T3.9.2

U. S. DEPARTMENT OF ENERGY
OAKLAND OPERATIONS OFFICE

LABORATORY FOR ENERGY RELATED HEALTH RESEARCH
DAVIS, CALIFORNIA

PHASE III FINAL REPORT

RE-ENGINEERING THE RI/FS WORK PLAN

April 14, 1995

INFORMAL NOTE

TO: LEHR Core Team

FROM: S. Golian, EM-22

DATE: April 14, 1995

Enclosed is the most current site conceptual model and summary notes from our meeting on April 4&5, 1995. Table 3 has been revised and an appendix prepared which outlines additional information needs and actions required to begin a more detailed evaluation of those likely response actions identified by the team.

Below I have outlined some thoughts for your consideration on how you may want to proceed over the next several weeks.

- o Initiate a more detailed evaluation of the response options discussed in our meeting as being the most appropriate, i.e., 1) capping of landfills, on-site disposal of non-adjacent ares into a RCRA-type cell; 2) capping of landfills and off-site disposal of non-adjacent areas. Team will also need to finalize a decision regarding the characterization of the landfills and the appropriateness of capping them in accordance with state and Federal recommendations. Should you elect to consider other options than capping for the landfills, this would serve to constitute a third or fourth alternative with either on-site or offsite disposal of materials in the landfills. [NOTE: related to these evaluations will be the consideration of treatment as an appropriate or possibly required response and the University's desire to look at the possibility of future research options on any waste remaining at the site; with respect to treatment needs, I have asked Jeff, Liz and Steve to begin drafting some thoughts on implementing treatment contingencies during excavation].

- o Begin evaluating the potential timing of response actions (e.g., removal of the dog pens and Goldman's box this fiscal year, sign interim action ROD for sources in early FY96 with remedial action in late FY96 or early FY97??????)

- o Begin comparing identified data needs (Table 3 and Appendix A) against the current draft of the RI/FS workplan to ensure all necessary data will be collected and any unnecessary data collection is eliminated. [NOTE: for most activities, necessary data collection may not be defined until the action items in Table 3 are addressed]

Mary

- o Compile and organize existing ground water data to facilitate the generation of a "picture" of the current conditions and what the remaining ground water data needs may be.

- o Generate a "user-friendly" site map identifying known sources with an accompanying table which describes what is currently known about each source. Particularly useful for each source would be a comparison of contaminant levels (either from samples or known release quantities) against the EPA and State preliminary remediation goals and action levels.

- o Revisit the public participation strategy in light of the direction the team is now moving, i.e., should a public meeting be held to 1) summarize known conditions (the site map, accompanying tables, and site conceptual model would be helpful to facilitate communication); 2) review the teams' initial screening of alternatives and supporting rationale (the "1st cut" FS analyses would be useful here); 3) identify what alternatives are designated to be evaluated in detail; and 4) outline the possible timing of response actions. Such a meeting would allow the public to inform you of other options they may want to have considered or concerns they may have with the alternatives being evaluated.

Allison

I believe the majority of the activities discussed above are "desk-top" paper exercises that could be completed over the next four to six weeks. If you think it would be helpful, we could hold one more

meeting together in late May or early June to wrap up the uncertainty discussions and data needs for all sources, establish ground water data needs and investigation strategy, timing of response actions, and develop decision rules for potential treatment contingencies, etc.

Please let me know how you would like to proceed. Thank you again for your participation with the strategic milestone review initiative.

To:

Duncan Austin	Cal EPA / DTSC
Jim Littlejohn	DOE-OAK
Julie McNeal	UC Davis
Lida Tan	U.S. EPA
Susan Timm	RWQCB

cc:

Salem Attiga	PNL
Ed Bailey	RHB
Elizabeth Dodge	CH2M HILL
Steve Golian	DOE-HQ
Tony Kluk	DOE-HQ
Jeff Smyth	PPC
Joe Niland	Dames & Moore
Steve Wilhelm	EG&G Environmental
Don Williams	DOE-HQ

II. Workshop Summary Notes

I. Cover Memo
II. Workshop Summary Notes
III. Agenda For LEHR Strategic Milestone Initiative Meetings
IV. Development of Conceptual Site Model and Likely Response Actions
    1. Describe the basis of the conceptual model (from the Draft RI/FS Work Plan)
    2. Expected Site Conditions Based on Existing Information
    3. Likely Response Actions Based on Expected Site Conditions
    4. Display of results of the conceptual model development in table and figure
    5. Display of results of likely response action development in table
    6. LEHR site map
V. Development of Data Needs
    1. Describe Approach
    2. Display of Data/Information Needs in Tables by Likely General Response Action
VI. Approximate Cost Comparison of Selected Alternatives
    1. Rationale and Limits
    2. Sensitivities
    3. Incompleteness of Cost Estimate
    4. Alternatives
    3. Results

Appendix A: Revisions to Summary Notes

III. Agenda For LEHR Strategic Milestone Initiative Meetings

1. Develop a conceptual site model based on existing information by identifying likely source areas, pathways, and receptors
   Goal: Come to an agreement on how site works and remaining uncertainties

2. Identify site concerns
   Goal: Come to agreement on priorities for response

3. Identify likely general response actions and land use
   Goal: Focus the feasibility study to a discrete set (2-3) of viable alternatives

4. Identify remaining data needs, manageable uncertainties, and requirements for a risk assessment
   Goal: Come to agreement on what data must be collected before response(s) and what data may be collected during response(s)

5. Develop a site management strategy
   1. Sampling/Analysis plan
   2. Type/Timing of response
   3. Public participation plan

   Goal: Appropriately remediate the site as efficiently and effectively as possible

IV. Development of Conceptual Site Model and Likely Response Actions

The conceptual model described in the Draft RI/FS Work Plan (Figure 1) was used as the starting point for discussions held in Oakland on March 15th and 16th. This conceptual model was revised based on the following:

- Use of existing information from LEHR (historical and current data)
- Consensus of LEHR core project team (Duncan Austin, Cal/EPA Department of Toxic Substances Control; Jim Littlejohn, DOE/OAK; Julie M^Neal, U.C. Davis; Alice Tackett, U.C. Davis; Lida Tan, U.S. EPA; Susan Timm, Regional Water Quality Control Board) with regards to current site conditions

The revised conceptual model (Figure 2) is the result of these discussions and represents only current site conditions. Probable or expected conditions are shown with solid lines. Uncertain conditions which were felt to be reasonable possibilities are shown with dotted lines. Table 1 summarizes the changes made to the original RI/FS conceptual model and the rationale for those changes.

Expected Site Conditions

Following a consensus on how the site was currently working, the extended LEHR team discussed site problems, expected conditions, and likely general response actions. Three site problems were identified:

1) Continuous releases to soil sub-surface from sources that leach to the upper and lower hydrostatigraphic units. The sources include:

- Radium-226 leach field
- Strontium-90 leach field/Imhoff underground tanks
- Forty-nine waste holes
- Southwest trenches
- Solid waste trenches adjacent to landfill unit #2
- DOE box
- Disposal trenches
- Landfill units # 1, 2, and 3
- Chemical dispensing area
- Seven septic systems
- Southwestern dog pens soils

2) Groundwater contamination that is known to exceed MCLs at specific points (both spatial and temporal). This includes contamination of both the upper and lower hydrostatigraphic units. This site problem has uncertainty associated with it because unknown sources may contribute to groundwater contamination.

3) Unknown "spills" to soil surface that have unknown likelihood of being resuspended by wind and storm water and being transported to offsite receptors, on-site workers, and Putah Creek. This includes intrusion into Landfill unit #3 and the southwestern trenches.

The team ranked the groundwater as the primary overall concern of these three site problems, but agreed that the first priority for considering general response actions should be the problem of continuous releases from the sources to the sub-surface soil. This decision was based on two key factors:

- The groundwater will continue to be affected as long as the sources are releasing contaminants to the sub-surface soil because the contaminants leach to the upper and lower hydrostatigraphic units; and
- Current data indicates that the groundwater contamination does not demand immediate attention or an emergency action.

Under these circumstances, the primary concern is for the long-term protection of the groundwater. This can only be accomplished by addressing the problem at the sources. Any remediation of currently contaminated groundwater is a second priority for considering general response actions.

Likely Response Actions

Consequently, the extended LEHR team focused the remaining time at the March 16th meeting discussing the site problems contributing to the continuous releases to the sub-surface soil. Table 2: Site Problems and Likely Response Actions at LEHR summarizes the sources contributing to this site problem, the expected conditions and the likely general response actions identified by the extended LEHR team. Please note that disposal signifies either on-site or off-site disposal.

