New Proposed Plan for the V-Tanks Contents (TSF-09 and TSF-18) at Test Area North, Operable Unit 1-10

U.S. Department of Energy
U.S. Environmental Protection Agency
Idaho Department of Environmental Quality

Idaho National Engineering and Environmental Laboratory April 2003

Inside this Plan

Public Comment Period

April 15 – May 14, 2003

Participate By:

Reading this proposed plan and reviewing related documents in the INEEL Administrative Record.

Calling the INEEL, State of Idaho, EPA, or DOE project managers for more information or to schedule a briefing.

Attending a public meeting to hear more, ask questions, and tell us what you think.

Commenting on this proposed plan by using the postage-paid comment form on the back cover.

See page 22 for more information about Public Involvement.

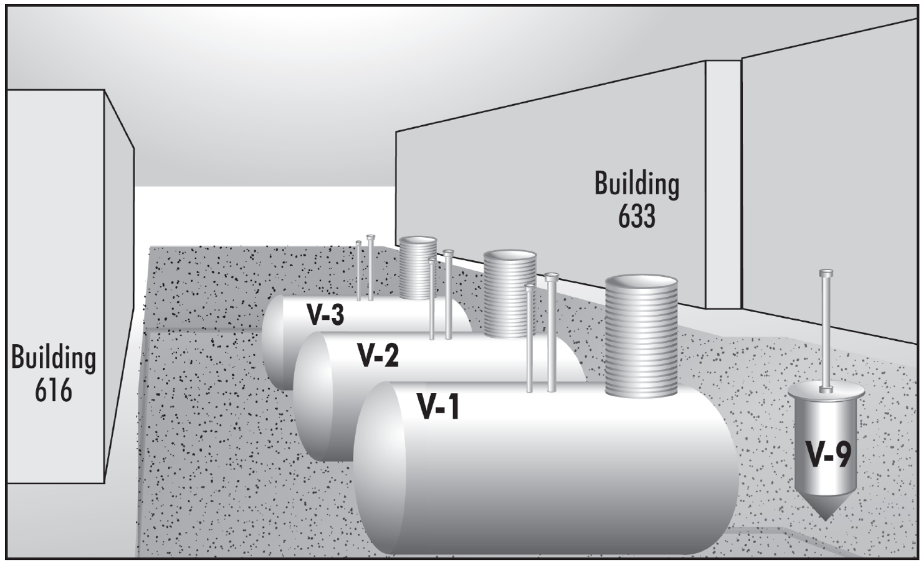


Figure 1. Configuration of the V-Tanks at Test Area North. Associated piping and soil covering the tanks are not shown.

INTRODUCTION

A change is proposed to the cleanup at the V-Tanks site at Test Area North (Figure 1). The V-Tanks site is part of Operable Unit 1-10 at Test Area North of the Idaho National Engineering and Environmental Laboratory (INEEL) (Figure 2).

The V-Tanks site includes four tanks, associated piping, and the soil around the tanks. The tanks contain contaminated sludge and liquid. In 1999, a cleanup remedy was selected for the V-Tanks specifying treatment of the tank contents at an approved off-Site treatment facility. The piping, the metal tank shells, and the surrounding soil were to be removed and disposed of at an approved facility on the INEEL or elsewhere. However, following the cleanup decision, the facility selected to treat the tank contents stopped carrying out this type of treatment. There is no other facility available that can do the treatment called for in the 1999 decision. Therefore, a new remedy for the tank contents must be selected. No change is being made to the part of the remedy that deals with the removal and disposal of contaminated soil from around the tanks.

This plan describes the contents of the V-Tanks and the original selected remedy. It explains the new set of alternatives for remedial action that have been developed, and evaluates how well each would perform. This information is provided so that the public can review and comment on the treatment proposed to complete remediation of this site. This document is issued to facilitate public involvement in the remedy selection process.

Note: When technical or administrative terms are first used, they are printed in ***bold italics*** *and explained in the margin. Referenced documents are listed at the end of this proposed plan. Footnotes provide additional information*

info The INEEL lies within the lands traditionally occupied by the Shoshone-Bannock Tribes. The tribes have used the land and waters within and surrounding the INEEL for fishing, hunting, and plant gathering, in addition to medicinal, religious, ceremonial, and other cultural uses. Under a cooperative agreement between the tribes and the DOE, some tribal activities continue today within the INEEL boundaries.[1]

info The Eastern Snake River Plain Aquifer, one of the largest in the U.S., was classified as a sole-source aquifer by the EPA in 1991. A sole-source aquifer supplies at least 50% of the drinking water consumed in the area overlying the aquifer. About 9% of the Eastern Snake River Plain Aquifer lies beneath the INEEL.

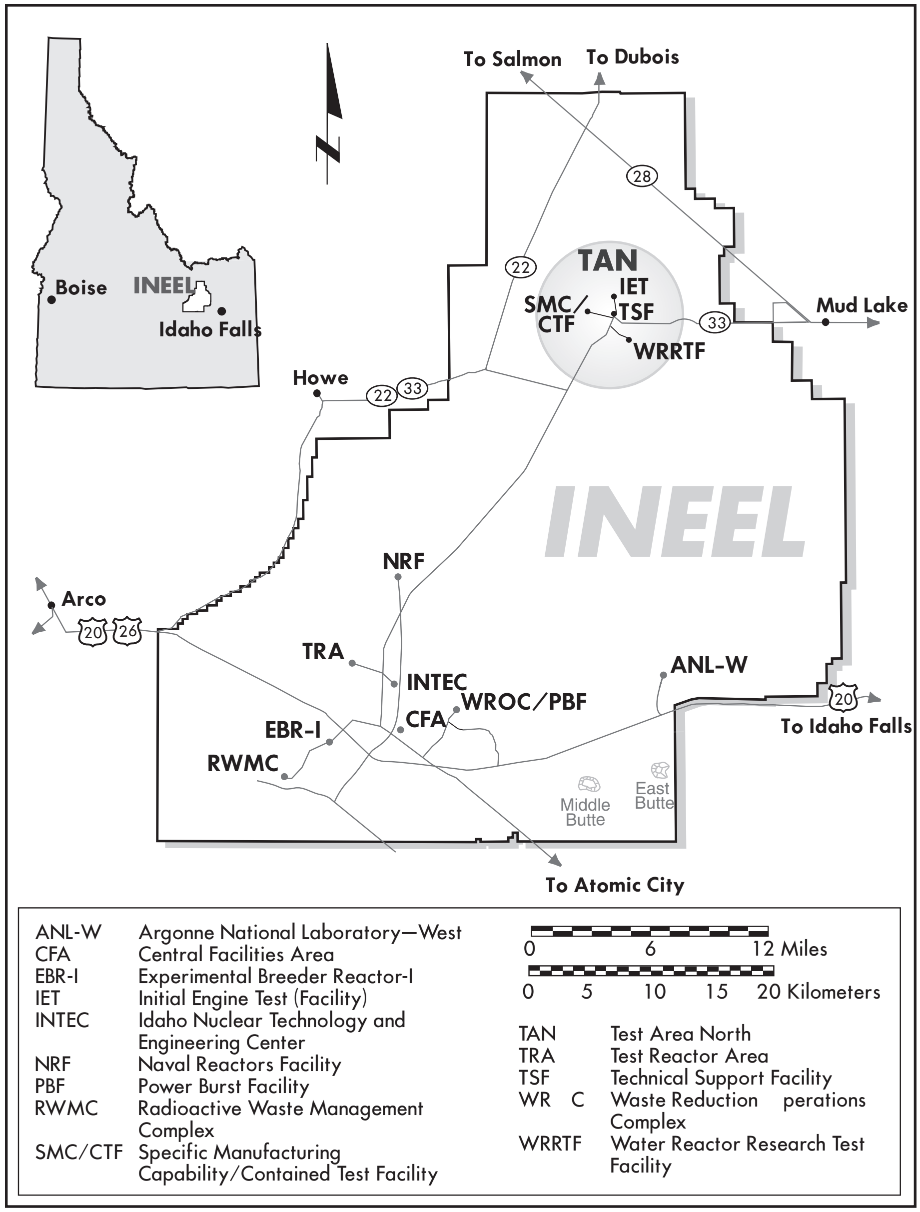


Figure 2. Location of Test Area North (Waste Area Group 1) and other major facilities at the Idaho National Engineering and Environmental Laboratory. Operable Unit 1-10 includes contamination sites at the Technical Support Facility (TSF) and the Water Reactor Research Test Facility (WRRTF).

Agencies

The DOE, the EPA, and the Idaho DEQ are the three agencies responsible for the scope and schedule of cleanup actions at the INEEL. The Agencies are issuing this proposed plan as part of their public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Three government agencies are responsible for cleanup activities at the INEEL. The U.S. Department of Energy (DOE) is the lead agency for site activities. The U.S. Environmental Protection Agency (EPA) and the State of Idaho Department of Environmental Quality (Idaho DEQ) are designated as the support agencies. Together, the three are referred to as the ***Agencies***.

The Agencies will decide how to modify the remedy selected in 1999 after reviewing and considering all information submitted during the 30-day public comment period for this proposed Plan (April 15 through May 14, 2003).

Comments may be submitted as described on page 22. The Agencies may modify the preferred cleanup alternative presented in this Proposed Plan based on public comments or additional information that becomes available after this plan is released.

The public is encouraged to review and comment on the alternatives presented in this proposed plan. Public comments and the Agencies' responses will be published in the Responsiveness Summary section of the ***Record of Decision (ROD) Amendment,*** which is scheduled for completion in or before December 2003.

This proposed plan is based on information presented in the 2003 Technology Evaluation Report[2] as well as in the 1999 Record of Decision.[3] These and other relevant documents used by the Agencies to reach this recommendation are contained in the ***Administrative Record*** file for this site. A Fact Sheet[4] on the new alternatives being considered for the V-Tanks was distributed to the public in August 2002. Comments received on the 2002 Fact Sheet and associated briefings were considered in development of the alternatives presented in this Proposed Plan. The Agencies encourage the public to review these documents for a more comprehensive understanding of the site and the ***CERCLA*** activities that have been conducted at the site.

SCOPE AND ROLE OF THE ACTION

The V-Tanks remedial action is part of the environmental restoration of the INEEL. The INEEL was placed on the ***National Priorities List***[6] of hazardous waste sites in 1989. In 1991, the Agencies signed a ***Federal Facility Agreement and Consent Order (FFA/CO)***[7] outlining the restoration process and schedule for the INEEL. Under the terms of the Consent Order, DOE will carry out the cleanup and pay for all costs associated with it. Within the INEEL's environmental restoration program, this action is one of several cleanup activities being carried out under Operable Unit 1-10. Cleanup of Operable Unit 1-10 began in 1999 with the signing of the Record of Decision. The other site cleanup activities that are being carried out under the 1999 Record of Decision are not affected by the change to the V-Tanks cleanup that is described in this proposed plan.

