EPA REGION VII
COMMENTS ON THE FEBRUARY 1993 DRAFT FEASIBILITY STUDY AND PROPOSED PLAN FOR THE DOE ST. LOUIS FUSRAP SITE

(Comments from EPA Region VII letter dated May 19, 1993)

GENERAL COMMENTS:

1. **The report contains very little preliminary engineering and other technical information to support conclusions regarding feasibility, or in some cases refers to studies which were not reviewed as part of any earlier RI/FS deliverables. The major areas of concern are outlined below.**

   Response: The FS was written to minimize redundancy with other St. Louis documents. The preliminary engineering and technical information sources for the FS-EIS are the site environmental reports, RI report, RI Appendices reports, BRA, ISA, Site Suitability Study (SSS), *Conceptual Design Report for a Permanent Disposal Site for FUSRAP Wastes* DOE/OR/20722-212 April, 1989 (CDRPDS), and RI Addendum report. As appropriate, the FS-EIS has been revised to either call out the reference source or repeat key information plus calling out the reference.

   It is concluded by DOE that onsite disposal is a technically feasible and implementable option. This judgment requires information on conceptual design requirements, monitoring requirements, siting requirements, spacial requirements, characteristics of likely cell locations, including geology, hydrology, and soil conditions, results of groundwater modeling studies, and an assessment as to whether or not site characteristics and disposal requirements are compatible. None of this information is provided. Similar kinds of information is needed to judge the feasibility of the consolidation and capping and beneficial reuse alternatives.

   Response: This type of information, provided in detail in the RI report, RI Appendices, and CDRPDS, is either referenced or, for key information, repeated in the FS/EIS. The information requested above can be found in the following St. Louis site documents:

Item	Document
Conceptual Design Requirements	*Feasibility Study - Environmental Impact Statement for the Contaminants at the St. Louis Site*, DOE/OR/21950-130 (FS-EIS), Sections 3.4.3 - Capping and Groundwater/Surface Water, Appendix B.1.1.0 and B.4

Item	Document
	Conceptual Design Report for a Permanent Disposal Site for FUSRAP Wastes, DOE/OR/20722-212, April, 1989 (CDRPDS), Sections 2, 3, and 4
Monitoring Requirements	FS-EIS, Section 3.4.7 - Environmental Monitoring, Appendix B.1.3 and B.1.1.3
	CDRPDS, Sections 4.7, 4.8, 5.1, 5.5, 5.6, and 5.7
Siting Requirements	FS-EIS, Section 3.2.2
	CDRPDS, Section 3.1.3
	Site Suitability Study for the St. Louis Airport Site, St. Louis, Missouri, May, draft 1993 (SSS), Section 5
Spatial Requirements	FS-EIS, Sections 5.2.3 (introductory paragraphs) and 5.3.1
	CDRPDS, Section 4
	SSS, Section 1
Characteristics of Cell Location	FS, Sections 2.1.2, 2.2.4.2, 2.2.7, and 2.3.2
	SSS, Sections 2, 3, 4 and Appendix A
	Preliminary Geological, Hydrogeological, and Chemical Characterization Report for the Ball Field Area, Hazelwood and Berkeley, Missouri, DOE/OR/20722-211, February, 1989 (RI), Sections 2, 3, and 3.4.5
	Remedial Investigation Addendum Report for the St. Louis Site, St. Louis, Missouri, DOE/OR/21950-132, Final, May, 1993, Sections 2.2, p. 2-34, and Table 3-46

Item	Document
Results of Groundwater Modeling Studies	FS, Sections 2.2.4.2 (Airport Area) and 4.3.5.4 (Effectiveness)
	SSS, Section 5, Appendix C, and Appendix D
Assessment of Site Characteristics and Disposal Requirements	FS, Section 3.4.3 - Capping and Groundwater/Surface Water
	SSS, Section 5

For beneficial reuse, the SLAPS/ball field information applies because the airport is in such close proximity to the SLAPS/ball field area.

Discussion on contaminated groundwater indicates that conclusions regarding the extent of natural attenuation and the impracticability of groundwater remediation are based on groundwater flow and solute transport modeling. This information has not been provided for review.

Response: Based on the groundwater flow and transport modeling studies, it was concluded that groundwater treatment through the use of pump-and-treat systems is not an effective option. A more detailed description of the computer models and assumptions used for this modeling is provided in the attached report entitled *Groundwater Flow and Transport Model for the Airport Area.*

Text has been added to Section 4.3.5.4 to explain that a groundwater flow and transport modeling study was performed for the SLAPS area for the purpose of determining whether or not groundwater treatment is a viable remedial alternative. This study used a finite-difference computer model developed by the U.S. Geological Survey (1978), with enhancements by Goode and Konikow (1989), and Tecsoft, Inc. (1992). The model is a two-dimensional, block-centered finite difference groundwater flow and chemical transport computer code that can be applied to compute the change in chemical concentration of a solute in groundwater over time as a result of convective transport, hydrodynamic dispersion, mixing, irreversible rate reactions (i.e., radioactive decay), and reversible equilibrium-controlled sorption and ion exchange reactions.