Figure 1
Conceptual Model Found in the RI/FS Work Plan

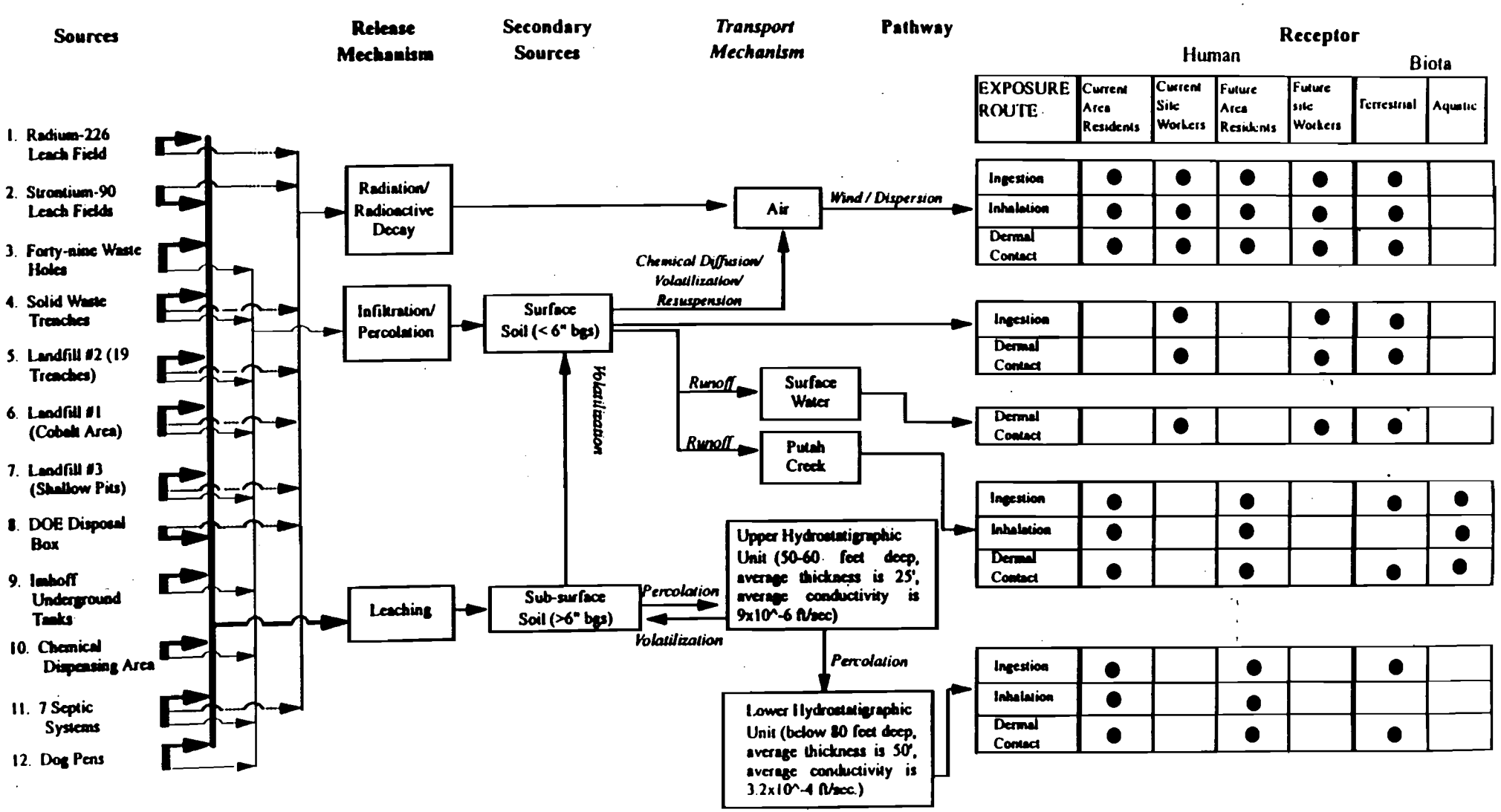


Table 1 -
Revisions to the Conceptual Model

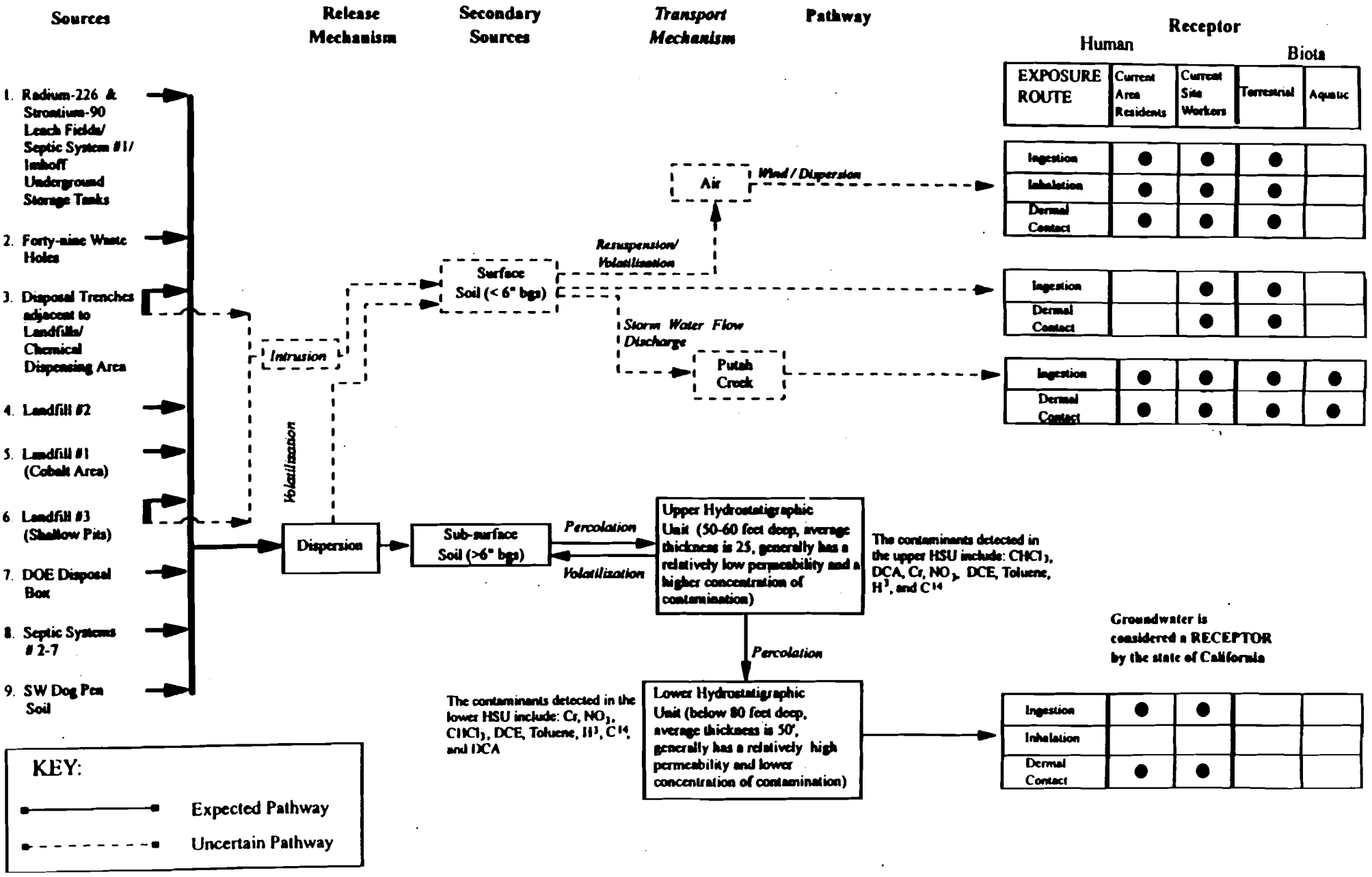
Type of Change	Change	Rationale
Source (Number 10 in Figure 1)	Eliminated the chemical dispensing area as a discrete source.	Combined with the solid waste trenches because of proximity in location and similarity of probable response actions.
Source (Numbers 1 & 2 in Figure 1)	Combined radium-226 and strontium-90 leach fields as one source area.	Combined the leach fields because of proximity in location, similarity of probable response actions, and similarity of probable contaminants. Although the leach fields received primarily either radium or strontium, some overlap in dispensing existed.
Source (Number 11 in Figure 1)	Eliminated septic system #1 from the septic systems source area.	Added septic system #1 to the leach fields source area because of proximity in location and similarity of probable response actions.
Source (Number 9 in Figure 1)	Eliminated the Imhoff underground tanks as a discrete source.	Combined with the radium and strontium leach fields source area because of proximity in location, similarity of probable response actions, and similarity of probable contaminants.
Release Mechanism	Deletion of the radiation/ radioactive decay release mechanism from the sources to the air.	Samples show no indication of contamination from this release mechanism. The only problem observed with radon is following rains, which is considered normal. Radioactive materials will not get into the air unless it is attached to volatiles.
Release Mechanism	Infiltration/Percolation release mechanism redefined as intrusion	Intrusion more adequately describes the possible release of contaminants from the sources. The consensus was that there was a possibility that sources could contaminate the surface soil because of historical disturbances, but not via infiltration or percolation.

Type of Change	Change	Rationale
Pathway	The pathway via intrusion was defined as uncertain.	Data do not show any indication of contamination of the surface soil. However, there are reports of historical disturbances into Landfill unit #3 and the Southwestern trenches, which could result in contamination via this pathway. Therefore, the entire pathway of contaminants being released via intrusion is considered an uncertainty.
Source/Release Mechanism	A number of sources were eliminated as possible contributors to contamination to the surface soil once the release mechanism was redefined as intrusion.	Past disturbances (e.g., digging) could have redeposited contaminants so that surface soil is a potential secondary source. There is an indication that two sources were disturbed: the southwest trenches and landfill unit #3. Although the pathway is uncertain, these two sources are displayed in the conceptual model as possible contaminators via intrusion. All other sources were eliminated as contributors to the surface soil. Consensus was that these sources were not contributing via infiltration, percolation, or intrusion.
Transport Mechanism	The transport of contaminants from the surface soil to the air was changed to an uncertainty, and chemical diffusion was eliminated as a transport mechanism.	Although data does not indicate that the air is contaminated, uncertainty exists because of historical disturbances which could have redistributed contaminants in the surface soils. However, consensus was that these contaminants would travel via volatilization or resuspension into the air, but not via chemical diffusion.
Receptors	Future site workers and future site residents were eliminated as receptors.	For the purposes of this conceptual model, future receptors were eliminated. This conceptual model reflects only the current condition of the site.

Type of Change	Change	Rationale
Source	Surface water was eliminated as part of the pathway for contaminants to reach receptors.	Surface water does not exist on-site except under storm conditions. In such a case, excess storm water would discharge into Putah Creek. The only place where surface water collects in along the western trenches. Consensus was that this is not a problem and that the only possible receptors of surface water contamination were exposed via Putah Creek.
Exposure Route	Inhalation was eliminated as an exposure route for contaminants that could be in Putah Creek.	Consensus was that inhalation was not a viable exposure route for possible contaminants in Putah Creek.
Release Mechanism	Leaching was redefined as dispersion.	Dispersion better describes the release of contaminants from the sources. It includes leaching, but also includes the movement of contaminants via release mechanisms that are not associated with water.
Transport Mechanism	Volatilization was eliminated as a transport mechanism from the sub-surface soil to the surface soil.	Contaminants in the upper hydrostatigraphic unit volatilize into the sub-surface soil, but the probable transport of these contaminants to the surface soil was eliminated. There is no indication from existing data that this is occurring. The soil is tight, which makes transport unlikely, and the quantities of contaminants makes this pathway insignificant.
Transport Mechanism	Volatilization was added as an uncertain transport mechanism into the surface soil of contaminants dispersing from the sources. and	Consensus of the group was that volatilization could not be eliminated as a transport mechanism of contaminants to the surface soil. The volatilization is shown from the dispersion release mechanism to the surface soil so as not to indicate that contaminants volatilize from the groundwater through the sub-surface soil to the surface soil.

Type of Change	Change	Rationale
Receptors	Groundwater was changed from a tertiary source to a receptor.	The State of California considers groundwater to be a receptor, per groundwater antidegredation policy.