Completion of this action will prevent current and future exposure of workers, the public, and the environment to contamination at this site. The responses described in this plan will permanently reduce the toxicity, mobility, and/or volume of the contamination.

SITE HISTORY

Under the 1991 FFA/CO, the four V-Tanks were administratively designated as Sites TSF-09 and TSF-18. Site TSF-09 consists of three 10,000-gallon underground storage tanks (numbered V-1, V-2, and V-3) (see Figure 1). They lie side-by-side with their tops approximately 10 feet below the ground surface. Site TSF-18 consists of one 400-gallon underground storage tank (numbered V-9). The top of this vertical tank is approximately 7 feet below the ground surface. All four tanks were installed in the early 1950s and used for about 30 years in a system that collected and treated radioactive liquid waste from Test Area North operations, beginning with the Aircraft Nuclear Propulsion Program in the 1950s and early 1960s. Waste was piped from the adjacent research facilities into Tank V-9, where some of the solids were removed. The remaining waste was then routed into one or more of the larger tanks, V-1, V-2, and V-3.

Record of Decision (ROD) Amendment

A public document that changes or modifies a previous Record of Decision and explains which remedy will be used at a site and why. The Responsiveness Summary contains the public comments received on the proposed actions and the Agencies' responses.

Administrative Record

The archive of information, including reports, public comments, and correspondence, used by the Agencies to select a cleanup action. A list of locations where the INEEL Administrative Record is available appears on page 21.

CERCLA

(Comprehensive Environmental Response, Compensation, and Liability Act, also known as the Superfund Act) The federal law that establishes a program to identify, evaluate, and remediate sites where hazardous substances may have been released (leaked, spilled, or dumped) to the environment.

Section 121 of CERCLA[5] states a preference for remedies that are permanent and that treat hazardous substances to reduce their volume, toxicity, or mobility. Remedies that leave untreated contamination in place are disfavored. Similarly, shipping hazardous substances off-site for disposal without treatment is also disfavored. When treatment technologies are available and practicable, permanent destruction of hazardous substances through treatment is preferred.

National Priorities List

The formal list of the nation's hazardous waste sites that have been identified for possible remediation (cleanup). Sites are included on the list because of their potential risk to human health and the environment.

Federal Facility Agreement and Consent Order (FFA/CO)

An agreement among the DOE, the EPA, and the State of Idaho to evaluate potentially contaminated sites at the INEEL, determine if remediation is warranted, and select and perform remediation, if necessary.

radionuclides

Alternate forms, or isotopes, of an element that are unstable and decay by giving off energy in the form of radioactivity. Examples are cesium-137 and uranium-234. Prolonged exposure may be harmful. Radionuclides are also called radiochemicals.

organic and inorganic compounds

Organic compounds contain carbon. These carbon compounds (proteins, carbohydrates, and other molecules) generally distinguish living organisms from non-living material. Carbon compounds can also be synthesized (for instance, pesticides). Inorganic compounds include metals and non-carbon compounds such as chlorides and nitrates.

polychlorinated biphenyls (PCBs)

A family of industrial compounds that can be toxic or carcinogenic (cancer-causing).

metals

Chemical elements that cannot be degraded or metabolized. Most elemental metals do not easily enter living tissues. However, metals can combine with other chemicals into compounds that harm living organisms. Plants and animals require some metals as essential trace elements, necessary in minute quantities. Iron, for instance, is necessary; mercury and cadmium are not. All metals are toxic to living organisms when taken up in excessive amounts.

remedial investigation/feasibility study (RI/FS)

A study that identifies which contaminants are present in an area, assesses the risk they pose to human health and the environment, and evaluates remedial options.

info The CERCLA process requires preparation of an Explanation of Significant Differences (ESD) whenever there are major changes to elements of a remedy that do not fundamentally alter the selected cleanup approach. An ESD was prepared in early 2003 to document several changes to the Test Area North cleanup activities selected in the 1999 Record of Decision. For the V-Tanks site, the ESD identifies the need for additional characterization of the contaminated soil around the V-Tanks and corresponding clarification of the boundaries of the area of contamination (AOC).[10]

The tanks contain various amounts and concentrations of ***radionuclides, organic compounds*** (including ***polychlorinated biphenyls,*** or PCBs), and ***inorganic compounds*** (including ***metals*** such as mercury). After the radioactive waste treatment system was shut down, liquids in Tanks V-1, V-2, and V-3 were periodically drawn off for treatment at TAN and disposal at the Radioactive Waste Management Complex (RWMC) or treatment at the Idaho Nuclear Technology and Engineering Center (INTEC). Residual solids in the waste settled to the bottom of the tanks, forming the sludge that is still in the tanks. Soils surrounding the tanks were contaminated by spills during removal of liquids.

A ***remedial investigation/feasibility study (RI/FS)*** for the V-Tanks was completed in 1997 to characterize the nature and extent of the contamination and determine what cleanup was required.[8] There was no evidence that the tanks had ever leaked. However, the Agencies agreed to remediate the tanks and their contents along with the contaminated soil to prevent any potential future release of the tank contents to the environment. A proposed plan based on the RI/FS was published in November 1998 to present the Agencies' recommendations for cleanup of the V-Tanks site. The Record of Decision that formally documented the Agencies' agreement to clean up the site was signed in October 1999. The remedy selected in the 1999 Record of Decision was different than the preferred alternative of In Situ Vitrification presented in the 1998 Proposed Plan.[9]

The remedy selected for the V-Tanks was Soil and Tank Removal, Ex Situ Treatment of Tank Contents, and Disposal (see box, "Original Selected Remedy," on p. 10). The tank contents would be removed and transported to an approved off-Site treatment facility. After thermal treatment to reduce toxicity, mobility, and volume, the treated waste would be returned to the INEEL for disposal or shipped to an approved off-Site disposal facility. The empty tanks and associated piping would be decontaminated, removed, and disposed of at the INEEL CERCLA Disposal Facility (ICDF) or another approved facility. The contaminated soil would also be removed, packaged, and disposed of at the ICDF or other approved facility. The excavated area would be backfilled with clean soil.

In early 2002, the selected treatment facility, operated by Allied Technology Group, stopped accepting waste for thermal treatment. No other approved facility is currently available for treating these wastes in accordance with the remedy selected in 1999. While other facilities may become available in the future, it is not known whether or when any of these facilities could treat the V-Tanks contents.

Other difficulties with carrying out the remedy selected in the 1999 Record of Decision were revealed during the remedial design process. The remedial design for the selected remedy, in which detailed technical specifications for the remedial action are defined, does not begin until after the record of decision is signed. The remedial design for the V-Tanks cleanup indicated that shipping and treating the tank contents involved more complexities and cost than had been anticipated. To reduce the volume of contaminated material shipped out of state and thereby lower the costs of shipping and off-Site treatment, the liquid would need to be separated from the sludge (with the liquid treated on the INEEL and only the sludge shipped off-Site). This added more steps to the remedial action. The treatment facility's permit limited the amount of radionuclide-containing waste it could have in inventory at any given time. This meant that the INEEL would have to ship the waste in multiple, timed shipments instead of all at once, adding delays to the project schedule. While waiting for shipment, the sludge would have to be stored at the INEEL. This added more steps to the process, and would also require special containers for storage that would have to be expensively disposed of after use. Also, the high levels of radionuclides would require special casks for shipping.

Even if an approved treatment facility had been available, these complications would have increased the total cost of the project by over $21 million, making it approximately $32.2 million instead of the original $11.2 million (in Fiscal Year 1999 dollars; $8.9 million in 1999 ***net present value***). This change in cost not only eliminated the cost advantage that had favored the selection of this remedy, but also contributed to the Agencies' decision to look for a different remedy.

Based on these facts, the decision was made to reevaluate technologies previously considered and develop additional alternatives so that a new remedy for the V-Tanks contents could be selected. In particular, the new set of alternatives focused on identifying multiple, currently available, cost-effective, safe, and feasible treatment, storage, and disposal options. The reevaluation and decision process is summarized in the 2003 Technology Evaluation Report.[11]

net present value

Net present value compares the value of a dollar today versus the value of that same dollar in the future after taking return and inflation into account.

info The V-Tanks and piping are part of a "tank system," which must be addressed under the Resource Conservation and Recovery Act (RCRA).[12] A RCRA closure plan will describe how actions proposed in this plan will meet RCRA requirements. Waste generated during the remedial action will be managed in accordance with the requirements established in the Operable Unit 1-10 Amended Record of Decision. Certification will be required to document the cleanup goals of both RCRA and CERCLA. The public will have an opportunity to comment on the RCRA closure plan. RCRA is a federal waste management law regulating transportation, treatment, storage, and disposal of waste that is listed on one of EPA's hazardous waste lists or meets one or more of EPA's four characteristics of ignitability, corrosivity, reactivity, or toxicity.

SITE CHARACTERISTICS

The V-Tanks hold varying amounts of sludge and liquid waste that contains both hazardous and radioactive chemicals. Table 1 shows the capacity and current contents of the V-Tanks. None of the four stainless steel tanks has secondary containment, nor does the associated piping. The tanks have exceeded their design life; that is, they cannot be expected to store these wastes indefinitely. However, there is no evidence that the tanks have ever leaked. The site also includes an in-line sand filter, the piping used to transfer waste into and between the tanks, and surrounding contaminated soil (resulting from spills during removal of liquids). The tanks are part of an interconnected waste handling system, and the contents of all four tanks are considered one waste stream.

Table 1. V-Tanks capacity and volume of contents (in gallons).

Tank	Capacity	Volume		
		Liquid	*Sludge*	*Total*
V-1	10,000	1,160	520	1,680
V-2	10,000	1,140	460	1,600
V-3	10,000	7,660	650	8,310
V-9	400	70	250	320
Total	30,400	10,030	1,880	11,910

Source: 2003 Technology Evaluation Report.

Tanks V-1, V-2, and V-3 are approximately 19 feet long, 10 feet in diameter, and 10,000 gallons in capacity (see Figure 1). Tank V-9 is approximately 7 feet high, including the tapered base, and 3-1/2 feet in diameter, with a 400-gallon capacity. The total V-Tanks area is approximately 80 feet long by 50 feet wide. The volume of contaminated soil, in-line filter, and piping is estimated to be about 3,100 cubic yards.

