs

Tables 7 and 8 show detailed cost estimate summaries for the selected soil and ground water remedies. The cost summary is based on the construction and annual O&M activities anticipated to implement the major components of the Selected Remedy. A 7% discount factor was used to derive these tables. The information in these cost estimate summary tables is based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes in cost for the Selected Remedy will be documented in the form of a memorandum in the Site file, an Explanation of Significant Differences (ESD), or a ROD amendment depending upon NCP requirements for the change in question. The cost estimate in this ROD is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

12.4 Expected Outcomes of the Selected Remedy

The Selected Remedy (Alternatives S-3 and G-5) meets the remedial action objectives in all of the affected media:

> ***Soil**:* The Selected Remedy will address significant low-level threat wastes in the soil medium through the treatment of the soil by soil vapor extraction to concentrations below the remediation goal.
>
> The primary expected outcome of implementation of the soil portion of the Selected Remedy is that the Site soils will no longer present an unacceptable risk of re-contaminating the ground water, and that the Site will continue to be suitable for residential and commercial development.
>
> ***Ground Water**:* The Selected Remedy will address the principal threat waste at the Site, COCs primarily including TCE, which is a major source of the Site ground water contamination, through removal of the COCs from the subsurface using hot spot treatment at the source area along with a pump and treat extraction and re-injection system for the shallow, intermediate, and deep portions of the aquifer. The Selected Remedy requires periodic environmental monitoring of the ground water to ensure that contamination is not migrating to non-contaminated areas, and it requires ground water use restrictions to protect human health until remediation goals are met. Under the EPA's Selected Remedy, the expected outcome is that the threat to human health posed by contaminated ground water at the Site will be addressed through treatment of the ground water to acceptable concentrations.
>
> The primary expected outcome of implementation of the ground water portion of the Selected Remedy is that the COCs in ground water will no longer act as a source of contamination of a drinking water resource, and that the Site will continue to be suitable for residential and commercial development.

The remediation goals and performance standards for the Selected Remedy, and the justification for their selection, are included in the Remedial Action Objectives and Goals section of this ROD.

13.0 Statutory Determinations

The Selected Remedy for the Fruit Avenue Plume Site is consistent with CERCLA and, to the extent practicable, the NCP. The Selected Remedy is protective of human health and the environment, will comply with ARARs, and is cost effective. In addition, the Selected Remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

13.1 Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through soil vapor extraction of contaminated soils, hot spot treatment of COCs, extraction and treatment of COCs, and institutional controls. More specifically, soil vapor extraction of contaminated soils will eliminate the risk from these soils as a potential source of ground water contamination. Hot spot treatment, and extraction and treatment of COCs in ground water, will remove the source of ground water contamination, eliminating potential risks to human health in this media. Institutional controls, in the form of ground water use restrictions imposed through a State Engineer's order, will control the risk to human health from possible ingestion or dermal exposure to Site ground water until remediation goals are met.

The Selected Remedy will reduce potential human health risk levels from exposure to Site ground water such that they do not exceed the EPA's acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk for the ground water. It will also reduce the non-carcinogenic hazards to below a level of concern (*i.e.*, to a level at which the HI will not exceed 1). The selected remedy will reduce potential human health risk levels to protective ARARs levels (*i.e.*, the remedy will comply with ARARs). Implementation of the Selected Remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

13.2 Compliance with ARARs

The Selected Remedy for ground water -- treating the hot spot area with either enhanced bioremediation or chemical oxidation, and pumping and treating the ground water by air stripping and carbon adsorption, complies with all ARARs. The ARARs are presented below and discussed in more detail in Section 3 of the Feasibility Study.

Chemical, Location, and Action-Specific ARARs include the following:

- Safe Drinking Water Act MCLGs and MCLs (40 CFR Part 141), which specify acceptable concentration levels in ground water that serves as a potential drinking water supply;
- Clean Water Act (CWA) Regulations (40 CFR Part 403);

- Clean Air Act requirements for emissions from air stripping units.

Table 9 summarizes ARARs. Some of these ARARs might not be invoked depending on the final Remedial Design decisions for the Selected Remedy.

In implementing the Selected Remedy, the EPA and the State have agreed to consider a non-binding criterion that is a To Be Considered (TBC). The TBC used for development of the soil remedial action objective includes calculated protective concentrations for TCE and PCE in soil such that the contaminated soil will not continue to contaminate ground water above MCLs. These concentrations were developed from the EPA soil guidance calculations, as described in Section 9.2 of this ROD.

13.3 Cost-Effectiveness

The Selected Remedy is cost effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR § 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The present worth cost of Alternative S-3, Soil Vapor Extraction, and Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component (the Selected Remedy), is $223,280 and $6.9 million, respectively. The cost for S-3 is the lowest of the soil alternatives that considered active treatment of the soil contamination. The cost for the ground water portion of the Selected Remedy (G-5) is moderately greater than the present worth cost of Alternative G-2 at $5.5 million, and is less than ground water Alternatives G-4 and G-3. The Selected Remedy offers by far the highest degree of protectiveness and overall effectiveness because it aggressively recovers and treats COCs in the shortest time period. The benefits of the Selected Remedy compared to all the other alternatives are much higher than the incremental increase in cost over the other alternatives.

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

The EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site. The Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, considering State and community acceptance, while also considering the statutory preference for treatment as a principal element and the bias against off-site treatment and disposal.

The Selected Remedy utilizes treatment to address the principal threat waste at the Site, the COCs in ground water. The COCs in ground water will be treated through treatment of the hot spot with either biodegradation or chemical oxidation, and through pump and treat technology. Once extracted, the COCs will be treated using air stripping, followed by granular activated carbon filtration. A portion of the treated ground water will be reinjected to optimize the pump and treat system and speed the remediation. The EPA expects that treatment of the COCs in ground water will restore the aquifer to a useable condition.

The low level threats at the Site posed by soil contaminated with either PCE or TCE will be treated through soil vapor extraction, air stripping, and if need be, granular activated carbon filtration. The EPA expects the treatment of the COCs in soil will meet the remedial action objective for the soil, and protect ground water from being re-contaminated by the soil.

13.5 Preference for Treatment as a Principal Element

By extracting the COCs in soil and ground water through soil vapor extraction or pump and treat technology and treating the extracted soil vapor or ground water through air stripping and granular activated carbon filtration, and by treating contaminants in the subsurface within the hot spot area through enhanced bioremediation or chemical oxidation, the Selected Remedy addresses principal and low-level threats posed by the Site through the use of treatment technologies. By utilizing treatment as the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

13.6 Five-Year Review Requirements

Upon completion of the remedy, no hazardous substances will remain within the Site at concentration levels that prevent unlimited use and unrestricted exposure. However, because this remedy will require more than five years to achieve these levels, EPA will review the remedy every five years until remediation goals are achieved.

14.0 Documentation of Significant Changes

The Proposed Plan for the Fruit Avenue Plume Site was released for public comment on June 29, 2001. The Proposed Plan identified Alternative S-3, Soil Vapor Extraction, and Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component, as the Preferred Alternative for soil and ground water remediation. The EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the Selected Remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