Revised Conceptual Model



Revised Conceptual Model

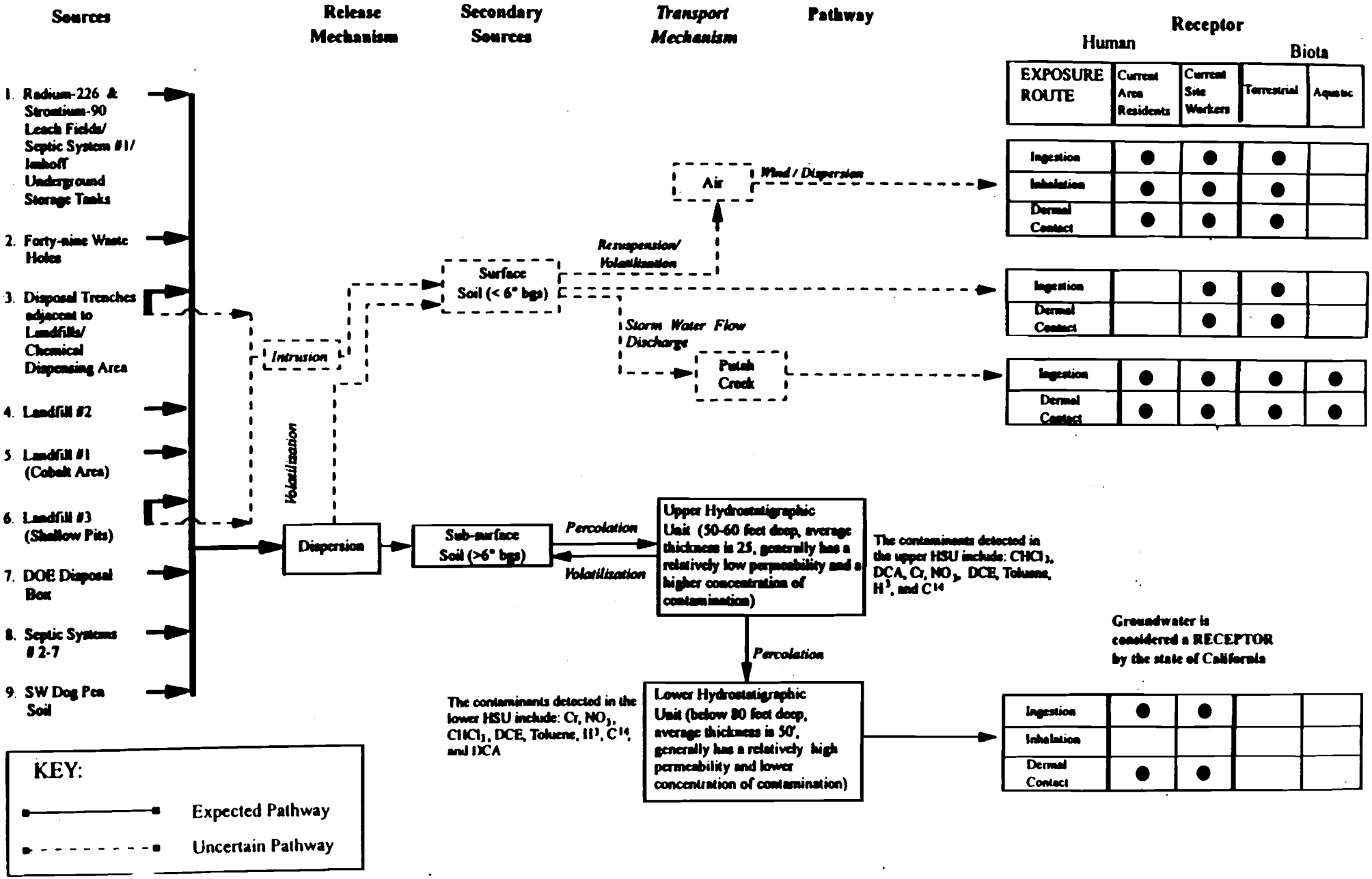


Table 2
Site Problems and Likely Response Actions at LEHR
Continuous Releases to Soil Sub-Surface

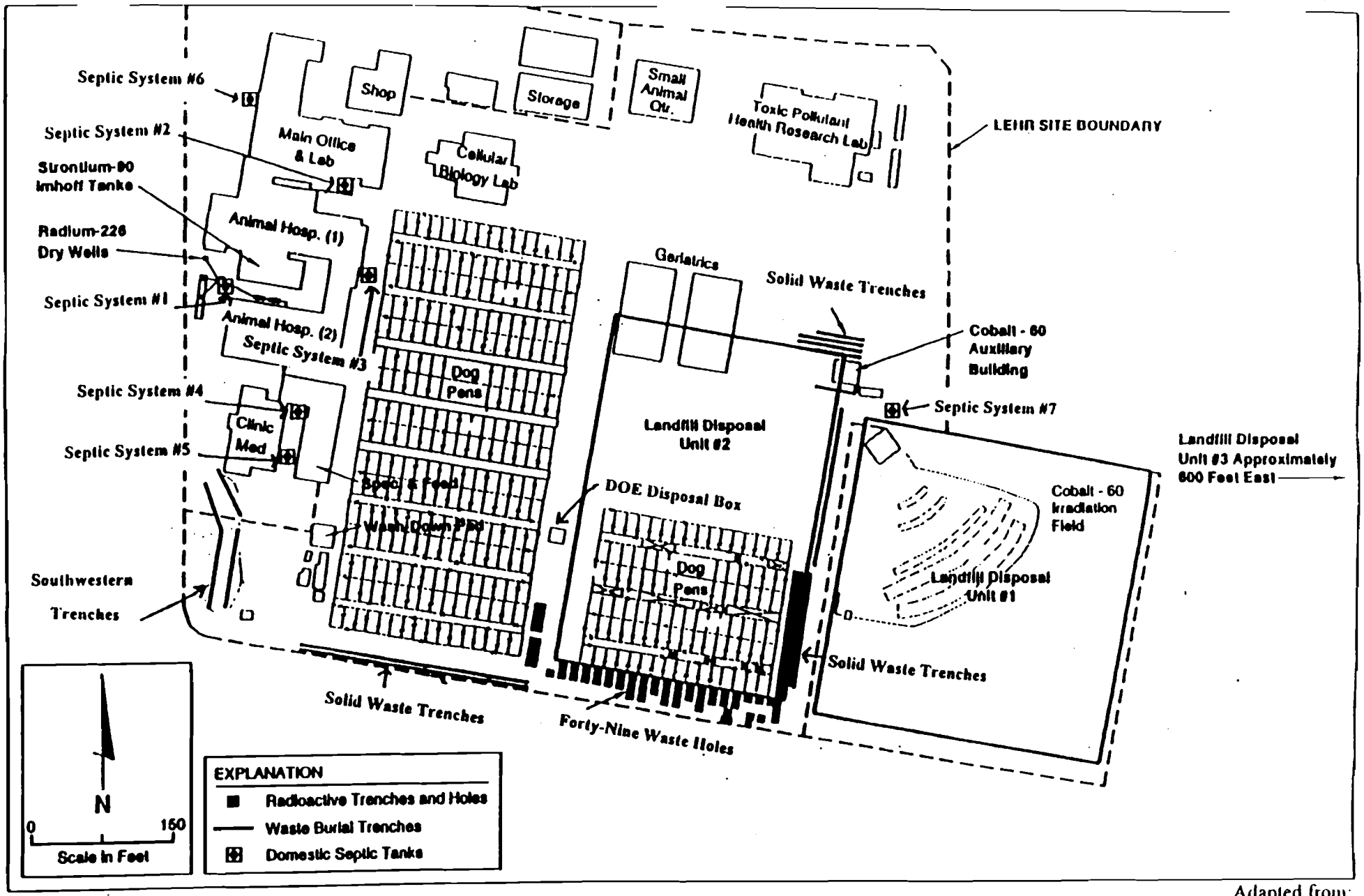
Sources Contributing to Site Problem	Expected Conditions	Division of Problem for Response Actions	Likely General Response Action
Radium and Strontium leach fields	**Radium leach field**: No VOCs and very low levels of radium-226 and strontium-90 are expected. A total of 3 millicuries of radium was released to these systems. Consists of 3 dry wells, each are approx.30" in diameter and 40' deep; a trench, which is approx. 91' long, 3' wide, and 14' deep. Public concern exists because of clogging of the system may have resulted in spills. No sampling was done inside of the trenches, dry wells, or directly underneath the trenches. **Strontium leach field**: This area consists of 2 fields, a box, and lines. The original leach field is located under a building. An estimated 2.5 millicuries of strontium-90 was discharged. 1 millicurie of plutonium-231 was discharged. Cesium was also detected. The Imhoff underground storage tanks and septic system #1 (see Figure 3), which processed sanitary waste, are included as part of the Ra/Sr leach systems.	Soils	1. No action 2. Removal, treat and disposal 3. In-situ treatment or containment
		Cobbles (includes trench and dry wells)	1. Removal, treat and disposal 2. Removal and disposal 3. In-situ treatment or containment 4. No action
		Structures (includes distribution box, tanks, piping, manholes and septic system #1)	1. Removal, treatment and disposal 2. Removal and disposal 3. In-situ treatment or containment 4. No action

Sources Contributing to Site Problem	Expected Conditions	Division of Problem for Response Actions	Likely General Response Action
Forty-nine waste holes	Radiological materials are expected, including: 17 different radionuclides, 8 of which where long-lived isotopes, and tritium. Records show that higher levels of tritium and bottles containing chemicals were disposed in the waste holes. Documents indicate that a total of 1.7 curies of radionuclides were disposed. One wipe sample detected alpha radionuclides. The dimensions of the waste holes are approximately 4'x4'x8-10'.	No division required	1. Removal, treat, and disposal 2. Removal and disposal 3. Selective/hot spot removal/capping
Disposal Trenches	Potential mixed waste, very low levels of chloroform and radium have been detected. Reported to be approx. 120' long and oriented roughly in a north/south direction. The exact number, location and depth of the trenches is not known. This category includes the chemical dispensing area. Chlordane is a possible contaminant.	Southwestern trenches	1. Removal, segregate and dispose 2. Removal, segregate, treat, and dispose 3. Selective/hot spot removal/capping
		Intrusion resulting in surface contamination (uncertain)	1. Removal, segregate and dispose 2. Removal, segregate, treat, and dispose 3. Selective/hot spot removal/capping

Sources Contributing to Site Problem	Expected Conditions	Division of Problem for Response Actions	Likely General Response Action
Disposal Trenches (Continued)	Chloroform is expected in the solid waste trenches adjacent to landfill unit #2. Containers with pesticides have been found. The trenches were typically 2' wide, ranged in length from 33' to 270', and estimated to be between 8-10' deep.	Solid waste trenches (both radiological and chemical)	1. Removal, segregate and dispose 2. Removal, segregate, treat, and dispose 3. Selective/hot spot removal/capping
Landfill unit #1	Received waste from campus and sludge from the wastewater treatment plant. Recent data has showed that landfill unit #1 is probably about 30' larger than originally expected. There is more of a random dumping pattern in landfill unit #1 than in either #2 or #3. A small quantity of mixed waste is possible. Chromium has been detected in the groundwater that may have come from landfill unit #1.	No division required	1. Capping 2. Selective removal, segregation, treat, dispose 3. Entire removal and disposal
Landfill unit #2	Trench and fill technique was used. Often the chemicals were burned to reduce the volume. Mixed waste is uncertain. The quantity of wastes disposed in #2 is estimated at 19,260 cubic yards.	No division required	1. Capping 2. Selective removal, segregation, treat, dispose 3. Entire removal and disposal

Sources Contributing to Site Problem	Expected Conditions	Division of Problem for Response Actions	Likely General Response Action
Landfill unit #3	Located off-site and only used for about 4 years. A trench and fill technique was used to dispose. Mixed waste is uncertain. The combined total acreage for the three disposal areas is estimated at approximately 6 acres	Landfill	1. Capping 2. Selective removal, segregation, treat, dispose 3. Entire removal and disposal
		Intrusion resulting in surface contamination (uncertain)	1. Capping 2. Selective removal, segregation, treat, dispose 3. Entire removal and disposal
DOE disposal box	A metal box is expected. No contamination has been detected in adjacent soil, but radiologic, and possibly mixed, waste is expected in the box.	No division required	1. Remove/excavate and disposal
Septic systems numbered 2-7 (See Figure 3)	Septic system #2 is at least partially under a building and may have been destroyed. Septic system #4 may contain x-ray chemicals Septic system #5 is cut by utilities Septic system #7 may not exist	Soils	1. No action 2. Removal and disposal 3. In situ treatment
		Structures	1. No action 2. Removal and disposal 3. Grout in place
Soil underneath the southwestern dog pens (below gravel)	Some chlordane and some low levels of radiation are expected. The expectation is for shallow contamination.	No division required	1. No action 2. Removal and disposal

Figure #3--LEHR Site Map



Adapted from:

FORMER WASTE DISPOSAL AREAS

RI/FS Work Plan
LEHR Environmental Restoration
Davis, California

FIGURE 3.1

10805-720-044 SJR 2/24/94 5705N

Draft

V. Development of Data Needs

The extended LEHR project team met in Oakland on April 4th and 5th to:

- Review the summary sheets of the prior LEHR meeting, and
- Discuss data needs for probable general response actions identified for sources of contamination at the site.

Corrections and modifications to the March 15th and 16th summary package have been incorporated into the previous sections and are summarized in Appendix A: Revisions to Summary Notes. These changes are based on the consensus of LEHR core project team (Duncan Austin, Cal/EPA Department of Toxic Substances Control; Jim Littlejohn, DOE/OAK; Julie M^Neal, U.C. Davis; Lida Tan, U.S. EPA; Susan Timm, Regional Water Quality Control Board).

