United States Environmental Protection Agency

Region 8
999 18th Street, Suite 300
Denver, CO 80202

Colorado, Montana,
North Dakota, South Dakota,
Utah, Wyoming

EPA Announces the Proposed Plan for the Former Tire Pile Area

Lowry Landfill Superfund Site
Arapahoe County, Colorado **May 2005**

This Proposed Plan will tell you about:

- Site History
- Description of the Remedial Action Selected by EPA in 1994
- Changes to the Remedial Action
- What are the Public Health Risks Posed by the FTPA Waste Pits?
- What are EPA's Objectives for Cleanup Action at the FTPA Waste Pits?
- Summary of Remedial Alternatives
- How does EPA Compare Alternatives?
- Evaluation Criteria
- The Preferred Alternative

In 1994, the Environmental Protection Agency (EPA) issued a Record of Decision (ROD) that laid out a plan for addressing contamination at the Lowry Landfill Superfund Site (the Site). The ROD specified that contamination in the three waste pits located in what is known as the Former Tire Pile Area (FTPA) would be excavated and transported to an offsite disposal facility. Three years later, EPA determined that the contaminated material could be safely and successfully treated to allow it to be disposed on the Site, and changed the ROD to permit this. EPA issued an "Explanation of Significant Differences" in 1997 to inform the public of the change.

In 1998, one FTPA waste pit (middle waste pit) was excavated successfully and the excavated material was treated onsite. However, when digging into the second waste pit (north pit) in May 1999, the amount and toxicity of vapors were not expected and overwhelmed the measures put in place to protect workers. Excavation of the second waste pit was stopped immediately and efforts were undertaken to:

- Gather additional information on the contents of the two remaining waste pits to better understand the conditions;
- Attempt another cleanup approach on a smaller scale; and
- Evaluate all that has been learned by conducting a study of alternatives.

The goal of these efforts has been to find the best solution for the two remaining FTPA waste pits.

EPA is pleased to announce this Proposed Plan for those waste pits. The plan identifies the alternative preferred by EPA to address the environmental problems posed by the two remaining FTPA waste pits at the Lowry Landfill Superfund Site. It also provides a brief summary of all the alternatives considered by EPA over the last several years and the rationale for selecting the Preferred Alternative.

The Preferred Alternative, Alternative 4, is to:

- **Extract the most highly concentrated undissolved liquid waste, called "non aqueous phase liquid" (NAPL), from within and immediately outside of the Former Tire Pile Area waste pits;**
- **Transport the NAPL offsite to a licensed disposal facility;**
- **Maintain an earthen cover over the waste pits; and**
- **Monitor the groundwater migrating away from the waste pits.**

The Preferred Alternative, in conjunction with the other Superfund actions being taken at the Site, will protect public health and the environment.

For More Information

PUBLIC MEETINGS

June 8, 5:30 - 8:00 p.m.

June 14, 6:00 - 8:30 p.m.

(see bottom of page 20 for meeting locations)

INFORMATION CENTERS

EPA Superfund Records Center
999 18th Street
Denver, CO 80202
(303) 312-6473

(Complete Site files and Administrative Records)

Aurora Public Library (Central Library)
14949 E. Alameda Parkway
Aurora, CO 80012
(303) 739-6600

(Selected Site documents)

Information about the Lowry Site can also be obtained on the Internet at:

http://www.epa.gov/region8/superfund/sites/co/lowry.html

KEY CONTACTS

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The public has 30 days to comment on this Proposed Plan from May 26 until June 27, 2005. During this time, send written comments to:

Lowry Landfill Comments
Bonnie Lavelle, Remedial Project Manager
EPA Region 8, 8EPR-SR
999 18th Street, Suite 300
Denver, CO 80202-2466

You may also email your comments to r8lowryftpacomments@epa.gov.

If you would like to request a 30-day extension of the public comment period, requests may be submitted in writing (or emailed) to the above address and must be postmarked no later than June 17, 2005.

One of EPA's responsibilities is to provide an opportunity for the public to comment on this Proposed Plan. During the comment period, comments may be submitted in writing by mail, email or orally at the public meetings on June 8 and June 14, 2005. Information regarding upcoming public meetings is provided in the shaded box on the bottom of page 20. You can find more information about the FTPA waste pits at the Lowry Landfill Superfund Site in reports and other documents located in the information centers listed in the shaded box to the left.

EPA encourages the public to review and comment on all the alternatives presented in this Proposed Plan. EPA will make its final cleanup decision after the comment period closes. As part of this process, EPA will consider comments and consult with the Colorado Department of Public Health and Environment (CDPHE). EPA may modify the Preferred Alternative or choose a different alternative based on public comments or new information.

Site History

The approximately 480-acre Lowry Landfill Superfund Site is located near the intersection of Quincy Avenue and Gun Club Road in Arapahoe County, 15 miles southeast of the City and County of Denver and 2 miles east of Aurora, Colorado. (Figure 1). The Denver Arapahoe Disposal Site, an operating municipal solid waste landfill northeast of the intersection of Gun Club Road and East Hampden Avenue, forms the northern boundary of the Site. The City and County of Denver (Denver) owns the Site.

From the mid-1960s until 1980, Denver operated a "co-disposal" landfill at the Site, which means that both industrial waste (solid and liquid) and municipal solid waste were accepted for disposal there. The liquids were placed into 78 unlined trenches over approximately 200 acres, and then solids such as soil, old tires and household refuse were added to the trenches to absorb the liquids. The types of waste disposed at Lowry Landfill using this practice included industrial de-greasers, paint, pesticides, hospital and veterinary waste, metal-plating waste, petroleum products, sewage sludge, tires and household waste.

