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EPA Superfund
Record of Decision:

FRESNO MUNICIPAL SANITARY LANDFILL
EPA ID: CAD980636914
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FRESNO, CA
09/30/1993

RECORD OF DECISION

Fresno Sanitary Landfill Superfund Site
Fresno, California
EPA ID# CAD980636914

PART I - DECLARATION

Statement of Basis and Purpose

This Record of Decision ("ROD") presents the selected interim remedial action for the Fresno Sanitary Landfill Superfund site ("the Site") in Fresno, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. 9601 et seq, and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300, and the laws of the State of California. The State of California concurs with this remedy. This decision is based on the administrative record for the Site which identifies the documents upon which the selection of the remedial action is based. Assessment of the Site

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

Description of the Remedy

The Fresno Sanitary Landfill (FSL) accepted waste from 1937 to 1989. The landfill is approximately 145 acres, is unlined and has a soil cover and no landfill gas (LFG) control system in place. This remedy is a source control operable unit (SCOU), and is an interim remedy. There will be a second and final operable unit ROD for the groundwater, off-site vadose soils and any ancillary issues. This selected remedy is an interim remedy because there is still subsequent remedial action to be undertaken at the site, but the SCOU ROD contains certain final ARARs for this portion of the cleanup.

The selected remedy consists of the following major components:

- Landfill gas collection and conveyance system consisting of interior gas extraction wells, perimeter gas extraction wells, a blower system, and a piping system for conveyance of collected LFG to a gas treatment system.
- Landfill gas treatment system consisting of on-site combustion of landfill gas in landfill gas flares.
- Gas condensate collection system consisting of piping and storage vessels to manage the condensate generated during the operation of the gas control system.
- A contingency leachate collection system consisting of liquid extraction pumps placed in the bottoms of gas extraction wells, piping to convey the leachate and storage vessels to manage the collected leachate. The collected leachate will be trucked off-site for treatment. This contingency will be implemented if EPA determines that liquid levels found in a gaswell are a threat to groundwater.
- Landfill gas migration monitoring system consisting of a series of monitoring probes placed along the landfill perimeter.
- Landfill cover consisting of a series of functional layers that together minimize the infiltration of water into underlying refuse by using a synthetic membrane as the low permeability layer, provide erosion control, and contribute to effective operation of the gas control system by providing a barrier to fugitive surface emissions and to ambient air entering the waste pile under vacuum conditions.
- Storm water management consisting of perimeter drains, retention basins, and associated structures.

RECORD OF DECISION

Fresno Sanitary Landfill Superfund Site
Fresno, California
EPA ID # CAD980636914

PART I - DECLARATION

1.0 Statement of Basis and Purpose

This Record of Decision (ROD) presents the selected final remedial action for the Fresno Sanitary Landfill Superfund site (the Site) in Fresno California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. § § 9601 et seq, and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based on the Administrative Record for the site.

The State of California Department of Toxic Substances Control, as the lead state agency, concurs with this remedy.

2.0 Assessment of the Site

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

3.0 Description of the Remedy

This operable unit is the final action of two operable units for the site. The first operable unit at the site involved a landfill cover, a landfill gas collection and treatment system, and storm water runoff collection system. This action addresses the groundwater. The selected remedy includes:

- a groundwater monitoring system,
- a landfill perimeter groundwater containment system,
- a plume perimeter containment system, and
- a aquifer restoration system

4.0 Statutory Determinations

The selected remedy is protective of human health and the environment, and complies with the Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining on-site above health-based levels, the five year review will apply to this action.

<IMG SRC 0996150>
Keith Takata Date
Director, Superfund Division, EPA Region IX

Statutory Determinations

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

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

PART II - DECISION SUMMARY

Fresno Sanitary Landfill Superfund Site
Fresno, California

Analysis of the selected remedial action for the Fresno Sanitary Landfill Site is contained in the Proposed Plan published by EPA on March 30, 1993. The Site information summarized below is discussed fully in the Revised Final Technical Memorandum Fresno Sanitary Landfill Source Control Operable Unit (FTM) prepared for the City of Fresno by Camp Dresser and McKee dated January 20, 1993. After considering public comments, EPA has adopted the Proposed Plan, with minimal change, as the selected remedy. The State of California concurs with EPA's selected remedy.

1. Site Name, Location, and Description.

The Fresno Sanitary Landfill is located four miles southwest of the City of Fresno in Fresno County, California. The landfill consists of approximately 145 acres and is bounded on the north by Jensen Avenue, on the east by West Avenue, on the south by North Avenue and the west by agricultural fields. The landfill stands approximately 60 feet above the surrounding flat grade and extends approximately 30 feet below the surrounding grade. The area surrounding the landfill is primarily agricultural with several residences adjacent to the north and south boundaries. The landfill is surrounded by a fence. Eight municipal wells are located within 3 miles of the site. Water from these wells is blended into a system serving 350,000 people. The site receives an annual average precipitation of 10.5 inches usually during a several month wet season from November to April.

2. Site History and Enforcement Activities.

The FSL was owned and operated solely by the City of Fresno from 1937 to 1989, and is reported to be the oldest compartmentalized landfill in the Western United States. Operations began in the north section in 1937 as short trenches were dug to a depth of 3 feet (eventually increased to 25 feet). Waste was then dumped into the trench by collection trucks and the pile was leveled off and compacted. A second trench was dug adjacent to the first trench, and the dirt from the second trench was used to cover the waste fill. The landfill was never lined.