FIGURES

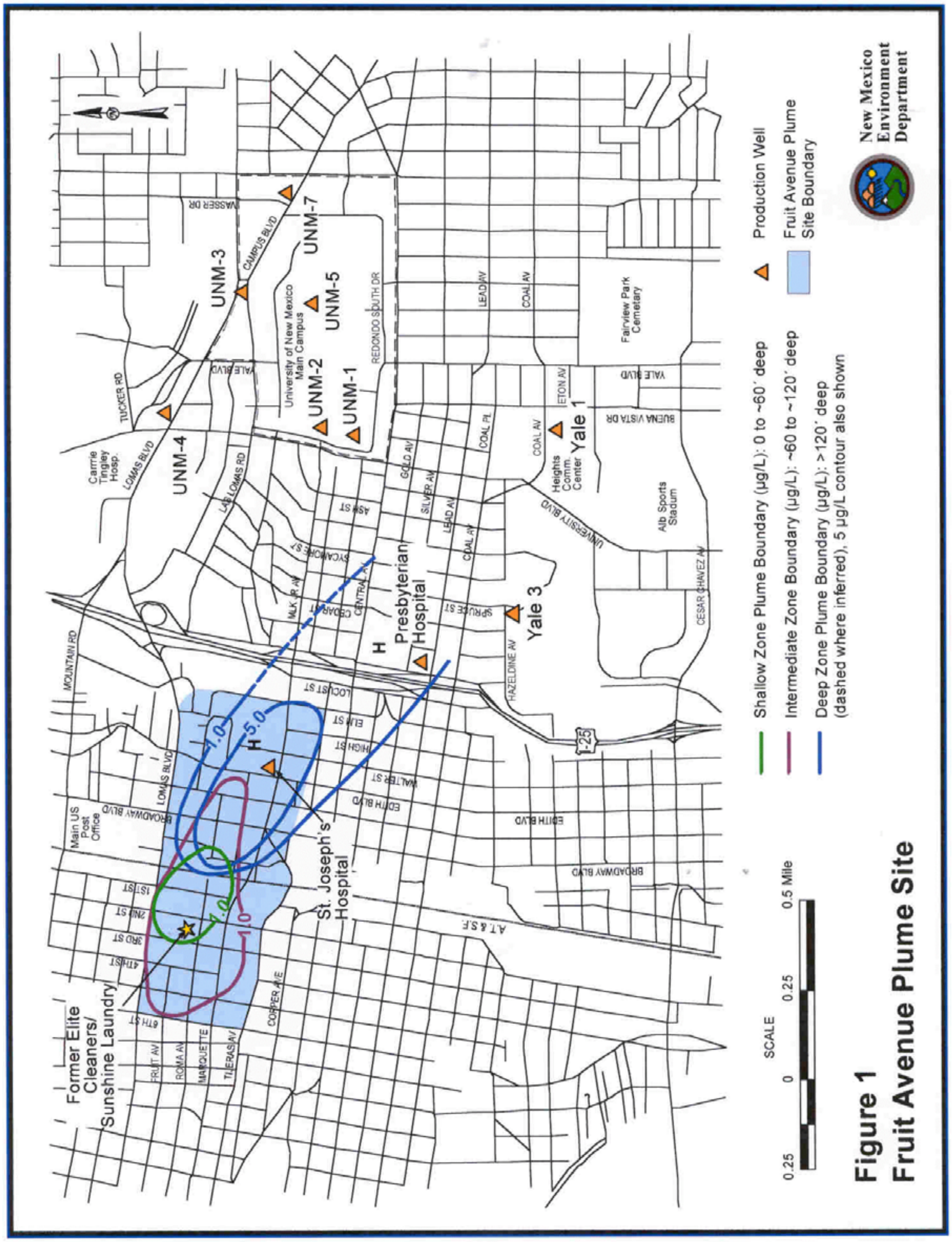

Figure 1
Fruit Avenue Plume Site

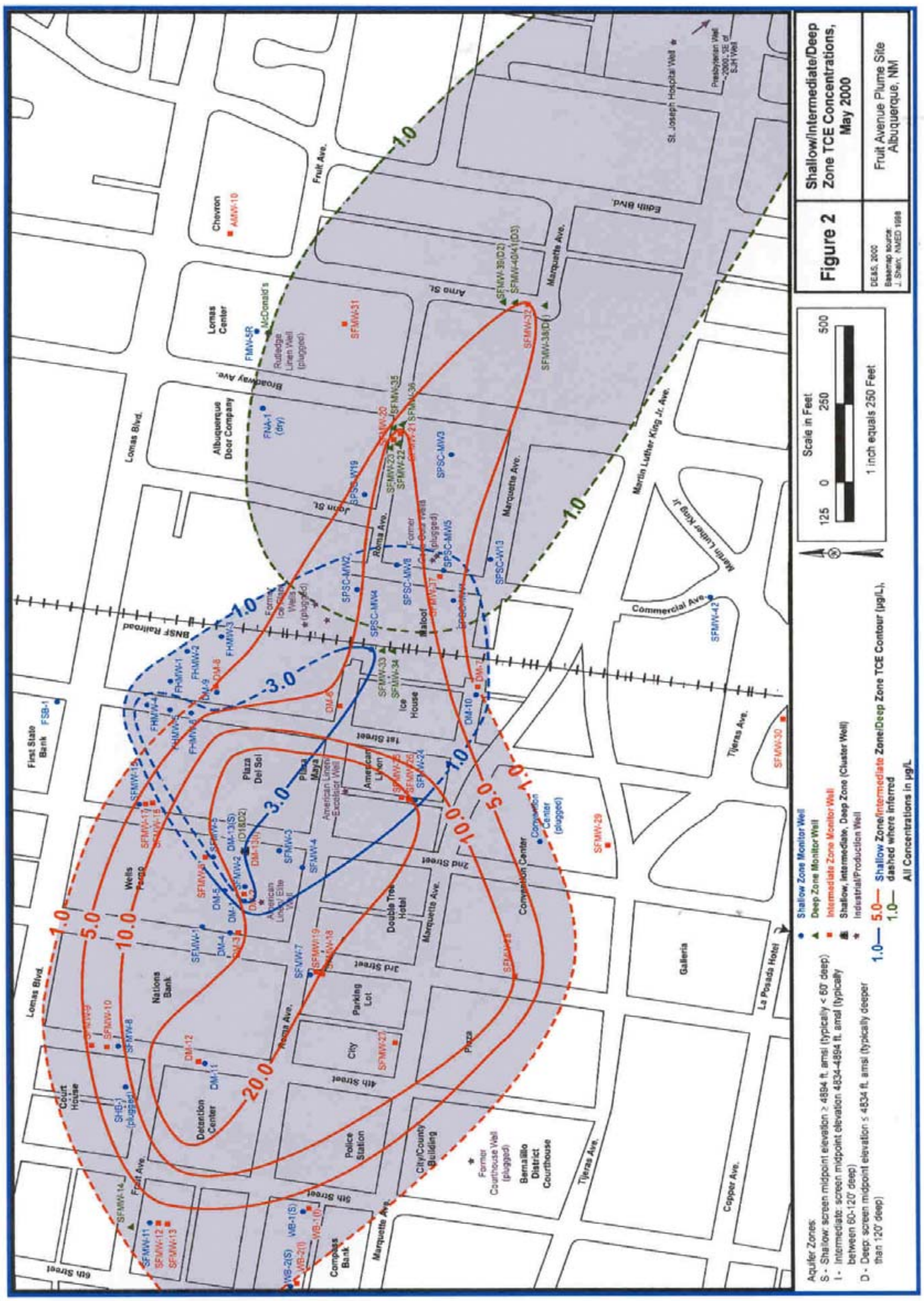

Figure 2
Shallow/Intermediate/Deep Zone TCE Concentrations, May 2000
Fruit Avenue Plume Site
Albuquerque, NM
Scale in Feet
125 0 250 500
1 inch equals 250 Feet
Aquifer Zones:
S - Shallow: screen midpoint elevation ≥ 4894 ft. amsl (typically < 60' deep)
I - Intermediate: screen midpoint elevation 4834-4894 ft. amsl (typically between 60-120' deep)
D - Deep: screen midpoint elevation ≤ 4834 ft. amsl (typically deeper than 120' deep)
Shallow Zone Monitor Well
Deep Zone Monitor Well
Intermediate Zone Monitor Well
Shallow, Intermediate, Deep Zone (Cluster Well)
Industrial/Production Well
Shallow Zone/Intermediate Zone/Deep Zone TCE Contour (µg/L), dashed where inferred
All Concentrations in µg/L

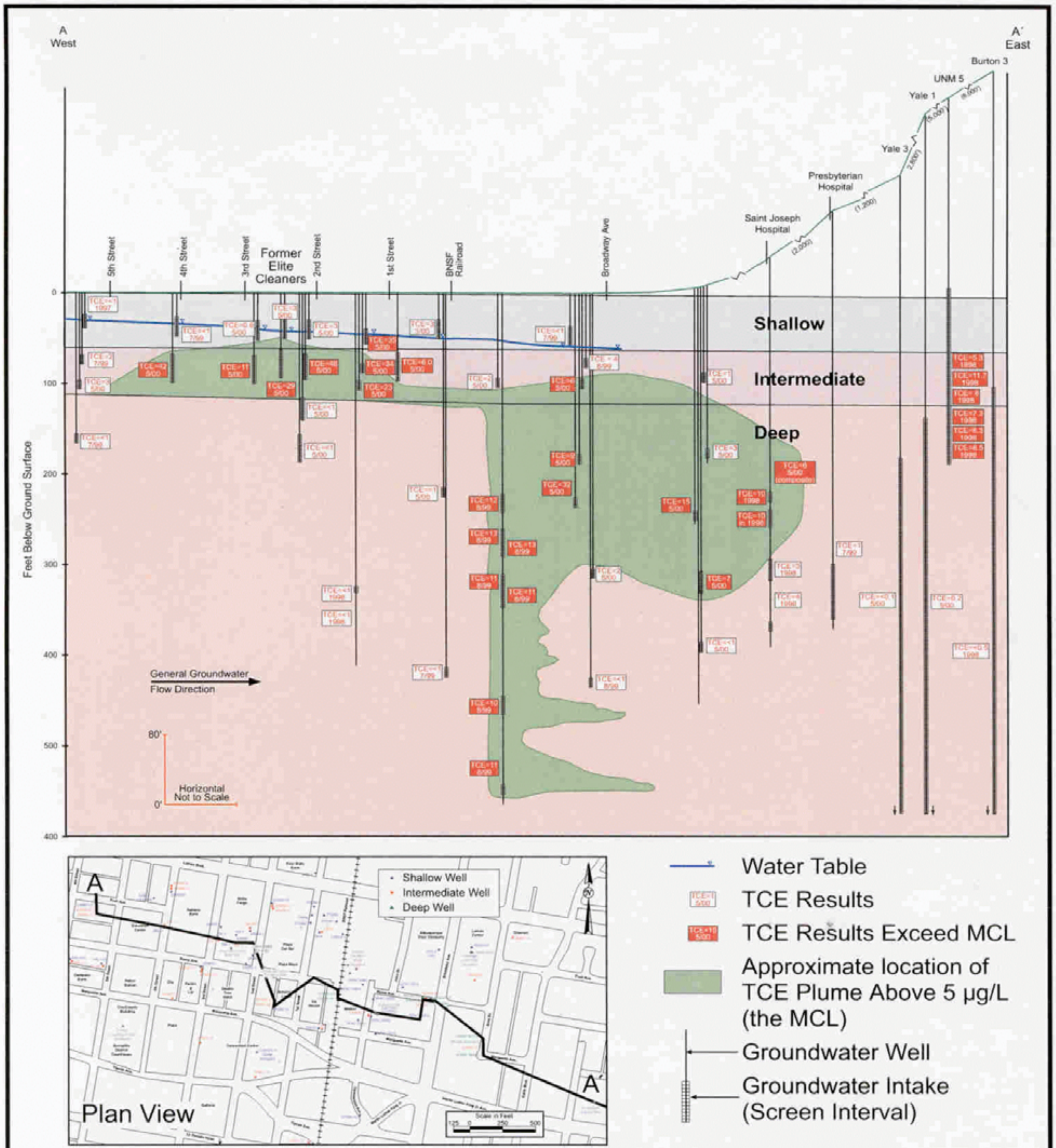

Figure 3
Schematic Cross-Section of TCE Plume at the Fruit Avenue Plume Site

New Mexico Environment Department

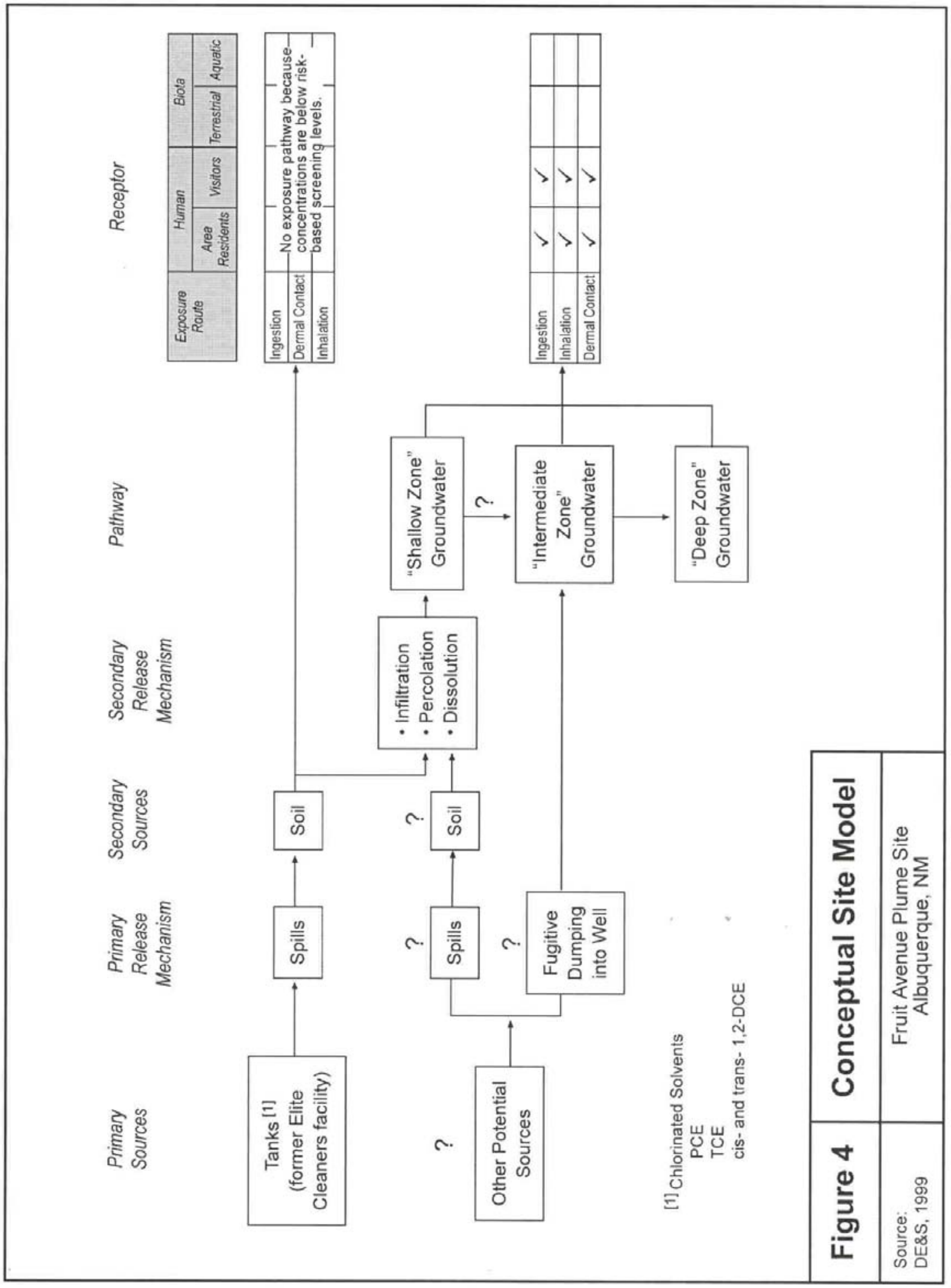

Figure 4 Conceptual Site Model

TABLES

Table 1

Fruit Avenue Plume

Summary of Chemicals of Concern and me Medium-specific Exposure Point Concentrations