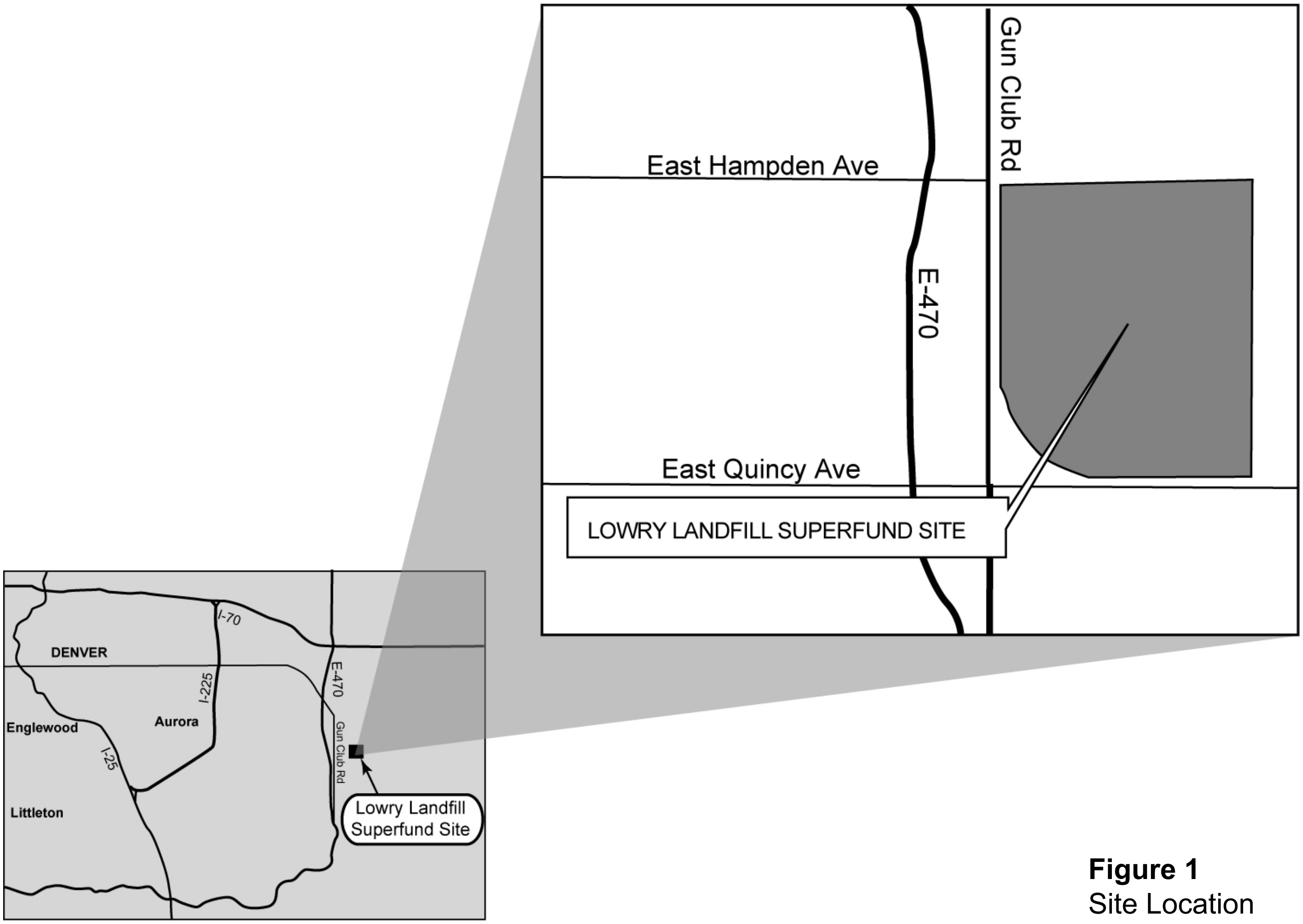


Figure 1
Site Location

EPA estimates that approximately 138 million gallons of industrial wastes were disposed of at Lowry Landfill. Nearly all of these wastes were disposed in the southern half of the Site within the 200-acre main landfill. A much smaller volume of waste was placed north of the main landfill in ponds and waste pits. Some liquids were sprayed directly onto the soil in large "leachate spraying" areas located in the northern part of the Site.

During the 1970s and 1980s, millions of tires had accumulated at the Site. The tires were laid on top of other waste that had been placed in three separate pits, each approximately 20-30 feet deep. From 1989 through 1992, the City and County of Denver and its contractors removed, shredded and consolidated the tires and placed the tire shreds in a monofill on the east side of the Site for potential future re-use as fuel. The area and three waste pits that lay under the tires became known as the FTPA.

In 1980, Denver stopped co-disposal practices. Landfill operations continued at the Site until 1990, but were restricted to disposal of municipal solid waste only. From 1980-1990, Waste Management of Colorado (WMC) operated the Lowry Landfill under a contract with Denver.

Co-disposal at the Lowry Site, 1970s

The waste disposed at Lowry Landfill contaminated the soils at the Site and eventually contaminated shallow groundwater. Additionally, gases from the buried wastes contaminated the air spaces in subsurface soil.

In 1984, EPA designated Lowry Landfill as a Superfund Site. This designation allowed EPA to access federal funding from the Superfund trust fund to conduct investigations into the environmental problems there. The Superfund designation also allowed EPA to compel those responsible for disposal of hazardous substances to perform investigations or otherwise contribute to the effort.

In 1990, all landfill operations stopped at the Site to allow environmental investigations to proceed without interference. The landfill operator, WMC, constructed a soil cover over the 200-acre main landfill in the southern part of the Site. The landfill cover is at least 4 feet thick and up to 12 feet in thickness in some places.

Description of the Remedial Action Selected by EPA in 1994

After investigating the contamination at the Site, evaluating the potential risk the Site posed to human health and the environment and considering alternative strategies for cleaning up the Site, EPA selected a comprehensive plan for the Site in 1994. The plan is described in detail in the ROD signed by both EPA and CDPHE on March 10, 1994.

The plan is based on the concept of "containment," which means protective measures are put in place to prevent movement offsite of contamination above safe levels. EPA requires proof that safe levels are achieved at locations inside the Site boundaries, called the "point of compliance," illustrated on Figure 2. Most of the components of the plan are currently in place and operating to achieve the objectives described in the 1994 ROD. The completed components are described below and illustrated on Figure 2.

An 8,800-foot-long underground Groundwater Barrier Wall of soil and clay encloses the west, south and east sides of the main landfill in the southern part of the Site. The wall is below the ground surface, approximately 40 to 75 feet deep. The wall minimizes the flow of clean groundwater onto the Site from the south and west, and the flow of groundwater away from the Site to the east, reducing the volume of contaminated groundwater produced by contact with the wastes buried in the landfill.

Former Tire Pile Area along Unnamed Creek, 1986

The landfill cover is maintained as part of the plan selected in the ROD. The cover minimizes the amount of rainwater that can seep into the landfill, thus reducing the amount of groundwater that could become contaminated by contact with the wastes in the landfill. In 1999, 2 feet of additional soil cover were placed on the 29-acre north face of the landfill to provide a minimum cover thickness of 4 feet over the entire closed landfill area.

At the northern limit of the main landfill, a trench (North Toe Extraction System) collects contaminated groundwater flowing north from the buried wastes. The groundwater collected in the trench is pumped to the water treatment plant located at the northern boundary of the Site.

At the intersection of the unnamed creek alluvial channel and the northern Site boundary, contaminated groundwater is captured in another system called the