The inputs given to the model were very conservative when compared against actual data collected during the remedial investigation. Some of the more critical input parameters include the maximum groundwater flow rate, maximum solute flow rate, hydraulic gradient, average distribution coefficient, average bulk density, and average annual precipitation. The values for input parameters used in the model are presented below:

List of Values Used For Key Input Parameters

Parameter Name	Value or Calculation	Units
Effective Porosity (n)	0.2	Dimensionless
Longitudinal Dispersivity (a_L)	20	ft
Transverse Dispersivity (a_T)	2	ft
Transmissivity (T = k*b)	0.164×10^{-5} * b	ft^2/sec
Aquifer Thickness (b)	Variable	ft
Hydraulic Conductivity (k)	0.164×10^{-5}	ft/sec
Distribution Coefficient (K_d)	167[1,2,3], 16.7[5], and 1.67[4]	mL/g
Bulk Density (ρ)	2.6	g/cm^3
Specific Yield (S_Y)	0.2	Dimensionless
Pump Rate (Q)	0[1,4], 2[2] and 4[3,5]	gpm
Concentration (C)	Variable	mg/L
Average Annual Recharge (Q_R)	0.661×10^{-8}	ft/sec
Stream Discharge	9.18×10^{-3}	ft/sec
Vertical Stream Bed Conductivity (K_Z)	1	ft/sec

[1] Value used in the first model simulation
[2] Value used in the second model simulation
[3] Value used in the third model simulation
[4] Value used in the fourth model simulation
[5] Value used in the fifth model simulation

Using the computerized model MOC to simulate groundwater flow and solute transport at the St Louis Airport sites results in the following conclusions:

- The distribution of uranium in groundwater below SLAPS remains very similar between stressed and unstressed simulations. This implies that pumping groundwater from the contaminated area has little effect on the distribution of contaminated groundwater.

- As a result of the slow movement of groundwater, relatively few wells with pumping rates of 4 gpm are able to contain the groundwater contaminant plume below SLAPS.

- Contaminant transport in the aquifer below SLAPS is not sensitive to changes in the key geochemical parameter (the distribution coefficient) up to two orders of magnitude lower than the site average value.

Although contaminated groundwater at SLAPS can be contained by pumping, extraction of groundwater has little effect on the distribution of contaminants. The concentration of uranium is apparently controlled by uranium in the solid phase, and uranium is not transported easily by groundwater. This is supported by geochemical modeling in the Site Suitability Study.

Conclusions regarding contaminated groundwater in the SLAPS and HISS area rely heavily on a statement that contamination is restricted to the shallow groundwater due to the geologic characteristics of the underlying sediments. Convincing evidence that this is the case needs to be presented.

Response: Text in Section 4.2.5 has been expanded to clarify how the deep aquifer was determined to be clean through analyzing samples from the deep aquifer and how the geologic characteristics of the site are naturally protecting the unit. Units 3B, 3M, and 3T together provide a continuous clay-layered unit across the airport site that restricts communication between the upper and lower aquifer. The uppermost Unit 3T acts as a confining layer with a mean vertical laboratory permeability of 2.7 x 10^{-6} cm/sec and tends to decrease in permeability in going from the top to the bottom of the subunit. Across the SLAPS/ball field area, the 3T Unit varies in thickness from 9 to 27 ft. The next confining unit that separates the upper from the lower aquifer is Unit 3M, which has a mean vertical laboratory permeability of 5.5 x 10^{-8} cm/sec. This unit is as thick as approximately 30 ft on the western edge of the ball fields and thins to the east. Unit 3M pinches out near the eastern edge of SLAPS. Unit 3B underlies Unit 3M and is the third confining layer with a mean vertical laboratory permeability of 3.1 to 10^{-7} cm/sec. This unit is continuous across the airport area and thickens towards the east. Near the southern end of the ball field, this unit varies from several ft to just under 30 ft in thickness. Further details on the hydrologic conditions at the airport site are given in Chapter 3 of the SSS and Chapter 3 of the RI Report.

The treatment of wastes prior to disposal has been eliminated from consideration based upon very cursory analysis, and no treatability testing has been proposed. Given the statutory preference for remedies that involve treatment, far more substantial justification and supporting information for this conclusion is warranted.