Following a consensus on revisions to the summary sheets of the March 15th and 16th meetings, discussions were held to determine data needs for the likely general response actions. The first sources discussed were landfill units #1, 2, and 3. The discussion focused on establishing criteria (i.e., what information is necessary) for determining whether entire removal (i.e., excavation) of the landfills or capping is more appropriate. These discussions were largely inconclusive because of the nature of characterization uncertainties (i.e., determining when the landfills have been sufficiently characterized).

In the interest of time, the following compromise was proposed and accepted. Generally, there are three types of uncertainties related to determining data needs:

1. Characterization uncertainties,
2. Regulatory uncertainties, and
3. Technical uncertainties.

In the case of the landfills discussion, the core group was trying to resolve characterization uncertainties. For landfills, resolving regulatory and technical uncertainties may resolve characterization uncertainties. There are two primary reasons for this:

- EPA and the Regional Water Quality Control Board technically have set precedents for capping landfills, and
- EPA and the Regional Water Quality Control Board have regulations and guidance that cap landfills as a preference.

As a result, the core group agreed to the following approach of discussing data needs:

- To shift their discussion of data needs to focus on uncertainties/data needs of other sources
- To evaluate regulatory and technical uncertainties to determine if reasons exist that would not allow the LEHR landfills to be capped and would require a response action different than the precedent.

During the remaining time, the team discussed the technical data needs of identified likely response actions. The discussions are summarized in Tables 3-9. Due to time constraints, the team was unable to discuss data needs for in-situ and ex-situ treatment.

Table 3
Likely General Response Action: No Action

Sources for which alternative has been designated likely: Radium & Strontium Leach Fields (soils and cobbles), Septic Systems numbered 2-7 (soils and structures), and Soil underneath the Southwestern Dog Pens (below gravel).

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Is future land-use consistent with no-action?	UC Davis would like to have limited use of LEHR.	None	UC Davis needs to determine long-term land use for LEHR
Are contaminant levels above action levels?	Sufficient soil contamination data exists to make initial screen. (See table of expected conditions).	None	Use action levels to conduct a preliminary risk screening: 1. Compare expected conditions by source to EPA Region IX Preliminary Remediation Goals (PRGs) 2. Use PRG values in Regional WQCB's Water Board's Designated Level Methodology (DLM) methododlogy to develop Regional WQCB action levels 3. Compare expected conditions by source to DLM values 4. Use action levels to distinguish which units cannot be considered for the no action alternative.

Table 3
Likely General Response Action: No Action

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
For sources that have contaminant levels below action levels, what additional data are required to support the no action alternative?	Sufficient soil data is expected to exist for the newer strontium-90 leach field to further support the no action alternative. Other sources do not have sufficient information.	None	If the prefered alternative is no action, DQOs must be developed to determine what constitutes sufficient information to support no action. This may be necessary for the following locations: the old Sr-90 leach field, the Ra-226 leach field, septic system #1 leach field, along the dry wells, along the trenches, and below the tanks. Other sources are not being considered for no action.
What is the cost of collecting data to support a no action alternative vs. the cost of excavation?	Sufficient data exists to do a preliminary cost analysis. The public would prefer an action alternative. If the cost to suppport a no action alternative is comparable in cost to an action alternative, action is preferable.	None	Determine if no action is cost-effective alternative by comparing relative costs of no action and action alternatives. Specifically, 1. Data collection to support a no action alternative (see above), and 2. Excavation and disposal Prior analysis discussed above must be completed before performing this analysis.

Table 3
Likely General Response Action: No Action

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Is no action a feasible alternative when considering interacting components?	Some sources are divided into separate components for the purpose of evaluating alternatives. If one component requires action, a no action alternative may no longer be feasible for other components of the source.	None	1. Determine if no action is the likely preferred alternative for all components of a divided source. 2. If no action is not the likely preferred alternative for all of the components, evaluate how the components of the source influence or interact with each other to determine if a no action alternative is still feasible for some of the components of the source.

Table 4
Likely General Response Action: Excavation

Sources for which alternative has been designated as likely: Radium & Strontium Leach Fields (soils, cobbles, and structures), Forty-nine waste holes, Disposal Trenches (southwestern trenches, area of intrusion, and solid waste trenches), DOE Disposal Box, Septic Systems numbered 2-7(soils and structures), and Soil underneath the Southwestern Dog Pens (below gravel).

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Are there health and safety issues associated with excavation?	Contaminants of concern for H&S issues and ranges of levels expected are known	None	Confirm uncertainties are manageable. Proposed contingnecy plan is to start at Level B and drop down to Level C if appropriate.
What are the approximate dimensions of needed excavations for use in feasibility study and design?	Varies. For some sources, location and general dimensions are known. For other sources, even location is not exactly known.	None	Develop order of magnitude volume/costs. Sufficient information exists to make relative, but not absolute, cost comparisons. This information will be used to determine if existing information can support FS-level definition and evaluation of alternatives.

Table 4
Likely General Response Action: Excavation

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
When should excavation be stopped?	Enough information is available to facilitate FS-level and design-level calculations of excavation volumes. Actual extent of contamination is not known for any source. Actual dimensions cannot be determined with great confidence prior to excavation.	None	There will always be surprises with volumes. This uncertainty is manageable with a contengency plan to guide the excavation. To assess the feasibility of this approach, use existing information to develop concentration profiles. The profiles are used to estimate depths and lengths/widths of required excavations with sufficient accuracy to determine when excavation methods would change.
What ARARs exist that affect the excavation alternative?	State has PRG type cleanup rules that may be ARARs for the excavation	None	Preliminary ARARs analysis to determine when to stop excavation. Use State/EPA PRGs as a first step in this determination
Will a CEQA analysis of the excavation will be required?	State has indicated preliminarily that a CEQA analysis will be required	None	Preliminary ARARs analysis to identify regulatory (e.g., CEQA) issues that the State, EPA, and DOE must resolve

Table 5
Likely General Response Action: On-Site Disposal

Sources for which alternative has been designated as likely: Radium and Strontium Leach Fields (soils, cobbles, and structures), Forty-Nine Waste Holes, Disposal Trenches (southwestern trenches, area of intrusion, and solid waste trenches), DOE Disposal Box, Septic Systems Numbered 2-7 (soils and structures), and Soil underneath the Southwestern Dog Pens (below gravel)

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Is future land-use consistent with on-site disposal?	UC Davis has indicated acceptance of on-site disposal	None	1. Location for on-site disposal 2. UC Davis' final land-use designation
What is the cost of constructing an on-site landfill?	Sufficient data exists to do a preliminary cost analysis (e.g., sizing and construction costs) of on-site disposal.	None	1. Develop preliminary cost 2. Determine volume sensitivity of costs
What regulations could impact on-site disposal?	Radioactive materials are expected in most of the sources listed above	None	ARARs analysis to determine radiological waste disposal requirements
Will the majority of the community accept on-site disposal?	Community preference is for off-site disposal. However, the majority of the community will base its acceptance on technical data and risk analysis.	Level of community acceptance with on-site disposal	Go to the public as early and as often as possible. Commit to public participation in the alternative selection process. Public opinion is one of many factors that will determine the final remediation strategy.

Table 5
Likely General Response Action: On-Site Disposal

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Are there permitting issues that could impact on-site disposal?	The State has indicated that it may waive the land ban ARAR CA rules and regulations are being developed for building a mixed waste facility	None	ARARs analysis in first-cut FS to determine: 1. Land ban restrictions 2. Feasibility of disposing mixed or radiologic waste on-site 3. May need to meet substantive requirements that are being developed in CA for building a mixed waste facility

Table 6
Likely General Response Action: Off-Site Disposal

Sources for which alternative has been designated as likely: Radium and Strontium Leach Fields (soils, cobbles, and structures), Forty-Nine Waste Holes, Disposal Trenches (southwestern trenches, area of intrusion, and solid waste trenches), DOE Disposal Box, Septic Systems Numbered 2-7 (soils and structures), and Soil underneath the Southwestern Dog Pens (below gravel)

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
What criteria must waste meet to be shipped off-site?	Existing information is sufficient to evaluate. DOE-OAK has waste acceptance criteria (WAC) for Hanford and Envirocare.	None	Compare WAC at likely disposal sites to expected conditions
What is the cost of shipping waste to an off-site disposal facility vs. the cost of on-site disposal or hot spot removal and capping?	Sufficient data exists to develop a preliminary cost analysis of off-site disposal for both Hanford and Envirocare.	None	Develop preliminary cost estimate of off-site disposal.
What other requirements (e.g., regulations, paperwork requirements) could impact off-site disposal?	Existing information is sufficient to evaluate	None	Evaluate paperwork requirements for off-site disposal

Table 6
Likely General Response Action: Off-Site Disposal

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
To which off-site disposal facility will LEHR send waste?	LEHR has previously shipped waste to Hanford. DOE has access to COE contract for Envirocare.	Cost and contract terms at each disposal facility.	Confirm that waste can be accepted at an off-site disposal facility and determine destination

Table 7
Likely General Response Action: In-Situ Containment

Sources for which alternative has been designated as likely: Radium and Strontium Leach Fields (structures) and Septic Systems Structures (systems numbered 2-7)

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Is the backfilling of systems' structures and the decision to leave them in place consistent with planned future land use?	University has indicated desire to not prohibit building or transportation over these sources	Future land-use	UC Davis to determine long-term future land use for LEHR
Will the stability of structures after backfilling be consistent with UC Davis expected land use?	General information on the sizes and types of structures	None	Explore backfilling methods and stability of structures after backfilling
Is backfilling and leaving structures in place protective of human health and the environment?	Information on materials of construction and conditions of liners. Information on the level of radioactivity is available for some lines.	Physical samples from structures to determine radiologic constituents/ contamination	Action levels analysis using PRGs and DLM
Would in-place backfilling be inconsistent with other actions (e.g., removal of soils under structures)?	GRAs identified for the soils around and under the structures	None	Determine the interactions that have to be considered in evaluating the alternatives

Table 8
Likely General Response Action: Hot Spot Removal

Sources for which alternative has been designated as likely: Forty-nine waste holes and Disposal Trenches (southwestern trenches, area of intrusion, and solid waste trenches)

Uncertainty	Existing Information	Additional Information Required Prior to Resolving Action-Item	Action Required
Which alternative (i.e., hot spot removal/capping or entire removal) is more cost effective?	Costs of excavation and disposal is known or can be determined.	None	Develop cost of excavation & disposal vs. cost of analysis, hot spot excavation & capping
What is a hot spot?	Currently a hot spot is defined as anything that does not meet the no action criteria	None	Develop definition of hot spot
Will the efforts needed to identify hot spots be cost effective?	References are available on this type of sampling. Limited site information available that would support identification of hot spots.	None	Determine sample types and number needed to identify hot spot locations (i.e., DQOs).

VI. Relative Cost Comparisons

Introduction

This package contains initial cost estimates for four general remediation alternatives for the LEHR site at the University of California at Davis. The alternatives were developed based on general guidelines from the extended project team and are intended to bound the range of alternatives considered to be "likely". Consideration of the range of feasible alternatives for the LEHR site is at a very preliminary stage. Initial cost estimates are useful at this stage in a CERCLA investigation to identify cost ranges for the possible alternatives that might be considered and to focus any additional data collection and evaluation toward the critical factors that determine feasibility, effectiveness, and cost. These initial cost estimates were prepared for initial comparison of *relative* costs of the alternatives. They also provide insight on the factors the final cost estimates will be most determined by, that is, the factors that costs are most sensitive to. They are not accurate or complete estimates of total costs that would be incurred to implement the alternatives. But, since they each contain the major cost items that will influence total costs, and because they are based on consistent assumptions about volumes, unit disposal costs, areas to be remediated, and other major factors, they can be used in relative comparisons. Where the estimates for two alternatives differ by a large factor and differences in potential protectiveness are not potentially worth the multiplication of costs, some modification or focussing of the alternatives under consideration might be warranted.