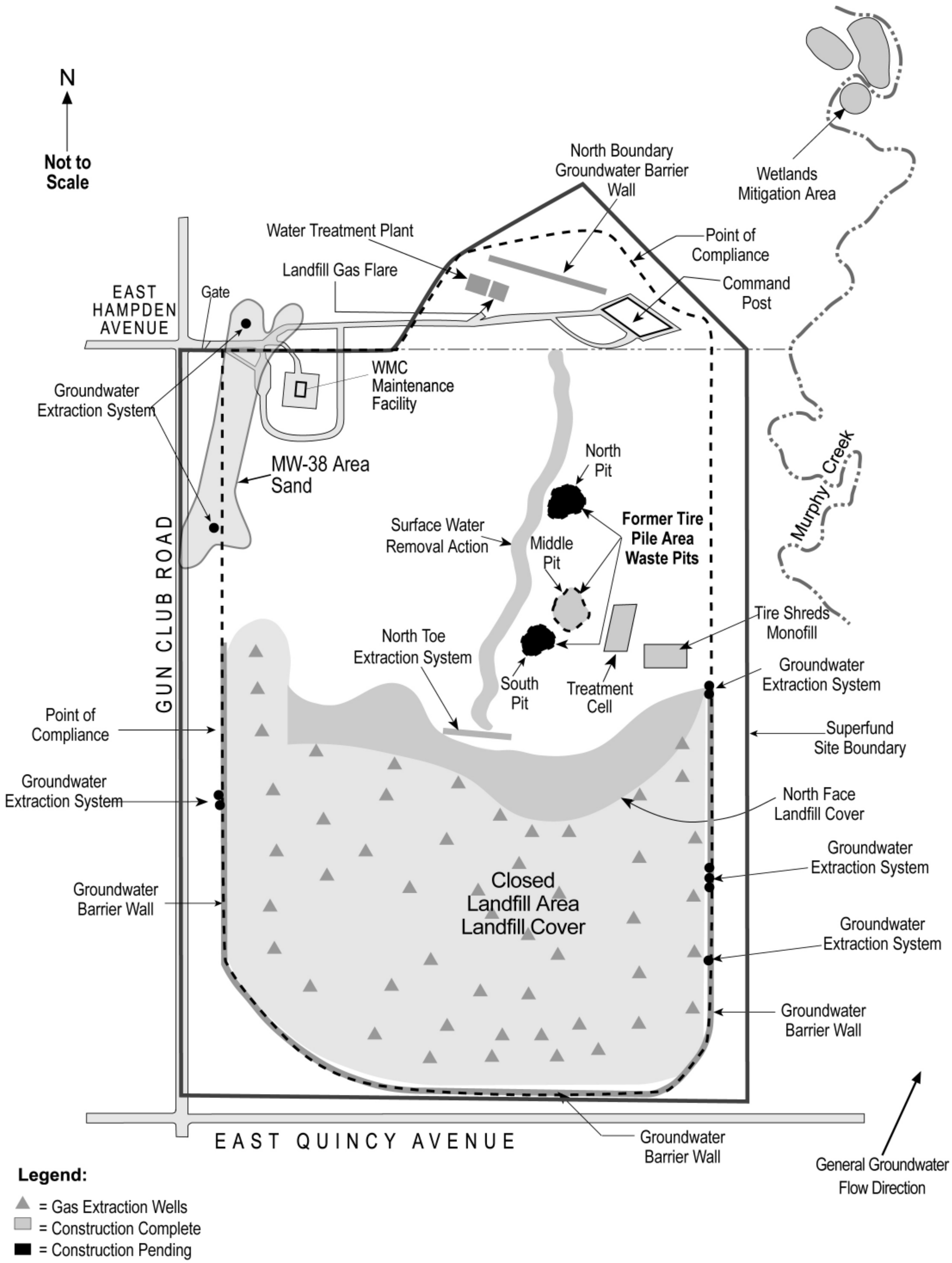


Figure 2
Site Remedy Details

Material Excavated from Middle Waste Pit, 1998

North Boundary Barrier Wall (NBBW). This 1,000-foot-long and 30-foot-deep clay wall provides a barrier to groundwater flow to the north. At the upstream side of the NBBW, a gravel bed allows collection and removal of migrating groundwater. Groundwater from the gravel bed is pumped to the water treatment plant.

Denver originally built an onsite water treatment plant in 1984. The plant has undergone several upgrades, most recently in 2004. Contaminated water collected from various areas of the Site is treated at the plant to a level safe for discharge into a sanitary sewer line. The discharged water eventually reaches the Metro Wastewater Reclamation District and Aurora's wastewater treatment facilities located offsite. The City of Aurora and the Metro Wastewater Reclamation District issued the industrial pretreatment discharge permit for the water treatment plant at the Site. The offsite facilities only accept water that complies with the terms of the Site industrial pre-treatment discharge permit.

North of the closed landfill area, contaminated groundwater is kept separate from clean surface water within the unnamed creek streambed by permeable material that has been placed in the streambed and covered with a clay layer. The permeable material provides a pathway for groundwater to flow to the north without contacting surface water. The top of the clay cover is now the streambed, allowing clean surface water to run off the surrounding Site areas and migrate to the north without coming into contact with contaminated groundwater flowing underneath the cover.

A landfill gas collection system of 54 extraction wells was installed in the main landfill to remove and burn gases generated from the buried waste. All of the extracted gas is routed to an enclosed flare at the northern end of the Site where it is burned. Emissions from the flare are monitored to ensure that they meet environmental standards and are safe for the surrounding community.

Excavation of Middle Waste Pit, 1998

As an extra measure of protection from exposure to the wastes remaining at the Site, the City and County of Denver, Arapahoe County and the City of Aurora enacted controls of land and groundwater usage. These controls work to prevent people from coming into contact with the contaminated soil, water or landfill gas that remains on the Site. In addition to the City and County of Denver, EPA and CDPHE have the authority to enforce the onsite controls.

Long-term monitoring programs are in place to evaluate the effectiveness of the containment and collection systems, and the overall protectiveness of the cleanup actions.

Changes to the Remedial Action

The FTPA comprises approximately 54 acres located immediately north of the main landfill area and east of the unnamed creek (see Figure 2). Initial investigations found three waste pits there. These pits are separate from the large main landfill in the southern part of the Site, although they contain similar wastes.

The 1994 ROD called for digging into the FTPA waste pits to remove surface and subsurface drums, associated free liquids and other visible contamination to the extent practicable. Contaminated materials were to be disposed of offsite. In 1997, EPA changed that plan to allow the contaminated materials to be treated using controlled aeration and disposed of onsite. This approach was implemented successfully at the middle waste pit in 1998. However, when excavation began in the northernmost pit in May 1999, highly contaminated waste liquids were encountered at depths of 6 feet and below. Some contaminated vapors were expected and precautions were taken such as digging within an enclosed structure and ventilating and treating vapors within the structure. However, the amount and toxicity of vapors produced were not expected, overwhelmed the safety measures in place and became dangerous to the workers. As a result, EPA granted permission for the digging to stop. Subsequently, EPA required additional investigations and studies in the FTPA waste pits.

Structure over North Waste Pit to Enclose Attempted Pit Excavation, 1999

Between March 2002 and January 2003, a new approach to cleaning up the FTPA waste pits was tested in a "pilot study." The study was called "pilot" because it was implemented only at the south waste pit as a test. EPA used the pilot study information to determine if that approach should be implemented at both the north and the south waste pits. The new approach was to use electricity to heat the waste pit and extract contaminated liquids and vapors. Heating enhances the volume of liquids and vapors that can be extracted. The pilot study was only partially successful.

At the conclusion of the pilot study in 2003, conditions at the FTPA north and south waste pits remained significantly different from those that had been anticipated when EPA selected the cleanup plan in 1994. Whenever there is a change in scope, performance or cost of a selected cleanup plan, EPA evaluates the significance of the change. If EPA determines that the change no longer reflects the plan selected in the ROD, it is considered a "fundamental" change, and EPA will formally modify the ROD. In 2003 through 2004, EPA evaluated excavation as described in the 1994 ROD against other alternatives to determine if a fundamental change in the cleanup approach for the FTPA waste pits is warranted.