The V-Tanks contents are considered "complex" and difficult to treat because they contain multiple hazards, including transuranic and other radionuclides, inorganic contaminants (including metals such as mercury), and ***volatile and semi-volatile organic compounds*** (including PCBs). The waste from the individual tanks will be combined, as necessary, to facilitate treatment. Table 2 lists the contaminants for treatment.

volatile and semi–volatile organic compounds (VOCs and SVOCs)

Volatile organic compounds evaporate readily at room temperature. Examples of volatile organic compounds are petroleum products and petroleum-based solvents. Semi-volatile organic compounds require higher temperatures for evaporation. Examples of semi-volatile organic compounds are PCBs, many pesticides sold for household use, and byproducts from burning, such as dioxin. Exposure to high concentrations of some volatile and semi-volatile organic compounds over a short time (acute exposure) can cause immediate damage to body tissues, or death. Lower concentrations over a longer time (chronic exposure) can lead to long-term effects, such as cancer. Even extremely low concentrations of dioxins can lead to cancer.

SUMMARY OF RISKS FROM V-TANKS CONTENTS

baseline risk assessment
The part of a remedial investigation that determines whether contaminants identified at a site pose a current or potential threat to human health and the environment if no remedial action is taken.

Under a CERCLA remedial investigation, a ***baseline risk assessment*** is carried out whenever hazardous substances have been released (through a leak, a spill, or by dumping) to the environment. The 1997 Remedial Investigation included a risk assessment for soils contaminated as a result of surface spills at the V-Tanks sites. However, a baseline risk assessment was not performed for the contaminants in the tank contents because there is no evidence that the tanks have ever leaked and the tank contents were to be removed during remedial action.

Table 2. Contaminants for treatment.[a]

	Concentration		
	Lowest	*Highest*	*Average* [b]
Inorganic Contaminants (mg/kg)			
Antimony	0.957	11.5	2.44
Arsenic	0.858	3.45	1.48
Barium	11.5	299	27.9
Beryllium	1.49	20.2	3.36
Cadmium	5.09	22.7	10.1
Chlorides	74.2	397	106
Chromium	25.8	1,880	297
Lead	72.7	454	141
Mercury	51.6	1,670	129
Nickel	23.9	319	47.7
Silver	6.96	522	31.9
Volatile Organic Compounds (VOCs) (mg/kg)			
Tetrachloroethylene (PCE)	36.3	438	118
1,1,1-Trichloroethane (TCA)	0.049	1,770	52.2
Trichloroethylene (TCE)	0.234	14,500	426
Semi-Volatile Organic Compounds (SVOCs) (mg/kg)			
Bis-2-ethylhexyl phthalate (BEHP)	338.0	919	454
Aroclor-1260 (a PCB)	9.99	95.9	17.9
Radionuclides (nCi/g)			
Cesium-137	528	4,480	988
Strontium-90	1,510	5,180	1,840
Transuranics [c]	2.03	26.4	4.27

a. The V-Tanks liquid and sludge also contain other elements and compounds. Because of their low concentrations, these constituents are not required to be addressed; however, all of the tank contents will be treated as part of the selected remedy.
b. A weighted average based on the mass of the entire V-Tanks contents.
c. The transuranics include plutonium, americium, curium, and neptunium.

Source: 2003 Technology Evaluation Report.

The long-range land use envisioned for Test Area North is for non-nuclear industrial facilities.[13] The Agencies agreed that the tank contents would pose unacceptable risk to current and future workers and future residents if the contents were ever released to the environment. The 1999 Record of Decision reflects the Agencies' judgment that the remedial action for the V-Tanks contents is necessary to protect public health and welfare from actual or threatened releases of hazardous substances into the environment.

Mercury and cadmium are the two metals of primary concern in the V-Tanks contents. Mercury has many uses in both household products and scientific research. Mercury is an extremely toxic element. Mercury poisoning can cause permanent damage to the nervous system or kidneys or cause birth defects. Cadmium has many uses, including corrosion-resistant metal coatings and control rods in nuclear reactors. Cadmium can damage kidneys, lungs, and the circulatory system.

Cesium-137 and strontium-90 are fission products of nuclear energy and weapons. Cesium-137 is rapidly absorbed into the bloodstream and affects all organs in the body. Its radioactive ***half-life*** is 30 years. Strontium-90 is chemically similar to calcium, and in humans tends to be incorporated into bone tissue, where its radioactivity damages the bone marrow. Its radioactive half-life is 29 years. The transuranic radionuclides are almost entirely artificially made as a result of nuclear energy and weapons research and use. They affect various organs of the body and have half-lives of tens of thousands of years.

Volatile and semi-volatile organic compounds among the contaminants include PCE, TCA, TCE, BEHP, and PCBs. PCE was formerly widely used in industry, usually as a metal degreaser and cleaning agent. In humans, PCE can cause liver, kidney, and central nervous system damage, and may cause cancer. TCA is in many common products such as glue, paint, and industrial degreasers. TCA may damage internal organs, especially the liver, and the nervous system, but it has not been shown to cause cancer. TCE is widely used in industry as a coolant, a solvent, or a metal degreaser. In humans, exposure to TCE can cause liver damage, and may cause cancer. BEHP (also called di-octyl phthalate or DOP) is commonly used to help plastics stay flexible and may have been used to test HEPA filters and other air filtration systems at Test Area North. It may also have been present in hydraulic fluids used in research. BEHP's effects range from gastrointestinal problems to cancer. PCBs are a family of industrial compounds that were used widely from 1929 to 1977, mainly as insulating liquids in electrical transformers. Aroclor-1260, which has been detected in the V-Tanks, is the trade name of a PCB.

half–life

The time it takes for a radioactive substance to lose half of its radioactivity through decay. Half-lives range from a fraction of a second to billions of years. Radioactivity comes from many sources, including outer space, the soil, medical x-rays, nuclear reactors and weapons, and even consumer products such as smoke detectors.

info Contaminants in the soil that were identified during the remedial investigation include cesium-137 and cobalt-60.[14] The baseline risk assessment conducted under the 1997 remedial investigation identified possible health risks from V-Tanks soil contaminants for people currently working at Test Area North, for workers in 100 years, and for children and adults who might live at Test Area North in 100 years. The contaminated soil will be removed and disposed of in accordance with the original selected remedy from the 1999 Record of Decision, except where minor amounts of contaminated soil may be added to the tank contents to facilitate treatment.

CERCLA PROCESS

Nine criteria, defined by CERCLA, are used to evaluate the cleanup options, which are called alternatives. Alternatives are compared to select the best one overall as the final remedy. The first two evaluation criteria — overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs) — are considered "threshold criteria." An alternative must meet the threshold criteria or it cannot be selected. The next five criteria are "balancing criteria" and are used to weigh major trade-offs among the alternatives. Each alternative is ranked in terms of how well it satisfies these criteria (high, moderate, or low). The final two criteria, called "modifying criteria," are used to factor in state and community concerns. During evaluation, each alternative is first assessed individually against the criteria. A comparative analysis then assesses the overall performance of each alternative relative to the others.

info The INEEL is expected to remain under government management and control for at least the next 100 years. After this time, the federal government is obligated to continue to manage and control areas that pose a significant health and/or safety risk to the public and workers until risk diminishes to an acceptable level.

Costs for each alternative are calculated in terms of net present value, with an estimated accuracy of +50% to -30%. Capital costs are those required to construct and operate the facilities necessary for the remedial action and the costs to perform the short-term remedial action. They include the costs of project and construction management, design, construction, and short-term operations. Operating and maintenance costs cover the labor and maintenance required for long-term remedial action operations, long-term site maintenance, and ***institutional controls***.

institutional controls

Administrative and engineering measures to protect current and future users from exposure to contamination. Institutional controls may include access restrictions (such as signs) and use restrictions, and are maintained until cleanup goals for unrestricted use have been achieved.

Remedial Action Objectives

The 1999 Record of Decision listed the following remedial action objective for the V-Tank contents:

- Prevent release to the environment of the V-Tanks contents.

Remedial action objectives state what the cleanup will accomplish, in terms of what contamination, if any, will remain when restoration is complete. The remedial

Evaluation criteria used in the CERCLA process

Threshold Criteria

√ ***Overall protection of human health and the environment***

Does the alternative protect human health and the environment in both the short and the long term by eliminating, reducing, or controlling the risk?

√ ***Compliance with applicable or relevant and appropriate requirements (ARARs)***

Does the alternative comply with environmental laws?

Balancing Criteria

√ ***Long-term effectiveness and permanence***

Does the alternative reliably protect human health and the environment over time? How certain is it that the alternative will be successful? Once cleanup goals have been met, will protection be maintained?

√ ***Reduction of toxicity, mobility, or volume through treatment***

How much of the contamination will be eliminated? Is the treatment permanent? What risks do the post-treatment residuals pose?

√ ***Short-term effectiveness***

Does the alternative pose any risks to the community, workers, or the environment during implementation? How soon will protection be achieved?

√ ***Implementability***

Is the proposed technology feasible and reliable? Can its effectiveness be monitored? Are the necessary materials, equipment, specialists, and services available?

√ ***Cost***

What are the estimates for capital costs and for operating and maintenance costs? Are the costs proportional to the overall effectiveness of the alternative?

Modifying Criteria

√ ***State acceptance***

Does the state concur with the preferred alternative?

√ ***Community acceptance***

Which aspects of the alternatives does the public support or oppose?

ARARs — Applicable or Relevant and Appropriate Requirements

The principal ARARs that the selected cleanup alternative must comply with are:

- RCRA Standards Applicable to Generators of Hazardous Waste
- RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
- RCRA Land Disposal Restrictions
- Toxic Substance Control Act (TSCA)
- Radiation Protection of the Public and the Environment (DOE Order 5400.5)

The Resource Conservation and Recovery Act (RCRA) is a federal waste management law. Its guidelines regulate transportation, treatment, storage, and disposal of waste. RCRA waste includes material that is listed on one of EPA's hazardous waste lists or meets one or more of EPA's four characteristics of ignitability, corrosivity, reactivity, or toxicity.

The Toxic Substances Control Act requires manufacturers to provide data on the environmental and health effects of chemical substances, and gives EPA comprehensive authority to regulate manufacture, use, distribution, and disposal of chemical substances.