Limits

The costs determined by this estimating effort are not as accurate as required for a CERCLA feasibility study; the latter are "order of magnitude" estimates defined as being accurate within + 50% and - 30%. No similar accuracy factor can be reliably attached to the estimates provided here. They are not, as CERCLA cost estimates typically are, built up from a semi-detailed breakout of line items that would be incurred in actually implementing the alternatives at a specific site. They are instead based on typical unit costs for large cost items, such as constructing a cap, plus large allowances for the sums of all the smaller cost items that are not broken out in detail. Cost estimates in a feasibility study are based on much better defined alternatives and are typically much more detailed and expensive to prepare than is necessary or justifiable at this early stage of exploring alternatives for the LEHR site. More accurate cost estimates will be appropriate later in the process of investigating the LEHR site, when the range of feasible alternatives is better understood.

More accurate and complete estimates of costs will have to await the development of better engineering descriptions of the alternatives in a feasibility study and perhaps additional information about the site. Based on the uncertainties identified in preparing these initial cost estimates, any additional information needed to improve the accuracy and reliability of the cost estimates can be identified. Whether current site information can support cost estimates sufficiently accurate to facilitate selection of remedial actions for the LEHR site needs to be

determined.

Sensitivities

The following are large cost determining factors and thus have the potential to significantly affect the total cost estimates:

- Actual waste quantities assumed to be excavated. (All of the alternatives assume at least partial excavation.) At any level of detail (i.e., preliminary or final) it is always difficult to estimate volumes of waste that will result from excavation, with errors approaching 50% not being uncommon.

- Type of cap assumed for those alternatives that assume at least partial capping of wastes in place. (i.e., Alternatives 2 and 3). The cost estimates are based on a RCRA type cap, which is traditionally considered to be a high efficiency and high cost capping method. There is no standard RCRA cap applicable in all settings. However the general features of a RCRA cap are: approximately five feet total thickness with a flexible membrane liner, a compacted clay layer, a sand drainage layer, and a topsoil layer. The entire cap is graded and sloped for drainage. While the exact requirements that would apply at the LEHR site have not been determined, the forgoing is typical and is not inconsistent with the approximate cost assumed for these estimates: $250,000 per acre. Less expensive capping alternatives, that meet minimum California regulatory requirements for closing old landfills, might reduce the unit cost for capping by as much as 40%.

- Unit costs for off-site disposal the wastes. The estimates are based on the current costs for DOE wastes going to a particular facility under a specific cost contract held by another federal agency. These are the probable costs that would be incurred. However, these are very favorable costs. If for any reason, that contract could not be used, LEHR could reasonably see unit costs twice as high as assumed in these estimates.

- Assumed waste designations for the wastes (i.e., hazardous waste, radioactive waste, or mixed waste). The assumed unit cost for transportation and disposal of soil classed as hazardous waste is $300 per cubic yard; for soil classed as low-level radioactive waste the same unit cost factor is $400 per cubic yard; for soil classed as mixed waste it is $1,400. Thus, the designations of the wastes assumed in the costs estimates are very large determining factors.

Incompleteness of Cost Estimate

The alternatives estimated here are not complete. The alternatives address source control actions. Additional remediation efforts may be required to address deeper soils if they are contaminated; additional efforts that may be necessary address groundwater cannot be designed or estimated at this time.

- Deep vadose zone soils. Contaminants have reached the groundwater and must have

passed through vadose zone soils to reach that point. Whether there are any areas of concentrated contamination that can or should be excavated or remediated in place has not been determined. The cost estimates do not assume any actions for deeper soils.

- Groundwater contamination. The precise needs for groundwater remediation, including general approach, extent, and pumping rates, have not been determined, and may be significantly altered by the source control efforts envisioned in the alternatives addressed here. The cost estimates do not address the potential need for groundwater remediation.

- The estimates do not fully account for LEHR being a DOE site. The estimates do not account for the higher programmatic, administrative, and procedural costs associated with DOE site remediations. Some of the unit costs are based on limited data available for working on a DOE site; some cost indications are available for capping and excavation on DOE sites, but not for constructing an onsite landfill.

- The estimates do not adequately account for differences in costs for handling radioactive, hazardous, and mixed wastes. Some of the unit costs for site work (excavation, capping, transportation, onsite landfilling) may vary significantly between these waste types. No allowances have been made for these differences.

Alternative 1: **Remove All Wastes from Their Current Locations and Consolidate in an On-Site, RCRA-Compliant Disposal Facility.**

- The following sources would be excavated:

  1. Radium and Strontium Leach Fields (includes Imhoff tanks and septic system #1)
  2. Forty-nine Waste Holes
  3. Disposal Trenches (including the southwest disposal trenches and the chemical dispensing area)
  4. Landfill # 2
  5. Landfill # 1
  6. Landfill # 3
  7. DOE Disposal Box
  8. Septic Systems 2 - 7
  9. Western Dog Pen Soils

- The total volume of soils and wastes assumed to be excavated and disposed in the RCRA-compliant unit is 50,000 cubic yards. (For comparative purposes, this volume would, if placed evenly on a three acre site, stack up to approximately ten feet deep.)

- Volumes of wastes to be excavated are estimated based on known and/or suspected dimensions of the original disposal units (e.g., trenches, holes), or based on assumed dispersion of the contaminants from the units. Over-excavation and bulking factors are added to the estimated, in-ground volumes of the wastes to better estimate the volumes that will be produced by the excavation activities.

- The estimate does not assume any particular action levels, either for excavation or demonstration of remediation completion/success (i.e., excavate until the residual levels are below X). Available data on the contamination distribution would not allow calculation of the impacts of assuming various action levels.

- Landfill 3 is assumed to be excavated only within the areas that showed anomalies on the geophysical surveys, approximately 30% of the total area of the landfill on the available maps. The landfill was operated for only a few years and the entire area of the landfill shown on some maps is not likely to contain wastes.

- The Western Dog Pen Soils would be excavated to six inches below the existing, clean gravel, a total of 2,100 cubic yards. The clean gravel would not be placed in the RCRA landfill.

- The landfill would be RCRA compliant, with liners, leachate collection, leak detection, RCRA cap, monitoring wells, and post-closure care and maintenance. The cost of

constructing, operating, closing, and maintaining the RCRA disposal unit are estimated on a per-cubic-yard-of-disposal-space basis, at $300 per cubic yard. Note that this assumes that disposing radioactive and mixed waste in a RCRA-type landfill will be acceptable.

- No location for the RCRA unit is assumed, but it is assumed that the exact location on the UCD site would not significantly affect the cost estimate.

- The RCRA landfill would be built first to avoid the need for temporary storage of wastes between the time of excavation and the availability of the disposal facility.

- Air emissions during remediation are considered to be manageable without extraordinary means, such as building temporary containment structures. Thus, the cost estimates do not include an allowance for air emissions control during remediation.

- Groundwater remediation is not considered in this alternative (or any of the other three alternatives).

- Unrestricted use of the site would be allowed by this alternative, but the remediation is assumed to include only backfilling of the excavations to grade, without any other replacements or modifications of infrastructure (e.g., roads, buildings).

Sensitivities

Other than the major cost determinants noted in the Introduction, no additional factors have the potential to significantly affect the total cost of the alternative as estimated here.

Alternative 2: **Remove Wastes from Sources Not Adjacent to Landfills 1, 2, and 3 and Consolidate in on-Site, RCRA-Compliant Disposal Facility.** Cap **Landfills 1, 2, and 3 and Their Adjacent Sources.**

The following units would be excavated:

1. Radium and Strontium Leach Fields (includes Imhoff tanks and septic system #1)
3. Trenches 1-5 of the Disposal Trenches
7. DOE Disposal Box
8. Septic Systems 2 - 7

The following sources are considered adjacent to one or more of the landfills for this alternative and would be capped in addition to the capping of the three landfills:

2. Forty-nine Waste Holes
3. Trenches 6-17 of the Disposal Trenches, which includes the SW Disposal Trenches (i.e., trenches 15, 16, and 17)
9. The Western Dog Pen Soils

The total volume of soils and wastes assumed to be excavated and disposed in the RCRA-compliant unit is 1,250 cubic yards. (For comparative purposes, this volume would, if placed evenly on a three acre site, stack up to approximately 3 inches deep.)

- Volumes of wastes to be excavated are estimated based on known and/or suspected dimensions of the original disposal units (e.g., trenches, holes), or based on assumed dispersion of the contaminants from the units. Over-excavation and bulking factors are added to the estimated, in-ground volumes of the wastes to better estimate the volumes that will be produced by the excavation activities.

- The estimate does not assume any particular action levels, either for excavation or demonstration of remediation completion/success (i.e., excavate until the residual levels are below X). Available data on the contamination distribution would not allow calculation of the impacts of assuming various action levels.

- Landfill 3 is assumed to be capped only at the areas that showed anomalies on the geophysical surveys, approximately 30% of the total area of the landfill on the available maps. The landfill was operated for only a few years and the entire area of the landfill shown on some maps is not likely to contain wastes.

- The landfill would be RCRA compliant, with liners, leachate collection, leak detection, RCRA cap, monitoring wells, and post-closure care and maintenance. The cost of

constructing, operating, closing, and maintaining the RCRA disposal unit are estimated on a per-cubic-yard-of-disposal-space basis, at $300 per cubic yard. Note that this assumes that disposing radioactive and mixed waste in a RCRA-type landfill will be acceptable.

- No location for the RCRA unit is assumed, but it is assumed that the exact location on the UCD site would not significantly affect the cost estimate.

- The RCRA landfill would be built first to avoid the need for temporary storage of wastes between the time of excavation and the availability of the disposal facility.

- The cap on Landfills 1 and 2, the forty-nine waste holes, the disposal trenches except trenches 1-5, and the southwest area would be one continuous cap. The area of this cap is assumed to be approximately 7.1 acres.

- The cap is assumed to comply with the standard requirements for a cap on a closed RCRA disposal unit. It would be approximately five feet thick and incorporate a flexible membrane liner, a compacted clay layer, a sand drainage layer, and a topsoil layer. The entire cover would be graded and sloped for drainage.

- Air emissions during remediation are considered to be manageable without extraordinary means, such as building temporary containment structures. Thus, the cost estimates do not include an allowance for air emissions control during remediation.

- Groundwater remediation is not considered in this alternative (or any of the other three alternatives).

Sensitivities

In addition to the major cost drivers noted in the Introduction, the following factors have the potential to significantly affect the total cost of the alternative as presented here.

- Whether or not the western dog pen soils are included in the area to be capped. These soils are very lightly contaminated, if contaminated at all. Further investigation may indicate that they do not require remediation. The 2,100 cubic yards are spread over an area of approximately 2 acres, which would cost $500,000 to cap.

- Type of cap assumed for the landfills and adjacent areas. A RCRA-type cap is assumed. A simpler, but perhaps equally effective cap could be constructed at a reduction in cost as high as 40%.