As a result of this evaluation, EPA is proposing to fundamentally change the approach to cleanup of the remaining two FTPA waste pits.

What are the Public Health Risks Posed by the FTPA Waste Pits?

In 1994, EPA determined that remedial actions are necessary at the FTPA waste pits because levels of arsenic, beryllium, polychlorinated biphenyls and chromium in subsurface soils exceed safe levels for residents and workers. This means that if people living or working on the Site swallowed or inhaled these soils or vapors, there would be a risk of harmful health effects. EPA also determined that the contaminated solids in the FTPA waste pits contribute to groundwater contamination.

South Waste Pit, 2005

Today, land use and groundwater use onsite is tightly restricted by institutional controls that are enforced by the City and County of Denver, EPA and CDPHE. These controls allow landfilling operations, cleanup activities and monitoring. Workers engaged in these activities could potentially come into contact with contaminants in the waste pits. Workers who dig into the subsurface or install monitoring wells could

What's in the North FTPA Waste Pit?

The north waste pit covers an area of approximately 0.4 acres. Most of the material in the north waste pit is clays, silts and sludges with debris such as wood and drums, all contaminated with hydrocarbons. There are about 11,800 cubic yards of contaminated material and 3,800 cubic yards are saturated. The contaminated material is between 9 and 28 feet below the ground surface and is 14 to 22 feet thick.

1,1,1-trichloroethane and tetrachloroethene make up over 40 percent of the total mass of volatile organic compounds (VOCs) in the contaminated solid material. Other VOCs include 1,1-dichloroethane, 1,2,4- and 1,3,5-trimethylbenzene, 4-methyl-2-pentanone, acetone, ethylbenzene, hexane, trichloroethene, toluene and xylenes. The source of these VOCs in the solid material is NAPL. The estimated volume of NAPL ranges from 115,000 to 125,000 gallons, consisting of both light NAPL and dense NAPL.

What's in the South FTPA Waste Pit?

The south waste pit covers an area of approximately 0.7 acres. Most of the material in the south waste pit is clays and silts with debris such as wood and drums, all contaminated with hydrocarbons. There are about 18,100 cubic yards of contaminated material in the pit and 5,400 cubic yards are saturated. The contaminated material is between 8 and 25 feet below the ground surface and is approximately 10 to 22 feet thick.

Hydrocarbons such as benzene, toluene, ethylbenzene and xylenes make up about 50 percent of the total mass of VOCs in the contaminated solid material. The source of these VOCs in the solid material is NAPL. Estimated volume of light NAPL ranges from 10,000 to 11,000 gallons. No dense NAPL is present.

potentially be exposed to contaminants in the waste pits by inhaling contaminated vapors, swallowing contaminated soil particles that are on fingers or hands while working or getting contaminated soil or groundwater on skin. Workers are required to follow health and safety plans and wear appropriate safety clothes and equipment. Therefore, potential exposures are expected to be insignificant. Workers engaged in landfilling operations above the ground surface or monitoring activities could potentially be exposed to contaminants in the waste pits by inhaling contaminated vapors or getting contaminated groundwater on skin. These potential exposures are also expected to be insignificant.

The components of the 1994 plan that are in place and operating at the Site are designed to prevent people who live or work offsite from being exposed to Site contamination, including contamination within the FTPA waste pits, now and in the future. These components are designed to prevent contaminated soil, groundwater, surface water and landfill gas from migrating outside the Site. The remaining problem to be addressed by remedial action is the presence of NAPL, which EPA considers a "principal threat waste."

What are EPA's Objectives for Cleanup Action at the FTPA Waste Pits?

Once EPA determined that action is necessary to address the environmental problems presented by the FTPA waste pits, the agency established the following seven objectives:

- Protect people and the environment from direct contact with contaminated solids in waste pits;
- Protect people from inhaling contaminated vapors or airborne particles coming from the waste pits;
- Minimize the amount of contaminated liquids leaching from the waste pits and migrating to groundwater;
- Minimize the migration of contaminated soils from the waste pits;
- Prevent the migration of contaminated soils from the waste pits to offsite areas;
- Protect people and the environment from direct contact with contaminated liquids leaching from the waste pits; and
- Prevent the offsite migration of contaminated liquids leaching from the waste pits or infiltration of these liquids into soil, surface water, sediment or groundwater.

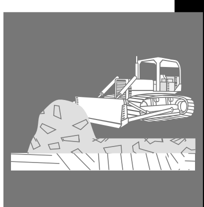
Summary of Remedial Alternatives

EPA evaluated nine alternative strategies (described on pages 9 - 15) for addressing the remaining two FTPA waste pits and meeting the objectives above. Each alternative includes all existing actions that have been completed or are ongoing at the Site. When operating effectively, these existing actions meet many of the objectives EPA has established for the Site. The FTPA waste pit alternatives were developed specifically to meet those objectives not already achieved by the existing actions.

No Action Alternative

Usually, a "no action" alternative is evaluated at Superfund Sites to provide a baseline for EPA to compare the reduction in overall risk provided by other alternatives. "No action" assumes that no additional work would be done. Activities such as Site access restrictions, compliance monitoring and operation of other components described above would be discontinued. However, all the components selected by EPA in the 1994 ROD and constructed since then will remain in place and operational at the Site. Thus, the no action alternative was not evaluated.

Alternative 1: Capping



Estimated Capital Cost: $202,000
Estimated Yearly Operations and Maintenance Cost: $1,600
Estimated Net Present Worth Cost: $244,000
Estimated Construction Timeframe: 6 months - 1 year

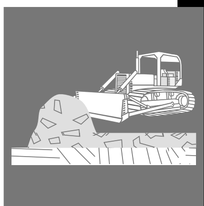
Alternative 1 uses the existing earthen cover or cap to isolate the contaminated materials in each waste pit. Components of the capping alternative include:

- All existing remedy components remain in place;
- Abandoning all piping and existing wells within and adjacent to the waste pits;
- Re-grading the waste pits for proper drainage;
- Monitoring groundwater downgradient of the waste pits to evaluate movement of contamination; and
- Completing inspections of earthen cover and performing necessary maintenance (e.g., fix erosion areas, re-grade settlement areas, etc.).

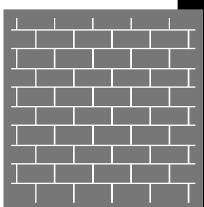
Soil covers were constructed in 2000 over the two waste pits. The covers extend a minimum of 30 feet beyond the perimeter of the contaminated material. Each cover consists of a 6-inch-thick erosion layer covering 24 inches of compacted clay. Beneath the clay layer are a minimum of 12 inches of gravel and variable depths of soil fill to provide a 2- to 5-percent slope. A layer of wire mesh is below the gravel layer.

Alternative 1 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). The cap provides a physical barrier to prevent direct contact with materials in the waste pits, reduce rainwater seepage through the contaminated material and minimize emission of vapors.