Scenario Timeframe: Current and Future

Exposure Point	Chemical of Concern	Conc. Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Ground water at tap								
	TCE	10	66	ug/l	13/13	29.3	ug/l	Avg.
	PCE	10	15	ug/l	(2/2)	15	ug/l	Max
	Cis 1,2 DCE	4	11	ug/l	13/13	8	ug/l	Avg.
	Trans 1,2 DCE	1	4	ug/l	(9/9)	2.2	ug/l	Avg.
Ground water Vapors at shower head	TCE	10	66	ug/l	13/13	29.3	ug/l	Avg.
	PCE	10	15	ug/l	(2/2)	15	ug/l	Max
	Cis, 1,2 DCE	4	11	ug/l	13/13	8	ug/l	Avg.
	Trans 1,2 DCE	1	4	ug/l	(9/9)	2.2	ug/l	Avg.
Ground water Homegrown vegetables and fruit								
	TCE	10	66	ug/l	13/13	29.3	ug/l	Avg.
	PCE	10	15	ug/l	(2/2)	15	ug/l	Max
	Cis, 1,2 DCE	4	11	ug/l	13/13	8	ug/l	Avg.
	Trans 1,2 DCE	1	4	ug/l	(9/9)	2.2	ug/l	Avg.

KEY

TCE= Trichloroethene

PCE= Tetrachlorethene

Cis 1,2 DCE = cis-1,2 -dichloroethene

trans 1,2 DCE = trans -1,2 -dichloroethene

Avg.= Arithmetic average(mean) of the sampled data

Max = Only two samples were included, no statisical medium EPC values could be completed, so the maximum detected conc. was used

Summary of Chemicals of Concern and Medium Specific Exposure Point Concentrations

This table presents the chemicals of concern (COCs) and exposure point concentrations for each of the COCs that could be detected in a worst scenario for ground water at the drinking water tap, ground water as vapors at the shower head, and ground water used for homegrown vegetables and fruit (i.e, the concentration that will be used to estimate the exposure and risk from each COC) . This table includes the range of concentration detected for each COC, as well as the frequency of detection in ground water samples, the exposure point concentration (EPC), and the basis for derivation of the EPC.

TABLE 2

CANCER TOXICITY DATA SUMMARY

FRUIT AVENUE PLUME SITE

Pathway: Ingestion (oral), Dermal

Chemical of Potential Concern	Cancer Slope		Dermal Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
Tetrachloroethylene; (Perchloroethylene)	5.20E-02		5.20E-02	$(mg/kg\text{-}day)^{-1}$	C-B2	(1)	2000
1,2-Dichloroethylene (cis-)	N/A		N/A	N/A	D/Cannot be determined	IRIS/RAIS	2000
1,2-Dichloroethylene (trans-)	N/A		N/A	N/A	D/Cannot be determined	RAIS	2000
Trichloroethylene (TCE)	1.10E-02		7.33E-02	$(mg/kg\text{-}day)^{-1}$	C-B2	(1)	2000

Pathway: Inhalation

Chemical of Potential Concern	Unit Risk	Units	Inhalation Cancer Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
Tetrachloroethylene; (Perchloroethylene)	5.80E-04	$(mg/m^3)^{-1}$	2.00E-03	g/kg-day)-	C-B2	(1)	2000
1,2-Dichloroethylene (cis-)	N/A	N/A	N/A	N/A	D/Cannot be determined	IRIS/RAIS	2000
1,2-Dichloroethylene (trans-)	N/A	N/A	N/A	N/A	D/Cannot be determined	RAIS	2000
Trichloroethylene (TCE)	1.7E-03	$(mg/m^3)^{-1}$	6.00E-03	mg/kg-day)-	C-B2	(1)	2000

Key

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

RAIS = Risk Assessment Information System, Chemical-Specific Toxicity Values, July, 2000 (DOE Center of Risk Excellence)

(1) Oral and Inhalation Cancer Slope Factors and Unit RIsk values were tak(Assessment Issue Papers" provided by the Superfund Technical Supp(These values have not been through an EPA formal review and are therefore, not an EPA verified assessment. They are, however, the best data available but do present an additional level of uncertainty. Weight of evidence is taken from the same document.

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data

B2 - Probable human carcinogen - indicates sufficient evidence in inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

SUMMARY OF TOXICITY ASSESSMENT

This table provides carcinogenic risk information which is relevant to the contaminants of concern in ground water. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Absorption values were obtained from a variety of sources and applied to the dermal slope factor. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants.

TABLE 3
N0N-CANCER TOXICITY DATA SUMMARY
FRUIT AVENUE PLUME SITE

Pathway: Ingestion (oral) Dermal

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY)
Tetrachloroethylene; (Perchloroethylene)	Chronic	1.00E-02	mg/kg-day	1.00E-02	mg/kg-day	Liver	1000	(A)	(A)
	Subchronic	1.00E-01	mg/kg-day	1.00E-01	mg/kg-day	Liver	100	HEAST	07/01/97
1,2-Dichloroethylene (cis-)	Chronic	1.00E-02	mg/kg-day	1.00E-02	mg/kg-day	Blood	3000	HEAST	07/01/97
	Subchronic	1.00E-01	mg/kg-day	1.00E-01	mg/kg-day	Blood	300	HEAST	07/01/97
1,2-Dichloroethylene (trans-)	Chronic	2.00E-02	mg/kg-day	2.00E-02	mg/kg-day	Blood	1000	IRIS	08/08/00
	Subchronic	2.00E-01	mg/kg-day	2.00E-01	mg/kg-day	Blood	100	HEAST	08/01/97
Trichloroethylene (TCE)	Chronic	6.00E-03	mg/kg-day	9.00E-04	mg/kg-day	Liver/Kidney	Not Reported	RAIS	08/08/00

Inhalation

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC (1)	Units	Adjusted Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors (2)	Sources of RfC:RfD: Target Organ	Dates (3) (MM/DD/YY)
Tetrachloroethylene; (Perchloroethylene)	Chronic	6.00E-01	mg/m^3	1.10E-01	mg/kg-day	(4)	1000	(6)	(3)
	Subchronic	3.50E-01	mg/m^3	1.00E-01	mg/kg-day	Liver	100	(2)	(3)
1,2-Dichloroethylene (cis-)	Chronic	3.50E-02	mg/m3	1.00E-02	mg/kg-day	Liver	3000	(7)	(3)
	Subchronic	3.50E-01	mg/m3	1.00E-01	mg/kg-day	Liver	300	(2)	(3)
1,2-Dichloroethylene (trans-)	Chronic	7.00E-02	mg/m3	2.00E-02	mg/kg-day	Liver	1000	(8)	(3)
	Subchronic	7.00E-01	mg/m3	2.00E-01	mg/kg-day	Liver	100	(2)	(3)
Trichloroethylene (TCE)	Chronic	2.10E-02	mg/m3	6.30E-03	mg/kg-day	(5)	Not Reported	(9)	(3)

Key (A) Oral RfD-IRIS; Target Organ-RAIS; Uncertainty-IRIS. Both searched 08/08/00

(1) Equation used for RfC derivation: RfC (mg/m^3) = RfD (mg/kg-day) x 70 kg x 1/20 m^3/day. (EPA, 1998)

(2) Values not provided by any other documents were taken from the Oral Non-Cancer Toxicity Data (EPA, 1998).

(3) Date RAIS was searched - 08/08/00; date EPA, 1999 was searched - 08/22/00.

(4) Central Nervous System/Liver/Kidney

(5) Central Nervous System/Liver/Kidney/Cariovascular System/Hematopoietic System/Reproduction

(6) RfC - RAIS; RfD - EPA, 1999; Target Organ - RAIS.

(7) RfC - Route to route extrapolation; RfD - EPA, 1999; Target Organ - RAIS.

(8) RfC - Route to route extrapolation; RfD - EPA, 1999; Target Organ - RAIS.

(9) RfC - Route to route extrapolation; RfD - EPA, 1999; Target Organ - RAIS.

NA-Not applicable

Sources:

EPA, 1998. EPA Region 6 Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities Peer Review Draft, Appendix A

EPA, 1999. EPA Region 6 Human Health Medium - Specific Screening Levels

RAIS: Risk Assessment Information System, Chemical-Specific Toxicity Values, July, 2000 (DOE Center for Risk Excellence).

SUMARY OF TOXICITY ASSESSMENT

This table provides available non-carcinogenic risk information which is relevant to the COCs in ground water. The COCs have data indicating their potential for adverse non-carcinogenic health effects in humans.