Alternative 3: **Remove Wastes from Sources Not Adjacent to Landfills 1, 2, and 3 and Dispose of Off-Site in Appropriate Disposal Facilities. Cap Landfills 1, 2, and 3 and Their Adjacent Sources.**

- The following units would be excavated:

  1. Radium and Strontium Leach Fields (includes Imhoff tanks and septic system #1)
  3. Trenches 1-5 of the Disposal Trenches
  7. DOE Disposal Box
  8. Septic Systems 2 - 7

The following sources are considered adjacent to one or more of the landfills for this alternative and would be capped in addition to the capping of the three landfills:

  2. Forty-nine Waste Holes
  3. Trenches 6-17 of the Disposal Trenches, which includes the SW Disposal Trenches (i.e., trenches 15, 16, and 17)
  9. The Western Dog Pen Soils

- The total volume of soils and wastes assumed to be excavated and disposed is 1,250 cubic yards. (For comparative purposes, this volume would, if placed evenly on a three acre site, stack up to approximately 3 inches deep.)

- Volumes of wastes to be excavated are estimated based on known and/or suspected dimensions of the original disposal units (e.g., trenches, holes), or based on assumed dispersion of the contaminants from the units. Over-excavation and bulking factors are added tot he estimated, in-ground volumes of the wastes to better estimate the volumes that will be produced by the excavation activities.

- The estimate does not assume any particular action levels, either for excavation or demonstration of remediation completion/success (i.e., excavate until the residual levels are below X). Available data on the contamination distribution would not allow calculation of the impacts of assuming various action levels.

- Off-site disposal is assumed to be at commercial facilities permitted to receive the types of wastes present at UCD. For purposes of this estimate, each waste unit was designated as containing either hazardous waste, radioactive waste, or mixed waste. The disposal requirements and disposal costs for these three types of wastes vary substantially (i.e., $300, $400, and $1,400 per cubic yard) and have a very significant impact on the overall

cost estimates for this alternative.

- Landfill 3 is assumed to be capped only at the areas that showed anomalies on the geophysical surveys, approximately 30% of the total area of the landfill on the available maps. The landfill was operated for only a few years and the entire area of the landfill shown on some maps is not likely to contain wastes.

- The cap on Landfills 1 and 2, the forty-nine waste holes, the disposal trenches except trenches 1-5, and the southwest area would be one continuous cap. The area of this cap is assumed to be approximately 7.1 acres.

- The cap is assumed to comply with the standard requirements for a cap on a closed RCRA disposal unit. It would be approximately five feet thick and incorporate a flexible membrane liner, a compacted clay layer, a sand drainage layer, and a topsoil layer. The entire cover would be graded and sloped for drainage.

- Air emissions during remediation are considered to be manageable without extraordinary means, such as building temporary containment structures. Thus, the cost estimates do not include an allowance for air emissions control during remediation.

- Groundwater remediation is not considered in this alternative (or any of the other three alternatives).

Sensitivities

In addition to the major cost drivers noted in the Introduction, the following factors have the potential to significantly affect the total cost of the alternative as presented here.

- Whether or not the western dog pen soils are included in the area to be capped. These soils are very lightly contaminated, if contaminated at all. The 2,100 cubic yards are spread over an area of approximately 2 acres, which would cost $500,000 to cap. Further investigation may indicate that they do not require remediation.

- Type of cap assumed for the landfills and adjacent areas. A RCRA-type cap is assumed. A simpler, but perhaps equally effective cap could be constructed at a reduction in cost as high as 40%.

Alternative 4: **Remove All Wastes from Their Current Locations and Transport to Appropriate Off-Site Disposal Facilities for Disposal**

- The following sources would be excavated:

  1. Radium and Strontium Leach Fields (includes Imhoff tanks and septic system #1)
  2. Forty-nine Waste Holes
  3. Disposal Trenches (including the southwest disposal trenches and the chemical dispensing area)
  4. Landfill # 2
  5. Landfill # 1
  6. Landfill # 3
  7. DOE Disposal Box
  8. Septic Systems 2 - 7
  9. Western Dog Pen Soils

- The total volume of soils and wastes assumed to be excavated and disposed in the RCRA-compliant unit is 50,000 cubic yards. (For comparative purposes, this volume would, if placed evenly on a three acre site, stack up to approximately ten feet deep.)

- Volumes of wastes to be excavated are estimated based on known and/or suspected dimensions of the original disposal units (e.g., trenches, holes), or based on assumed dispersion of the contaminants from the units. Over-excavation and bulking factors are added to the estimated, in-ground volumes of the wastes to better estimate the volumes that will be produced by the excavation activities.

- No action levels for excavation or demonstration of remediation completion/success are assumed. Available data on the contamination distribution do not allow calculation of the impacts of various action levels.

- Landfill 3 is assumed to be excavated only within the areas that showed anomalies on the geophysical surveys. The landfill was operated for only a few years and the entire area of the landfill shown on some maps is not likely to contain wastes.

- The Western Dog Pen Soils would be excavated to six inches below the existing, clean gravel. The clean gravel would not be disposed of offsite.

- Off-site disposal is assumed to be at commercial facilities permitted to receive the types of wastes present at UCD. For purposes of this estimate, each waste unit was designated as containing either hazardous waste, radioactive waste, or mixed waste. The disposal

requirements and disposal costs for these three types of wastes vary substantially (i.e., $300, $400, and $1,400 per cubic yard) and have a very significant impact on the overall cost estimates for this alternative.

- Air emissions during remediation are considered to manageable without extraordinary means, such as building temporary containment structures.

- Groundwater remediation is not considered in this alternative (or any of the other three alternatives).

- Unrestricted use of the site would be allowed by this alternative, but the remediation is assumed to include only backfilling of the excavations to grade, without any other replacements or modifications of infrastructure (e.g., roads, buildings).

Sensitivities

Other than the major cost determinants noted in the Introduction, no additional factors have the potential to significantly affect the total cost of the alternative as estimated here.

LEHR COST ESTIMATE(preliminary)
Cost Summary for Restoration Alternatives

ALTERNATIVE	COST	COMMENTS
ALT 1 -- Onsite Landfill	$23,000,000	Excav. all areas incl. 70% of LF #1 & LF #2, and 30% of LF #3
ALT 2 -- Cap and Onsite Landfill	$10,000,000	Excav. Ra/Sr leach, some SW trenches, DOE box, septic sys #2 to 7
ALT 3 -- Cap and Offsite Landfill	$10,000,000	Excav. Ra/Sr leach, some SW trenches, DOE box, septic sys #2 to 7
ALT 4 -- Offsite Landfill	$31,000,000	Landfills 1,2, and 3 as Hazardous Waste
ALT 4 -- Offsite Landfill	$137,000,000	Landfills 1,2, and 3 as Mixed Waste

LEHR COST ESTIMATE (preliminary) -- Unit Costs

UNIT COSTS	Waste Type	Unit cost	Unit	Comments
Transport/dispose mixed waste (soil)	MWS	$2,000	cy	Approx. 750 mi haul
Transport /dispose mixed waste debris	MWD	$3,700	cy	Approx. 750 mi haul
Transport/dispose rad waste (soil)	RWS	$430	cy	Approx. 750 mi haul
Transport/dispose rad waste debris	RWD	$980	cy	Approx. 750 mi haul
Transport/dispose haz waste	HW	$300	cy	Approx. 250 mi haul
RCRA Cap		$325,000	Ac	
Excavate haz, rad, or mixed waste		$75	cy	Soil excav. & analyses;H&S, air monit, backfill
Onsite Landfill -- large		$150	cy	construction, handling, placement, closure
Onsite Landfill -- small		$250	cy	construction, handling, placement, closure

LEHR COST ESTIMATE(preliminary) -- Quantity Spreadsheet

SITE AREA	ALT 1 Onsite LF Volumes (cy)	ALT 2 Onsite LF Volumes (cy)	ALT 2 Cap Area (acres)	ALT 3 Offsite LF Volumes (cy)	ALT 3 Cap Area (acres)	ALT 4 Offsite LF Volumes (cy)	ALT 5 Consol/Cap Volumes (cy)	ALT 5 Cap Area (acres)	WASTE TYPE Rad,Haz,Mixed Soil or Debris	Comments
1 RADIUM/Sr LEACH FIELDS	500	500		500		500	500		RWS	Imhoff tanks, Ssys #1
2. 49 WASTE HOLES	400		incl w/ LF #2		incl w/ LF #2	400		incl w/ LF #2	RWS	
3. SOLID WASTE TRENCHES	2500	300	incl w/ LF #2	300	incl w/ LF #2	2500	300	incl w/ LF #2	RWS	
4. LANDFILL # 2	22000		2.4		2.4	22000		2.4	HW	Alt as Mixed waste
5. LANDFILL #1	23000		2.6		2.6	23000		2.6	HW	Alt as Mixed waste
6. LANDFILL #3	2600		0.2		0.2	2600		0.2	HW	Alt as Mixed waste
7. DOE DISPOSAL BOX	50	50		50		50	50		MWD	Volume allowance
8. SEPTIC SYSTEMS 2 THRU	400	400		400		400	400		RWS	
9. SW DOG PEN SOILS	2100		2.1		2.1	2100		2.1	RWS	
Incremental Cap from consolid								0.2		
TOTALS	53550	1250	7.3	1250	7.3	53550	1250	7.5		
Soil Bulking Factor	*1.25*									
Overexcavation Factor	*1.3*									

LEHR COST ESTI. .E (preliminary)
Alternative 1 -- Excavate/Onsite Landfill

AREA/Cost Item	QUANTITY	UNITS	UNIT COST	COST TOTAL	COMMENTS
GENERAL COSTS					
Investigations	1	ls	$1,000,000	$1,000,000	Preliminary allowance (2x offsite landfill Alt. 4)
Site Preparation	1	ls	$200,000	$200,000	Preliminary allowance (2x offsite landfill Alt. 4)
Site Controls	1	ls	$200,000	$200,000	Preliminary allowance (2x offsite landfill Alt. 4)
Temporary Facilities	1	ls	$200,000	$200,000	Preliminary allowance (2x offsite landfill Alt. 4)
1. RADIUM/Sr LEACH FIELDS					Trenches, Imhoff tank,,Septic system #1
Excavate	500	cy	$75	$38,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Onsite Landfill	500	cy	$150	$75,000	
2. 49 WASTE HOLES					
Excavate	400	cy	$75	$30,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Onsite Landfill	400	cy	$150	$60,000	
3. SOLID WASTE TRENCHES					
Excavate	2500	cy	$75	$188,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Onsite Landfill	2500	cy	$150	$375,000	
4. LANDFILL # 2					
Excavate	22000	cy	$75	$1,650,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Onsite Landfill	22000	cy	$150	$3,300,000	
5. LANDFILL #1					
Excavate	20000	cy	$75	$1,500,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Onsite Landfill	20000	cy	$150	$3,000,000	
6. LANDFILL #3					
Excavate	6000	cy	$75	$450,000	Assumed excavate 30%, soil analyses, air monitoring, H&S
Onsite Landfill	6000	cy	$150	$900,000	
7. DOE DISPOSAL BOX					
Excavate	50	cy	$75	$4,000	
Onsite Landfill	50	cy	$150	$8,000	
8. SEPTIC SYSTEMS 2 THRU 7					
Excavate	400	cy	$75	$30,000	
Onsite Landfill	400	cy	$150	$60,000	
9. SW DOG PEN SOILS					
Excavate	2100	cy	$75	$158,000	Excavate 6 inches over entire area;gravel not incl.
Onsite Landfill	2100	cy	$150	$315,000	
GROUNDWATER					Not included in preliminary estimate
Extraction Well Installation(Cr)					___ wells, avg depth ea =
Groundwater Treatment System					___ gpm system;Cr(6) reduction/ppt and IX
Discharge Line					