Alternative 2: Capping with Vertical Barrier/ Limited Groundwater Extraction and Treatment

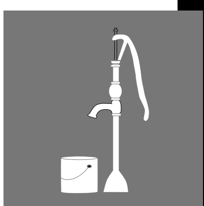


Estimated Capital Cost: $1,580,000
Estimated Yearly Operations and Maintenance Cost: $12,000
Estimated Net Present Worth Cost: $1,770,000
Estimated Construction Timeframe: 6-18 months



Alternative 2 isolates the contaminated material with the existing soil cover and adds a vertical barrier such as an underground barrier wall. The components of Alternative 2 are:

- All components of Alternative 1; and
- Installation of a vertical barrier around the perimeter of each waste pit.

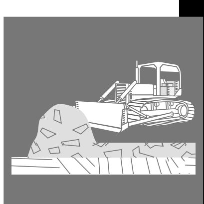


The vertical barriers would extend approximately 35 to 45 feet below the ground surface and be approximately 2.5 feet wide. This width is the same as the width of the barrier wall around the east, south and west sides of the landfill mass. A vertical barrier would encircle each pit. During construction, approximately 800 cubic yards of soils would be excavated. These soils would be tested for contamination and, if found to be contaminated, would be transported offsite for disposal.

Because each waste pit will be capped and encircled, groundwater/liquids may need to be pumped out of the pit periodically at a rate equal to the amount of rainwater that seeps in. The pumped liquids (approximately 3,500 gallons per year) would be stored onsite temporarily, tested and transported offsite for disposal.

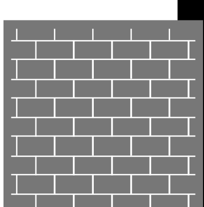
Alternative 2 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). In addition to the benefits described above for Alternative 1, the vertical barrier component of Alternative 2 reduces the volume of contaminated groundwater migrating laterally from the two waste pits and potentially minimizes the movement of highly contaminated NAPLs.

Alternative 3: Capping/Vertical Barrier/ Subsurface Horizontal Barrier with Limited Groundwater Extraction and Treatment



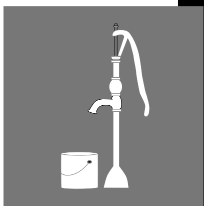
Estimated Capital Cost: $17,300,000
Estimated Yearly Operations and Maintenance Cost: $12,000
Estimated Net Present Worth Cost: $17,500,000
Estimated Construction Timeframe: 1.5-2.5 years

Alternative 3 isolates the contaminated material within each waste pit with all the components of Alternative 2, as well as the addition of a subsurface horizontal barrier (SHB). The components of Alternative 3 include:



- All components of Alternatives 1 and 2; and
- Installation of an SHB beneath each waste pit.

Alternative 3 - Continued

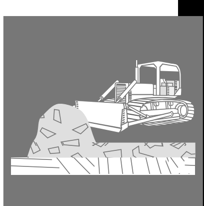


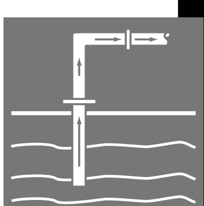
The SHB evaluated for this alternative is the EarthSaw™ buoyant barrier process, developed by Carter Technologies. The EarthSaw™ process would first surround each waste pit with vertical barrier trenches full of high-density grout. Then a cable saw mechanism would cut a horizontal pathway under each waste pit from the bottom of the vertical trenches. Gravity forces the high-density grout to flow into the horizontal cut as it is being made by the cable saw. The high-density grout is denser than the soil and causes the severed block of earth to float. When additional grout is placed into the trench, it gradually raises the block of earth upward until the bottom barrier reaches the desired thickness. Each waste pit would thus be encased in low-permeability grout that forms a containment barrier. This technology has not been applied on a project of this size.

As with the vertical barrier, the SHB would be constructed to approximately 2.5 feet in thickness and extend approximately 32 to 42 feet below the ground surface. The SHB would connect to the base of the vertical barrier walls surrounding each waste pit, thus enclosing the waste pit contents in a "bowl" capped by the existing soil cover. Separate barriers would be constructed for each waste pit. Similar to Alternative 2, groundwater and liquids may need to be pumped periodically at a rate equal to the amount of rainwater that seeps in.

Alternative 3 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). In addition to the benefits provided by Alternative 2, the SHB in Alternative 3 reduces potential downward migration of groundwater/liquids.

Alternative 4: Capping with Product Recovery





Estimated Capital Cost: $393,000
Estimated Yearly Operations and Maintenance Cost: $112,800
Estimated Net Present Worth Cost: $887,000
Estimated Construction Timeframe: 6-7 years

Alternative 4 isolates the contaminated material within each waste pit using all the components of Alternative 1 and reduces the volume of highly contaminated liquids (NAPL) within each waste pit by pumping the liquids and transporting them offsite for disposal. The components of this alternative include:

- All the components of Alternative 1; and
- Extracting NAPL within and immediately outside of the two waste pits.

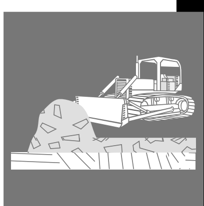
NAPL would be pumped out of each pit using either top-loading or bottom-loading pumps installed in existing wells. Liquids would be stored temporarily onsite (up to approximately 10,000 gallons; 5,000 gallons at each waste pit) until transported to a licensed disposal facility via tanker truck. Prior to being transported offsite, the liquids would be tested to determine the amount of contamination that is being removed from the waste pits.

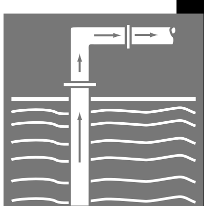
Alternative 4 - Continued

Pumping would continue until NAPL thickness in every well point fell below 0.5 feet for at least 30 days.

Alternative 4 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). Alternative 4 provides all the benefits of Alternative 1 and, additionally, removal of NAPL will minimize potential movement of highly contaminated liquids by reducing the volume of liquids that are the most highly concentrated and most likely to move underground.

Alternative 5: Capping with Enhanced Product Recovery





Estimated Capital Cost: $458,000
Estimated Yearly Operations and Maintenance Cost: $1,663,200
Estimated Net Present Worth Cost: $6,080,000
Estimated Construction Timeframe: 4-5 years

Alternative 5 isolates the contaminated material within each waste pit with all the components of Alternative 1 and reduces the volume of highly contaminated NAPL within each waste pit by pumping the liquids out using methods to increase the volume recovered. The liquids would be transported offsite for disposal. The components of this alternative include:

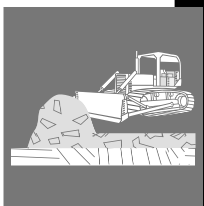
- All the components detailed for Alternative 1;
- Enhanced recovery of NAPL that is floating on the groundwater surface; and
- Recovery of NAPL that has sunk to the bottom of the area within and immediately outside the north waste pit.

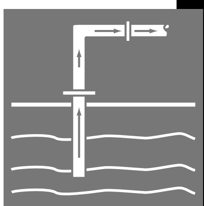
Recovery of dense or sinking NAPL would be similar to Alternative 4 where bottom-loading pumps are operated within existing well. NAPL that is floating on top of the water table (light NAPL) would be recovered using a system where both groundwater and NAPL are recovered simultaneously in the same well. Recovery of NAPL is enhanced by lowering the water table with groundwater extraction from each well, thereby inducing gravity flow of the NAPL to the well.