Response: In accordance with Sections 4.1.2.1 and 4.1.2.2 of *EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 540 G-89 004), the treatment of soil via solidification/stabilization, vitrification, or enhanced soil washing was evaluated in the FS process for effectiveness (EPA guidance Section 4.2.5.1), implementability (EPA guidance Sections 4.2.4 and 4.2.5.2), and cost (EPA guidance Section 4.2.5.3). These evaluations resulted in elimination of treatment based on the following (summarized from FS-EIS Sections 3.4.4., 4.3.1, and 4.4):

- The benefit of solidification/stabilization/vitrification is the ability to decrease the mobility of contaminants in the waste. The contaminants in the clayey soils, which comprise by far the major portion of the waste volume, have a natural low mobility; therefore, the benefit of such treatment is not significant.
- Because there is no below regulatory concern level, the disposal of solidified soil, vitrified soil, or the cleaner fraction of the enhanced soil washing would still be a radwaste disposal implementation process. That is, there is no gain from an applicability of regulations perspective.
- The effectiveness of treatment is questionable because of the uncertainty in vitrification and enhanced soil washing technology.
- The heterogeneous nature of the waste, and the resultant complications introduced into design of any treatment process.
- The sensitivity of enhanced soil washing to grain-size and clay content requiring extensive treatability studies.
- The energy-intensive, and therefore costly, nature of vitrification.
- No net change in mobility or toxicity of radionuclides in waste volume requiring disposal for enhanced soil washing.
- Soil washing results in generation of new waste streams requiring treatment and disposal as radwaste.
- Treatment will result in an increased total waste volume from solidification or enhanced soil washing.
- Based on the FS-EIS Appendix B.9 treatment cost analysis, enhanced soil washing is not cost effective because the cost of treatment is not offset by disposal cost savings.

In particular, text on solidification of soils has been added to Section 3.4.4 to clarify the fact that solidification lacks a justifiable contaminant mobility reduction as a result of the natural low mobility properties of the soil and the volume and cost increases. Based on the Superfund Innovative Technology Evaluation (SITE) program testing and analysis; the impact of solidifying soils on the leachability of metals can be quantified by calculating the migration potential. The migration potential is obtained from leach testing by dividing the weight of a metal in the leachate by the weight of the metal in the solid leached. An upper bound value for the migration potential of uranium, thorium, or radium is estimated to be 100. This value is based on results for heavy metals and is considered conservative because of the tendency of radionuclides to be strongly absorbed on the St. Louis clayey soil. The solute transport rate for uranium, which is the most mobile of the three radionuclides in the St. Louis clayey soil, is a low value of 1.2×10^{-8} cm/sec and is a result of the low groundwater flow velocity of 1.2×10^{-5} cm/sec and a retardation factor of 101μ (BNI 1993). Based on the *EPA Handbook for Stabiliztion/Solidation of Wastes*, EPA/540/2-86/001, June 1986, it is estimated that the cost to solidify the St Louis soil in cement is roughly \$75/yd^3. For a soil volume of 10^6 d^3 (note: the in situ soil total volumes in Table 2-19 of 756,000 yd^3 and 826,000 yd^3 adjusted to ex situ volumes of 983,000 yd^3 and 1,140,000 yd^3 using a 30 percent expansion factor) the cost of solidification is \$75 million. With an additional 30 percent volume increase due to the solidification in cement, the 10^6 yd^3 becomes 1.3×10^6 yd^3. Thus, the use of solidification would increase the burial volume by 300,000 yd^3, cost an additional \$75 million, and reduce the migration rate from the low value of 1.2×10^{-8} cm/sec to, at best, 1.2×10^{-10} cm/sec. Based on this analysis, it was decided not to carry the solidification option forward.

The NCP and EPA CERCLA guidance (FR 1990, EPA 1988a) recognize that using treatment technologies may not be practical at sites having large volumes of low-concentration wastes. The preamble to the final implementation of the NCP (FR 1990) lists specific situations that may limit the use of treatment. Two of these specific situations cited in the preamble apply here:

- treatment technologies are not technically feasible or are not available within a reasonable time frame, and

- the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable.

It is for all these reasons, which are (in accordance with EPA guidance Section 4.1.3.1) briefly discussed in the FS-EIS, that treatment is not, at this time, included in any of the proposed site-wide alternatives. The FUSRAP system-wide effort includes a considerable treatability investigation effort that could lead to treatment becoming viable for St. Louis-type soils. Thus, consistent with the EPA Section 4.1.2.1 guidance, treatment will receive further consideration if additional information becomes available that indicates further evaluation is warranted (e.g., see FS-EIS Section 4.3.1.6).

2. **The rationale provided for selecting consolidation and capping as the preferred alternative is quite brief and not particularly convincing. The lesser cost of this alternative compared to the excavation and disposal alternatives appears to be the primary rationale for its selection. However, consolidation and capping appears to be inferior to the disposal alternatives in almost every other area of comparative analysis, although the DOE tends not to emphasize the relative downsides of consolidation and capping, i.e., lesser overall protectiveness and long-term effectiveness, reduced ability to monitor the effectiveness of the remedial action, and increased reliance on institutional controls.**

Further, while consolidation and capping does cost less than the excavation and disposal alternatives, this observation does not provide an evaluation of cost-effectiveness. When costs are weighted according to the degree of overall effectiveness that is achieved, the disparity in cost between the two alternatives is narrowed considerably.