TABLE 4

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

FRUIT AVENUE PLUME SITE

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water	Tetrachloroethylene; (Perchloroethylene)	3.13E-06	--	6.82E-07	3.82E-06	Tetrachloroethylene; (Perchloroethylene)	liver	1.69E-02	--	5.33E-04	1.74E-02
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	blood	9.00E-03	--	7.73E-04	9.78E-03
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	blood	1.24E-03	--	1.07E-04	1.35E-03
			Trichloroethylene (TCE)	1.30E-06	--	1.93E-06	3.23E-06	Trichloroethylene (TCE)	liver	5.50E-02	--	3.15E-02	8.65E-02
			(Total)	4.43E-06	--	2.61E-06	7.04E-06	(Total)		8.21E-02	--	3.29E-02	1.15E-01

Total Risk Across Groundwater	7.04E-06
Total Risk Across All Media and All Exposure Routes	7.04E-06
Total Hazard Index Across All Media and All Exposure Routes	1.15E-01
Total Liver HI =	1.04E-01
Total Blood HI =	1.11E-02

TABLE 4

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

FRUIT AVENUE PLUME SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water	Tetrachloroethylene; (Perchloroethylene)	1.10E-05	--	4.05E-05	5.14E-05	Tetrachloroethylene; (Perchloroethylene)	liver	4.93E-02	--	2.64E-02	7.56E-02
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	blood	2.63E-02	--	3.82E-02	6.45E-02
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	blood	3.63E-03	--	5.27E-03	8.90E-03
			Trichloroethylene (TCE)	4.54E-06	--	1.15E-04	1.19E-04	Trichloroethylene (TCE)	liver	1.61E-01	--	--	1.61E-01
									skin	--	--	1.56E+00	1.56E+00
			(Total)	1.55E-05	--	1.55E-04	1.70E-04	(Total)		2.40E-01	--	1.63E+00	1.87E+00
Groundwater	Groundwater	Homegrown Fruits and Vegetables	Tetrachloroethylene; (Perchloroethylene)	8.67E-08	--	--	8.67E-08	Tetrachloroethylene; (Perchloroethylene)	liver	3.89E-04	--	--	3.89E-04
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	blood	1.23E-03	--	--	1.23E-03
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	blood	7.60E-05	--	--	7.60E-05
			Trichloroethylene (TCE)	1.34E-07	--	--	1.34E-07	Trichloroethylene (TCE)	liver	4.74E-03	--	--	4.74E-03
			(Total)	2.21E-07	--	--	2.21E-07	(Total)		6.43E-03	--	--	6.43E-03

TABLE 4

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

FRUIT AVENUE PLUME SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Water Vapors at Shower Head	Tetrachloroethylene; (Perchloroethylene)	--	4.12E-07	--	4.12E-07	Tetrachloroethylene; (Perchloroethylene)	liver/CNS/ kidney	--	4.37E-03	--	4.37E-03
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	liver	--	2.92E-02	--	2.92E-02
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	liver	--	3.22E-03	--	3.22E-03
			Trichloroethylene (TCE)	--	3.09E-06	--	3.09E-06	Trichloroethylene (TCE)	(1)	--	1.91E-01	--	1.91E-01
			(Total)	--	3.50E-06	--	3.50E-06	(Total)		--	2.28E-01	--	2.28E-01

Total Risk Across Groundwater	1.74E-04
Total Risk Across All Media and All Exposure Routes	1.74E-04
Total Hazard Index Across All Media and Exposure Routes	2.10E+00

(1) Central Nervous System/Liver/Kidney/Cardiovasular System/Hematopoietic System/Reproduction

Total Liver HI =	2.74E-01
Total Blood HI =	7.47E-02
Total Skin HI =	1.56E+00
Total CNS/Kidney/Liver HI =	4.37E-03
Total (1) HI =	1.91E-01

TABLE 4

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

FRUIT AVENUE PLUME SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water	Tetrachloroethylene; (Perchloroethylene)	5.79E-06	--	1.72E-05	2.29E-05	Tetrachloroethylene; (Perchloroethylene)	liver	1.30E-02	--	5.59E-03	1.86E-02
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	blood	6.93E-03	--	8.10E-03	1.50E-02
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	blood	9.57E-04	--	1.12E-03	2.08E-03
			Trichloroethylene (TCE)	2.40E-06	--	4.86E-05	5.10E-05	Trichloroethylene (TCE)	liver	--	--	--	--
									skin	--	--	--	--
			(Total)	8.19E-06	--	6.57E-05	7.39E-05	(Total)		2.09E-02	--	1.48E-02	3.57E-02
Groundwater	Groundwater	Homegrown Fruits and Vegetables	Tetrachloroethylene; (Perchloroethylene)	1.11E-07	--	--	1.11E-07	Tetrachloroethylene; (Perchloroethylene)	liver	2.48E-04	--	--	2.48E-04
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	blood	7.92E-04	--	--	7.92E-04
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	blood	4.94E-05	--	--	4.94E-05
			Trichloroethylene (TCE)	1.74E-07	--	--	1.74E-07	Trichloroethylene (TCE)	liver	--	--	--	--
			(Total)	2.85E-07	--	--	2.85E-07	(Total)		1.09E-03	--	--	1.09E-03

TABLE 4

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

FRUIT AVENUE PLUME SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Water Vapors at Shower Head	Tetrachloroethylene; (Perchloroethylene)	--	2.89E-07	--	2.89E-07	Tetrachloroethylene; (Perchloroethylene)	liver/CNS/ kidney	--	1.68E-02	--	1.68E-02
			1,2-Dichloroethylene (cis-)	--	--	--	--	1,2-Dichloroethylene (cis-)	liver	--	1.02E-02	--	1.02E-02
			1,2-Dichloroethylene (trans-)	--	--	--	--	1,2-Dichloroethylene (trans-)	liver	--	1.13E-03	--	1.13E-03
			Trichloroethylene (TCE)	--	2.16E-06	--	2.16E-06	Trichloroethylene (TCE)	(1)	--	N/A	--	N/A
			(Total)	--	2.45E-06	--	2.45E-06	(Total)		--	2.82E-02	--	2.82E-02

Total Risk Across Groundwater	7.66E-05
Total Risk Across All Media and All Exposure Routes	7.66E-05
Total Hazard Index Across All Media and Exposure Routes	6.50E-02
Total Liver HI =	3.02E-02
Total Blood HI =	7.47E-02
Total CNS/Kidney/Liver HI =	1.68E-02
Total (1) HI =	0.00E+00

(1) Central Nervous System/Liver/Kidney/Cardiovasular System/Hematopoietic System/Reproduction

Table 5
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

CRITERIA	**S-1** No Action	**S-2** Institutional Controls	**S-3** Soil Vapor Extraction	**S-4** Excavation + Disposal
OVERALL PROTECTIVENESS	Alternative S-1 is not protective of human health and the environment.	Because the soils do not present a risk to human health, institutional controls will not provide additional protection. However, the risk to ground water posed by contaminated soils will not be reduced.	PCE/TCE mass will be removed from the vadose zone by this alternative.	PCE/TCE mass will be removed from the subsurface by this alternative. This alternative is expected to reduce PCE and TCE concentrations in excavated areas to below RAO-specified levels.
COMPLIANCE WITH ARARs	There are no chemical-specific ARARs for Site soil.	There are no chemical-specific ARARs for Site soil.	There are no chemical-specific ARARs for Site soil.	There are no chemical-specific ARARs for Site soil.
LONG TERM EFFECTIVENESS AND PERMANENCE				
● Magnitude of Residual Risk	RAOs will not be met and contaminated soil will remain in place.	RAOs will not be met and contaminated soil will remain in place.	Risks to ground water quality will be reduced through removal of COC mass in the vadose zone within two years.	Risks to ground water quality will be reduced through removal of COC mass in the vadose zone. Excavation will not remove all of the COCs in the vadose zone because some areas of low level contamination are impractical to excavate.

Table 5
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

CRITERIA	**S-1** No Action	**S-2** Institutional Controls	**S-3** Soil Vapor Extraction	**S-4** Excavation + Disposal
● Adequacy and Reliability of Controls	No activities are planned to identify and manage long-term risks.	No activities are planned to identify and manage long-term risks.	No activities beyond confirmation sampling are planned to identify and manage long-term risks. Sampling of soils should be adequate to confirm that RAOs have been met.	No activities are planned to identify and manage long-term risks. Sampling of soils should be adequate to confirm that RAOs have been met within the excavated areas.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
● Treatment Used	None	None	Vapor Extraction, Volatilization, Vapor-Phase Activated Carbon	Excavation, Off-Site Treatment-Disposal
● Materials Treated	None	None	Vapor-phase and sorbed-phase PCE & TCE.	Vapor-phase and absorbed-phase PCE & TCE.
● Amount of Hazardous Materials Treated or Destroyed	This Alternative does not treat any contaminated soil.	This Alternative does not treat any contaminated soil.	This alternative will treat nearly 100% of the contaminated soil.	This alternative does not treat low-level contaminated soil because it is impractical to excavate entire volume of soil contaminated at low levels.

Table 5
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

CRITERIA	**S-1** No Action	**S-2** Institutional Controls	**S-3** Soil Vapor Extraction	**S-4** Excavation + Disposal
● Reduction in Volume	This alternative will result in no reduction in contaminant volume.	This alternative will result in no reduction in contaminant volume.	This alternative will reduce the volume of contaminated soil by approximately 100%.	This alternative will reduce the volume of contaminated soil by approximately 90%, and therefore less effective than S-3. The deeper soil not to be excavated, while above detection limits, has shown low concentrations of COCs that are below RAOs.
SHORT-TERM EFFECTIVENESS				
● Protection of Community and On-Site Workers	No risks are posed to the community and workers.	No significant risks are posed to the community or workers.	There are normal safety risks associated with the construction of this alternative. Health and safety risks can be minimized by adherence to safe work practices.	There are normal safety risks associated with the construction of this alternative. There is a risk of exposure to fugitive VOC gas emissions from excavated soil. Health and safety risks can be minimized by adherence to safe work practices, but significant construction-related risks still exist.

Table 5
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

CRITERIA	**S-1** No Action	**S-2** Institutional Controls	**S-3** Soil Vapor Extraction	**S-4** Excavation + Disposal
● Environmental Impacts	Contaminated soil is not addressed by this alternative.	Contaminated soil is not addressed by this alternative.	SVE will recover soil gas containing COCs, which will be treated with activated carbon. This alternative will generate mininmal residuals that require treatment.	Excavation will generate contaminated soil, requiring off-site treatment and/or disposal.
● Time to Meet RAOs	RAOs will not be met by this alternative.	RAOs will not be met by this alternative.	RAOs will be met within 2 years.	RAOs will be met within 1 year for areas addressed by the excavation.
IMPLEMENTABILITY				
● Technical Feasibility	No action is taken; feasibility is not an issue	No action is taken; feasibility is snot an issue.	This alternative has been successfully implemented at may sites contaminated with PCE. The unsaturated zone geology is favorable for this technology.	This alternative has been successfully implemented at may sites to remove contamination in the saturated and unsaturated zones. The depths of contamination and area of contamination make excavation of all soils above the water table impractical. Excavation in the areas of greatest PCE concentration is feasible.

Table 5
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

CRITERIA	**S-1** No Action	**S-2** Institutional Controls	**S-3** Soil Vapor Extraction	**S-4** Excavation + Disposal
● Administrative Feasibility	No action is taken; feasibility is not an issue	This alternative must be implemented by the property owner.	This alternative is admininstratively feasible because there are no administrative barriers that would prevent the implementation of this alternative.	This alternative is administratively feasible because there are no administrative barriers that would prevent the implementation of this alternative.
● Availability of Resources	No resources are required.	No resources are required.	Services, equipment, and materials for this alternative are readily available.	Services, equipment, and materials for this alternative are readily available.
COST				
● Capital Cost	$0	$0	$160,000	$540,000
● Annual O&M Cost	$0	$2,000	$35,000	$0
● Present Worth Cost	$0	$46,400	$224,000	$540,000
State/City Acceptance	Not Acceptable	Not Acceptable	Acceptable	Acceptable
Community Acceptance				

Table 6
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUND WATER

CRITERIA	*G-1*	G-2	G-3	G-4	G-5
OVERALL PROTECTIVENESS	Alternative G-1 is not protective of human health and the environment.	Concentrations of COCs in ground water within some portions of the deep zone down gradient of the proposed alternative will be below MCLs in 30 years. However, COCs in the intermediate zone will remain above RAOs for 30 years.	Alternative G-3 is expected to reduce COC concentrations within all aquifer zones to below MCLs within 30 years, except for COC concentrations near the source area that are not actively treated.	Concentrations of COCs in ground water will be treated to below MCLs at selected point-of-use locations. Alternative G-4 will not be protective of human health if new private water supply wells are installed within the area covered by the contaminated plume. Ground water quality will not be restored.	Concentrations of TCE in ground water in the shallow, intermediate, and deep zones throughout the plume will be below MCLs in 30 years.
COMPLIANCE WITH ARARs	Alternative G-1 does not comply with chemical-specific ARARs.	Alternative G-2 complies with chemical-specific ARARs immediately downgradient from the extraction well capture zone in the shallow, intermediate, and deep zones. Persistent areas of contamination in the source area will remain above chemical-specific ARARs in the shallow and intermediate zones indefinitely.	Alternative G-3 complies with chemical-specific ARARs immediately downgradient from the treatment and containment systems in the shallow, intermediate, and deep zones. Persistent areas of contamination in the source area will remain above chemical-specific ARARs in the shallow and intermediate zones indefinitely.	Alternative G-4 complies with chemical-specific ARARs at the point of use (i.e. deep zone production wells). However, this alternative does not comply with chemical-specific ARARs throughout much of the plume in the shallow, intermediate, and deep zones.	Alternative G-5 complies with chemical-specific ARARs throughout the shallow, intermediate, and deep zones.