Wastes containing high levels of mercury must be treated (by roasting or retorting) to recover and recycle the metal. PCBs are usually treated by incineration to destroy them. However, in the V-Tanks these contaminants are part of a complex mixture of wastes that also includes radionuclides, so incineration or retorting alone are inappropriate. Moreover, any mercury recovered from the V-Tanks waste would remain radioactive and could not be recycled. The Agencies may need to prepare a Petition for an Alternative Treatment Standard under 40 CFR 268.44(a), to allow the use of vitrification or chemical oxidation/reduction technologies. Sludge with PCB concentrations over 50 mg/kg is regulated as "PCB remediation waste" and must meet regulations under the Toxic Substances and Control Act (TSCA). To meet these requirements, a Risk-Based Petition under 40 CFR 761.61(c) will be prepared and submitted as necessary. The Agencies will prepare any required petitions as part of the Record of Decision Amendment.

A detailed list of specific laws and regulatory requirements that apply to remediation of the site is in Section 5 of the 2003 Technology Evaluation Report.

action objectives always confirm that either the contaminants will be removed, or actions will be taken to protect human health and the environment from any risks posed by any contaminants that remain.

DESCRIPTION AND EVALUATION OF ALTERNATIVES

The technology evaluation process completed in 2002 considered the feasibility and reliability of more than two dozen potential technologies, including all of those that were evaluated during the original 1997 feasibility study for this site.[15] Three remedial technologies were identified that can be used as the main components for cleanup of the V-Tanks contents: vitrification, thermal desorption, and chemical oxidation/reduction with stabilization.

The contents of the V-Tanks are a complex mixture of wastes, requiring use of multiple treatment steps to ensure that all the hazardous constituents are properly treated before disposal. There is no single technology that can destroy the organic contaminants; stabilize the metals, inorganic contaminants, and radionuclides; and meet requirements for disposal at approved facilities. The alternatives presented in this proposed plan utilize a combination of technologies that treat this mixture of organic, inorganic, and radioactive constituents to meet disposal facility requirements.

The waste streams that must be addressed by the alternatives in this proposed plan include the tank contents, the ***off-gas*** produced by volatilization during treatment, the filtration systems used to collect contaminants in the off-gas, the metal tank shells, and the piping. The contaminated soil will be removed and disposed of in accordance with the original selected remedy from the 1999 Record of Decision, except where contaminated soil may be added to the tank contents to facilitate treatment. Compared to the total volume of contaminated soil requiring disposal, the amount of soil incorporated in the treatment will be relatively minor.

The five CERCLA balancing criteria described in the previous section were used to compare the effectiveness of the alternatives. The Agencies collaborated in the development of a Decision Support Model tailored to evaluate the V-Tanks contents alternatives in a way that would minimize future implementation issues. This proposed plan presents the results on a comparative basis to clearly differentiate between alternatives. Consequently, a high or low ranking reflects how an alternative compares to other alternatives, not whether it performs well or poorly relative to the specified criterion. (Information about the absolute ranking of each alternative is in Section 4 of the 2003 Technology Evaluation Report.)

The evaluation included reconsideration of the No Action and Limited Action (institutional controls) alternatives. Both were rejected because they would leave contaminants in tanks not designed for indefinite storage. However, institutional controls, which are a part of Limited Action, were retained as a component of the cleanup action.

The following sections describe the seven alternatives being considered. Two alternatives use vitrification as the main treatment technology, three use thermal desorption, and two use chemical oxidation/reduction with stabilization. For each of

info The term "laws" is being used in this proposed plan to designate applicable or relevant and appropriate requirements (ARARs), the second CERCLA evaluation criterion. ARARs are the body of Federal and State laws, regulations, and standards governing environmental protection and facility siting with which the selected cleanup alternative must comply.

off-gas

Gases given off during a process; in this instance, gases produced from heating that contain contaminants.

info To fine-tune their evaluation of potential treatment technologies for the V-Tanks contents under the five CERCLA balancing criteria, the Agencies studied more than 20 areas of specific concern. Among them are:

- availability of storage and disposal facilities
- reliability of the alternative
- ability to construct and operate
- monitoring considerations
- administrative feasibility
- time to ROD completion
- shipments out of the INEEL
- worker protection
- primary waste volume
- irreversibility of treatment
- treatment residuals

A detailed list of the subcriteria developed for the Decision Support Model is in Section 4 of the 2003 Technology Evaluation Report.

in situ
Literally "in place." Typically, in situ treatments remediate the contamination in place without excavation. For greater efficiency, some contaminants may be removed from their original location and consolidated with other contaminants for treatment. This is still considered an in situ treatment.

these three technologies, variations were developed to compare ***in situ*** versus ***ex situ*** treatment, and on-Site versus off-Site treatment and disposal.

Common Elements

All of the new alternatives considered include some of the same components. For all alternatives, it is expected that treatment of the V-Tanks contents will be completed by the end of 2005, and removal of the contaminated soil will be completed by 2006. All the alternatives will result in the removal of the tank contents, the tanks, and associated piping. Likewise, all alternatives are compatible with the retained portion

Original Selected Remedy—Soil and Tank Removal, Ex Situ Treatment of Tank Contents, and Disposal

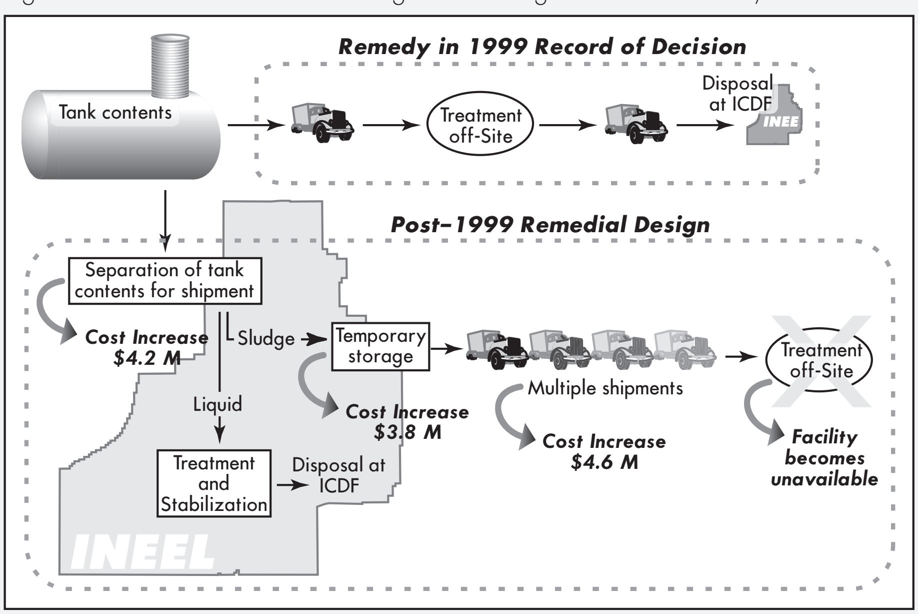
Under the 1999 Original Selected Remedy, the tank contents would be removed, placed into containers, and transported to an approved off-Site treatment facility. Thermal treatment at the facility would reduce toxicity, mobility, and volume of the contaminants. The treatment residue would either be returned to the INEEL for disposal at the ICDF or disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, or other approved facility. The empty tanks and associated piping would be decontaminated, removed, and disposed of at the ICDF or other approved facility. The contaminated soil would be excavated and disposed of at the ICDF or other approved facility. Institutional controls such as signs, access control, and land-use restrictions would be established and maintained as necessary.

As originally evaluated in the 1999 Record of Decision, the Original Selected Remedy would have met the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* was ranked high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* was ranked high because volatile and semi-volatile organic compounds would be destroyed, volatile metals would be removed, and the remaining metals and radionuclides would be immobilized. The *short-term effectiveness* was ranked low, due to the complexity of worker protection measures, uncertainties as to acceptance criteria at off-Site disposal facilities, and the risks to communities during off-Site shipment.

If this alternative were evaluated today, the rankings for long-term effectiveness, reduction of toxicity, mobility, and volume through treatment, and short-term effectiveness would remain the same. However, the rankings for implementability and the cost would change. In the 1999 Record of Decision, the implementability was ranked moderate. Today, the implementability would be ranked low because facilities for this treatment are not currently available, and the waste would have to be stored at an approved facility until treatment became available. The estimated cost of the Original Selected Remedy was $11.2 million (in Fiscal Year 1999 dollars; $8.9 million in net present value). However, during the remedial design, new information on technical complexities showed that the actual cost of remediation was likely to be nearly three times the original estimate. (The design complexities are described in Site History, on page 4.)

Figure 3 shows some of the major cost and complexity differences between the remedy developed for the 1999 Record of Decision and the detailed 2002 design estimate. The costs shown are only those related to the tank contents, and do not include other project costs such as remedial design, post-record of decision sampling, removal and disposal of empty tanks, piping, and contaminated soil, and project management. The majority of the increased complexity and cost is related to the tank contents.

Figure 3. Post-Record of Decision changes to the Original Selected Remedy.



of the original selected remedy — removal and disposal of contaminated soil — for the complete remediation of the V-Tanks site. For all alternatives, the portions of the tanks, piping, and soil not incorporated in the treatment process will be disposed of at the ICDF or other approved facility, such as Envirocare in Utah. Personal protective equipment and non-recoverable materials and equipment (items that cannot be easily or cost-effectively decontaminated for reuse) will be treated as necessary and also disposed of at the ICDF or other approved facility. Institutional controls for the V-Tanks site will be maintained until cleanup levels for soils have been reached. The excavated area will be backfilled with clean soil after cleanup is complete. None of the remedies relies exclusively on institutional controls for its effectiveness.

The estimated cost for each alternative is presented as part of its evaluation. Estimated costs are in net present value, with an estimated accuracy of +50% to -30%. Actual project costs for V-Tanks remediation through September 2002 are $6.0 million. Cost estimates provided for each alternative include the costs to date.

Technology 1—Vitrification

Vitrification uses electricity to heat waste to temperatures high enough to melt the waste into a glass-like material as hard as basalt or obsidian. Through vitrification, many contaminants, including radionuclides and most metals, are bound up into the glass and permanently immobilized. Volatile and semi-volatile contaminants are either destroyed by the heat or driven off as gas that is then captured and treated. To the extent possible, the contaminated piping and soil associated with the V-Tanks would be incorporated into the melt. Vitrification of the V-Tanks would include construction of an off-gas system to capture and treat volatilized contaminants. After vitrification, the glass would be disposed of at the ICDF. Contaminated soil, tanks, and piping not incorporated in the glassified waste would be removed and disposed of at the ICDF, as under the Original Selected Remedy. Two variations of vitrification were considered, differing in whether the vitrification takes place in situ or ex situ.