Response: The discussion in the Comparative Analysis section of the Proposed Plan and Section 5.4 of the FS-EIS has been expanded to clarify the rationale for selecting consolidation and capping as the preferred alternative. The section clarifies that the discussion on overall protection of human health and the environment includes comparison of compliance with ARARs, short-term impacts, and long-term effectiveness for each of the alternatives. Also, the extent to which each alternative relies on institutional controls is clarified, in Section 5.4.2, to explain that Alternative 2 would be the least protective; Alternatives 3 and 4, onsite disposal, would be more protective; and Alternative 5 would provide the highest protection.

Consolidation and capping would utilize a slurry wall keyed into the cap and underlying naturally high clay content zones to prevent horizontal contaminant migration in groundwater. This would provide essentially equal overall protection and long-term effectiveness to the clay wall and clay bottom of the onsite cell disposal alternative. The slurry wall, by isolating the contaminated media from the surrounding upper aquifer, would also improve the ability to monitor the site for effectiveness of the remedial action because the source term would be isolated. Therefore, consolidation and capping would be equal to the onsite disposal cell option for long-term effectiveness. The degree and length of monitoring would be the same for both disposal facility alternatives. Both cells would require local application of IC's.

The texts in Section 5.4.1 on overall protection and Section 5.4.5 on short-term impacts have been expanded to clarify that overall protectiveness is highest for consolidation and capping under protection from short-term impacts to workers in that it provides the lowest non-radiological occupational excavation and construction hazards (56 injuries) and risk of fatality (1×10^{-2}) due to less movement and handling of soil and a shorter time to complete the remedial action. In comparison, the offsite disposal alternatives pose a much greater risk with non-radiological occupation excavation and construction hazards ranging from 82 to 125 injuries and 0.02 risk of fatality. Also, consolidation and capping is more protective of the public by the lower transportation risk (2.3 injuries and 0.94 risk of fatality) due to less backfill soil requirements and less transport of contaminated soils. Offsite disposal alternatives pose a much greater risk with the non-radiological transportation risk ranging from 2.8 to 116 injuries and 0.05 to 4.4 risk of fatality.

Alternative 3, Consolidation and Capping, is not inferior to the disposal alternatives especially in regard to Alternative 4 onsite disposal. These two alternatives are the same in terms of overall groundwater protection effectiveness for contaminant migration as described in the SSS. This is a result of the fact that the SLAPS geology is the overriding controlling factor as shown by the HELP model results and the MULTIMED model analysis. Text has been added to Section 5.2.3.3 to explain the results of these two models.

Two onsite disposal alternatives are being considered for SLAPS. The first alternative involves leaving the contaminated materials (fill and soil) in place at SLAPS and compacting the fill in situ by means of controlled dynamic consolidation. This will create a uniform base over which contaminated soils from the vicinity properties could be placed. A cover will then be placed over the waste pile. The second alternative involves removing all of the contaminated material at SLAPS and replacing it with clean backfill. A bottom clay liner would be constructed, and all of the contaminated material would be placed on top. The same pile cover design would be used for both alternatives.

In both design alternatives, based on the HELP model, the waste pile cover is the controlling factor in the amount of percolation through the pile (see the response to the fourth part of general question 1). The pile cover design is based on the design for a generic FUSRAP permanent waste pile (CDRPDS). Over a period of time, an equilibrium will be reached in the pile so that the average annual percolation through the pile bottom will become the same as the average annual percolation through the pile cover. Thus, these two alternatives are the same in terms of groundwater moving contaminants out of the disposal facility.

Next, the contaminants must migrate through the site geologic setting to reach a user. The SLAPS site geology consists of:

- upper aquifer (Units 1, 2, and 3T),
- aquiclude (Units 3M and 3B), and
- lower aquifer (Units 4, 5, and 6).

The aquiclude is thick, varying from 19 to 75 ft, has high fines levels (86 to 92 percent); and has low water content, as evidenced by soil testing data (from Table A-1 of the SSS). The transport through this site geology has been analyzed using the MULTIMED computer model. This model is a multimedia exposure assessment model developed for the U.S. Environmental Protection Agency's Center for Exposure Assessment Modeling. The model includes modules for unsaturated flow and transport, saturated flow and transport, atmospheric releases, and surface water interaction. For the SLAPS model, the unsaturated and saturated flow and transport portions of the program were used. The modeling only used the 3M and 3B subunits, which is conservative since the 3T subunit can be considered part of the aquiclude.