At the time of its inception, the landfill was located north of Annadale Avenue. The City expanded the landfill to the south of Annadale Avenue in 1945. Prior to this expansion, an irrigation canal extended in an east-west direction through what is now the south portion of the landfill. After expansion, this canal was replaced with a pipeline that is currently in use and is covered by landfill material.

The FSL was first evaluated by EPA pursuant to a CERCLA Section 103(c) notification by the City of Fresno Solid Waste Management Division filed on May 27, 1981. The California Department of Toxic Substances Control (DTSC) (formerly, California Department of Health Services) conducted a preliminary inspection of the site in June 1984 in response to complaint letters from nearby residents. The state inspectors found off-site migration of methane and also reviewed the documentation of volatile organic compound (VOC) contamination of groundwater.

In 1988 the City retained Laidlaw Gas Recovery Systems to design a landfill gas (LFG) extraction and energy recovery system for the FSL. Also, in 1988 two methane barriers were installed, on

the north and south sides of the landfill, by the City to prevent the exposure of nearby residents to migrating LFG. These barriers were designed and installed independent of any environmental agency involvement or oversight. The methane barriers are 26 foot deep trenches backfilled with gravel and a membrane liner on the landfill side of the barrier. The trenches have two perforated horizontal collection pipes at 12 and 19 feet in depth which are passively vented to the surface.

The Fresno Sanitary Landfill was finalized on the National Priorities List on October 4, 1989. EPA sent the City of Fresno a General Notice of liability for the FSL Superfund Site on April 5, 1990. On June 22, 1990 EPA sent the City a Special Notice letter inviting the City to submit a good faith offer to EPA to conduct the remedial investigation and feasibility study (RI/FS) for the FSL. On September 21, 1990 EPA and the City signed an Administrative Consent Order (U.S. EPA Docket No. 90-22) wherein the City of Fresno agreed to conduct the RI/FS.

In the summer of 1990, EPA held discussions with the City regarding the problem of migrating LFG and the possibility of installing a landfill cover and energy recovery facility on-site. Subsequently, with the consent of the City, EPA issued a Unilateral Order (U.S. EPA Docket No. 90-19) to the City on September 19, 1990. This order directed the City to: 1) apply an active vacuum system to the methane barriers to improve their gas LFG capture performance and 2) to install a landfill gas extraction system in the body of the landfill. Subsequently, the City's contractor, Laidlaw Gas Recovery Systems, withdrew from the gas extraction and energy recovery facility project. EPA then issued a second Unilateral Order to modify the original Order. The direction to install a vacuum system on the methane barriers was retained but because overall LFG control was not possible in the near future, the second Unilateral Order (U.S. EPA Docket No. 90-23) directed the City to implement a monitoring program to ensure that residents near the landfill, not protected by the methane barriers, were not being exposed to vinyl chloride (a potent carcinogen in the migrating LFG) in their homes.

From September 1990 to August 1991, the City proceeded to install a vacuum system on the methane barriers. The discharge from the vacuum system was to be passed through an activated carbon system to remove harmful VOCs. During start-up of the vacuum system the City discovered that the barriers were in direct contact with trash. Consequently the vacuum system collected some gas from the residents' side of the barrier but also collected gas from the refuse prism. The constant supply of LFG from the trash prism overwhelmed the activated carbon system. Without effective treatment, vacuum system operation would have necessitated discharge of the extracted LFG directly to the atmosphere.

Also in the summer of 1991, the City prepared a sampling plan to sample the soil gas between the landfill and homes not protected by the methane barriers. This sampling, which the City of Fresno conducted in September and October of 1991, revealed that not only was there vinyl chloride and other LFG contaminants in the soil gas near homes not protected by the barriers, but that homes supposedly protected by the barriers also had dangerous levels of vinyl chloride nearby in the soil gas. These homes were up to 700 feet from the landfill. In November 1991, the City sampled the in-home air of seven potentially affected residences. No vinyl chloride was detected in any of the homes on three different occasions (November 1991, March 1992 and November 1992).

EPA then determined that operation of the methane barrier vacuum system would not be appropriate. This was because; 1) the methane barriers had allowed LFG to migrate 700 feet directly past the barriers, 2) the vacuum system discharge would have to be released untreated and 3) the in-home air sampling showed no apparent immediate exposure to LFG under or near the homes.

These response efforts were performed concurrent with the RI, and were temporary and partial measures in response to the principle threat of migrating landfill gas. The source control operable unit should control migrating landfill gas and obviate any further temporary or partial measures.

3. Highlights of Community Participation.

Five fact sheets have been released describing activities at the Site. In March, 1993 EPA released a proposed plan for the Site. Site documents were made available at the EPA offices and at a local repository, and a public notice was published allowing 30 days for public comment

on the Proposed Plan. A 30 day extension to the public comment period was requested and granted. A public meeting was held on March 30, 1993 to describe the proposed remedy and receive comments. Four members of the public asked questions or made comments during the public meeting, and two written comment letters were received from the potentially responsible party (PRP) community. EPA has responded to all comments received during this period in the attached "Analysis of Public Comments."

4. Scope and Role of Remedial Actions.

The selected remedy is a source control operable unit and an interim remedy. The trash prism is the source of contamination at the FSL site with landfill gas and leachate acting as the primary release mechanisms. Surface runoff/erosion is considered a secondary release mechanism. This remedy will address only on-site control of contaminants. This will be by confinement, and by extraction and treatment of landfill gas, LFG condensate and leachate.