Table 6
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUND WATER

CRITERIA	*G-1*	G-2	G-3	G-4	G-5
LONG TERM EFFECTIVENESS and PERMANENCE					
● Magnitude of Residual Risk	RAOs will not be met with Alternative G-1 within 30 years.	RAOs will be met in portions of the shallow, intermediate, and deep zones within 30 years. Persistent areas of contamination in the source area will remain above RAOs for 30 years. Once RAOs are met, even though the time period is >30 years, residual risk will be acceptable.	RAOs will be met in portions of the shallow, intermediate, and deep zones within 30 years. Persistent areas of contamination in the source area will remain above RAOs for 30 years. Once RAOs are met, even though the time period is >30 years, residual risk will be acceptable.	It is difficult to ensure that humans in the Site area only drink from treated wells; consequently, residual risks remains the same as BRA-identified risk, except at treated wells. For treated wells, risks are acceptable if equipment is used properly.	RAOs will be met for the entire Site within 30 years. Once RAOs are met, residual waste is not expected to be present.
● Adequacy and reliability of Controls	Alternative G-1 provides no controls.	Ground water monitoring will be used to assess the reliability of these controls. There is a strong likelihood that these controls will adequately identify and manage remaining risks.	Ground water monitoring will be used to assess the reliability of these controls. There is a strong likelihood that these controls will adequately identify and manage remaining risks.	Ground water monitoring will be used to assess the reliability of these controls. There is a strong likelihood that these controls will adequately identify and manage remaining risks.	Ground water monitoring will be used to assess the reliability of these controls. There is a strong likelihood that these controls will adequately identify and manage remaining risks.

Table 6
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUND WATER

CRITERIA	*G-1*	G-2	G-3	G-4	G-5
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
● Treatment Used	None	Ground Water Extraction, Air Stripping, Vapor- and Liquid-Phase Activated Carbon	Biotic Reductive Dechlorination, or Chemical Oxidation, Ground Water Extraction, Air Stripping, Vapor- and Liquid-Phase Activated Carbon	Ground Water Extraction, Activated Carbon	Biotic Reductive Dechlorination or Chemical Oxidation, Ground Water Extraction, Air Stripping, Vapor- and Liquid-Phase Activated Carbon
● Materials Treated	None	Dissolved-phase COCs	Dissolved-phase COCs	Dissolved-phase COCs	Dissolved-phase COCs
● Amount Destroyed or Treated	The alternative does not treat any contaminated ground water.	Alternative G-2 removes contaminant mass from the shallow, intermediate, and deep zones as it moves toward the extraction wells. Treatment occurs aboveground through air stripping. Persistent contaminant mass in the source area is not treated by Alternative G-2. Approximately 16 lb of COCs removed.	Alternative G-3 treats contaminant mass in the intermediate zone as it migrates past the permeable reactive barrier and removes contaminant mass from the deep zone as it moves toward the extraction wells. Treatment occurs aboveground through air stripping. Persistent contaminant mass in the source area is not treated by Alternative G-3. About 16 to 20 lb of COCs removed.	Alternative G-4 removes contaminant mass from the deep zone as it moves toward the production wells. Treatment occurs aboveground at the point-of-use location. No active treatment occurs in the intermediate zone. Approximately 10 lb of COCs removed.	Alternative G-5 treats contaminant mass in the source zone through chemical oxidation or biotic reductive dechlorination. Alternative G-5 also treats dissolved-phase contaminants throughout the plume through extraction and above ground air stripping. Approximately 16 lb of COCs removed.
● Reduction in Volume	The alternative does not treat any contaminated ground water.	Alternative G-2 will reduce the volumes of contamination in the shallow, intermediate, and deep zones through pump and treat technology. However, persistent contamination not actively treated in the source area will remain.	Alternative G-3 will reduce the volumes of contamination in the shallow, intermediate, and deep zones through pump and treat technology, and in situ treatment. However, persistent contamination not actively treated in the source area will remain.	Alternative G-4 will result in some reduction in the volume of contamination in the deep zone through point-of-use treatment. However, contamination will persist in the shallow and intermediate zones of the aquifer.	Through active treatment in the shallow and intermediate zones (hot spot treatment) and pump and treat technology in the shallow, intermediate, and deep zones, significant reductions in the volume of contamination are expected. Approximately 100% destruction efficiency of COCs can be expected.

Table 6
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUND WATER

CRITERIA	*G-1*	G-2	G-3	G-4	G-5
SHORT-TERM EFFECTIVENESS					
● Protection of Community and On-Site Workers	No risks are posed to the community or workers.	There are normal safety risks associated with the construction of Alternative G-2. Health and safety risks can be minimized by adherence to safe work practices.	There are normal safety risks associated with the construction of Alternative G-3. Health and safety risks can be minimized by adherence to safe work practices.	There are normal safety risks associated with the construction of Alternative G-4. Health and safety risks can be minimized by adherence to safe work practices.	There are normal safety risks associated with the construction of Alternative G-5. Health and safety risks can be minimized by adherence to safe work practices.
● Environmental Impacts	Contaminated ground water is not addressed by Alternative G-1.	Alternative G-2 will temporarily drawn down the aquifer in the vicinity of the extraction wells. The drawdown is expected to be minor and will not affect production wells in the area. This alternative will generate residuals that will require treatment.	Alternative G-3 has impacts on subsurface geochemistry, and involves the extraction of ground water, which will temporarily draw down the aquifer in the vicinity of the extraction wells. Alternative G-3 will generate residuals that will require treatment.	Alternative G-4 involves the extraction of ground water, and treatment of ground water will be required for at least 30 years. In addition, Alternative G-4 does not treat the majority of contaminated ground water in the aquifer.	Alternative G-5 has impacts on subsurface geochemistry, and involves the extraction of ground water, which will temporarily drawn down the aquifer in the vicinity of the extraction wells. Alternative G-5 will generate residuals that will require treatment.
● Time To Meet RAOs	RAOs will not be met within 30 years.	RAOs would be immediately met in the shallow, intermediate, and deep zones in the vicinity of the extraction and injection wells. COCs within larger capture zone may take longer than 30 years, depending on source zone condition.	RAOs will be met in the ground water in all parts of all three subsurface zones immediately downgradient from the extraction wells and treatment barrier. RAOs will not be met for entire site within 30 years if a continuous source exists.	Alternative G-4 will meet RAOs at the point-of-use location. However, RAOs will not be met throughout the remainder of the plume. Because no active remediation will occur in the intermediate zone, COC concentrations are expected to remain above RAOs for greater than 30 years throughout the majority of the plume.	RAOs are expected to be met throughout the plume in the shallow, intermediate, and deep zones in 15 years.

Table 6
Fruit Avenue Plume Site, Albuquerque, New Mexico

COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUND WATER

CRITERIA	*G-1*	G-2	G-3	G-4	G-5
IMPLEMENTABILITY					
● Technical Feasibility	No action is taken; feasibility is not an issue.	Pump and treat has been successfully implemented at numerous sites. There are no site-specific conditions that would make Alternative G-2 technically infeasible.	Pump and treat has been successfully demonstrated at numerous sites. The use of enhanced bioremediation or chemical oxidation barriers is in still in the developmental approach. Therefore, significant uncertainties remain as to its technical implementability.	Point-of-use treatment is technically feasible and uses proven technology. Siting of the equipment may be an issue at some locations due to space limitations in the Site.	Hot spot treatment (by chemical oxidation or enhanced bioremediation) and pump and treat have been demonstrated separately at numerous sites. The combined use of these two technologies is considered to be technically feasible.
● Administrative Feasibility	No action is taken; feasibility is not an issue.	There are no administrative barriers that would prevent the implementation of Alternative G-2.	There are no administrative barriers that would prevent the implementation of Alternative G-3.	Acceptance of Alternative G-4 will be required both from the City and the property owners. Because the City has previously discouraged this alternative, it is unlikely to be administratively feasible.	There are no administrative barriers that would prevent the implementation of Alternative G-5.
● Availability of Resources	No action is taken; availability of resources is not an issue.	Services, equipment, and materials for Alternative G-2 are readily available.	Services, equipment, and materials for Alternative G-3 are readily available.	Services, equipment, and materials for Alternative G-4 are readily available.	Services, equipment, and materials for Alternative G-5 are readily available.
COST					
● Capital	$0	$2,275,000	$1,930,000	$2,435,000	$3,732,120
● Annual O&M Cost	$0	$255,000	$835,000	$360,000	$255,000
● Present Worth Cost	$21,578	$5,455,000	$12,307,000	$6,918,000	$6,912,000
STATE/CITY ACCEPTANCE	Not Acceptable. Not Protective of human health and environment.	Acceptable	Acceptable	Not Acceptable	Acceptable
COMMUNITY ACCEPTANCE	Not Acceptable.	Acceptable	Acceptable	Acceptable	Acceptable

Table 7

Cost Estimate Summary for Soil Alternative S-3, Soil Vapor Extraction

Capital Costs for Soil Alternative S-3

Description	Quantity	Unit	Unit Cost	Cost
1. Design/Modeling				
SVE Design Modeling	---	LS	---	$20,000
Workplan Preparation	---	LS	---	$15,000
2. SVE System Installation				
Well Installation	12	Well	$1,750.00	$21,000
Soil Sampling	84	Sample	$120.00	$10,080
Blower Package	---	LS	---	$10,000
Remediation System Enclosure	---	LS	---	$10,000
SVE Pipe Installation	450	LF	$40.00	$18,000
SVE System Start-Up, As-Built Report	---	LS	---	$20,000
3. System Installation Oversight				
Field Oversight	20	Day	$600.00	$12,000
Senior Oversight	---	LS	---	$3,000
Subtotal				$139,080
Contingency Allowances (15%)				$20,862
Total Capital Cost				**$159,942**

Annual Operation and Maintenance Costs for Soil Alternative S-3

Description	Quantity	Unit	Unit Cost
1. SVE System Operation	2	Year	$15,000
2. SVE System Maintenance	2	Year	$5,000
3. Sampling and Analysis	2	Year	$15,000
Total Annual O&M Costs			**$35,000**