The model results show that, for this site's geologic conditions, both groundwater flow and contaminant transport are protective in and of themselves. Study of the hydrology of the site shows that there is no downward groundwater flow from the upper aquifer at SLAPS to the lower aquifer. There is no direct interconnection of the upper and lower aquifers. The groundwater does not readily flow in the upper aquifer which has the high fines levels (91 to 93 percent). The average linear velocity is 5.7 ft/yr. In terms of contaminant transport, the contaminants do not readily desorb into groundwater as a result of the high clay content. The distribution coefficients (ml/gm) for the soils are:

Uranium	533
Radium	643
Thorium	186,000

The MULTIMED transient transport results show that the movement of contaminants is slow:

Contaminant	Unsaturated Zone Breakthrough (yr)	Detection at Receptor (yr)	Pseudo-steady-state (yr)
Uranium	1,100	500	3,000
Radium	6,300	1,000	16,000
Thorium	316,000	100,000	800,000

These results for the transient simulations indicate that travel times from the facility to the hypothetical receptor, for the contaminant of concern, range from hundreds to hundreds of thousands of years. Thus, there is sufficient time to detect and respond to radionuclide releases that exceed concentration guidelines before exposure of offsite receptors would occur.

The presence of a capped, engineered structure would have a localized effect on infiltration rates, which may affect groundwater flow rates. The present annual infiltration rate at SLAPS is estimated to be 20.1 cm/unit area (7.9 in./unit area). The infiltration rate for the preferred cap design, determined using the Hydrologic Evaluation of Landfill Performance (HELP) model, was estimated to be less than 2.7 cm/unit area (1.1 in./unit area).

The HELP model is used to determine the average annual percolation through the waste pile (Schroeder 1988). The HELP computer model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills. The model is widely used and has been tested extensively using both field and laboratory data. HELP utilizes climatologic, soil, and design data to estimate the runoff, infiltration, percolation, evapotranspiration, and lateral drainage from a landfill.

Two onsite SLAPS/ball field disposal alternatives were evaluated: consolidation and capping without a slurry wall and onsite cell with a bottom clay liner. Consistent with the FS/EIS, the same pile cover design was used for both alternatives. In both design alternatives, the waste pile cover is the controlling factor in the amount of percolation through the pile. Over a period of time, an equilibrium will be reached in the pile so that the average annual percolation through the pile bottom will become the same as the average annual percolation through the pile cover.

The results are presented in Appendix B of the SSS (BNI 1993). Rates were identical for both caps and were less than 2.7 cm/unit area (1.1 in./unit area) annually. Thus, the annual infiltration rate is lowered by a factor of 7 by the cap. The decrease in infiltration would affect recharge to the groundwater at SLAPS; modeling (presented in Appendix D of the SSS) has shown that the water table would actually rise 0.1 m (0.3 ft). The rise in the water table would result from an increase in capillary pressure caused by the storage facility. The increase in the capillary pressure would offset the decrease in infiltration.

The results of the steady-state simulations indicate that, for the hydrogeologic system and hypothetical receptor scenario simulated, the dilution/attenuation factor (DAF) is 3.6. One advantage of using the DAF is that it represents a dimensionless concentration ratio; thus, source/receptor units can be in mg/L, μg/L, or pCi/L. For example, if the hypothetical receptor concentration is fixed at the total uranium derived concentration guideline of 600 pCi/L, then the maximum source concentration of total uranium would be 2,160 pCi/L.

In summary:

- Modeling results and observed conditions (i.e., environmental monitoring) show that the shallow groundwater at the site moves slowly and that contaminants move at an even slower rate.

- Any potential future impact from either the onsite cap or onsite cell would be extremely localized by a slurry wall, geology flow characteristics, the presence of Coldwater Creek as an intercept, and the favorable properties of the geology which facilitate monitoring and maintaining the status quo.

- As a result of the poor hydrogeologic properties; existing, natural low-quality groundwater conditions (i.e., the upper aquifer is Class IIIA); and the abundance of surface water, the potential use of the groundwater is remote.

- As a result of the isolation of the lower aquifer from the upper by the aquiclude, there is no impact on the lower aquifer.

With regard to the detailed analysis in general, the DOE tends to overstate the effectiveness of deed and land use restrictions over the long-term. Remedies that rely on institutional controls should not be considered to rank as highly in long-term effectiveness and permanence as those remedies that rely more on engineering controls.

Response: The preferred alternative selection process involved balancing engineering and institutional controls from the perspectives of effectiveness (including risk), implementability, and cost. The objective is to realize the optimal combination of all factors. Evaluation of the alternatives factored the relative long-term effectiveness and permanence aspects of institutional controls and engineering approaches, as well as the other CERCLA factors, into the preferred alternative selection. In terms of these two factors, Alternatives 3 and 4 were considered to offer the best combination (i.e., preferred over Alternative 2, which relies to a greater extent on institutional controls, and preferred over Alternative 5, which relies to a greater extent on engineering). The text in Section 5.4 has been revised to incorporate this comparison of institutional controls versus engineering controls. The following table provides the proposed institutional controls for access-restricted soils and the rationale for invoking them.