As in Alternative 4, pumping would continue until NAPL thickness in every well fell below 0.5 feet for at least 30 days. This goal is expected to be reached more quickly than in Alternative 4 due to the enhanced recovery methods. However, a much higher volume of groundwater will be extracted along with the NAPL and will need to be transported offsite for disposal.

Alternative 5 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). Alternative 5 provides all the benefits of Alternative 1 and, additionally, removal of NAPL minimizes potential migration of highly contaminated liquids by reducing the volume of liquids that are the most highly concentrated and most likely to migrate.

Alternative 6: Capping/Product Recovery/ Vapor Recovery





Estimated Capital Cost: $650,000
Estimated Yearly Operations and Maintenance Cost: $817,200
Estimated Net Present Worth Cost: $4,040,000
Estimated Construction Timeframe: 6.5-7.5 years

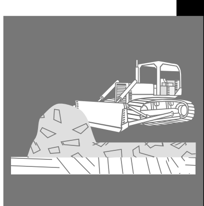
Alternative 6 includes all the components of Alternative 4 and includes extracting contaminated vapors from each waste pit. The components of this alternative include:

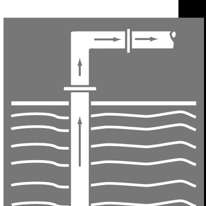
- All the components detailed for Alternative 4; and
- Extracting contaminated vapors from existing extraction points at both waste pits.

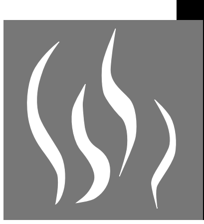
Under Alternative 6, NAPL would be pumped out of each waste pit as described for Alternative 4. Contaminated vapors within each waste pit would be extracted and treated onsite using existing equipment. Vapor recovery would continue until contaminant mass recovery rates fell below 20 kilograms per day (kg/day) for a period of greater than 60 days.

Alternative 6 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2). Alternative 6 provides all the benefits of Alternative 4, and vapor recovery would remove additional contaminant mass, thereby further reducing the potential for groundwater contamination.

Alternative 7: Capping/Enhanced Product Recovery/Vapor Recovery







Estimated Capital Cost: $715,000
Estimated Yearly Operations and Maintenance Cost: $2,375,000
Estimated Net Present Worth Cost: $8,210,000
Estimated Construction Timeframe: 5-6 years

Alternative 7 includes all the components of Alternatives 1, 5 and 6. Product recovery would be implemented as described for Alternative 5. Vapor recovery would be implemented as described for Alternative 6.

Alternative 7 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). Alternative 7 provides all the benefits of Alternatives 5 and 6.

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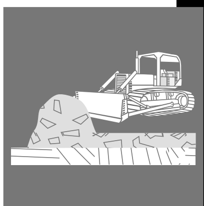
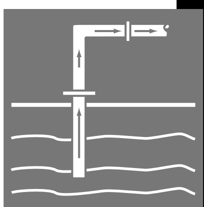




Alternative 8: Capping/Product Recovery/Vapor Recovery/Thermal Enhancement

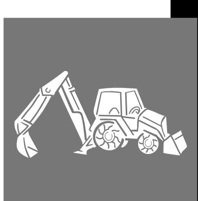
Estimated Capital Cost: $1,120,000
Estimated Yearly Operations and Maintenance Cost: $6,504,000
Estimated Net Present Worth Cost: $9,960,000
Estimated Construction Timeframe: 2-3 years

Alternative 8 includes all the components of Alternatives 1, 4 and 6. It includes enhancement of the recovery of contaminated materials method of Alternative 4 and the vapor recovery method of Alternative 6 by increasing the subsurface temperatures using electricity. The components of this alternative include:

- All the subsurface components detailed for Alternatives 1, 4 and 6; and
- Enhancement of product and vapor extraction by increasing subsurface temperatures using Electrical Resistance Heating (ERH).

Thermally enhanced liquid and vapor recovery were pilot tested on the south waste pit in 2002-2003. Methods for liquid and vapor recovery and treatment would be similar to those used in the pilot study, except that the lessons learned during the pilot study would be implemented. Subsurface temperatures would be increased by application of ERH using an onsite power control unit and subsurface electrodes. With ERH, subsurface temperatures could be increased to greater than 80 degrees Celsius.

Alternative 8 relies on the existing remedy components to maintain containment of the contaminants within the point of compliance boundary set by EPA (Figure 2, page 5). Alternative 8 provides all the benefits of Alternative 7 and, by increasing subsurface temperatures, contaminated materials could be extracted at a higher rate than would be extracted for Alternatives 4, 5, 6 and 7. Thus, it is expected that the goals for NAPL and vapor extraction could be achieved more quickly.



Alternative 9: Excavation/Onsite Treatment

Estimated Capital Cost: $11,600,000
Estimated Yearly Operations and Maintenance Cost: $785,000
Estimated Net Present Worth Cost: $13,200,000
Estimated Construction Timeframe: 4-5 years

Alternative 9 includes the following components:

- All existing remedy components would remain in place;
- Abandoning/demobilization of any existing equipment and piping at each waste pit;

Alternative 9 - Continued

- Excavation of source materials (including sludge, soils, debris, drums, etc.) at both waste pits;
- Pumping contaminated water out (dewatering) of the pits as necessary to complete the work;
- Backfilling and grading excavated areas for proper drainage; and
- Treatment of excavated solids onsite.

Excavation of the two remaining pits would be performed using methods similar to those used in 1998 to successfully excavate the middle pit. However, due to concerns about the release of contaminated vapors during excavation, emission controls would go far beyond those used in 1998. Emission controls would include enclosures over each waste pit, the treatment area and the decontamination area. Each enclosure would require ventilation and treatment of gases by incineration. A natural gas transmission pipeline would be installed near the southeast corner of the Site along Quincy Avenue to provide fuel to each incinerator. A new decontamination area would also be constructed. The existing drum storage pad at the north end of the Site would be refurbished to ensure its integrity for temporarily storing the excavated drums.

Approximately 19,900 cubic yards would be excavated from the south waste pit and approximately 13,000 cubic yards would be excavated from the north waste pit. Upon completion of the excavation, the open area would be backfilled with uncontaminated soil and graded to promote proper drainage. Excavated intact drums and liquids would be temporarily stored at an onsite storage pad for testing and offsite disposal to a licensed disposal facility. Excavated debris (including wood, smashed drums, etc.) would be decontaminated and disposed in an onsite disposal area. Excavated solids/soils would be treated onsite in the existing treatment area that would be closed in-place.

Alternative 9 relies on the existing remedy components to maintain containment of the Site contaminants within the point of compliance boundary set by EPA. It removes all the source material associated with the waste pits, preventing further groundwater contamination from this material, but does not clean up the existing contamination in groundwater.

How does EPA Compare Alternatives?

EPA evaluated all nine alternatives using the criteria specified in the National Contengency Plan, the regulations that implement the Superfund laws. These criteria are used to evaluate the different alternatives individually and to compare them.

Table 1, on pages 16 and 17, provides a summary of the comparative analysis of the nine alternatives. The evaluation criteria are explained in detail on page 18.