Summary of Present Worth Analysis: Alternative S-3

Year	Capital Cost	Annual O&M Cost	Total Cost	Discount Factor (7%)	Present Worth
0	$159,942		$159,942	1.000	$159,942
1		$35,000	$35,000	0.935	$32,725
2		$35,000	$35,000	0.873	$30,555
TOTALS	$159,942	$70,000	$229,942		$223,222

Total Present Worth Cost **$223,222**

Notes

Unit costs are for illustration only and should not be used for developing firm budgets for construction.
Costs will be refined when the remedy is designed.
Cost estimates are within +50% to -30% accuracy expectation.
LS = Lump Sum
LF = Linear Feet

Table 8

Cost Estimate Summary for Groundwater Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration through Pump and Treat Technology with a Reinjection Component

Capital Costs for Groundwater Alternative G-5

	Description	Quantity	Unit	Unit Cost	Cost
	Hot Spot Treatment				
1.	Laboratory/Pilot Scale Study	---	LS	---	$30,000
2.	Design/Numerical Modeling				
	Design	---	LS	---	$60,000
	Numerical Modeling	---	LS	---	$15,000
	Work Plan	---	LS	---	$20,000
3.	Biostimulant Material	128520	LB	$5.00	$642,600
4.	Biostimulant Injection				
	Cone Penetrometer Contractor	160	Day	$2,500.00	$400,000
	Field Oversight Labor	160	Day	$600.00	$96,000
	Senior Oversight Labor	16	Day	$720.00	$11,520
5.	Monitor Well Installation				
	Well Installation	5	Well	$8,400.00	$42,000
	Oversight Labor	---	LS	---	$10,000
Subtotal Hot Spot Treatment					$1,327,120

Table 8

Shallow, Intermediate, and Deep Zone Pump and Treat				
1. Design/Numerical Modeling				
Design	---	LS	---	$175,000
Modeling	---	LS	---	$60,000
Aquifer/Pilot Testing	---	LS	---	$90,000
Work Plan	---	LS	---	$35,000
2. Extraction Well Installation				
Shallow Zone Well Installation	2	Well	$7,980.00	$15,960
Intermediate Zone Well Installation	3	Well	$15,980.00	$47,940
Shallow/Intermediate Well Vault Construction	5	Vault	$2,000.00	$10,000
Deep Zone Well Installation (450' Deep)	3	Well	$90,600.00	$271,800
Deep Zone Well Installation (550' Deep)	1	Well	$109,400.00	$109,400
Deep Well Vault Construction	4	Vault	$3,000.00	$12,000
Field Oversight	50	Day	$600.00	$30,000
Senior Oversight	13	Day	$720.00	$9,360
3. Injection Well Installation				
Intermediate Zone Well Installation	3	Well	$15,980.00	$47,940
Intermediate Well Vault Construction	3	Vault	$2,000.00	$6,000
Deep Zone Well Installation	4	Well	$90,600.00	$362,400
Deep Well Vault Construction	4	Vault	$3,000.00	$12,000
Field Oversight	49	Day	$600.00	$29,400
Senior Oversight	8	Day	$720.00	$5,760
4. Construction				
Mobilization/Demobilization	---	LS	---	$30,000
Trenching/Pipeline	---	LS	$320,000.00	$320,000
Shallow Zone Treatment System	---	LS	---	$80,000
Deep Zone Treatment	---	LS	---	$145,000
Field Oversight	120	Day	$600.00	$72,000
Senior Oversight	40	Day	$720.00	$28,800
As-Built Report	---	LS	---	$20,000
Operation and Maintenance Manual	---	LS	---	$20,000
Start-Up	---	LS	---	$20,000
Subtotal Pump and Treat				$2,065,760
Subtotal Capital Costs				$3,392,880
Contingency Allowances (10%)				$339,288
Total Capital Cost				**$3,732,168**

Annual Operation and Maintenance Costs for Groundwater Alternative G-5

Description	Quantity	Unit	Unit Cost
1. Site-Wide Groundwater Monitoring	30	Year	$120,000
2. Operation	30	Year	$100,000
3. Maintenance	30	Year	$35,000
Total Annual O&M Costs			**$255,000**

Note: Costs for 5-year reviews are not Annual O&M costs. They are included below, in Present Worth calculations.

Table 8

Summary of Present Worth Analysis: Alternative G-5

Year	Capital Cost	Annual O&M Cost	5-YR Review Cost	Total Cost	Discount Factor (7%)	Present Worth
0	$3,732,168			$3,732,168	1.000	$3,732,168
1		$255,000		$255,000	0.935	$238,425
2		$255,000		$255,000	0.873	$222,615
3		$255,000		$255,000	0.816	$208,080
4		$255,000		$255,000	0.763	$194,565
5		$255,000	$7,000	$262,000	0.713	$186,806
6		$255,000		$255,000	0.666	$169,830
7		$255,000		$255,000	0.623	$158,865
8		$255,000		$255,000	0.582	$148,410
9		$255,000		$255,000	0.544	$138,720
10		$255,000	$7,000	$262,000	0.508	$133,096
11		$255,000		$255,000	0.475	$121,125
12		$255,000		$255,000	0.444	$113,220
13		$255,000		$255,000	0.415	$105,825
14		$255,000		$255,000	0.388	$98,940
15		$255,000	$7,000	$262,000	0.362	$94,844
16		$255,000		$255,000	0.339	$86,445
17		$255,000		$255,000	0.317	$80,835
18		$255,000		$255,000	0.296	$75,480
19		$255,000		$255,000	0.277	$70,635
20		$255,000	$7,000	$262,000	0.258	$67,596
21		$255,000		$255,000	0.242	$61,710
22		$255,000		$255,000	0.226	$57,630
23		$255,000		$255,000	0.211	$53,805
24		$255,000		$255,000	0.197	$50,235
25		$255,000	$7,000	$262,000	0.184	$48,208
26		$255,000		$255,000	0.172	$43,860
27		$255,000		$255,000	0.161	$41,055
28		$255,000		$255,000	0.150	$38,250
29		$255,000		$255,000	0.141	$35,955
30		$255,000	$7,000	$262,000	0.131	$34,322
TOTALS	$3,732,168	$7,650,000	$42,000	$11,424,168		$6,911,555

Total Present Worth Cost $6,911,555

Notes

Unit costs are for illustration only and should not be used for developing firm budgets for construction. Costs will be refined when the remedy is designed.
Cost estimates are within +50% to -30% accuracy expectation.
LS = Lump Sum
SF = Square Feet
LF = Linear Feet
LB = Pound

Summary of Costs for Selected Remedies

Description	Capital Cost	Annual O&M Cost	Present Worth Cost
Soil Alternative S-3	$ 159,942	$ 35,000	$ 223,222
Groundwater Alternative G-5	$ 3,732,168	$ 255,000	$ 6,911,555
TOTAL	$ 3,892,110	$ 290,000	$7,134,777

Table 9
Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
CHEMICAL SPECIFIC				
Federal Drinking Water Regulations	40 CFR 141	Maximum Contaminant Level Goals (MCLGs).	Ground Water	Ground water will be treated to meet non-zero MCLGs.
New Mexico Regulations for Public Drinking Water Systems	20 NMAC, Chapter 7	State primary drinking water regulations. Health-based maximum contaminant levels (MCLs) for public water systems.	Ground Water	Where MCLGs are zero, ground water will be treated to meet MCLs.
New Mexico Water Quality Control Commission Regulations	20 NMAC, Chapter 6, Part 2	Water Quality Control Commission Standards for ground water.	Ground Water	Ground water may need to be restored to these standards, if more stingent than MCLs or MCLGs; however, they are not more stringent for the Site COCs.
ACTION SPECIFIC				
Resource Conservation and Recovery Act (RCRA)	20 NMAC, Chapter 4	Identification and Listing of Hazardous Waste. Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR Parts 262–265 and Parts 270, 271, and 124.	Soils & Residuals	Excavated soils and residuals from treatment operations may be considered hazardous and subject to manifesting and storage requirements, and land disposal restrictions.
New Mexico Air Quality Control Act	20 NMAC, Chapter 2	Identifies permit requirements for facilities with air emissions.	Air	Air emissions from air stripping treatment of extracted ground water may need to meet these standards.

Table 9
Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
ACTION SPECIFIC (Continued)				
Clean Water Act				
NPDES	40 CFR 122–125	Discharge of effluent to receiving bodies of water must meet the regulations of 40 CFR 122, which establishes limitations and standards for discharge.	Surface Water	An alternative for discharge of treated ground water is to a receiving stream. If used, discharge will meet NPDES criteria.
Water Quality Criteria	40 CFR 131	Criteria for water quality based on toxicity to aquatic organisms and public health.	Surface Water	Same as immediately above
POTW Discharge	40 CFR 403	Discharge of effluent to public works must comply with the requirements of 40 CFR 403 as well as any Albuquerque, New Mexico requirements.	Surface Water	Another alternative for discharge of treated ground water is to the POTW. If used, the discharge will meet Albuquerque discharge to the POTW standards.
State of New Mexico Standards for interstate and intrastate streams	20 NMAC, Chapter 6, Part 1	Provides for the protection of surface water through narrative and numerical standards.	Surface Water	Ground water that is discharged to surface water will not degrade the surface water quality.
LOCATION SPECIFIC				
Historic Sites, Buildings, and Antiquities Act	16 USC 461-467 40 CFR §6.301(a)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts upon such landmarks.	Land, Buildings, & Resources	Construction of remedial alternatives will meet this ARAR where designated properties exist.

Table 9
Potentially Applicable or Relevant and Appropriate Requirements (ARARs)

STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION	CITATION	DESCRIPTION	MEDIA	RATIONALE & DISCUSSION
LOCATION SPECIFIC (Continued)				
National Archeological and Historic Preservation Act National Historic Preservation Act	16 USC 468 16 USC 470 40 CFR §6.301(c) 36 CFR Part 800	Provides for preservation of historical and archaeological sites which might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally licensed activity or program.	Land, Buildings, & Resources	The Selected Remedy will meet this ARAR by ensuring that construction areas are surveyed for archeological and historic impact.
New Mexico Cultural Properties Act	NMSA 1978	Requires the identification of cultural resources, assessment of impact on those resources that may be caused by the proposed project, and consultation with the State Historic Preservation Officer.	Land, Buildings, & Resources	Construction of remedial alternatives will meet this ARAR by ensuring that construction areas are surveyed for cultural resources impact.