Alternative 1(a)—In Situ Vitrification

Under Alternative 1(a), the V-Tanks and their contents would be vitrified in their existing underground location (in situ) (Figure 4). Some of the contaminated soil would be added to the tanks before vitrification to absorb excess water and eliminate void space in the tank. The tank contents could be vitrified in separate tanks or could be vitrified in one melt if all the contents were first consolidated into one tank. The exact number of melts and how much piping and soil could be included in the melt would be determined in the remedial design process. On completion of the vitrification,

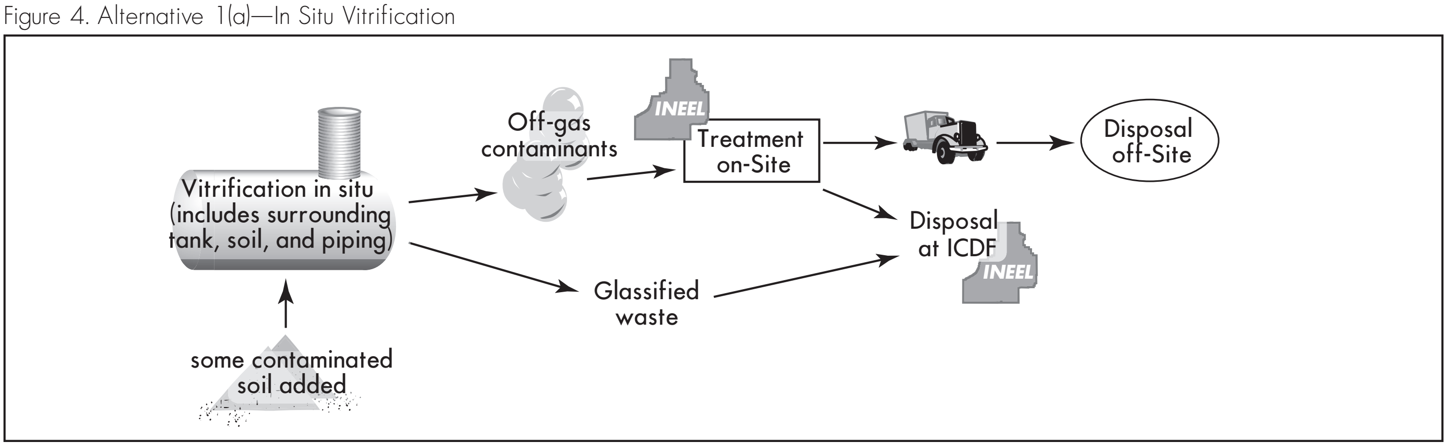
ex situ
No longer in its original location. Ex situ treatments are technologies that remove the contaminated material, usually by bringing it to the surface, before treatment.

info For all the alternatives, several off-gas treatment technologies would be used in combination as required to ensure contaminants are removed from the off-gas before it is released to the environment. Treatments expected to be used include:

- filtration
- stabilization
- amalgamation
- thermal oxidation

info The INEEL CERCLA Disposal Facility (ICDF) was selected as the primary disposal facility on the INEEL for evaluation in the 2003 Technology Evaluation Report. The facility, which is projected to open in mid-2003, will accept only wastes generated within INEEL boundaries during CERCLA actions, such as the remediation described in this proposed plan. It is possible that some waste from the V-Tanks cleanup may not be accepted at the ICDF or that it would be more cost-effective to dispose of the waste elsewhere. Thus, although the ICDF is the primary facility mentioned in this plan and was used for cost estimating disposal on the INEEL, the Agencies may choose to dispose of the V-Tanks waste at a different approved disposal facility.

Figure 4. Alternative 1(a)—In Situ Vitrification



the glass-like material would be broken into pieces and placed into containers for disposal at the ICDF. Contaminants captured in the off-gas system would be treated as necessary and disposed of at the ICDF or an approved off-Site facility.

Evaluation. Alternative 1(a) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would be high because volatile and semi-volatile organic compounds would be destroyed or treated, volatile metals (such as mercury) would be captured in the off-gas system, and the remaining metals and radionuclides would be immobilized. Incorporation of some soil, part of the tank shells, and some of the piping into the melt would increase the volume of the glassified waste, but vitrification would treat some contaminated soil that otherwise would be excavated and disposed of without treatment. The *short-term effectiveness* would be moderate, because the high energy and high temperature involved in the vitrification process could pose risks to workers that are complex to manage. Most processes would take place on-Site, minimizing risks to off-Site communities. The *implementability* would be moderate. Although in situ vitrification has been successfully implemented on similar sites, and disposal facilities are available, it is a relatively complicated process with complex ***recovery*** and monitoring considerations. Testing after vitrification would be required to verify completeness of the melt. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $33.0 million.

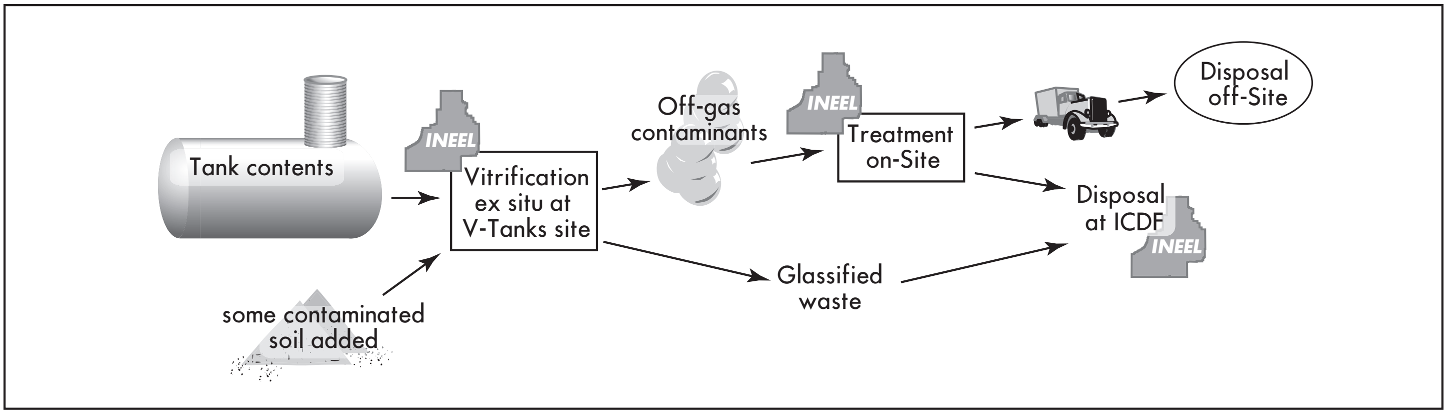
recovery
The ease of adjusting a treatment technology if the initial treatment does not fully satisfy objectives.

Alternative 1(b)—Ex Situ Vitrification

Under Alternative 1(b), the contents would be removed from the tanks and vitrified in a treatment unit at the V-Tanks site (Figure 5). As with Alternative 1(a), contaminated soil would be added to the mix. The vitrified material would be disposed of at the ICDF. Contaminants captured in the off-gas system would be treated as necessary and disposed of at the ICDF or an approved off-Site facility.

Evaluation. Alternative 1(b) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would be moderate. As with Alternative 1(a), volatile and semi-volatile organic compounds would be destroyed or treated, volatile metals (such as mercury) would be captured in the off-gas system, and the remaining metals and radionuclides would be immobilized. Vitrification would treat some contaminated soil that otherwise would be excavated and disposed of without treatment. The addition of contaminated soil would reduce the volume of

Figure 5. Alternative 1(b)—Ex Situ Vitrification



soils disposed of without treatment. However, ex situ processes require substantial amounts of treatment equipment, some of which could not be decontaminated and would need to be disposed of as secondary waste. The *short-term effectiveness* would be moderate, because the high energy and high temperature involved in the vitrification process could pose risks to workers that are complex to manage, especially because the treatment takes place aboveground, increasing potential worker exposure hazards. The on-Site treatment of contaminants in the off-gas also adds to the process complexity. However, since most of the wastes will be disposed of on-Site, risks associated with disposal facility availability are reduced. Most processes would take place on-Site, minimizing risks to off-Site communities. The *implementability* would be moderate because portable temporary vitrification units are not widely used, and vitrification is a relatively complicated process with complex recovery and monitoring considerations. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $32.7 million.

Technology 2—Thermal Desorption

Thermal desorption uses heat to separate the volatile and non-volatile contaminants into two waste streams. Separating the contaminants into two waste streams provides more remediation options than would be available for just one waste stream containing all the contaminants. Additional treatments are required to destroy organic constituents, such as PCBs, and ***amalgamate*** the mercury (as required). Under all variations of this technology, the tank contents would be pumped into a thermal desorption unit at the V-Tanks site and heated to remove the volatile and semi-volatile organic compounds and mercury. The ***bottoms***, which would contain the non-volatile contaminants (including most of the metals and radionuclides), would be treated by stabilization (as required) and disposed of. Stabilization is not required if soil is added during the desorption process. The off-gas system would destroy volatilized contaminants or capture them for treatment. Under all variations of this technology, the tanks and associated piping would be excavated and disposed of at the ICDF.

Three variations of thermal desorption were considered, differing in whether the treatment and disposal steps are carried out on-Site, off-Site, or with a combination of on- and off-Site.

The alternatives also differ in whether soil is added to the desorber. Thermal desorption has been used successfully elsewhere in the U.S. to treat contaminated soil, but has rarely been used on extremely moist materials such as the sludge in the V-Tanks. Alternatives 2(a) and 2(b) would add soil to the sludge to lower the moisture content. This would prevent clumping and uneven heating, resulting in faster drying. Under Alternative 2(c), the sludge would be treated without the addition of soil.

Alternative 2(a)—Thermal Desorption with Both On-Site and Off-Site Disposal

Under Alternative 2(a), the tank contents and some contaminated soil would be added to the thermal desorption unit to begin the process (Figure 6). After desorption, the bottoms would be disposed of at the ICDF. The contaminants captured in the off-gas system would be shipped off-Site for treatment and disposal at an approved facility.