The SCOU systems in the remedy are intended to: (1) collect and control the release of LFG through the surface of the landfill and in the subsurface, (2) control the infiltration of storm water into the trash which would result in leachate percolation into the underlying groundwater, (3) collect and truck off-site for treatment leachate encountered in the gas extraction wells or LFG condensate encountered in the gas collection system, (4) control the intrusion of oxygen into the trash which would happen if a vacuum system were installed without a landfill cover, (5) control erosion and off-site transport of contaminated soils, (6) collect and manage the incident storm water, (7) treat the collected LFG to destroy any harmful contaminants in the LFG stream.

There will be a second and final operable unit ROD for the site. This second OU ROD will address groundwater, off-site vadose soils and any ancillary issues. This selected remedy is an interim remedy because there is still subsequent remedial action to be undertaken at the site, however the SCOU ROD contains certain final ARARs for this portion of the cleanup.

5. Site Characteristics.

The trash prism, which is the source of contamination, contains approximately 4.7 million tons (7.9 million cubic yards) of trash. The City has conducted site investigations which have included sampling and analysis of ambient air, indoor residential air, soil gas, landfill well groundwater, residential well groundwater and surface and subsurface soils. The City has also conducted a hydrogeologic investigation. While EPA had planned a leachate investigation it was not executed because of the health and safety issues of drilling through the refuse prism and the high expense of this investigation relative to the potential of locating leachate and the value of that information. The City has completed field investigations for a remedial investigation (RI) report, and a preliminary draft RI report has been submitted.

Ambient Air: Six air sampling stations were used where 24 hour composite samples were collected over two separate 24 hour periods. Samples were taken with Summa canisters under vacuum using control flow orifices. Samples were analyzed for benzene, carbon tetrachloride, chloroform, 1,2dichloroethane, 1,2-dichloromethane, methylene chloride, tetrachloroethane (PCE), 1,1,1-trichloroethane, trichloroethene (TCE), vinyl chloride and dichlorodifluoromethane (Freon-12). Vinyl chloride is typically the only contaminant which can be uniquely attributed to a landfill. Vinyl chloride results showed non-detect for all upwind ambient air samples while downwind samples were as high as 1 part per billion by volume (ppbv). Results for PCE and TCE were also non-detect for upwind samples and were as high as 1.8 ppbv and 0.64 ppbv respectively in the downwind ambient air. Residential Air: Indoor air samples were taken at three different times spanning 1 year at seven residences where temporary soil gas probe results indicated the potential for exposure of residents to vinyl chloride. Samples were taken with Summa canisters as 24 hour composite samples and were analyzed for the same contaminants as the ambient samples. Vinyl chloride was never detected in any indoor air samples.

Soil Gas: All soil gas samples were analyzed for the same contaminants as the ambient air samples plus methane except as noted. Samples which were taken with Summa canisters provided the only reliable data on vinyl chloride contamination. Summa canister samples were analyzed at a fixed base laboratory with a sophisticated cryogenic sample preconcentration step and a GC-mass spectrophotometer. Other sample analysis techniques had vinyl chloride reliability problems due to interference by other light chlorinated VOCs. All sampling and analysis has

provided reliable data on other LFG vadose contaminants.

Soil gas sampling comprised: (1) 199 temporary soil gas monitoring probe samples taken at a depth of 15 feet and analyzed with an on-site GC, (2) 48 temporary soil gas monitoring probe samples taken at a depth of 15 feet using a Summa canister and analyzed at a fixed base laboratory with a Gcmass spectrophotometer, (3) 26 samples taken with Summa canisters from permanent multidepth landfill perimeter gas monitoring wells, (4) 21 samples taken from permanent multidepth landfill perimeter gas monitoring wells analyzed with a hand held instrument for only methane, (5) 12 samples taken with Summa canisters from permanent off-site multidepth gas monitoring wells. The temporary soil gas probe samples were configured as columns 400 feet apart moving out from the landfill perimeter at 100 foot intervals. The permanent multidepth landfill perimeter gas monitoring wells are spaced 1000 feet apart along the perimeter of the landfill. Results from the soil gas investigation show extensive off-site LFG vadose contamination. Landfill gas was detected up to 700 feet from the landfill on the north, south and east sides, and up to 1000 feet from the landfill on the southwest side. Some maximum contaminant concentrations detected off-site in the vadose were: vinyl chloride - 9,000 ppbv, PCE - 25,665 ppbv, TCE - 3,753 ppbv, Freon 12 - 870,730 ppbv (8.7%, on the northwest side of the landfill) and methane - 57,256,858 ppbv (57%).

Results from the permanent multidepth landfill perimeter gas monitoring wells show maximum contaminant concentrations of: vinyl chloride 39,000 ppbv, PCE - 10,000 ppbv, TCE - 7,100 ppbv and methane - 58%.

Landfill Groundwater Monitoring Wells: Various investigations have identified three general hydrostratigraphic units: shallow (60-80 feet BGS), intermediate (110 - 140 BGS) and deep (180 - 235 BGS). These units appear to correspond to aquifer zones of more permeable sand units. These units were selected for well completion to vertically characterize a somewhat interconnected aquifer system. Any aquifer interconnection may be due to the natural stratigraphy and in part to the numerous irrigation and domestic wells in the area that are often screened or open across multiple permeable layers. Off-site groundwater wells were installed and completed at up to three discrete depths for a given location. A total of 43 wells were sampled at 26 locations. Water samples were analyzed for VOCs, semi-volatiles also known as base, neutral, acids (BNAs), pesticides/PCBs, herbicides, dioxins, metals and water quality parameters.