Evaluation Criteria*	Alt 1: Capping	Alt 2: Capping/Vertical Barrier with Limited Groundwater Extraction and Treatment	Alt 3: Capping/Vertical Barrier/Subsurface Horizontal Barrier with Limited Groundwater Extraction and Treatment	Alt 4: Capping/Product Recovery
Overall Protection of Human Health and the Environment	Meets EPA's objectives except does not minimize the horizontal movement of NAPLs. High short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Minimizes horizontal migration of NAPLs. High short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Minimizes horizontal migration of NAPLs. High short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Reduces horizontal migration of NAPLs. Moderate to high short-term effectiveness. Does not change the Sitewide risk.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Long-Term Effectiveness and Permanence	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.
Reduction of Toxicity, Mobility and Volume (TMV) Through Treatment	No reduction in TMV provided by Alternative 1.	No reduction in TMV provided by Alternative 2.	No reduction in TMV provided by Alternative 3.	Moderate reduction of TMV is achieved. Treatment of ~24,000 kilograms (kg) VOCs and 37,000 gallons principal threat waste.
Short-Term Effectiveness	High level of short-term effectiveness. Low risk to workers and community. 6 to 12 months to complete.	High level of short-term effectiveness. Low risk to the community. Slightly higher risks to workers than Alternative 1. 6 to 18 months to complete.	High level of short-term effectiveness. Low risk to the community. Slightly higher risks to workers than Alternative 1. 1.5 to 2.5 years to complete.	Moderate to high level of short-term effectiveness. Slightly higher risk to the community than Alternatives 1-3 due to transport of liquids offsite. Slightly higher risks to workers than Alternative 1. 6 to 7 years to complete.
Implementability	High level of implementability.	Moderate to high level of implementability.	Low level of implementability.	Moderate to high level of implementability.
Cost (30-Year Present Worth)	$244,000	$1,770,000	$17,500,000	$887,000

*The last two criteria, State Acceptance and Community Acceptance, will be evaluated for the alternatives after the close of the public comment period.

Alt 5: Capping/Enhanced Product Recovery	Alt 6: Capping/Product Recovery/Vapor Recovery	Alt 7: Capping/Enhanced Product Recovery/ Vapor Recovery	Alt 8: Capping/Product Recovery/Vapor Recovery/ Thermal Enhancement	Alt 9: Excavation/Onsite Treatment
Meets EPA's objectives. Reduces horizontal migration of NAPLs. Moderate to high short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Reduces horizontal migration of NAPLs. Moderate to high short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Reduces horizontal migration of NAPLs. Moderate to high short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives. Reduces horizontal migration of NAPLs. Moderate to high short-term effectiveness. Does not change the Sitewide risk.	Meets EPA's objectives slightly better than Alternatives 4-8 because of minimizing horizontal migration of NAPLs. Low short-term effectiveness. Does not change the Sitewide risk.
Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.	Does not change the Sitewide risk. Existing actions provide long-term protection.
Moderate reduction of TMV is achieved. Treatment of ~41,000 kg VOCs and 37,000 gallons principal threat waste.	Moderate reduction of TMV is achieved. Treatment of ~83,000 kg total VOCs and 37,000 gallons principal threat waste.	Moderate reduction of TMV is achieved. Treatment of ~100,000 kg total VOCs and 37,000 gallons principal threat waste.	Moderate to high reduction of TMV is achieved. Treatment of ~105,000 kg total VOCs and 64,000 gallons of principal threat waste.	Highest reduction of TMV is achieved of all Alternatives. ~203,000 kg total VOCs treated.
Moderate to high level of short-term effectiveness. Slightly higher risk to the community than Alternatives 1-3 due to transport of liquids offsite. Slightly higher risks to workers than Alternative 1. 4 to 5 years to complete.	Moderate to high level of short-term effectiveness. Slightly higher risk to the community than Alternatives 1-3 due to transport of liquids offsite. Slightly higher risks to workers than Alternative 1. 6.5 to 7.5 years to complete.	Moderate to high level of short-term effectiveness. Slightly higher risk to the community than Alternatives 1-3 due to transport of liquids offsite. Slightly higher risks to workers than Alternative 1. 5 to 6 years to complete.	Moderate level of short-term effectiveness. Presents higher risk to workers and community than Alternatives 1-7. 2 to 3 years to complete.	Low level of short-term effectiveness. Presents highest risk to workers and community of all Alternatives. 4 to 5 years to complete.
Moderate to high level of implementability.	Moderate to high level of implementability.	Moderate to high level of implementability.	Moderate level of implementability.	Low level of implementability.
$6,080,000	$4,040,000	$8,210,000	$9,960,000	$13,200,000

Table 1
Summary of Comparative Analysis of FTPA Remedial Alternatives

Evaluation Criteria

The evaluation criteria used by EPA at every Superfund site are:

Threshold Criteria

Alternatives must, at a minimum, meet the first two criteria, called the Threshold Criteria, to be retained for further consideration.

1. ***Overall Protection of Human Health and the Environment*** considers whether or not an alternative provides adequate protection by eliminating, reducing, or controlling unacceptable risks.
2. ***Compliance with Applicable or Relevant and Appropriate Requirements*** (ARARs) considers whether or not an alternative will meet all Federal and State standards required by environmental laws or, if not, whether there is justification for waiving the standards.

Primary Balancing Criteria

Alternatives that meet the threshold criteria are next evaluated against the following five criteria known as the Primary Balancing Criteria.

3. ***Long-Term Effectiveness and Permanence*** considers the magnitude of public health risk that will remain after each alternative is implemented.
4. ***Reduction of Toxicity, Mobility, and Volume through Treatment*** indicates EPA's preference for alternatives that include physical or chemical treatment processes to reduce or eliminate the hazardous nature of material, its ability to move in the environment, and the quantity left after treatment.
5. ***Short-Term Effectiveness*** considers the risks that might be posed to the community and workers during the implementation of each alternative and the time it will take each alternative to achieve protection of human health and the environment.
6. ***Implementability*** considers the technical and administrative feasibility of implementing each alternative and the availability of the services and materials required during implementation.
7. ***Cost*** considers construction costs as well as long-term operation and maintenance costs of each alternative. EPA evaluates each alternative by considering whether more costly alternatives provide additional public health benefits for the increased cost.

Table 1, on pages 16 and 17, provides a detailed analysis of the alternatives using EPA's primary balancing criteria. A summary of the evaluation results are graphically shown in Figure 3 on page 19.

Modifying Criteria

The last two criteria are used to evaluate concerns the State and the public may have regarding each alternative. The State and the public have an opportunity to comment on the Proposed Plan during the comment period and EPA will evaluate their comments.

8. ***State Acceptance*** considers whether the State agrees with, disagrees with or has no comment on EPA's analysis of alternatives and selection of the Preferred Alternative.
9. ***Community Acceptance*** considers the concerns or support the public may have regarding each alternative.