Evaluation. Alternative 2(a) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would be low. Volatile and semi-volatile organic compounds captured in the off-gas system would be treated, and

amalgamate

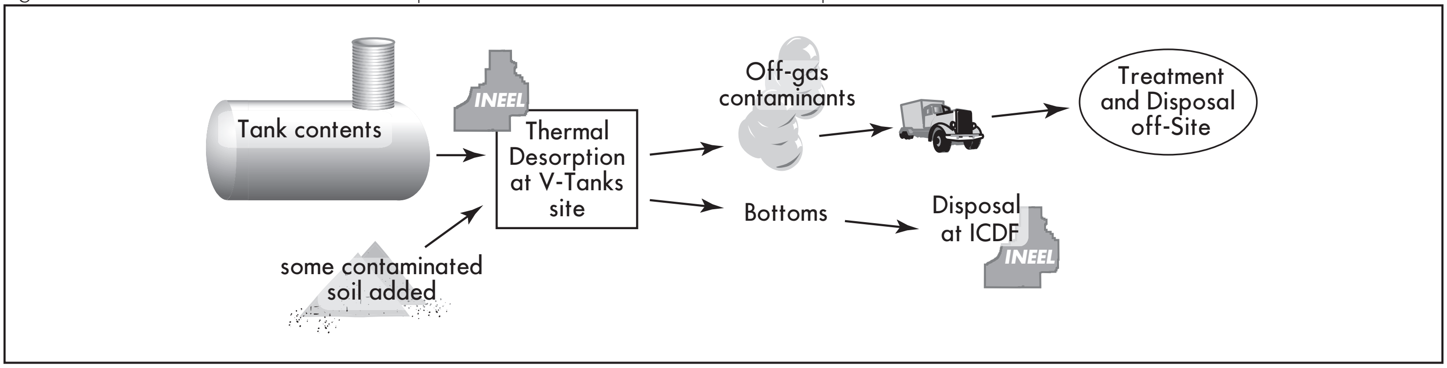
Mixing elemental mercury with sulfur or metals such as copper, zinc, nickel, or gold. The compounds formed have less potential to release mercury to the air or groundwater.

bottoms

The dried contents (residue) remaining after thermal desorption.

info Remediation of these sites will produce secondary waste from activities such as sampling and monitoring. This waste could include contaminated sampling equipment, personal protective equipment, and laboratory samples. Any such waste will be stored near the area where it was generated until treated or disposed of at an approved facility.

Figure 6. Alternative 2(a)—Thermal Desorption with Both On-Site and Off-Site Disposal



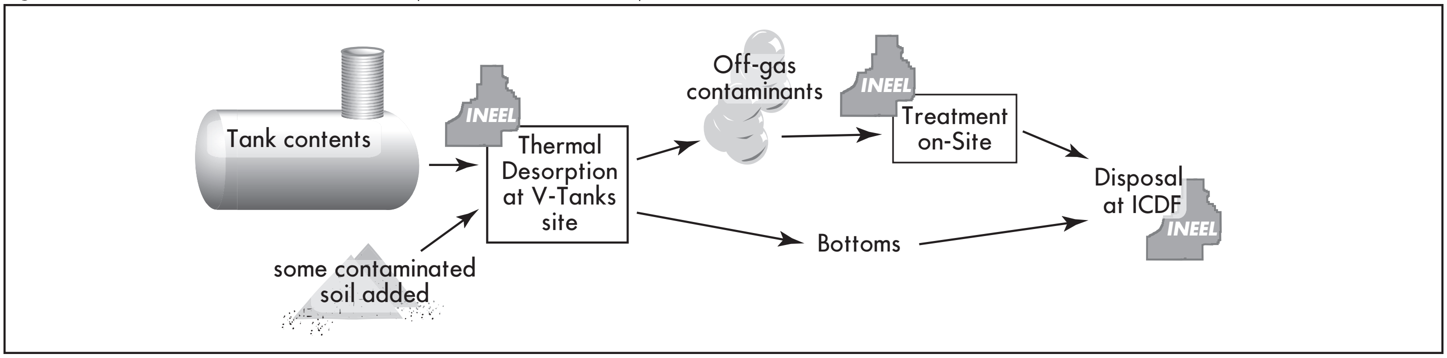
volatile metals (such as mercury) that are captured would be stabilized as necessary. The mobility of the remaining metals and radionuclides in the bottoms would not be affected. Although water is driven off by the thermal processing, the volume of the bottoms would increase due to the addition of soil in the desorption process. The *short-term effectiveness* would be moderate due to potential worker exposure hazards from materials handling and the dust created during the process. Off-site shipping could pose risks to communities. The *implementability* would be high because thermal desorption is widely used. However, application to radioactive materials is limited, and this lack of experience adds design and operating complexities. The technology is moderately complex but has good recovery. The regulatory process is relatively simple for this alternative. Shipment of organic contaminants off-Site for treatment reduces regulatory and operational complexity. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $30.3 million.

Alternative 2(b)—Thermal Desorption with On-Site Disposal

Under Alternative 2(b), the tank contents and some contaminated soil would be added to the thermal desorption unit to begin the process (Figure 7). After desorption, the bottoms would be disposed of at the ICDF. The contaminants captured in the off-gas system would be treated on-Site and then disposed of at the ICDF.

Evaluation. Alternative 2(b) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would be low. Volatile and semi-volatile organic compounds captured in the off-gas system would be treated, and

Figure 7. Alternative 2(b)—Thermal Desorption with On-Site Disposal



volatile metals (such as mercury) that are captured would be stabilized as necessary. The mobility of the remaining metals and radionuclides in the bottoms would not be affected. Although water is driven off by the thermal processing, the volume of the bottoms would increase due to the addition of soil in the desorption process. The *short-term effectiveness* would be high, because all treatment and disposal processes would take place on-Site, avoiding risks to off-Site communities. There are potential worker exposure hazards from materials handling and dust created during the process. The *implementability* would be high because thermal desorption is widely used. However, application to radioactive materials is limited, and this lack of experience adds design and operating complexities. The on-Site treatment of contaminants in the off-gas also adds to the process complexity. However, since all wastes would be disposed of on-Site, availability of disposal facilities would be more assured. The technology as a whole is moderately complex and has good recovery. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $30.3 million.

Alternative 2(c)—Thermal Desorption with Off-Site Disposal

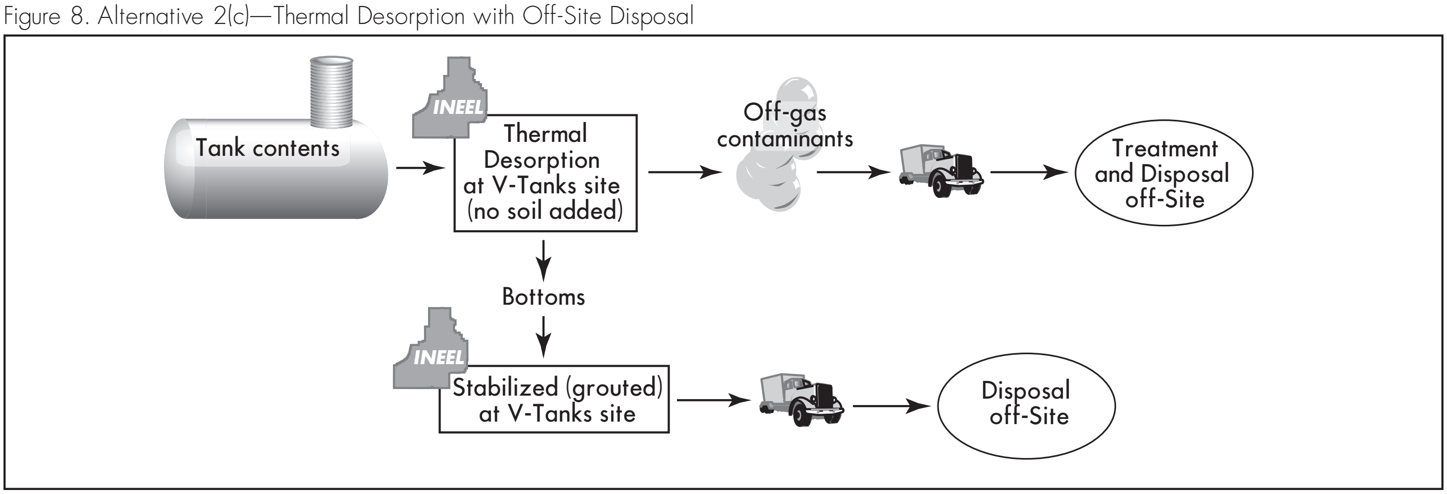
Under Alternative 2(c), the tank contents would be added to the thermal desorption unit to begin the process (Figure 8). No soil would be added. After desorption, the bottoms would be stabilized on-Site with a small amount of grout or similar material and disposed of off-Site. Not adding soil to the desorption process would decrease the volume, and therefore the cost, of shipping the waste off-Site. The contaminants captured in the off-gas system would be shipped off-Site for treatment and disposal at an approved facility. Potential disposal facilities for the bottoms include the Nevada Test Site and the Hanford Reservation. Currently, the Nevada Test Site and Hanford are accepting mixed wastes from within their respective states and are pursuing the capability to receive out-of-state wastes. Since these sites are not currently authorized to accept the V-Tanks waste, it is assumed that the waste would be placed in interim storage at the INEEL until authorization is granted.

Evaluation. Alternative 2(c) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would be moderate. Volatile and semi-volatile organic compounds captured in the off-gas system would be treated, and volatile metals (such as mercury) that are captured would be stabilized as necessary. The residual waste from the desorber would be grouted to stabilize toxic metals to

info Waste that contains transuranic radionuclides in concentrations greater than 10 nCi/g cannot be disposed of at the ICDF. The concentration of transuranic radionuclides in the untreated contents of the V-Tanks is approximately 4 nCi/g.

Because no soil would be added to the tanks in Alternative 2(c) and the volume of the tank contents would be reduced through thermal desorption treatment, the concentration of transuranic and other radionuclides in the treated bottoms would likely be greater than 10 but less than 100 nCi/g. Waste with concentrations in this range could be disposed of at off-Site facilities, such as the Nevada Test Site, if the facilities are approved to accept this type of waste from the INEEL.

Figure 8. Alternative 2(c)—Thermal Desorption with Off-Site Disposal



meet disposal facility acceptance criteria. Grouting would reduce the mobility of the contaminants with only a slight increase in volume. The concentration of transuranic radionuclides in the final waste would be greater than 10 nCi/g, which would prevent disposal at the ICDF. The *short-term effectiveness* would be low. The technology poses potential worker exposure hazards from materials handling, dust created during the process, and high radiation levels. Off-site shipping could pose risks to communities. The *implementability* would be low. Although desorption is widely used, it has not been previously carried out on high-radiation sludges. Recovery would be relatively complex. Final completion of the project could be delayed and the costs increased if an approved off-Site disposal facility is not available when needed. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $33.8 million.