The results from the groundwater wells, in the three of five planned rounds of year long sampling have shown no pesticides, herbicides or dioxins. VOC contamination above health based acceptable levels includes vinyl chloride - 12 ppb (maximum contaminant level or MCL=0.5), PCE - 140 ppb (MCL=5), TCE - 140 ppb (MCL=5) and trans 1,2 DCE - 15 ppb (MCL=10). VOC contamination appears to be most significant in the shallow aquifer zone. There is slight VOC contamination of the intermediate zone and VOCs were not detected in the deep zone in this investigation. In addition, VOC contamination was detected in an irrigation well proximal to the landfill that has an unknown screen interval and may be open to a depth of several hundred feet.

The horizontal extent of VOC contamination in groundwater, varies between 400 and 700 feet to the east, between 700 and 1500 feet to the south, between 1200 to 1500 feet to the west and at least 1300 feet to the south.

Residential Groundwater Wells: There were 13 residential private drinking water wells sampled near the landfill (7 on the south and 6 on the north of the landfill). The samples were analyzed for VOCs, BNAs, pesticides/PCBs, herbicides, dioxins, metals and water quality parameters. Six of the 13 wells showed VOC contamination (1 on the north side and 5 on the south of the landfill). Residential well contaminants included PCE - 2.9 ppb, methylene chloride - 2.0 ppb, 1,2-dichloropropane - .53 ppb and trichloroflouromethane - 2.6 ppb. The City of Fresno has provided a number of the residences near the landfill with bottled drinking water or the City has installed activated carbon filters on their private domestic water systems.

Surface and Subsurface Soils: Surface soil samples were collected at 7 sites around the landfill. Samples were analyzed for volatile and semi volatile organics, pesticides, herbicides, PCBs, dioxins and metals. Xylenes (VOC) were detected in one sample on the east side of the landfill at .03 parts per million (ppm). The pesticide/PCB analysis showed one surface sample with several endosulfans and DDE (a degradation product of the pesticide DDT) at low

levels. All of the surface soil samples (except one) showed a variety of dioxin contamination at levels below a health based concern.

Subsurface soil samples were collected at various depths during the installation of seven landfill perimeter LFG monitoring wells. Samples were analyzed for volatile and semi volatile organics, pesticides, herbicides, PCBs, dioxins and metals. Analysis showed 1,4-dichlorobenzene - .04 ppm, xylenes .03 ppm and chloromethane - .1 ppm all on the east side of the landfill at depths between 3.5 and 6.5 feet. No pesticides, herbicides or BNAs were detected in these samples. Various dioxins were detected on the east side of the landfill at depths between 1 and 6.5 feet at levels below health based concern. During the installation of off-site groundwater monitoring wells pilot borings were sampled at depths ranging from 70 to 235 feet. These samples were analyzed for VOCs and total organic carbon. Methylene chloride and chloromethane were detected in three samples at low levels (0.4 and 0.03 ppm respectively.

6. Summary of Site Risks.

A final risk assessment for the site will be incorporated into the final operable unit ROD. An ecological assessment has not been performed but may be incorporated into the final risk assessment if EPA determines a need for such a study. EPA has determined that the landfill cover and gas control systems are necessary to stabilize the site, prevent further degradation of groundwater and achieve significant risk reduction quickly. A landfill cover and gas control system are necessary in order for any remedial action for off-site groundwater and vadose cleanup to be effective.

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

The Site is currently fenced and unoccupied. There is no surface cover other than several inches to several feet of local soil. A potential risk exists from inhalation of air contaminated by landfill gas seeping through the existing cover and mixing with the ambient air. There is also a potential risk that air in nearby residences could be contaminated from subsurface LFG migration, followed by gas transport into the living space. All monitoring performed to date, however has shown no LFG migration into homes. These potential inhalation risks are important because the LFG contaminant vinyl chloride is an especially potent carcinogen for young children. Until the landfill gas is collected and treated these potential risks will remain. The performance criteria for the gas collection and treatment system will ensure that these risks are minimized.

Possible ingestion of contaminants can occur if landfill gas comes into contact with and contaminates groundwater which is a drinking source. There are several private drinking water wells which have been contaminated by landfill contaminants. This risk is minimized with the control of the subsurface migration of landfill gas. Collection and treatment components of the selected remedy will provide this control.

Groundwater contamination can also occur as leachate generated in the refuse prism comes in contact with groundwater underlying the site. The impact of this contaminant transport mechanism will be limited by the construction of the landfill cover and drainage system. By preventing ponding of storm water and subsequent infiltration into the refuse, leachate generation is minimized.

7. Description of Alternatives.

Alternatives were analyzed to address contaminant source control at the site. The primary contaminant transport mechanisms addressed are LFG and leachate. A summary of the alternatives is presented below. Each alternative is described in detail in the Source Control Operable Unit Final Technical Memorandum found in the Administrative Record. With the exception of the no action alternative the various remedial alternatives are some combination of a landfill cover and on-site or off-site LFG treatment. The different landfill coversare the same except for the low permeability layer.

Alternative 0 - No Action:

As required by the NCP, a no-action alternative was considered as a baseline for comparison. This alternative would leave the landfill as it is with no further effort to clean up the problems associated with the landfill. Landfill gas monitoring would be conducted, however, to determine the impacts associated with no cleanup action. The costs associated with this alternative are due to the regular gas monitoring and the maintenance of the monitoring wells. The annual cost of Alternative 1 is $24,000, and the thirty year present worth cost is approximately $369,000.