NOTES:

ARAR	Applicable or Relevant and Appropriate Requirements	NMAC	New Mexico Administrative Code
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NMSA	New Mexico Statutes Annotated
CFR	Code of Federal Regulations	NPDES	National Pollutant Discharge Elimination System
EPA	Environmental Protection Agency	POTW	Publicly Owned Treatment Works
MCL	Maximum Contaminant Level	RCRA	Resource Conservation and Recovery Act
MCLG	Maximum Contaminant Level Goal	USC	United States Code

APPENDIX A - RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
Fruit Avenue Plume Superfund Site

The purpose of this responsiveness summary is to address comments that the public has made regarding the U.S. Environmental Protection Agency's (EPA) proposed plan for the cleanup of hazardous substance contamination at the Fruit Avenue Plume Superfund Site (the "Site"). An informal Open House was held on June 19, 2001, at 7:00 P.M. at the South Broadway Cultural Center, located at 1025 Broadway SE, Albuquerque, New Mexico, to summarize the activities conducted as part of the Remedial Investigation/Feasibility Study (RI/FS), and introduce the Proposed Plan. Following the informal Open House, a formal public meeting was held on July 17, 2001, at 7:00 P.M. at the South Broadway Cultural Center. The public was invited to orally comment on this Proposed Plan during the July public meeting. A transcript from the public meeting is included in the Administrative Record. The official public comment period began on June 29, 2001, and ended on July 30, 2001.

This responsiveness summary serves two vital functions: first, it provides the decision maker with information about the views of the public, government agencies, the support agency, and potentially responsible parties (PRPs) regarding the proposed remedial action and other alternatives. Second, it documents the way in which public comments have been considered during the decision-making process and provides answers to all significant comments.

Responsiveness summaries are divided into two parts. The first part is generally a summary of commenters' major issues and concerns, and generally it will expressly acknowledge and respond to those issues and concerns raised by major stakeholders. At this Site, the stakeholders are the local community, the New Mexico Environment Department (NMED), and the City of Albuquerque. "Local community" here means those individuals who have identified themselves as living and/or working in the immediate vicinity of the Superfund site, and who are threatened from a health or environmental standpoint. The first part of a responsiveness summary is presented by subject in nontechnical terms that are intended for the lay person.

The second part of a responsiveness summary is a comprehensive response to all significant comments. It will be comprised mostly of specific legal and technical questions and, if necessary, will elaborate with technical detail on answers covered in the first part of the responsiveness summary. Rather than divide the Site responsiveness summary into two parts, however, EPA decided that, in this case, it made more sense, and provided a more cohesive discussion, if each comment was dealt with completely in one unified response.

For more information regarding EPA's policy regarding responsiveness summaries, please see *Superfund Responsiveness Summaries (Superfund Management Review: Recommendation Number 43E)* (OSWER 9230.0-06, June 1990) which is a part of the Administrative Record for the Site. Documents referenced in this responsiveness summary as part of the Administrative Record for the Site may be viewed at the Albuquerque Public Library - Main Downtown Branch, 510 Copper Street NW, Albuquerque, NM 87102. The phone number to the library is (505) 768-5140.

Community Members' Comments

1. **Comment:** It appears that Preferred Alternatives S-3, and G-5 offer the best hope of a clean-up without being unnecessarily intrusive. Hopefully clean-up can be done without a lot of noise and disruption but should proceed with due haste to minimize spread of contaminants.

   Response: Comment noted.

   In order to minimize any noise problems, the treatment systems will be enclosed in insulated buildings. Every reasonable effort will be made to minimize any disruption to any businesses and neighborhoods. The above ground remedial systems will be located in areas that provide the least impact to the public. The remedial system will be implemented as quickly as possible.

2. **Comment:** Who is going to pay for the cleanup, and will individual landowners with property over the plume have to pay anything?

   Response: This is a National Priorities List (NPL) Site, and the EPA will pay for 90% of the cost of the cleanup and the State will pay the remaining 10% for the first ten years of operation. The State will be responsible for 100% of the cost after the 10^{th} year of operation. Based on information that EPA presently has on hand, the EPA does not intend to pursue any landowners for the cleanup costs, and the EPA does not anticipate any change in this enforcement decision at the Site.

3. **Comment:** The government is the one that knows about the problem and has the knowledge to fix it, so I support the recommendations in the proposed plan.

   Response: Comment noted.

4. **Comment:** Time is of the essence. As soon as possible, get started on the preferred alternatives. The problem needs to be taken care of before more ground water wells are impacted.

   Response: Comment noted.

5. **Comment:** Alternative S-1 (No Action) and G-1 (No Action) are the best for this area. There would be no residential wells in this entire area, so why not let nature take its course. There is no reason to spend $11.5 million of the people’s money to correct a problem (maybe). In my opinion, there are far better ways to spend these millions than giving them to some environmental contractors.

Response: Alternatives S-1 and G-1 are the baseline conditions against which other soil and ground water remedial alternatives are compared, as required by the National Contingency Plan (NCP). Alternatives S-1 and G-1 provide no remedial action, and do not address the human health risks identified at the Site. Alternatives S-1 and G-1 do not protect human health, nor do they meet Applicable or Relevant and Appropriate Requirements (ARARs); consequently, they are ineligible for selection under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the NCP. In addition, Alternatives S-1 and G-1 do not reduce contaminant toxicity, mobility, or volume and they are not effective or permanent remedies. Lastly, according to computer modeling, municipal supply wells will be impacted if remedial action is not undertaken.

6. **Comment:** It's difficult for citizens to make a decision regarding courses of remediation for contaminated sites, especially when it involves technical methods/issues. Has the public been involved in the process? Is there a citizen's group that has formed to look at cleanup options for this Site?

Response: The EPA and NMED have held the following meetings with the local community to discuss the Site activities and to disseminate pertinent information:

On November 24, 1998, a meeting was held with the Downtown Action Committee (DAC). The DAC is Albuquerque Mayor Jim Baca's redevelopment team. The DAC is composed of business leaders, property owners, lenders, and investors.

On June 10, 1999, a meeting was held with representatives from the City of Albuquerque, EPA, NMED, Mayor Jim Baca's office, the City of Albuquerque City Attorney's Office, Downtown Action Team (formerly DAC), and Duke Engineering & Services to notify participants that the Site was in the process of being proposed to the NPL.

On July 21, 1999, NMED, the City of Albuquerque, and the EPA held a meeting with local landowners and lenders to notify them that the Site was in the process of being proposed to the NPL. Questions were answered regarding liability concerns, and regarding the use of private land for remediation purposes at the Site. The opportunity for landowners and lenders to request comfort letters from the State and the EPA was provided.

A Site Summary Fact Sheet was developed in July 1999 for the Site and mailed to approximately 800 addresses (all addresses within 0.5-mile of the Site).

On July 23, 1999, the *Albuquerque Journal* and Channel 7 television ran news stories about the Site discussing the general location of the plume and its contaminants. On August 3, 1999, at his request, NMED and the City of Albuquerque made a presentation concerning the Site to Ken Sanchez, Bernalillo County Commissioner.

The NMED, the EPA, and the City of Albuquerque jointly conducted a public Open House on February 7, 2000, to discuss the placement of the Site on the National Priorities List (NPL), current activities, and future plans for the Site. Mailers printed in both English and Spanish were sent to approximately 800 addresses (all addresses within 0.5-mile of the Site), and were hand-delivered to public housing units along Arno Street and to downtown businesses. Eight neighborhood associations were notified of the meeting. The meeting notice was also posted in the two Albuquerque newspapers. NMED provided a Spanish interpreter for the meeting.

The NMED assisted the Agency for Toxic Substances and Disease Registry (ATDSR) in conducting a public Open House on July 12, 2000, to discuss public health concerns. The NMED contacted neighborhood association leaders, businesses, concerned citizens on the mailing list, and former Coca-Cola employees. A notice was also placed in the *Albuquerque Journal*.

On June 19, 2001, the EPA and the NMED held a public meeting to discuss the results of the Remedial Investigation and Feasibility Study, and to describe the Proposed Plan of Action. The meeting was publicized by notices in the *Albuquerque Journal* and the *Albuquerque Tribune*, as well as a direct mailing post card announcement to approximately 2,000 people. A Site Fact Sheet summarizing the Proposed Plan was mailed shortly after this Open House to approximately 2,000 people.

On June 29, 2001, the EPA made the Administrative Record available for public review at the EPA's offices in Dallas, TX; at NMED's offices in Santa Fe, NM; and at the Site repository located at the Albuquerque Downtown Library branch.

From June 29, 2001, to July 30, 2001, the EPA held a 30-day public comment period to accept public comment on the Remedial Investigation, on the alternatives presented in the Feasibility Study and the Proposed Plan, and on the supporting analysis and information located in the Site repository. The public comment period was publicized by notices in the *Albuquerque Journal* and the *Albuquerque Tribune*, as well as a direct mailing post card announcement to approximately 2,000 people.

On July 14, 2001, the *Albuquerque Journal* ran an article about the Fruit Avenue Plume Site. The newspaper article noted the public meeting on July

17, 2001. In addition, the newspaper article stated that EPA was very interested in hearing the community's concerns and comments on the proposed plan of action.

On July 17, 2001, the EPA and the NMED held a public meeting to discuss the Proposed Plan and to accept any oral comments. The meeting was publicized by notices in the *Albuquerque Journal* and the *Albuquerque Tribune*, as well as a direct mailing post card announcement to approximately 2,000 people. A transcript of this meeting is included in the Administrative Record for this Site.

7. **Comment:** The proposed remedy for soil should consist of the preferred Alternative S-3, Soil Vapor Extraction **and** Alternative S-4, Excavation and Off-Site Disposal to remove concentrated amounts of contamination at the source.

   Response: Alternative S-3, the selected remedy for soil, provides the best overall protection of the environment because **all** of the contaminant mass in the soil will be treated by this alternative, making Alternative S-4 unnecessary. Moreover, any additional protectiveness gained by using S-4 in addition to S-3 would be disproportionate to the additional cost of using S-4; therefore, using S-3 and S-4 is not cost effective and is unacceptable under the NCP. S-3 is also preferable to S-4 under the NCP because it is the most effective in the short term since the installation of the SVE system poses less short term risks to the community, and needs fewer engineering controls, making it more implementable than the deep excavation required by Alternative S-4.

8. **Comment:** The proposed remedy for ground water should consist of Alternative G-5, Hot Spot Treatment and Shallow, Intermediate, and Deep Zone Restoration Through Pump and Treat Technology with a Reinjection Component **and** Alternative G-4, Point-of-Use Treatment to address residual contaminants.

   Response: Alternative G-5, the selected remedy for ground water, will provide the best overall protection, compared to the other alternatives, because TCE concentrations in the intermediate zone areas showing the highest concentrations of contaminants (the "hot spots") will be reduced below the remediation goals thereby remediating the intermediate zone in the shortest time-frame compared to the other alternatives. Moreover, under Alternative G-5, the toxicity mobility, and volume of TCE in all the ground water zones will be reduced below remediation goals through treatment by pump and treat technology, and such treatment is preferred under the NCP. The shortened time frame for the overall remediation to be accomplished is the main reason that Alternative G-5 provides the greatest overall protection of human health and the environment compared to the other alternatives, and is, therefore, preferable under the NCP. Using Alternative G-4, in addition to G-5 would not decrease the time required to reach the remedial goals. However, Alternative G-4 would increase the cost of the remedy by approximately $13 million; consequently, the use of G-4 in addition to G-5 would not be cost effective. Alternatives that are not cost effective are not acceptable under the NCP.

Comments from the Public Meeting Transcript -- July 17, 2001

9. **Comment:** One commentor noted the urgency of getting the ground water cleaned up as quickly as possible.

   Response: Comment noted.