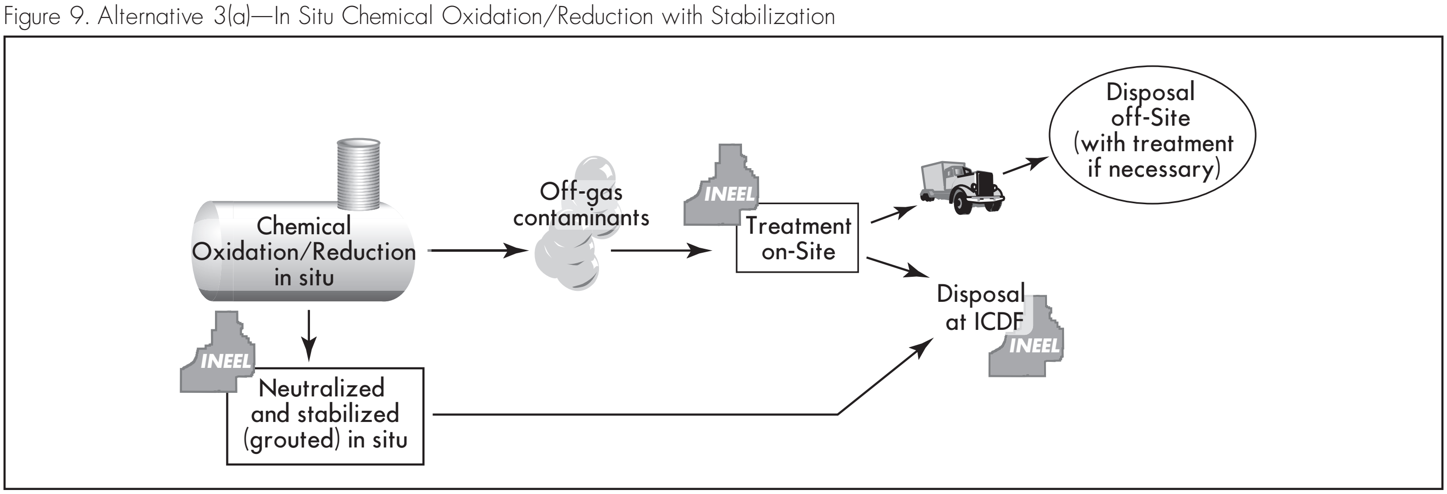
Technology 3—Chemical Oxidation/Reduction with Stabilization

For chemical oxidation/reduction with stabilization, a chemical solution would be added to the tank contents to destroy the organic contaminants, including PCBs. Heating may be applied, up to boiling temperatures, to facilitate destruction. An off-gas system would be used to capture volatilized contaminants. After oxidation or reduction, the tank contents would then be chemically neutralized and the metals and radionuclides stabilized with grout or a similar material. The stabilized waste would be disposed of at the ICDF. The contaminants captured in the off-gas and the filters used in the off-gas system would be disposed of at the ICDF or an approved off-Site facility. The tanks and piping, along with the remaining contaminated soil, would be excavated and disposed of at the ICDF. Two variations of this technology were considered, differing in whether chemical oxidation/reduction and stabilization takes place in situ or ex situ.

Alternative 3(a)—In Situ Chemical Oxidation/ Reduction with Stabilization

Under Alternative 3(a), the chemical oxidation/reduction process would be carried out in the V-Tanks (Figure 9). Since Tank V-9 is not large enough for in situ processing, the sludge and liquid from that tank would be transferred to another V-Tank for treatment. After oxidation or reduction, the waste would be neutralized and grouted to stabilize the contaminants and eliminate free liquid. The grouted material would form a solid mass inside the V-Tanks. The V-Tanks, with the solidified waste inside,

Figure 9. Alternative 3(a)—In Situ Chemical Oxidation/Reduction with Stabilization



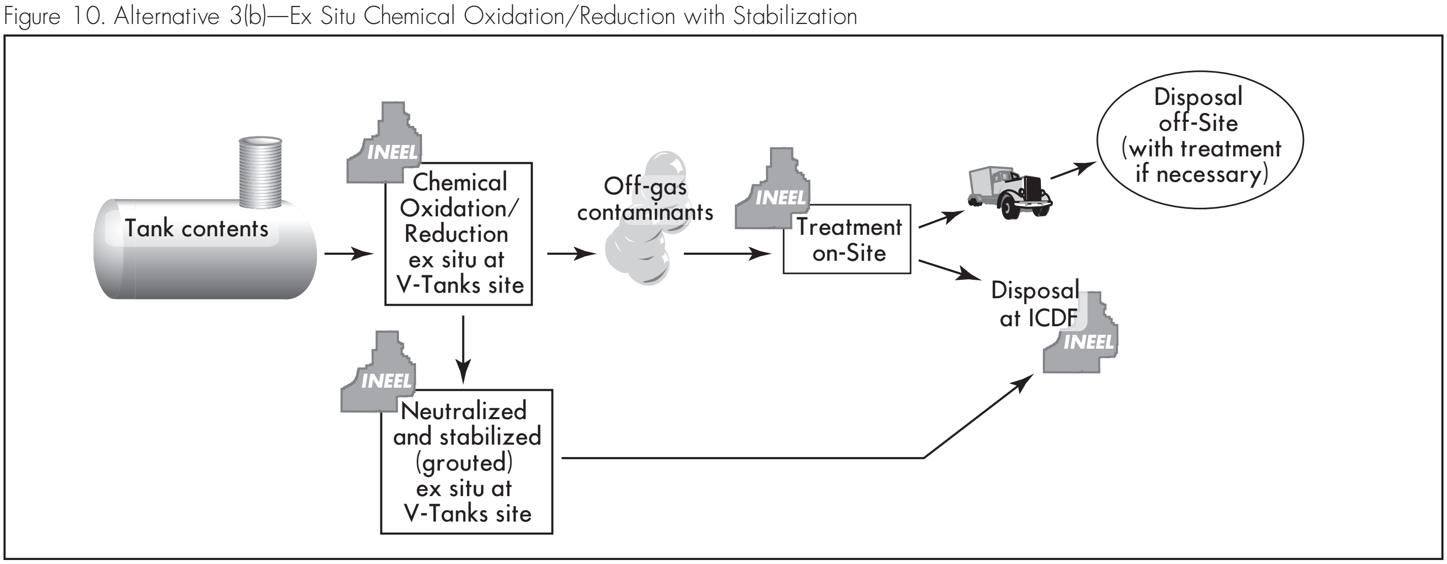
would be removed and disposed of at the ICDF. The contaminants captured in the off-gas system would be treated on-Site and then disposed of at the ICDF or off-Site. Disposal off-Site may include additional treatment at the off-Site facility, depending on its acceptance criteria.

Evaluation. Alternative 3(a) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would reduce toxicity by destroying the volatile and semi-volatile organic compounds through oxidation or reduction and would reduce mobility of metals and radionuclides through grouting, but would increase the volume of waste requiring disposal by adding the oxidizing/reducing and neutralizing chemicals, and the grout. Therefore, the overall ranking for this criterion is low. The *short-term effectiveness* would be high. In situ processing minimizes potential risks to workers and the environment. Most treatment processes would take place on-Site, minimizing risks to off-Site communities. The technology's relative simplicity reduces complexity in worker protection measures. The *implementability* would be high. The systems and equipment involved have a high technical reliability with relatively few major components. The technology is very flexible and thus has excellent recovery. However, design of in situ treatment involves some complexities associated with integrity of the tank once the chemical solution is added, in-tank heating and mixing issues, and removal and transport of the grout-filled tanks. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $29.5 million.

Alternative 3(b)—Ex Situ Chemical Oxidation/ Reduction with Stabilization

Under Alternative 3(b), the contents of the tanks would be pumped into a separate treatment unit on the surface at the V-Tanks site, and the chemical oxidation or reduction would be carried out in that unit (Figure 10). After oxidation or reduction, the waste would be neutralized and grouted to stabilize the contaminants and eliminate free liquid. The stabilized waste would be disposed of at the ICDF. The now-empty tanks would be removed and also disposed of at the ICDF. The contaminants captured in the off-gas system would be treated and then disposed of at the ICDF or off-Site. Disposal off-Site may include additional treatment at the off-Site facility, depending on its acceptance criteria.

Figure 10. Alternative 3(b)—Ex Situ Chemical Oxidation/Reduction with Stabilization



Evaluation. Alternative 3(b) would meet the threshold criteria for protection of human health and the environment and compliance with laws. *Long-term effectiveness* would be high because the contamination would be removed from the site. The *reduction of toxicity, mobility, and volume through treatment* would reduce toxicity by destroying the volatile and semi-volatile organic compounds through oxidation or reduction and would reduce mobility of metals and radionuclides through grouting, but would increase the volume of waste requiring disposal by adding the oxidizing/reducing and neutralizing chemicals, and the grout. Therefore, the overall ranking for this criterion is low. The *short-term effectiveness* would be high. The relative simplicity and low temperatures of this technology makes worker-protection measures less complicated. In addition, most or all treatment processes would take place on-Site, minimizing risks to off-Site communities. As an ex situ process, this alternative would pose slightly more risks to workers and the environment than an in situ process. The *implementability* would be high. The systems and equipment involved are relatively simple, although as an ex situ process, it requires additional systems for worker protection (specifically, shielding from radioactivity). The design of this alternative minimizes issues with tank integrity, heating and mixing, and dealing with grout-filled tanks. The ex situ process would resolve the technical uncertainties associated with in situ treatment. The technology is very flexible and thus has excellent recovery. The *estimated cost* of cleaning up the entire V-Tanks site using this alternative is $29.4 million.

PREFERRED ALTERNATIVE—3(b), EX SITU CHEMICAL OXIDATION/ REDUCTION WITH STABILIZATION

Table 3 summarizes the evaluation of the alternatives. The preferred alternative for removing, treating, and disposing of the V-Tanks contents is Alternative 3(b)—Ex Situ Chemical Oxidation/Reduction with Stabilization. The preferred alternative would protect human health and the environment and comply with laws. It would have high long-term effectiveness since the contamination would be removed from the site. It would reduce toxicity by destroying volatile and semi-volatile organic compounds. Although stabilization immobilizes contaminants, it would increase the volume. Its short-term effectiveness would be high because it uses low temperatures and pressures. Off-Site shipments would be minimal or not required, which makes this alternative more protective of off-Site communities. Its implementability would be high. Although data is somewhat limited for application of chemical oxidation/reduction on wastes with comparable contaminants, the process has a strong technical basis. The equipment and system operations are relatively simple, and recovery after process interruptions would be easy to accomplish. The estimated cost of cleaning up the entire V-Tanks site using this alternative is $29.4 million.