Containment Component

Landfill Cover: The landfill cover will have different layers. Starting from the bottom, they are a foundation layer, a low permeability layer, a drainage layer, a filter layer and a landscaped layer. There are several alternatives for the low permeability layer of the landfill cover, which is the most important feature of the cover. This layer will prevent storm water from infiltrating into the landfill and will prevent gas from escaping from the landfill. The other layers in the cover will remain the same regardless of which low permeability layer is used. The low permeability layer alternatives which were considered are given below with the capital costs for the entire cover using that particular low permeability layer.

Alternative (1) a one foot thick low permeability clay layer, cost - $18,893,000

Alternative (2) a two foot thick layer of more permeable local clay, cost - $14,406,000

Alternative (3) a synthetic membrane similar to a thick plastic sheet, cost - $12,621,000 and

Alternative (4) a composite of one foot of low permeability clay under a synthetic membrane, cost - $21,766,000.

Treatment Components

Landfill Gas Treatment: The two landfill gas treatment alternatives are on-site LFG flaring which is alternative 5 or off-site LFG combustion to generate electricity which is alternative 6. The off-site energy recovery alternative requires a conveyance pipeline to the Power Generation Facility.

Alternatives 5 and 6 have several components in common. Both alternative 5 and 6 include: (1) a landfill gas collection and conveyance system consisting of interior gas extraction wells, perimeter gas extraction wells, a blower system, and a piping system for conveyance of collected gas; (2) a gas condensate collection system consisting of piping and storage vessels to manage the condensate generated during the operation of the gas control system (collected condensate will be trucked off-site for treatment); (3) a storm water management component consisting of perimeter drains, retention basins, and associated structures; (4) a landfill gas migration monitoring system consisting of a series of monitoring probes placed along the landfill perimeter; and (5) a contingency leachate collection system consisting of liquid extraction pumps placed in the bottoms of gas extraction wells, piping to convey the leachate and storage vessels to manage the collected leachate. The collected leachate will be trucked off-site for treatment. This leachate contingency will be implemented if EPA determines that liquid levels found in a gas well are a threat to groundwater.

The performance criteria for the flare station operation will include a minimum combustion temperature and flow rate restrictions which will maintain a minimum residence time. These requirements together will achieve a destruction efficiency for VOCs. Periodic emission monitoring will be carried out to assess the effectiveness of the system in meeting the destruction efficiency. The specific destruction efficiency necessary will be determined by EPA during the design of the system pursuant to the 10[-6] maximum excess cancer risk performance criteria.

Alternative (5) - On-site Landfill Combustion In A Landfill Gas Flare: The on-site LFG treatment facility will consist of two landfill gas flares of the same or similar size. One will be used to combust gas collected from the interior gas control system and one will combust gas collected from the perimeter system. The two flares of same or similar size will allow for some redundancy within the system and flexibility in the way the total facility is operated (e.g., blending of all gases, if appropriate). Flares and accessory equipment, piping, and

valving will be designed so that various operational scenarios can be used. Blowers will be installed to withdraw the gas by placing a vacuum on the header lines. A spare blower will be installed at the treatment facility for redundancy in case one blower should fail.

The capital cost of alternative (5), independent of the landfill cover is $5,295,000, and the present worth cost of thirty years operation and maintenance (O&M) is $5,279,000. The total present worth cost is $10,574,000.

Alternative (6) - Off-site Landfill Gas Combustion For Energy Recovery: The off-site LFG combustion, alternative (6) is similar to the on-site LFG combustion, alternative (5) except that one flare is eliminated and the high methane content LFG collected from the interior control system would be transported by conveyance pipeline, three miles west, to the City of Fresno Regional Wastewater Facility (RWWF) for combustion and energy recovery in a Power Generation Facility (PGF). Landfill gas collected from the perimeter extraction system would be combusted using a LFG flare system located on-site. This system will have one flare and two blowers. There will be a primary blower and a back-up blower in case of a primary blower failure.

The capital cost for alternative (6) without the landfill cap is $9,835,000 and the present worth of the operation and maintenance for thirty years is $6,041,000. The total present worth cost is $17,876,000. These costs do not include any credits for the electricity savings at the treatment plant. It is difficult to accurately calculate the present worth of the electricity savings, but it is likely that the net cost of this alternative would be lower than alternative (5) if the electricity savings were included.

8. Summary of Comparative Analysis of Alternatives.

Overall Protection of Human Health and the Environment

Alternative 0 (no action) will not be protective of human health and the environment.

Containment Component: Alternatives 1,2,3 and 4 equally and adequately will control landfill gas surface emissions, subsurface LFG migration, enhance LFG extraction well efficiency and control odors. Alternatives 1,3 and 4 will control infiltration of stormwater into the trash thereby protecting the underlying groundwater. Alternative 2 is less likely than Alternatives 1, 3 and 4 to adequately control stormwater infiltration and protect groundwater.

Treatment Component: Alternatives 5 and 6 equally and adequately will treat the collected LFG by thermally destroying hazardous contaminants in the LFG stream.

Compliance with ARARs and Performance Standards

Containment Component: Alternatives 1,3 and 4 will achieve the action specific ARAR of a maximum 10[-6]cm/sec water permeability landfill cover. Alternative 2 is not likely to comply with this action specific ARAR.

Alternatives 1,2,3 and 4 will achieve the chemical specific performance standard for surface emission control of 1000 parts per million methane maximum at any point on the landfill surface. Alternatives 1,2,3 and 4 will achieve the chemical specific ARAR, Section 17783 of Title 14 of the California Code of Regulations, for subsurface migration control of less than 5% methane at the boundary.