10. **Comment:** We are concerned about the property implications that are inherent in being designated a Superfund site. We are concerned about property rights, the issue of resale, the issue of public perception and stigma, the issue of the residential integrity of that area in trying to maintain quality environment, and then the issue that some of the fill dirt that was used in the redevelopment process in that area came from the Convention Center site. So there is a strong sense of concern that potentially being in a Superfund site, the implications that it has for us immediately in terms of property value, clear title, and all the legal difficulties that go with that, the resale value, valuations and so on, and the residential integrity, the ability for us to attract people to move into the area with the clear understanding that we are in a Superfund site.

    Response: The threat at the Site is confined to contaminated ground water, and the surface of the Site is completely suitable for development. The EPA sees absolutely no reason why commercial activity including property sales and leasing on the Site should not proceed as it would in any other American city. The only environmental problem on the Site concerns ground water contamination. At present no one is exposed to this ground water contamination, and the remedial action selected in this ROD is intended to ensure that no one is ever exposed to the ground water contamination.

    The EPA and NMED have determined that the threat to Site ground water that is used as drinking water is serious, and it will cost millions of dollars to remediate. In order for EPA to spend this much money on a remedial action under the Superfund law, EPA must publish a notice in the Federal Register which indicates EPA's intent to list the site in question on the National Priorities List (NPL) of Superfund sites. Notification of the proposed listing gives the public a chance to make comments and criticisms of the proposed listing. That is, it gives the public a chance to voice its opinion as to whether the Superfund remedial process should be used at the site proposed for listing. The EPA proposed the Fruit Avenue Plume Site to the NPL on July 22, 1999, with a notice in the Federal Register. The EPA received no unfavorable comments regarding the listing, and it is supported by NMED and the City of Albuquerque. It should also be noted that the Governor requested EPA to list the Site.

    The EPA is aware that property markets can be irrational, and we understand your concern. Nonetheless, we hope you can see that in order to help preserve the long term value of

Albuquerque real estate it is essential that there is a safe supply of drinking water. The large volume of contaminated water underlying the Site means that millions of dollars must be spent to clean it up, and the only way to get these dollars is to list the Site on the National Priority List of Superfund Sites. In short, NPL listing will help ensure the long term value of Albuquerque property.

To address the immediate concerns of those who are buying, selling, or leasing Site property, EPA has agreed to prepare letters addressing the concerns of anyone involved in property transactions. These letters, specifically written to address the needs of those who request them, are signed by the EPA Superfund Division Director who has been delegated CERCLA remedial action and enforcement authority in EPA Region 6. So far, these letters have helped many individuals solve transaction problems related to contamination concerns. Anyone who would like such a letter, should contact the Remedial Project Manger, Mr. Greg Lyssy at (214) 665-8317.

11. **Comment:** Are there regulations or anything that relate to mortgage lending and preventing banks from using Superfund cleanup, which in the long run is a positive event, as a reason to deny mortgages?

    Response: Please see the Response to Comment #10 above. There are not any regulations which preclude mortgage lending to owners of properties located on a Superfund Site.

12. **Comment:** Please go into further detail about the cleanup and doing the hot spot treatment? What are the by-products, not in just generalities, but a little more specifically, and how noisy is the remedial process? What kind of impact on the neighborhoods will it have?

    Response: The hot spot identified in the proposed plan is in the shallow and intermediate zones which underlie the former Elite Cleaners/Sunshine Laundry property. Identification of any additional hot spots requiring remediation will be done during the Remedial Design.

    Hot spot remediation will include injection of either a bioremediation additive, or a chemical oxidant (to be determined during Remedial Design) into the subsurface to degrade COCs in place.

    Enhanced in-situ biodegradation involves the addition of food sources (substrate), electron acceptors/donors, or nutrients (known as biostimulation) and/or microbes (known as bioaugmentation) into the subsurface to accelerate the rate of natural biodegradation. The resident and/or introduced microbes then degrade the contaminants in the ground water into methane and water.

    Chemical oxidation processes involve oxidation-reduction (redox) reactions, which are essentially an exchange of electrons between chemical species. Strong oxidants attack contaminant organic molecules and the organic compounds are converted to carbon dioxide, water, and chloride ions, which are all relatively harmless.

In order to minimize any noise problems, the pump and treat system will be enclosed in an insulated building. Every reasonable effort will be made to minimize any disruption to businesses and neighborhoods. The above ground remedial systems will be located in areas that provide the least impact to the public.

13. **Comment:** 15 years seems like a very long time for the remediation. Is that about money or bureaucracy, or the technology, the bacteria itself?

    Response: The specific issue at this Site is that we have 320 million gallons of ground water that is impacted. It is simply going to take some time to pump that volume of water -- extract it, get it through our treatment system, and then re-inject it. 15 years is based upon our computer modeling. The actual time frame may be a little less, or it may be a little longer.

14. **Comment:** What sort of processes are in place for getting public opinion from the neighborhood associations? Is there a formal way to approach and include them?

    Response: Please see the Response to Comment #6 above.

15. **Comment:** Will the ground water plume continue to grow during the fifteen years that it takes to cleanup the site?

    Response: No, the intent of the remedial action is to cleanup the ground water. The remedial system will be designed to ensure that the plume becomes smaller in size, and that the concentrations of the chemicals of concern are decreased during the remedial action.

16. **Comment:** Will the ground water plume migrate towards the west where the neighborhoods are located?

    Response: No, the ground water plume will not migrate towards the west. Historically, ground water was flowing towards the west, towards the Rio Grande. But as the City supply wells started pumping ground water, flow actually reversed almost 180 degrees towards the wells located east of I-25 and started flowing towards the east. The historical ground water flow initially caused the contamination to migrate towards the west, and that's why there is a portion of the ground water plume located west of the source area. However, at the current time, the ground water is flowing towards the east, and that is the direction that the plume is moving. The contaminant plume will move toward the extraction wells, and away from the municipal wells, once remediation begins.

17. **Comment:** When you talk about stripping, what do you mean?

Response: As part of the treatment process, ground water will be pumped out of the shallow, intermediate, and deep zones of the aquifer through a series of extraction wells. This extracted water will flow through below-ground piping to an above-ground treatment plant located within the Site boundaries. Once in the treatment plant, the extracted water will be directed through an air stripper to volatilize the contaminants. An air stripper typically includes a tower filled with material (trays or whiffle balls) that breaks the water into smaller droplets so that more surface area is created to mix with air. The contaminated water is pumped to the top of the air stripper tower and allowed to cascade down. Air under pressure is blown up through the tower and mixes with the water droplets. Mixing of the air and the cascading contaminated water droplets results in volatilization of the contaminants in the water. The vapor emissions from the air stripper pass through a granular activated carbon filter to clean the emissions prior to release into the atmosphere. The discharge water at the bottom of the air stripper would also go through a granular activated carbon filter to remove any remaining contaminants.

18. **Comment:** If the demand for water in the City increases, and the City pulls more water from the supply wells, or the hospital wells pump out more water, will the contaminant plume move faster? Have any modeling studies been performed? How long will it take to implement the remedy?

    Response: Based upon our computer modeling, it is estimated that the plume will reach the city supply wells in five to twenty years, if the remedial actions are not implemented. There are many variables that impact this five to twenty year figure, including pumping rates, changes in the geology, and natural attenuation of the constituents. In general, if the supply wells have higher pumping rates, then the ground water plume will move towards the pumping wells more quickly. The remedy should be implemented in 18 to 24 months.

19. **Comment:** Is there any DNAPL at the Site, or is it just dissolved contamination.

    Response: No free-phase dense non-aqueous phase liquids (DNAPLs) have been found at the Site in any of our investigations. Constituents detected in ground water at the Site consist mainly of the chlorinated solvents TCE, PCE, and DCE, which are DNAPLs at high concentrations. However, the contamination at the Site is in the dissolved, or aqueous phase.

20. **Comment:** Would the remedial activities take place in the City right-of-ways and on City property?

    Response: Every reasonable effort will be made to locate the remedial system on City property and City right-of-way. However, the parking lot that is located over the source area will have to be used for the remedial activities, including hot spot treatment and the soil vapor extraction.

21. **Comment:** One commentor requested that the Wells Fargo Bank (the current tenant at the former Elite Cleaners location) be allowed to be involved in the design process. I've said it to you unofficially, but now I would like to have it put in the record, we would like to be involved in the planning process, since our parking lot is involved.

    Response: Comment noted.

22. **Comment:** Several commentors noted that the notices for the open house, were received the day after the meeting.

    Response: The notices were mailed nine days before the open house meeting. Generally, we have found that this is sufficient time for the notices to be received. The EPA also published a notice of the open house and public meeting in the *Albuquerque Journal* and the *Albuquerque Tribune* prior to the actual meeting dates.

APPENDIX B - CONCURRENCE LETTERS

State of New Mexico
ENVIRONMENT DEPARTMENT
Office of the Secretary
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502-6110
Telephone (505) 827-2855
Fax (505) 827-2836

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

PAUL RITZMA
DEPUTY SECRETARY

May 25, 2001

Mr. Donald Williams
New Mexico Team Leader
USEPA Superfund Division Region 6 (6SF-LT)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: Concurrence of Proposed Plan of Action for the Fruit Avenue Plume Superfund Site, Albuquerque, New Mexico

Dear Mr. Williams:

The New Mexico Environment Department (NMED) has reviewed the United States Environmental Protection Agency (EPA) draft Proposed Plan of Action for the Fruit Avenue Plume Superfund Site located in Albuquerque, New Mexico. NMED concurs with the preferred remedial actions outlined in the plan to address contamination associated with this Site. The plan is a culmination of careful work conducted by the EPA, NMED, and the City of Albuquerque, and all agencies appear to be in agreement on an appropriate plan of remedial action for the Site.

NMED appreciates the continued supportive working relationship with EPA. If you have any questions, please call me at (505) 827-2855, or Birgit Landin of my staff at (505) 827-9669.

Sincerely,

Peter Maggiore

PETER MAGGIORE
Secretary

PM:bkl

cc: Greg Lyssy, EPA Remedial Project Manager
Mary Lou Leonard, Albuquerque Environmental Health Department

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

Environmental Health Department

Jim Baca, Mayor

May 7, 2001

Greg J. Lyssy
U.S. EPA Region 6
(6SF-LT)
Superfund Division
1445 Ross Avenue
Dallas, TX 75202-2733

Dear Mr. Lyssy:

After careful review of the Proposed Plan of Action, Fruit Avenue Plume Superfund Site, Albuquerque, NM, the City of Albuquerque Environmental Health Department concurs with the preferred remedial actions outlined in the plan to address contamination at this site. The plan is the culmination of careful work by the New Mexico Environment Department, the Environmental Protection Agency, and the City of Albuquerque, and all agencies appear to be in agreement on an appropriate plan of action for the site.

The City of Albuquerque appreciates its partnership in this process. We look forward to continuing in a partnership role with the Environmental Protection Agency and the New Mexico Environment Department in the developing the Record of Decision, the design and implementation of the remedy, and monitoring its progress.

Sincerely,

Sarah B. Kotchian
Director
Albuquerque Environmental Health Department

cc: Peter Maggiore, Cabinet Secretary, New Mexico Environment Department
File