The preferred alternative received the highest combined ranking of all the alternatives in the 2003 Technology Evaluation Report. Compared to the other six alternatives, it would have the same long-term effectiveness and the same or greater short-term effectiveness. Because the preferred alternative would increase the volume of waste to be disposed of, even though it reduces toxicity and mobility, its overall ranking for reduction of toxicity, mobility, and volume through treatment is lower

info The preferred alternative is not compared to the original selected remedy because the original remedy is no longer viable.

Table 3. Comparison of alternatives.

	Vitrification: In Situ 1(a)	Vitrification: Ex Situ 1(b)	Thermal Desorption: Both On-Site and Off-Site 2(a)	Thermal Desorption: On-Site Disposal 2(b)	Thermal Desorption: Off-Site 2(c)	Chemical Oxidation/Reduction with Stabilization: In Situ 3(a)	Chemical Oxidation/Reduction with Stabilization: Ex Situ 3(b) ☑
Threshold Criteria [a]							
Overall protection	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ
Compliance with laws	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ	Ⓨ
Balancing Criteria							
Long-term effectiveness	●	●	●	●	●	●	●
Reduction of toxicity, mobility, or volume through treatment	●	◒	○	○	◒	○	○
Short-term effectiveness	◒	◒	◒	●	○	●	●
Implementability	◒	◒	●	●	○	●	●
Cost (in millions) [b]							
Capital costs	$32.7	$32.4	$30.0	$30.0	$33.5	$29.2	$29.1
Operating and maintenance costs [c]	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Cost	$33.0	$32.7	$30.3	$30.3	$33.8	$29.5	$29.4

Note: The Original Selected Remedy was Soil and Tank Removal, Ex Situ Treatment of Tank Contents, and Disposal. However, the alternative is no longer viable, prompting development of a new remedy.

a. An alternative must meet the threshold criteria to be considered for selection. An alternative either fully satisfies the criteria or does not. The No Action and Limited Action (Institutional Controls) alternatives did not meet the threshold criteria and were eliminated from detailed analysis.
b. Costs are estimated and rounded. Costs are in net present value, with an estimated accuracy of +50% to -30%. Detailed cost estimates are in Appendix A of the 2003 Technology Evaluation Report. Cost estimates provided for each alternative include the costs to date. (See page 8 for additional information about costs.)
c. The only operating and maintenance costs required would be for institutional controls and would be identical for all alternatives, since all alternatives would remove contamination in order to meet remediation goals.

☑ Indicates the preferred alternative
Ⓨ Yes, meets criterion
● High, most satisfies criterion
◒ Moderate, satisfies criterion
○ Low, least satisfies criterion

than Alternatives 1(a) and 1(b), the two vitrification alternatives, and also lower than Alternative 2(c), Thermal Desorption with Off-Site Disposal. However, its ranking is the same as the other three alternatives. Its implementability would be the same or higher than the other alternatives, largely due to the simplicity of the treatment systems used. The estimated $29.4 million cost is the lowest of all the alternatives.

Alternative 3(b)—Ex Situ Chemical Oxidation/Reduction with Stabilization is preferred over the other alternatives because it is a low-temperature operation, uses a simplified off-gas treatment system, and generates a stabilized waste form that can be disposed of at the ICDF.

- Compared to Alternative 1(a)—In Situ Vitrification, the preferred alternative has fewer monitoring concerns, lower cost, higher system reliability, and produces less off-gas wastes.
- Compared to Alternative 1(b)—Ex Situ Vitrification, the preferred alternative offers risks to workers that are more manageable, has a lower cost, and has higher system reliability.
- Compared to Alternative 2(a)—Thermal Desorption with Both On-Site and Off-Site Disposal, the preferred alternative produces a lower volume of off-gas wastes, fewer off-Site shipments, and fewer potential hazards to workers.
- Compared to Alternative 2(b)—Thermal Desorption with On-Site Disposal, the preferred alternative poses fewer potential hazards to workers, higher reliability, and produces less off-gas wastes.
- Compared to Alternative 2(c)—Thermal Desorption with Off-Site Disposal, the preferred alternative poses fewer potential hazards to workers, more readily available disposal facilities, a lower cost, fewer required off-Site shipments, and better system reliability.
- Compared to Alternative 3(a)—In Situ Chemical Oxidation/Reduction with Stabilization, the preferred alternative has equal system reliability and fewer design complexities.

Based on the information available at this time, the Agencies believe the preferred alternative would be protective of human health and the environment, would comply with ARARs, would be cost-effective, and would utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative may be modified or changed by the Agencies in response to public comment or new information that becomes available after this plan is released.

REFERENCES

The following list of source material is provided for readers who want more detailed information than is presented in this proposed plan. These documents are available in the INEEL Administrative Record or other federal archives as indicated. Locations of the Administrative Record are listed in the margin of the next page. The titles of the primary sources have been shortened in subsequent entries for convenience.

1. Agreement-in-Principle between the Shoshone-Bannock Tribes and the U.S. Department of Energy, August 6, 1998; available on-line at http://www.id.doe.gov/doeid/BUSINESS/PDF/AIP.PDF
2. *Technology Evaluation Report for the V-Tanks, TSF 09/18 at Waste Area Group 1, Operable Unit 1-10, Idaho National Engineering and Environmental Laboratory,* U.S. Department of Energy, Idaho Operations Office, March 2003, DOE/ID-11038, available on-line at http://ar.inel.gov/ (2003 Technology Evaluation Report).
3. *Final Record of Decision for Test Area North, Operable Unit 1-10, Idaho National Engineering and Environmental Laboratory,* U.S. Department of Energy, Idaho

Operations Office, October 1999, DOE/ID-10682; available on-line at http://ar.inel.gov/ (1999 Record of Decision).

4. *New Alternatives Considered for V-Tanks at Waste Area Group 1*, INEEL Environmental Restoration Program, U.S. Department of Energy, Idaho Operations Office, August 2002, AR No. 24774; available on-line at http://ar.inel.gov/

5. CERCLA, 42 U.S.C. § 9621, "Cleanup Standards"; available on-line at http://www4.law.cornell.edu/uscode/42/9621.html

6. 54 FR 48184, 40 CFR 300, "National Priorities List of Superfund Sites," *Code of Federal Regulations,* Final Rule, U.S. Government Printing Office, July 1997; available on-line at http://www.access.gpo.gov/nora/cfr/cfr-tablesearch.html from the National Archives and Records Administration.

7. *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* December 9, 1991, AR No. 1088-06-29-120; available on-line at http://www.em.doe.gov/lffaa/inelcerc.html (FFA/CO)

8. *Comprehensive Remedial Investigation and Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory,* November 1997, DOE/ID-10557 (1997 Comprehensive Investigation).

9. 1999 Record of Decision, Section 11.2, "Changes to the V-Tanks (TSF-09 and TSF-18) Preferred Alternative."

10. *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory,* Idaho Falls, Idaho, March 2003, DOE/ID-11050; available on-line at http://ar.inel.gov.

11. 2003 Technology Evaluation Report, Section 4, "Detailed Analysis of Alternatives."

12. RCRA, 42 U.S.C., §§ 6901 et seq.; available on-line at http://www4.law.cornell.edu/uscode/42/6901.html

13. *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan,* December 1997, AR No. DOE/ID-10514.

14. 1997 Comprehensive Investigation, Section 8, "RI/BRA Summary and Conclusions."

15. 1997 Comprehensive Investigation, Section 10, "Identification and Screening of Technologies."

info The INEEL Administrative Record may be accessed on the Internet at http://ar.inel.gov. It is also available to the public at the following locations:

INEEL Technical Library
DOE Public Reading Room
1776 Science Center Drive
Idaho Falls, ID 83415
208-526-1185

Albertsons Library
Boise State University
1910 University Drive
Boise, ID 83725
208-385-1621

University of Idaho Library
University of Idaho Campus
434 2nd Street
Moscow, ID 83843
208-885-634

info The Agencies

Kathleen E. Hain
Office of Program Execution
U.S. Department of Energy
Idaho Operations Office
P.O. Box 1625
Idaho Falls, ID 83415-3911

Wayne Pierre
U.S. Environmental Protection Agency Region 10, HW-074
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-7261

Dean Nygard
Idaho Department of Environmental Quality
1410 North Hilton
Boise, ID 83706
(208) 373-0285
(800) 232-4635

info INEEL Community Relations Office

Contact Joe Campbell, the INEEL Community Relations representative for Test Area North, at 208-526-3183 or at campjl@inel.gov. For general information, call 1-800-708-2680, or send mail to P.O. Box 1625, Idaho Falls, ID 83415-3911

info INEEL on the Internet

http://www.inel.gov
http://environment.inel.gov (INEEL Environmental Restoration)

Public Involvement

The public comment period for this proposed plan for the V-Tanks extends from April 15 through May 14. Citizens are encouraged to review this proposed plan, attend a public meeting or briefing, and provide feedback to the Agencies or the INEEL Community Relations Office.

Community Acceptance is an important criterion in the evaluation of the CERCLA cleanup alternatives. The Agencies will review and consider comments from citizens about this proposed plan and may modify the preferred alternative presented in this plan based on the comments that they receive. Agency responses to all comments on this plan will be published as part of the Record of Decision Amendment for the V-Tanks contents, which is scheduled to be completed in or before December 2003.

One public meeting will be held during the public comment period. The meeting will be held in Idaho Falls on April 30, 2003, at the Shilo Inn, 780 Lindsay Boulevard. The meeting will begin at 6:00 p.m. with an opportunity for informal discussion with Agency and project representatives. The Agencies will give a formal presentation at 7:00 p.m., and a question and answer session with an opportunity to comment will follow. A court reporter will record the comments and the transcripts will be placed in the Administrative Record. Written comments can be submitted to one of the project representatives at the meeting or mailed.

Public Meeting

Wednesday,
April 30, 2003

Shilo Inn
780 Lindsay Blvd.
Idaho Falls, Idaho

APRIL 2003

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	**30**			

A form is included in this proposed plan for your convenience. To ensure they will be considered, written comments must be mailed to the name and address specified on the form: Kathleen E. Hain, Environmental Restoration Program, DOE Idaho Operations Office MS 3911, P.O. Box 1625, Idaho Falls, ID 83403-9987.

This proposed plan and an on-line form for submitting comments are also available online at **http://environment.inel.gov**. To arrange briefings in other communities, call the INEEL's toll-free number, 1-800-708-2680.

Comments (continued)

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Please return this form by May 14, 2003

Tell Us What You Think

*The Agencies want to hear from you to decide what actions to take for the V-Tanks Contents (TSF-09 and TSF-18) at Test Area North, Operable Unit 1-10.**

Comments ____

** If you want a copy of the Record of Decision and Responsiveness Summary, please make sure your mailing label is correct.*

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