LEHR COST ESTIMATE (preliminary)
Alternative 1 -- Excavate/Onsite Landfill

AREA/Cost Item	QUANTITY	UNITS	UNIT COST	COST TOTAL	COMMENTS
Monitoring Well Installation					Additional wells
Extraction Well Installation(CHCl3)					___ wells, avg depth ea =
Groundwater Treatment System					___ gpm system, GAC
Discharge Line					
Monitoring Well Installation					
VADOSE ZONE REMEDIATION					Not included in preliminary estimate
Soil Vapor Extraction/Offgas Trtmt					
CONSTRUCTION SUBTOTAL				$13,700,000	
Mobilization/demobilization	1	ls	$400,000	$400,000	Preliminary allowance (2x offsite landfill Alt. 4)
Site Preparation and Utility Hookups	1	ls	$200,000	$200,000	Preliminary allowance (2x offsite landfill Alt. 4)
Bonding and Insurance	1	ls	$1,000,000	$1,000,000	Preliminary allowance (2x offsite landfill Alt. 4)
Permitting and Legal	1	ls	$500,000	$500,000	Preliminary allowance (2x offsite landfill Alt. 4)
Site Administration	1	ls	$200,000	$200,000	Contractor office admin; Preliminary allowance (2x offsite landfill Alt. 4)
Corrective Action Plans/Designs	1	ls	$1,000,000	$1,000,000	Preliminary allowance (2x offsite landfill Alt. 4)
Services During Construction	1	ls	$200,000	$200,000	Preliminary allowance (2x offsite landfill Alt. 4)
SITE REMEDIATION SUBTOTAL				$17,200,000	
Contingency	1	ls	30%	$5,200,000	
REMEDIATION CONSTRUCTION	TOTAL			$22,000,000	
ANNUAL O&M					
Landfill cap monitoring, maintenance	1	ls	$20,000	$20,000	Allowance
Groundwater monitoring	1	ls	$20,000	$20,000	Allowance
Groundwater Treatment O&M				$0	Not incl. in preliminary estimate
SVE system O&M					Not incl. in preliminary estimate
Site Administration	1	ls	20%	$8,000	
Oversite Services	1	ls	10%	$4,000	
Annual O&M Subtotal				$52,000	
Contingency	1	ls	30%	$15,600	
Annual O&M Total				$67,600	
30-Yr O&M Present Worth	1	ls	15.372	$1,040,000	At 5% discount rate
Total Present Worth				$23,000,000	

LEHR COST ESTI. E (preliminary)
Alternative 2 -- Cap and Onsite Landfill

AREA/Cost Item	QUANTITY	UNITS	UNIT COST	COST TOTAL	COMMENTS
GENERAL COSTS					
Investigations	1	ls	$750,000	$750,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Preparation	1	ls	$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Controls	1	ls	$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Temporary Facilities	1	ls	$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
1. RADIUM/Sr LEACH FIELDS					Trenches, Imhoff tank, Septic system #1
Excavate	500	cy	$75	$38,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Onsite Landfill	500	cy	$250	$125,000	
2. 49 WASTE HOLES					
Cap	0	Ac	$325,000	$0	Incl. with landfill #2 cap
3. SOLID WASTE TRENCHES					Trenches 1 thru 5 only; 6 thru 17 incl. with LF #2 cap
Excavate	300	cy	$75	$23,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Onsite Landfill	300	cy	$250	$75,000	
4. LANDFILL # 2					
Cap	2.4	Ac	$325,000	$780,000	
5. LANDFILL #1					
Cap	2.6	Ac	$325,000	$845,000	
6. LANDFILL #3					
Cap	0.2	Ac	$325,000	$65,000	
7. DOE DISPOSAL BOX					
Excavate Hot Spots	50	cy	$75	$4,000	
Onsite Landfill	50	cy	$250	$13,000	
8. SEPTIC SYSTEMS 2 THRU 7					
Excavate Hot Spots	400	cy	$75	$30,000	
Onsite Landfill	400	cy	$250	$100,000	
9. SW DOG PEN SOILS					
Cap	2.1	Ac	$325,000	$683,000	
GROUNDWATER					Not included in preliminary estimate
Extraction Well Installation(Cr)					___ wells, avg depth ea =
Groundwater Treatment System					___ gpm system;Cr(6) reduction/ppt and IX
Discharge Line					
Monitoring Well Installation					Additional wells
Extraction Well Installation(CHCl3)					___ wells, avg depth ea =
Groundwater Treatment System					___ gpm system, GAC
Discharge Line					

LEHR COST ESTIMATE (preliminary)
Alternative 2 -- Cap and Onsite Landfill

AREA/Cost Item	QUANTITY	UNITS	UNIT COST	COST TOTAL	COMMENTS
Monitoring Well Installation					
VADOSE ZONE REMEDIATION					Not included in preliminary estimate
Soil Vapor Extraction/Offgas Trtmt					
CONSTRUCTION SUBTOTAL				$4,000,000	
Mobilization/demobilization	1	ls	$300,000	$300,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Preparation and Utility Hookups	1	ls	$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Bonding and Insurance	1	ls	$750,000	$750,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Permitting and Legal	1	ls	$375,000	$375,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Administration	1	ls	$150,000	$150,000	Contractor office admin; preliminary allowance (1.5x offsite landfill Alt. 4)
Corrective Action Plans/Designs	1	ls	$750,000	$750,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Services During Construction	1	ls	$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
SITE REMEDIATION SUBTOTAL				$6,600,000	
Contingency	1	ls	30%	$2,000,000	
REMEDIATION CONSTRUCTION	TOTAL			$9,000,000	
ANNUAL O&M					
Landfill/cap monitoring, maintenance	1	ls	$20,000	$15,000	Allowance
Groundwater monitoring	1	ls	$20,000	$20,000	Allowance
Groundwater Treatment O&M				$0	Not incl. in preliminary estimate
SVE system O&M					Not incl. in preliminary estimate
Site Administration	1	ls	20%	$7,000	
Oversite Services	1	ls	10%	$3,500	
Annual O&M Subtotal				$45,500	
Contingency	1	ls	50%	$22,750	
Annual O&M Total				$68,250	
30-Yr O&M Present Worth	1	ls	15.372	$1,050,000	At 5% discount rate
Total Present Worth				$10,000,000	

LEHR COST ESTI. .E(preliminary)
Alternative 3 -- Cap and Offsite Landfill

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
GENERAL COSTS						
Investigations	1	ls		$650,000	$650,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Preparation	1	ls		$130,000	$130,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Controls	1	ls		$130,000	$130,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Temporary Facilities	1	ls		$130,000	$130,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
1. RADIUM/Sr LEACH FIELDS						Trenches, Imhoff tank, Septic system #1
Excavate	500	cy		$75	$38,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Offsite Landfill	500	cy	RWS	$430	$215,000	
2. 49 WASTE HOLES						
Cap	0	Ac		$325,000	$0	Incl. with landfill #2 cap
3. SOLID WASTE TRENCHES						Trenches 1 thru 5 only; 6 thru 17 incl. with LF #2 cap
Excavate	300	cy		$75	$23,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Offsite Landfill	300	cy	RWS	$430	$129,000	
4. LANDFILL # 2						
Cap	2.4	Ac		$325,000	$780,000	
5. LANDFILL #1						
Cap	2.6	Ac		$325,000	$845,000	
6. LANDFILL #3						
Cap	0.2	Ac		$325,000	$65,000	
7. DOE DISPOSAL BOX						
Excavate Hot Spots	50	cy		$75	$4,000	Volume allowance
Onsite Landfill	50	cy	MWD	$3,700	$185,000	
8. SEPTIC SYSTEMS 2 THRU 7						
Excavate Hot Spots	400	cy		$75	$30,000	
Onsite Landfill	400	cy	RWS	$430	$172,000	
9. SW DOG PEN SOILS						
Cap	2.1	Ac		$325,000	$683,000	
GROUNDWATER						Not included in preliminary estimate
Extraction Well Installation(Cr)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system;Cr(6) reduction/ppt and IX
Discharge Line						
Monitoring Well Installation						Additional wells
Extraction Well Installation(CHCl3)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system, GAC
Discharge Line						

LEHR COST ESTIMATE(preliminary)
Alternative 3 -- Cap and Offsite Landfill

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
Monitoring Well Installation						
VADOSE ZONE REMEDIATION						Not included in preliminary estimate
Soil Vapor Extraction/Offgas Trtmt						
CONSTRUCTION SUBTOTAL					$4,200,000	
Mobilization/demobilization	1	ls		$300,000	$300,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Preparation and Utility Hookups	1	ls		$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Bonding and Insurance	1	ls		$750,000	$750,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Permitting and Legal	1	ls		$375,000	$375,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Site Administration	1	ls		$150,000	$150,000	Contractor office admin; preliminary allowance (1.5x offsite landfill Alt. 4)
Corrective Action Plans/Designs	1	ls		$750,000	$750,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
Services During Construction	1	ls		$150,000	$150,000	Preliminary allowance (1.5x offsite landfill Alt. 4)
SITE REMEDIATION SUBTOTAL					$6,800,000	
Contingency	1	ls		30%	$2,000,000	
REMEDIATION CONSTRUCTION	TOTAL				$9,000,000	
ANNUAL O&M						
Cap monitoring, maintenance	1	ls		$10,000	$10,000	Allowance
Groundwater monitoring	1	ls		$20,000	$20,000	Allowance
Groundwater Treatment O&M					$0	Not incl. in preliminary estimate
SVE system O&M						Not in[illegible] in preliminary estimate
Site Administration	1	ls		20%	$6,000	
Oversite Services	1	ls		10%	$3,000	
Annual O&M Subtotal					$39,000	
Contingency	1	ls		50%	$19,500	
Annual O&M Total					$58,500	
30-Yr O&M Present Worth	1	ls		15.372	$900,000	At 5% discount rate
Total Present Worth					$10,000,000	

LEHR COST EST TE (preliminary)
Alternative 4 -- Excavate/Dispose Offsite:
landfills as hazardous waste

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
GENERAL COSTS						
Investigations	1	ls		$500,000	$500,000	prelim allowance
Site Preparation	1	ls		$100,000	$100,000	prelim allowance
Site Controls	1	ls		$100,000	$100,000	prelim allowance
Temporary Facilities	1	ls		$100,000	$100,000	prelim allowance
1. RADIUM/Sr LEACH FIELDS						Trenches, Imhoff tank, Septic system #1
Excavate	500	cy		$75	$38,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	500	cy	RWS	$430	$215,000	Transport approximately 750 miles and dispose
2. 49 WASTE HOLES						
Excavate	400	cy		$75	$30,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	400	cy	RWS	$430	$172,000	Transport approximately 750 miles and dispose
3. SOLID WASTE TRENCHES						
Excavate	2500	cy		$75	$188,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	2500	cy	RWS	$430	$1,075,000	Transport approximately 750 miles and dispose
4. LANDFILL # 2						
Excavate	22000	cy		$75	$1,650,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Transport and Dispose	22000	cy	HW	$300	$6,600,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
5. LANDFILL #1						
Excavate	20000	cy		$75	$1,500,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Transport and Dispose	20000	cy	HW	$300	$6,000,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
6. LANDFILL #3						
Excavate	6000	cy		$75	$450,000	Assumed excavate 30%, soil analyses, air monitoring, H&S
Transport and Dispose	6000	cy	HW	$300	$1,800,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
7. DOE DISPOSAL BOX						
Excavate	50	cy		$75	$4,000	
Transport and Dispose	50	cy	MWD	$3,700	$185,000	
8. SEPTIC SYSTEMS 2 THRU 7						
Excavate	400	cy		$75	$30,000	
Transport and Dispose	400	cy	RWS	$430	$172,000	
9. SW DOG PEN SOILS						
Excavate	2100	cy		$75	$158,000	Excavate 6 inches over entire area;gravel not incl.
Transport and Dispose	2100	cy	RWS	$430	$903,000	
GROUNDWATER						Not included in preliminary estimate
Extraction Well Installation(Cr)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system;Cr(6) reduction/ppt and IX
Discharge Line						