Institutional Controls (ICs) for Access-Restricted Soils
(Total Volume 120,000 yd^3)

AREA	SITE	VOLUME (yd^3)	PROPOSED IC	ACCESS-RESTRICTION RATIONALE
Airport	Banshee Road	3,000	Deed restrictions negotiated with local officials to control digging under roads.	• Increased worker risk of injury and fatality from roadway removal, excavation, and replacement of roadway • Economic impact to commercial properties along roadway • Rerouting of traffic • Increased transportation risk due to rerouting of traffic • Economic impact to city/county to remove and replace roadway
	Norfolk and Western Railroad	7,000	Deed restrictions with railroad company to control digging under railroad lines.	• Economic impact to railroad companies due to down time during remedial action • Rerouting of railroad and roadway traffic • Increased transportation risk due to rerouting of railroad and road traffic • Increased worker risk to injury and fatality from railroad track removal, soil excavation, and replacement of track • Economic impact to railroad company to remove and replace railroad tracks
	Soils under Airport Ramp	Not Available	Deed restrictions negotiated with the Airport Authority to control digging under the ramp.	• Increased worker risk of injury and fatality from ramp removal, excavation, and replacement of ramp • Economic impact to the Airport and commercial properties near ramp • Rerouting of traffic • Increased transportation risk due to rerouting of traffic • Economic impact to Airport Authority to remove and replace ramp

Institutional Controls (ICs) for Access-Restricted Soils
(Total Volume 120,000 yd³) (continued)

AREA	SITE	VOLUME (yd^3)	PROPOSED IC	ACCESS-RESTRICTION RATIONALE
Airport (continued)	Haul Roads (Eva Ave., Frost Ave., Hazelwood Ave., McDonnell Blvd., and Pershall Road)	23,000	Deed restrictions negotiated with local officials to control digging under roads.	• Increased worker risk of injury and fatality from roadway removal, excavation, and replacement of roadway • Economic impact to commercial properties along roadway • Rerouting of traffic • Increased transportation risk due to rerouting of traffic • Economic impact to city/county to remove and replace roadway
	Futura Coatings Buildings	18,000	Deed restrictions negotiated with Futura Coatings to control digging under buildings; deed restrictions with city/county on groundwater well installations; groundwater monitoring.	• Covered by large buildings that are expensive to replace • Increased worker risk of injury and fatality from demolition, excavation, and removal of building • Increased transportation risk of injury and fatality to public and transportation crew from increased volume of material to transport • Economic impact to Futura Coatings operations due to displacement of building occupants during removal of building • Economic impact to Futura Coatings to remove and replace buildings • Increased length of time to complete remedial action

Institutional Controls (ICs) for Access-Restricted Soils
(Total Volume 120,000 yd³) (continued)

AREA	SITE	VOLUME (yd³)	PROPOSED IC	ACCESS-RESTRICTION RATIONALE
Downtown	SLDS Buildings	62,000	Deed restrictions negotiated with Mallinckrodt to control digging under buildings; deed restrictions with city/county on groundwater well installations; worker protection program at SLDS for radon exposure; groundwater monitoring and use restrictions	• Covered by large buildings that are expensive to replace • Increased worker risk of injury and fatality from demolition, excavation, and removal of building • Increased transportation risk of injury and fatality to public and transportation crew from increased volume of material to transport • Economic impact to Mallinckrodt operations due to displacement of building occupants during removal of building • Economic impact to Mallinckrodt to remove and replace buildings • Increased length of time to complete remedial action
	Railroad Properties (i.e., Norfolk and Western; St. Louis Terminal; and Chicago, Burlington, and Quincy)	7,000	Deed restrictions negotiated with railroad companies to control digging under railroad lines; restrictions with city/county on groundwater well installations; groundwater monitoring	• Economic impact to railroad companies due to down time during remedial action • Rerouting of railroad and roadway traffic • Increased transportation risk due to rerouting of railroad and road traffic • Increased worker risk of injury and fatality from railroad track removal, soil excavation, and replacement of track • Economic impact to railroad company to remove and replace railroad tracks
	Levee	Not Available	Deed restrictions negotiated with the City of St. Louis to control digging under the levee.	• Increased worker risk of injury and fatality from removing levee, soil excavation, and replacement of levee • Economic impact to the City of St. Louis to remove and replace the levee

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The proposed consolidation and capping alternative, including institutional controls, is consistent with remedial actions at other regional National Priorities List sites such as:

Site	Contamination	Remedial Action
Wheeling Disposal Service, MO	Soil, sediment, groundwater, and surface water contaminated with VOCs (including TCE and toluene), PCBs, other organics, and metals (including arsenic, chromium, and lead)	Upgrading the existing landfill cap with a revegetated clay and soil cover; monitoring onsite groundwater and surface water; abandoning onsite wells; and implementing institutional controls including deed restrictions and site-access restrictions, such as fencing
Lawrence Todrz Farm, IA	Groundwater contaminated with VOCs (including benzene, toluene, carbon disulfide, and tetrahydrofuran) and metals (including arsenic, lead, and chromium)	Installation of soil cover over impoundment, provision of an alternate water supply to affected residences, groundwater monitoring, and implementation of institutional controls and land use restrictions
Industrial Waste Lagoon at Tooele Army Depot, Salt Lake City, UT	Soil and sludge contaminated with metals, such as chromium and lead; organics solvents, such as TCE, PCE, toluene, carbon tetrachloride; and other organic compounds	Placement and compaction of contaminated soil in the Industrial Waste Lagoon and covering it with a multilayered cap
White Farm Equipment Dump, IA	Soil, debris, and groundwater contaminated with VOCs (including benzene and toluene) and metals (including arsenic, chromium, and lead)	Regrading and covering the landfill with an impermeable layer of topsoil and vegetation to prevent infiltration, leaching, runoff, and erosion
Conservation Chemical, MO	Soil and groundwater contaminated with VOCs, organics, pesticides, metals, and inorganics	Capping, decontamination, and destruction of onsite structures
Missouri Electric Works, MO	Soil, sediment, and groundwater contaminated with VOCs, PCBs, and other organics	Excavating and treating PCB contaminated soils and sediment onsite using incineration, removing acid gases in situ, backfilling with residual materials based on leachability test results, and construction of a soil cover over site

The response to general question 5 discusses further the effectiveness of institutional controls.

Probably as a result of the lack of engineering information, the DOE does not do adequate evaluation of the implementability criterion. The extent of analysis provided is typically a simple statement that no difficulties are expected because conventional equipment or well established technologies are being used.

Response: Engineering information to support the implementability of well-established technologies can be found in various support documents and procedures.

The Conceptual Design Report for a Permanent Disposal Site for FUSRAP Wastes, DOE/OR/20722-212, April 1, 1989, gives the specific design criteria, facility description, and engineering requirements for an above-grade disposal facility that establishes a permanent management and disposal system for FUSRAP wastes.

The Site Suitability Study for the St. Louis Airport Site, DOE/OR/21949, draft May 1993, was performed to assess the suitability of SLAPS as a location for a final waste disposal facility. The report addresses the potential for seismic activity at or near the site and the ability of the site to withstand it; the suitability of the soils at the site to be the foundation for a storage facility; the potential for, impact of, and migration pathways for seepage of waste materials from the storage site; and the potential for flooding at the site. Information used to evaluate the suitability of the site came from published literature on the geologic conditions of the region and analyses of samples from existing geologic boreholes and groundwater monitoring wells at the site. Evaluation of this information was aided by the construction of contour maps and cross sections, conceptual models, and computer models. The conclusion is that SLAPS is suitable for location of a waste disposal facility.

FUSRAP has been performing remedial actions including soil and sediment excavations, building decontamination and removal, disposal cell design and construction, and mitigative measures over the past ten years. Remedial actions have been successfully completed at ten sites throughout the U.S. including Acid/Pueblo Canyon, Los Alamos, NM; Albany Research Center, Albany, OR; Bayo Canyon, Los Alamos, NM; Kellex/Pierport, Jersey City, NJ; Niagara Falls Storage Site, Lewiston, NY; National Guard Armory, Chicago, IL; University of California, Berkeley, CA; University of Chicago, Chicago, IL; and Elza Gate, Oak Ridge, TN.

Well-established FUSRAP engineering procedures on excavation (i.e., use of front-end loaders, backhoes, bulldozers, and manual techniques), survey equipment usage, decontamination, decommissioning, location of utility lines, dredging, dust control, sewer and drain line removal, and monitoring provide detail on the numerous engineering techniques that would be used during remediation. Technical procedures have been developed and are in place that will allow for straightforward implementation of the proposed remedial actions

Additional information on implementability has been added to FS-EIS Sections 5.2.3.6, 5.2.4.6, 5.2.5.6, 5.3.1, 5.3.4, and 5.3.5 that includes availability of resources, equipment, procedures, transportation, and administrative requirements.

3. **The detailed analysis of alternatives should include a complete discussion of the specific requirements considered to be Applicable or Relevant and Appropriate Requirements (ARARs) for each alternative.**

Response: The ARAR discussion in Section 3.2 and Appendix A has been refined to be more specific to the St. Louis site. The discussion has been expanded to describe that UMTRCA 40 CFR 192 design standards will be followed for the disposal site control. The 40 CFR 258 municipal solid waste landfill requirements will be used where relevant and appropriate to supplement 40 CFR 192 requirements. A discussion of 10 CFR 40 applicable requirements and DOE Order 5820.2A requirements as "To Be Considered" (TBC) were also added. Explanations on RCRA requirements of 40 CFR 264 and OSHA requirements of 29 CFR 1910 have been clarified to make it clear they are not ARARs. Discussion on the applicability of the Clean Water Act and Toxic Substances Control Act have been added. The ARAR discussions in Chapter 5 (Sections 5.2.2.2, 5.2.3.2, 5.2.4.2, and 5.2.5.2) on detailed analysis of site-wide alternative compliance with ARARs have been modified to clarify when action, location, and chemical-specific ARARs apply. Discussion of the key regulations (i.e., design criteria, cleanup guidelines, air, water, and transportation) for each alternative and how they apply is provided. Discussion of supplemental standards has been expanded (see response to general comment 5).