Treatment Component: Alternatives 5 and 6 will achieve the action specific performance standard of 10[-6]excess cancer risk from the landfill gas treatment facility emissions, and the action specific threshold minimum of 98% destruction efficiency for any reactive organic except methane.

Long-term Effectiveness and Permanence

Containment Component: A quantitative residual risk calculation has not been performed for this operable unit. Alternative 2 may have a higher residual risk due to a greater water permeability and consequently a greater threat to groundwater. Alternatives 3 and 4 have a greater likelihood of long-term effectiveness during differential settlement. A clay low

permeability layer will crack during differential settlement of the trash whereas a synthetic membrane will tend to deform but remain effective during differential settlement. Alternatives 1,2 and 4, which use clay as part or all of the low permeability layer will require water to be applied to keep the cover moist. If the cover is not kept moist it will desiccate and crack in the arid Fresno climate, which will render the cover ineffective. Alternative 3 will not require such a watering system and will not crack due to desiccation, and therefore satisfies the requirement of long-term effectiveness and permanence.

Treatment Component: Alternatives 5 and 6 will have equivalent and adequate long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Containment Component: Alternatives 1,2,3 and 4 equally and adequately will improve the efficiency of the LFG collection and treatment alternatives.

Treatment Component: Alternatives 5 and 6 will achieve adequate treatment of the collected LFG stream. Generally, LFG flares (Alternative 5) achieve a greater destruction and removal efficiency of hazardous contaminants than energy recovery units (Alternative 6) because flares can achieve higher operating temperatures.

Short-Term Effectiveness

Containment Component: Short term risks to the community posed by construction may exist, but will be mitigated by proper controls. Environmental impacts which may include noise, LFG emissions, erosion, odors and dust during construction will require engineering controls. Alternatives 1,2,3 and 4 will have equal and adequate short-term effectiveness.

Treatment Component: Alternatives 5 and 6 will have equal and adequate short-term effectiveness.

Implementability

Containment Component: Alternative 1 is the most administratively implementable because it is the prescriptive landfill cover alternative. Alternatives 2,3 and 4 will require administrative approval by EPA as engineered alternatives to the prescriptive landfill cover. Alternative 3 is the most administratively implementable engineered alternative because EPA has selected the RWQCB proof criteria for this Alternative.

Alternative 3 has the greatest technical implementability because a synthetic membrane can be easily anchored to the top of the landfill and will be less likely to slip on the steep slopes on the east side of the landfill. Alternatives 1, 2 and 4, which call for clay covers, would not be as easily implementable or stable.

Alternative 3 can be implemented with a variety of services and materials, however Alternatives 1 and 4 will require clay, which may not be as easily available. Alternative 2 would use a clay like material which is locally available.

Treatment Component: Alternative 5 is administratively and technically implementable. Alternative 6 is technically implementable and will require construction of a conveyance pipeline and energy recovery units in addition to the LFG flare facilities required in Alternative 5. Alternative 6 is not as administratively implementable because it will require various offsite permits and local agency involvement beyond that required for Alternative 5. Alternative 6 will also require integration with another existing facility.

Alternative 5 can be implemented with readily available services and materials. For Alternative 6, the emissions standards established to operate the energy recovery units on landfill gas will impact the availability of this equipment. The LFG contaminants may limit the number of vendors with established track records able to offer the engines and turbines capable of meeting the emissions standards.

Cost

Each alternative was formulated in sufficient detail to develop capital and operating costs within a range of -30% and +50%. A present worth analysis was used to evaluate annual operations and maintenance (O&M) costs, and a discount rate of 5% was applied for analysis. Capital costs for each containment alternative are provided and the present worth costs for the treatment alternatives are provided. The treatment present worth cost includes a lump sum annual O&M cost for the containment alternatives.

Containment Components: All containment components are the same except for the low permeability layer.

Alternative (1) a 1 foot thick 10[-6]cm/sec permeability claylayer, cost - $18,893,000

Alternative (2) a two foot thick layer of more permeable local clay (approximately 10[-6]cm/sec), cost - $14,406,000

Alternative (3) a synthetic membrane cost - $12,621,000 and

Alternative (4) a composite of one foot of 10[-6]cm/sec permeability clay under a synthetic membrane, cost - $21,766,000.

Treatment Component:
Alternative (5), on-site LFG flare.

The capital cost of alternative (5), independent of the landfill cover is $5,295,000, and the present worth cost of thirty years operation and maintenance (O&M) is $5,279,000. The total present worth cost is $10,574,000.

Alternative (6), off-site LFG combustion for energy recovery.

The capital cost for alternative (6) without the landfill cap is $9,835,000 and the present worth of the operation and maintenance for thirty years is $6,041,000. The total present worth cost is $17,876,000. These costs do not include any credits for the electricity savings at the treatment plant. It is difficult to accurately calculate the present worth of the electricity savings, but it is likely that the net cost of this alternative would be lower than alternative (5) if the electricity savings were included.

State Acceptance

EPA is the lead agency and is responsible for overseeing the remedy selection for the Site and this interim remedy operable unit. The California Department of Toxic Substances Control is the lead state agency coordinating state response and interaction for the Site. After considering comments from the public, potentially responsible parties, and other state agencies, all of which are included in the attached Response to Public Comment Summary, EPA is finalizing its selection of this interim remedial action for the Site in this ROD. The Department of Toxic Substances Control as the representative for the State of California concurs with the choice of remedy.