LEHR COST ESTIMATE (preliminary)
Alternative 4 -- Excavate/Dispose Offsite:
landfills as hazardous waste

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
Monitoring Well Installation						Additional wells
Extraction Well Installation(CHCl3)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system, GAC
Discharge Line						
Monitoring Well Installation						
VADOSE ZONE REMEDIATION						Not included in preliminary estimate
Soil Vapor Extraction/Offgas Trtmt						
CONSTRUCTION SUBTOTAL					$22,000,000	
Mobilization/demobilization	1	ls		$200,000	$200,000	preliminary allowance
Site Preparation and Utility Hookups	1	ls		$100,000	$100,000	preliminary allowance
Bonding and Insurance	1	ls		$500,000	$500,000	preliminary allowance
Permitting and Legal	1	ls		$250,000	$250,000	preliminary allowance
Site Administration	1	ls		$100,000	$100,000	Contractor field and home office admin;preliminary allowance
Corrective Action Plans/Designs	1	ls		$500,000	$500,000	preliminary allowance
Services During Construction	1	ls		$100,000	$100,000	preliminary allowance
SITE REMEDIATION SUBTOTAL					$23,800,000	
Contingency	1	ls		30%	$7,100,000	
REMEDIATION CONSTRUCTION	TOTAL				$31,000,000	
ANNUAL O&M						
Groundwater monitoring	1	ls		$5,000	$5,000	Allowance
Groundwater Treatment O&M					$0	Not incl. in preliminary estimate
SVE system O&M						Not incl. in preliminary estimate
Site Administration	1	ls		20%	$1,000	
Oversite Services	1	ls		10%	$500	
Annual O&M Subtotal					$6,500	
Contingency	1	ls		50%	$3,250	
Annual O&M Total					$9,750	
30-Yr O&M Present Worth	1	ls		15.372	$150,000	At 5% discount rate
Total Present Worth					$31,000,000	

LEHR COST ESTI...TE(preliminary)
Alternative 4 -- Excavate/Dispose Offsite:
landfills as mixed waste

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
GENERAL COSTS						
Investigations	1	ls		$500,000	$500,000	prelim allowance
Site Preparation	1	ls		$100,000	$100,000	prelim allowance
Site Controls	1	ls		$100,000	$100,000	prelim allowance
Temporary Facilities	1	ls		$100,000	$100,000	prelim allowance
1. RADIUM/Sr LEACH FIELDS						Trenches, Imhoff tank, Septic system #1
Excavate	500	cy		$75	$38,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	500	cy	RWS	$430	$215,000	Transport approximately 750 miles and dispose
2. 49 WASTE HOLES						
Excavate	400	cy		$75	$30,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	400	cy	RWS	$430	$172,000	Transport approximately 750 miles and dispose
3. SOLID WASTE TRENCHES						
Excavate	2500	cy		$75	$188,000	Soil excavation and analyses;incl. air monitoring and health and safety costs
Transport and Dispose	2500	cy	RWS	$430	$1,075,000	Transport approximately 750 miles and dispose
4. LANDFILL # 2						
Excavate	22000	cy		$75	$1,650,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Transport and Dispose	22000	cy	MWS	$2,000	$44,000,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
5. LANDFILL #1						
Excavate	20000	cy		$75	$1,500,000	Assumed excavate 70%, soil analyses, air monitoring, H&S
Transport and Dispose	20000	cy	MWS	$2,000	$40,000,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
6. LANDFILL #3						
Excavate	6000	cy		$75	$450,000	Assumed excavate 30%, soil analyses, air monitoring, H&S
Transport and Dispose	6000	cy	MWS	$2,000	$12,000,000	Transport approx. 250 mi. if Haz Waste, 750 mi. if Mixed Waste
7. DOE DISPOSAL BOX						
Excavate	50	cy		$75	$4,000	
Transport and Dispose	50	cy	MWD	$3,700	$185,000	
8. SEPTIC SYSTEMS 2 THRU 7						
Excavate	400	cy		$75	$30,000	
Transport and Dispose	400	cy	RWS	$430	$172,000	
9. SW DOG PEN SOILS						Excavate 6 inches over entire area;gravel not incl.
Excavate	2100	cy		$75	$158,000	
Transport and Dispose	2100	cy	RWS	$430	$903,000	
GROUNDWATER						Not included in preliminary estimate
Extraction Well Installation(Cr)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system;Cr(6) reduction/ppt and IX
Discharge Line						

LEHR COST ESTIMATE(preliminary)
Alternative 4 -- Excavate/Dispose Offsite:
landfills as mixed waste

AREA/Cost Item	QUANTITY	UNITS	TYPE	UNIT COST	COST TOTAL	COMMENTS
Monitoring Well Installation						Additional wells
Extraction Well Installation(CHCl3)						___ wells, avg depth ea =
Groundwater Treatment System						___ gpm system, GAC
Discharge Line						
Monitoring Well Installation						
VADOSE ZONE REMEDIATION						Not included in preliminary estimate
Soil Vapor Extraction/Offgas Trtml						
CONSTRUCTION SUBTOTAL					$103,600,000	
Mobilization/demobilization	1	ls		$200,000	$200,000	preliminary allowance
Site Preparation and Utility Hookups	1	ls		$100,000	$100,000	preliminary allowance
Bonding and Insurance	1	ls		$500,000	$500,000	preliminary allowance
Permitting and Legal	1	ls		$250,000	$250,000	preliminary allowance
Site Administration	1	ls		$100,000	$100,000	Contractor field and home office admin;preliminary allowance
Corrective Action Plans/Designs	1	ls		$500,000	$500,000	preliminary allowance
Services During Construction	1	ls		$100,000	$100,000	preliminary allowance
SITE REMEDIATION SUBTOTAL					$105,400,000	
Contingency	1	ls		30%	$31,600,000	
REMEDIATION CONSTRUCTION	TOTAL				$137,000,000	
ANNUAL O&M						
Groundwater monitoring	1	ls		$5,000	$5,000	Allowance
Groundwater Treatment O&M						Not incl. in preliminary estimate
SVE system O&M						Not incl. in preliminary estimate
Site Administration	1	ls		20%	$1,000	
Oversite Services	1	ls		10%	$500	
Annual O&M Subtotal					$6,500	
Contingency	1	ls		50%	$3,250	
Annual O&M Total					$9,750	
30-Yr O&M Present Worth	1	ls		15.372	$150,000	At 5% discount rate
Total Present Worth					$137,000,000	

Appendix A

Appendix A
Revisions to Summary Notes

Document Changed	Type of Change	Change	Rationale
Figure 2: Revised Conceptual Model	Modification to upper and lower HSUs	Replace the average hydraulic conductivity numbers (located in the descriptions of the hydrostatigraphic units) with relative descriptions of conductivity	Uncertainty exists in the actual numbers and it is more important to convey the relative hydraulic conductivities of the two hydrostatigraphic units
Figure 2: Revised Conceptual Model	Modification to upper and lower HSUs	Note which contaminants have been detected in the upper and lower HSUs and their relative concentrations, but do not distinguish between those that have been detected over or under MCLs	The core group agreed to reflect facts that are unarguable in the conceptual model.
Table 1: Revisions to the Conceptual Model	Correction to a type of change	Refer to surface water as a source, rather than a tertiary source.	Tertiary sources were not delineated as such in Figure 1.
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Radium and Strontium leach fields	Add no action as an alternative for Radium and Strontium leach fields: cobbles	No action is a likely general response action for this source
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Radium and Strontium leach fields	Replace in-situ treatment or containment with containment as an alternative for Radium and Strontium leach fields: structures	In-situ treatment is not a likely general response action for this source. However, containment remains a viable response action for the tanks and septic systems.

Document Changed	Type of Change	Change	Rationale
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Radium and Strontium leach fields	Delete no treatment (should have read no action) as an alternative for Radium and Strontium leach fields: Structures	No action is not a likely general response action for this source.
Table 2: Site Problems and Likely Response Action at LEHR	Modification to 49 waste holes and disposal trenches	Add capping to the Selective/hot spot removal alternative for the forty-nine waste holes and the disposal trenches	Hot spot removal, or selective removal is not a likely general response action without capping included as a part of the action
Table 2: Site Problems and Likely Response Action at LEHR	Correction to disposal trenches	Modify the expected conditions section of the disposal trenches to correct errors	Sections of the southwestern and the solid waste trenches descriptions were switched and there were errors in the expected contaminants
Table 2: Site Problems and Likely Response Action at LEHR	Modification to disposal trenches	Add a division to the Disposal Trenches to reflect the area where intrusion may have resulted in surface contamination	The area of the disposal trenches where intrusion may have resulted in surface contamination should be looked at separately as a different general response action may be appropriate
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Landfill unit #1	Add to the expected conditions of Landfill unit #1 that a small quantity of mixed waste is possible and that chromium, which may have originated in the landfill, has been detected in the groundwater	Additions clarify the expected conditions

Document Changed	Type of Change	Change	Rationale
Table 2: Site Problems and Likely Response Action at LEHR	Correction to Landfill unit #2 and 49 waste holes	Move the sentence beginning, "Records show..." from the expected conditions of Landfill unit #2 to the expected conditions of the 49 waste holes	Description was in the wrong location
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Landfill unit #3	Add a division to Landfill unit #3 to reflect the area where intrusion may have resulted in surface contamination	The area of Landfill unit #1 where intrusion may have resulted in surface contamination should be looked at separately, as a different general response action may be appropriate
Table 2: Site Problems and Likely Response Action at LEHR	Modification to Landfill units #2 and 3	Change wording in the expected conditions of Landfill units #2 and 3 to read that mixed waste is uncertain	The Expected Conditions section should reflect that mixed waste is an uncertainty in landfill units #2 and 3 rather than an expected waste
Table 2: Site Problems and Likely Response Action at LEHR	Modification to DOE disposal box	Modify the expected conditions to read that the metal box is expected to contain radiological contaminants	More accurate
Table 2: Site Problems and Likely Response Action at LEHR	Modification to septic systems numbered 2-7	Divide the source into soils and structures	There are different likely general response actions to be considered for the soils and the structures of the septic systems
Table 2: Site Problems and Likely Response Action at LEHR	Modification to septic systems numbered 2-7	The likely general response actions for the soils should be: 1. No action 2. Removal and disposal 3. In situ treatment	The likely general response actions are different for the soils than for the structures

Document Changed	Type of Change	Change	Rationale
Table 2: Site Problems and Likely Response Action at LEHR	Modification to septic systems numbered 2-7	The likely general response actions for the soils should be: 1. No action 2. Removal and disposal 3. Grout in place	The likely general response actions are different for the structures than for the soils
Table 2: Site Problems and Likely Response Action at LEHR	Modify the soil underneath the SW dog pens	Include that the soil is below the gravel	Clarification