State and community acceptance will be evaluated based on comments received during the public comment period.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Overall Protection of Human Health and the Environment	◔	◒	◒	◒	◒	◒	◒	◒	◔
Compliance with ARARs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Long-Term Effectiveness and Permanence	◒	◒	◒	◒	◒	◒	◒	◒	◒
Reduction of Toxicity, Mobility and Volume through Treatment	○	○	○	◔	◔	◔	◔	◒	●
Short-Term Effectiveness	●	●	●	◒	◒	◒	◒	◔	○
Implementability	●	◒	○	◒	◒	◒	◒	◔	○
Cost	●	◒	○	●	◔	◒	◔	◔	○

LEGEND

✓ = Complies

Better → Worse: ● ◒ ◔ ○

Figure 3
Alternative Evaluation Summary

The Preferred Alternative

EPA selected Alternative 4 as the Preferred Alternative to address the environmental problems posed by the FTPA waste pits at the Lowry Landfill Superfund Site. All nine alternatives, when considered along with the existing actions that are already in place at the Site, will meet EPA's objectives for the Site. The rationale for EPA's selection is as follows:

- Alternative 4 is preferred over Alternatives 1, 2 and 3 because it includes extraction and treatment of some of the highly concentrated undissolved NAPLs from the waste pits; whereas Alternatives 1, 2 and 3 do not include treatment of NAPL. EPA considers NAPL to be "principal threat waste" and has a preference for choosing an alternative that includes treatment of principal threat waste as long as that alternative also fulfills the nine evaluation criteria. Alternative 4 is also more easily implemented and less costly than Alternatives 2 and 3, although equally effective in meeting EPA's objectives.

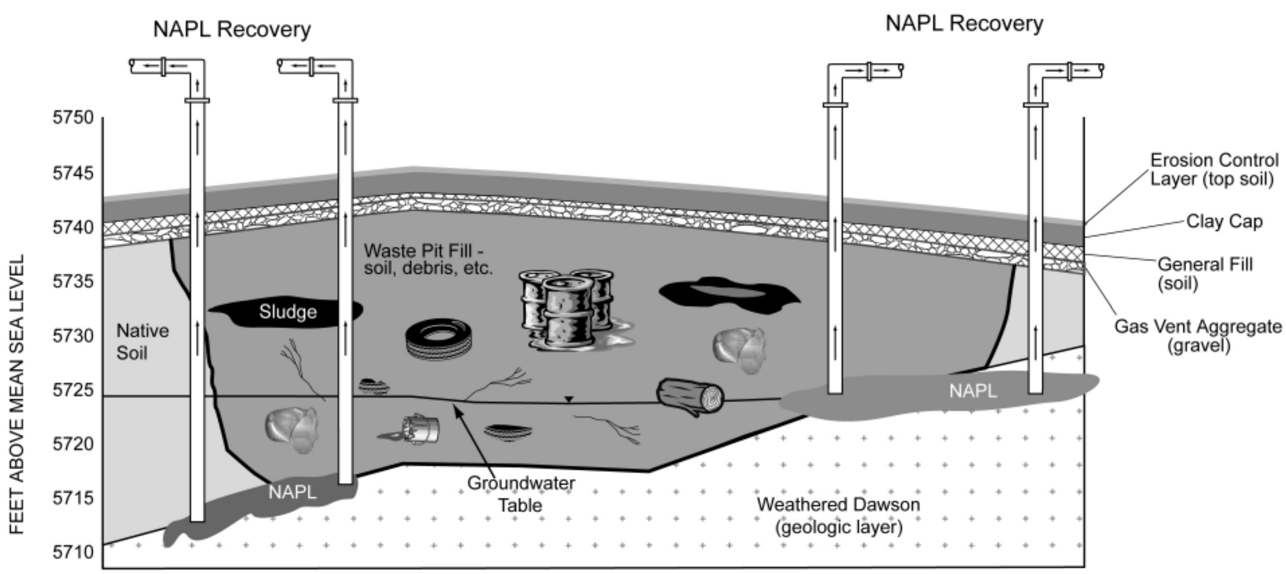


Figure 4
Alternative 4 - EPA's Preferred Alternative

EPA's Preferred Alternative - Alternative 4

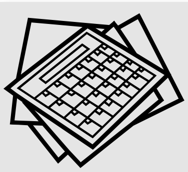
Alternative 4 consists of pumping out the most highly contaminated liquids from the south and north FTPA waste pits, transporting these liquids offsite for disposal, maintaining a cap on the pits and monitoring groundwater migrating from the waste pits.

The Preferred Alternative (continued)

- Alternatives 5, 6, 7, 8 and 9 also include treatment of principal threat waste. Alternative 4 is preferred over Alternatives 5, 6 and 7 because it results in treatment of an equal volume of NAPL as those alternatives, yet is more easily implemented and less costly. Alternative 4 is preferred over Alternative 8 because it is more easily implemented, less costly and presents a slightly lower risk to workers.
- Alternative 4 is preferred over Alternative 9, excavation, because it is more easily implemented, less costly and presents far less risk to workers and the surrounding community. Although Alternative 9 would result in treatment of a greater volume of NAPL than Alternative 4, the volume of waste that would be removed under Alternative 9 is insignificant when compared to the volume of waste that will remain on the entire Site. Implementation of Alternative 9 would not change the effectiveness of the overall project in achieving EPA's objectives, yet it presents higher risks to workers and the community. EPA considered the risks and the benefits of Alternative 4 and Alternative 9, and determined that Alternative 4 best meets the evaluation criteria.
- Based on the information available at this time, EPA believes that Alternative 4 will be protective of human health, will meet all Federal and State standards required by environmental laws, will be effective in the long term, will be cost effective and will be readily implemented at the Site.

Acronym List

ARARs	Applicable or Relevant and Appropriate Requirements
CDPHE	Colorado Department of Public Health and Environment
EPA	Environmental Protection Agency
ERH	Electrical Resistance Heating
FTPA	Former Tire Pile Area
NAPL	Non Aqueous Phase Liquid (concentrated undissolved liquid waste)
NBBW	North Barrier Boundary Wall
ROD	Record of Decision
SHB	Surface Horizontal Barrier
TMV	Toxicity, Mobility and Volume
VOC	Volatile Organic Compounds
WMC	Waste Management of Colorado



Mark Your Calendar!

Please attend one of our upcoming public meetings to provide your thoughts on the Proposed Plan.

Public Meeting #1

Date: Wednesday, June 8, 2005
Time: 5:30 to 8:00 p.m.
Location: Aurora Central Library
Community Room 1st Floor

Public Meeting #2

Date: Tuesday, June 14, 2005
Time: 6:00 to 8:30 p.m.
Location: Horizon Middle School
Cafeteria

Directions to Aurora Library (303-739-6600): I-225 to Alameda Avenue, east, cross Sable Boulevard. Library is on the left (north) on Alameda. Park on east and north sides of building.

Directions to Horizon Middle School (720-886-6100): I-225 to Parker Road (exit 4), Parker Road south to Hampden, east (left) on Hampden to South Tower Road (about 3 miles), right on South Tower Road (about 0.8 mile) it will turn into South Reservoir Road. School is on the left at about 0.1 mile *(Please note: north of Hampden Avenue, Reservoir Road is called Tower Road and south of Quincy Avenue, Reservoir Road is called Himalaya Street).*

Please contact Nancy Mueller at (303) 312-6602 with questions.