Community Acceptance

A public meeting to discuss and receive comment on the proposed remedy was held on March 30, 1993. Community members appeared satisfied with agency responses to questions and with the selected remedy. Residents and nearby community members have long supported a landfill cover and gas extraction system for protection of their health, protection of their property values and for aesthetic reasons. Specific responses to public comments are included in the attached Response to Comments, which is incorporated as part of the Administrative Record for this decision.

9. Selected Remedy.

EPA's Selected Material For The Low Permeability Layer Of The Landfill Cap:

The synthetic membrane (Alternative 3) is the selected low permeability layer in the cover. This alternative has several important advantages over the others (Alternative 1,2,4). It is

the least maintenance intensive, and it will not require water to be applied to keep it moist. If a clay cap is allowed to dry it will crack (Alternatives 1,2). A synthetic membrane will also be effective as portions of the landfill settle. Differential settling may crack a clay cap (Alternatives 1,2). The synthetic membrane (Alternative 3) will deform slightly without failure as the landfill settles. On the steep slopes on the east side of the landfill a synthetic membrane can be anchored to the top easily and would be less likely to slip on the slope which could be a problem for a clay cap (Alternatives 1,2,4). A synthetic membrane (Alternative 3) is also the least costly of the various alternatives.

EPA's Selected Landfill Gas Treatment Remedy:

The selected alternative for landfill gas treatment is Alternative 5, on- site landfill gas combustion in a landfill gas flare. This is because it is protective of human health and the environment, meets ARARs, and it can be implemented immediately. The off-site landfill gas combustion for energy recovery, alternative 6, has a number of issues which presently jeopardize its implementability. Also, most of the components of Alternative 5, the on-site landfill gas flare alternative will be required as backup facilities if Alternative 6, the off-site energy recovery alternative is ever implemented. Furthermore, EPA would like to encourage the use of Alternative 6, the off-site energy recovery, if the City of Fresno determines that it is advantageous. EPA would allow implementation of the off-site energy recovery alternative through a modification to this ROD if and when the City of Fresno is prepared to design and construct this alternative.

The control of storm water infiltration will be effective as soon as the landfill cover construction is complete. While leachate generation will be reduced, leachate may still pose some reduced threat to groundwater.

The major components of the selected remedy include:

- Landfill gas collection and conveyance system consisting of interior gas extraction wells, perimeter gas extraction wells, a blower system, and a piping system for conveyance of collected gas to an on-site gas treatment system.
- Landfill gas migration monitoring system consisting of a series of monitoring probes placed along the landfill perimeter.
- Landfill gas treatment system consisting of on-site combustion of landfill gas in landfill gas flares.
- Gas condensate collection system consisting of piping and storage vessels to manage the condensate generated during the operation of the gas control system. Collected condensate will be trucked off-site for treatment.
- A contingency leachate collection system consisting of liquid extraction pumps placed in the bottoms of gas extraction wells, piping to convey the leachate and storage vessels to manage the collected leachate. The collected leachate will be trucked off-site for treatment. This leachate contingency will be implemented if EPA determines that liquid levels found in a gas well are a threat to groundwater.
- Landfill cover consisting of a series of functional layers that together minimize the infiltration of water into underlying refuse by using a synthetic membrane as the low permeability layer, provide erosion control, and contribute to effective operation of the gas control system by providing a barrier to fugitive surface emissions and to ambient air entering the waste pile under vacuum conditions.
- Storm water management consisting of perimeter drains, retention basins, and associated structures.

10. Statutory Determinations

Protection of Human Health and the Environment

The selected remedy protects human health and the environment through extraction and thermal

destruction of landfill gas and installation of landfill cover. The thermal destruction will permanently remove harmful contaminants in the LFG such that the excess cancer risk from ambient air exposure to LFG treatment facility effluent will not be greater 10[-6]. The landfill cover will be designed to reduce surface emissions and odors; prevent oxygen intrusion into the refuse, which will allow the gas control system to work effectively; prevent surface water infiltration which will assist in leachate management; and promote erosion control.

Short-term risks associated with the selected remedy can be easily controlled. In addition, no adverse cross-media impacts are expected from this remedy.

Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy for the source control operable unit will be designed to attain the following ARARs. These ARARs were identified from federal, and more stringent promulgated state and local environmental and public health laws.

The California Regional Water Quality Control Board - Central Valley Region (CRWQCB-CVR) has identified Sections of Title 23, Chapter 15 of the California Code of Regulations as ARARs. The Sections EPA selects as ARARs are; Section 2510(a), 2510(b), 2510(c) and 2510(d) of Chapter 15, which pertain to applicability of chapter 15 and to engineered alternatives to the prescriptive standard for final cover at a waste management unit; Section 2580 of Chapter 15, which pertains to general closure requirements; Section 2581 of Chapter 15, pertaining to landfill closure requirements; Section 2540 of Chapter 15, which pertains to general construction standards for containment structures; Section 2541 of Chapter 15, which pertains to general design and construction requirements for containment structures; Section 2546 of Chapter 15, which pertains to the design, construction and maintenance of drainage, collection and holding facilities for waste management units; Section 2547 of Chapter 15, which pertains to design and construction of landfill structures to withstand seismic events; Section 2596 of Chapter 15, which pertains to the information required in the design reports and operations plan for containment structures, precipitation and drainage control facilities and ancillary facilities.

The California Integrated Waste Management Board (CIWMB) has identified Sections of Title 14, California Code of Regulations as ARARs. The Sections which EPA selects as ARARs are; Section 17705 of Title 14, which pertains to gas control; Section 17774 of Title 14, which pertains to construction quality assurance; Section 17783 of Title 14, which pertains to gas monitoring and control during closure and post-closure; Section 17783.9 of Title 14, which pertains to monitored parameters; Section 17783.11 of Title 14, which pertains to monitoring frequency; Section 17773 of Title 14, which pertains to final cover; Section 17777 of Title 14, which pertains to final site face; Section 17778 of Title 14, which pertains to final drainage; Section 17779 of Title 14, which pertains to slope protection and erosion control; Section 17778.5 of Title 14, which pertains to perimeter monitoring network; Section 17783.7 of Title 14, which pertains to structure monitoring; Section 17776 of Title 14, which pertains to final grading; Section 177783.15 of Title 14, which pertains to gas control; Section 17788 of Title 14, which =pertains to post-closure maintenance; Section 17792 of Title 14, which pertains to change of ownership during closure and post-closure maintenance; Section 17796 of Title 14, which pertains to post-closure land use.

Additional Performance Requirements

EPA selects the following as performance criteria for the selected interim remedy. Ambient air concentrations of landfill gas contaminants or landfill gas treatment facility contaminant emissions shall not exceed a level, as determined by EPA, which would cause a 10[-6] excess cancer risk as determined pursuant to the California Air Pollution Control Officers Association (CAPCOA) Air Toxics "Hot Spots" Program Risk Assessment Guidelines (January 1991).

At a threshold minimum, the remedy must meet the requirements of the Solid Waste Disposal Sites - Draft Rule 46-42, which (1) establishes a reactive organic destruction efficiency of 98% for any reactive organic except methane, (2) requires that flares designed as part of the landfill gas control system be enclosed in a shroud, and (3) requires that the maximum concentration of organic compounds measured as methane, measured at any point on the surface of the landfill, shall not exceed 1000 ppm.

(Note: Section 4.2.1.6 of Rule 2201 of the Rules and Regulations of the San Joaquin Valley

Unified Air Pollution Control District (SJVUAPCD) exempts the selected interim remedy from the "offset" requirements which would otherwise be applied to the flare effluent, including oxides of nitrogen under the Rule.)

The landfill gas extraction system will be operated until LFG production has declined to the extent that the compliance points LFG monitoring (at the surface an organic compound maximum of 1000 ppm measured as methane and at the perimeter monitoring wells a maximum of 5% methane) requirements can be met without active LFG extraction. The LFG flares shall be operated as long as the LFG extraction system is in operation.

Cost-Effectiveness

The selected remedy is the most cost effective remedy which is protective of human health and the environment, complies with ARARs. The selected remedy is also the most cost effective remedy which has the greatest likelihood of long-term effectiveness, reducing toxicity, mobility, or volume through treatment, short-term effectiveness and implementability. The present worth cost of the proposed synthetic membrane landfill cover, LFG control system with on-site LFG treatment and other ancillary systems will be approximately $23,195,000.

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

EPA believes the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used for this operable unit at the Fresno Sanitary Landfill. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined the selected remedy provides the best balance in terms of long-term effectiveness and permanence, reduction in toxicity, mobility and volume through treatment, short-term effectiveness, implementability, and cost while considering the statutory preference for treatment as a principal element as well as community input.

The combination of alternatives 3 and 5 reduces the toxicity, mobility, and volume of the contaminants in the landfill gas, complies with ARARs, provides short-term effectiveness, and protects human health and the environment more effectively and more rapidly than any of the other alternatives considered. The selected remedy is more reliable and can be implemented with less difficulty than the other landfill cover alternatives or off-site gas combustion for energy recovery, and is therefore determined to be the most appropriate and cost-effective remedy for this operable unit at the Fresno Sanitary Landfill site.

Preference For Treatment As A Principal Element

By treating the landfill gas using thermal destruction, the selected remedy satisfies the statutory preference for remedies that employ treatment of the principal threat which permanently and significantly reduces toxicity, mobility, or volume of hazardous substances as a principal element. The landfill cover further increases the efficiency of the gas control system by reducing surface emissions and preventing oxygen intrusion into the refuse. The selected interim remedy also uses treatment for the collected LFG and leachate which will be trucked off-site for treatment. The NCP (55 FR 8846, March 8, 1990) indicates that "EPA expects to use treatment to address the principal threat posed by a site, whenever practicable" and "...to use engineering controls, such as containment, for waste that poses a relatively low long term threat or where treatment is impracticable." The selected remedy for hazardous substances remaining on-site meets the NCP expectation for engineering controls rather than treatment of wastes where treatment is impracticable, because it would be impracticable to remove and treat the estimated 4.7 million tons (7.9 million cubic yards) of trash in the landfill due to severe implementability problems, the potential for significant short-term risks and prohibitive costs.

11. Documentation of Significant Changes:

The synthetic membrane landfill cover and on-site landfill gas combustion in a landfill gas flare were presented in the proposed plan as the preferred alternative. No significant changes have been made to these alternatives, although a contingency has been added to the selected remedy which includes a leachate collection system in any gas extraction wells which are found to contain levels of leachate which may pose a threat to groundwater. Any collected leachate may be added to the landfill gas condensate collection system and will be trucked off-site for

treatment. This leachate collection contingency, even if implemented in each gas well, will not significantly affect the cost of the selected remedy. The use of this contingency in every gas well may increase the total remedy costs by $1 to $2 million. Since the cost of the proposed remedy is estimated to be $23,195,000, with an accuracy range of -30% to +50%, the cost of the remedy is not significantly affected.