In developing the ARAR discussion, be aware that we question whether DOE Orders meet the prerequisites for consideration as ARARs.

Response: The text in Section 3.2 has been clarified to explain that DOE Orders will be treated as TBC in the FS-EIS. However, DOE activities still must comply with DOE Orders, so they are special TBCs. DOE Orders can be considered ARARs if they are promulgated under the Code of Federal Registers. A notice of proposed rulemaking for DOE Order 5400.5 has been published: Federal Register, Vol. 58, No. 56, p. 16268, Thursday, March 25, 1993. The requirements in this proposed rule govern activities conducted by, or for, DOE that might result in the release of radioactive material, the exposure of members of the public to radiation, or contamination of the environment with radionuclides from DOE activities.

4. **We believe the FS should examine the feasibility of establishing a temporary storage area or areas to allow more expeditious remediation of residential and other publicly accessible properties in the vicinity of SLAPS. Given that controlled areas are already established, it seems only prudent to begin removal and storage of some of the more controlled contamination prior to such time as a permanent disposal facility is available.**

Response: Text has been added to Sections 5.2.3 and 5.4.6 to explain that the preferred Alternative 3, Consolidation and Capping, would readily accommodate the establishment of an expeditious approach to remediation of residential and other publicly accessible properties as a result of the straightforward process of waste placement inherent to consolidation at SLAPS. That is, except for Alternatives 1 and 2, Alternative 3 is the most readily implemented remedial approach. It requires the least site preparation, provides the fastest disposal unit establishment, requires the least regulatory/federal agency coordination, and involves the fewest logistical problems. Section 5.3.1 has been modified to reflect the viability of using the temporary storage area feature of the onsite cell design for expediting soil removal.

5. **The rationale for invoking "supplemental standards" in accordance with 40 CFR 192.21 to permit leaving certain soils in place needs to be better developed. The text defines certain criteria that must be met. However, in some cases supplemental standards seem to be invoked merely as a matter of convenience, e.g., under the institutional controls and site maintenance alternative, compliance with ARARs is achieved by invoking supplemental standards for the entire site.**

In other cases, it is implied that supplemental standards are to be invoked for what is referred to as "access-restricted" soils. The primary justification given in Section 3.2.1.4 is an argument that remediation would pose a clear and present risk of injury to workers or members of the public - based on the hazards of removal. This justification is more convincing for some of the access-restricted soils, e.g., soils under the Mallinckrodt buildings, than for others, e.g., soils under roadways. In any event, the criteria outlined for defining access-restricted soils appears to be unrelated to the criteria outlined for cases when supplemental standards may be invoked, and therefore an assumption that supplemental standards may be invoked for all the indicated access-restricted soils may not be a valid one.

Also, to the extent invoking a supplemental standard amounts to waiving an ARAR, a basis needs to be included for doing so.

Response: Text has been added to Section 4.3.2.2 to clarify the following points. The criteria used to define access-restricted soils, as stated in Section 4.2.2, are those soils not currently accessible to excavation due to interference from buildings, roads, and railroads or other permanent structures. Supplemental standards apply to access-restricted soils because specific circumstances apply, including:

- the remedial action, because it involves demolition of buildings, roads, and railroads, would pose a clear and present risk of injury to workers;

- the remedial action would cause environmental harm that is excessive compared to the health benefits (reduction in current and/or future risk) to persons living on or near the site; and

- the established cost of the remedial action (i.e., removal of a building, road, railroad) is unreasonably high (due to actual removal plus costs associated with disruption of use) relative to the long-term benefits, and the residual radioactive materials do not pose a clear present or future hazard.

The discussion of supplemental standards for each site-wide alternative has been augmented. Information has been provided summarizing the worker/public exposure scenarios from the BRA by defining what pathways were evaluated and which of those resulted in the most significant contributions to total risk. A description of the specific institutional controls that would be implemented to eliminate or substantially reduce the critical pathways has been added to each alternative. The risk associated with each particular institutional control alternative is given. A comparison of risk versus costs has been done to clarify the value of institutional controls. The cost difference between Alternative 1 and the subject Alternative is calculated to enable evaluation of the change in risk versus cost as compared to the no action alternative.

The following table summarizes the institutional controls, risks, and costs for the Site-Wide Alternatives which characterizes the relative attributes of each Alternative. Under Alternatives 2, 3, 4, and 5 (for 5, only until the inaccessible soil is removed), institutional controls and supplemental standards would be used to protect human health and the environment. In the Site-Wide Alternatives involving excavation and disposal (i.e, Alternatives 3, 4, and 5), the remediation-related injuries, deaths, and cancer risks increase significantly in going from Alternative 3 to 4 or 5, and increase somewhat in going from Alternative 4 to 5.

See the third response paragraph under specific comment 17 for further information on the basis for the conclusion that no surface water is being contaminated above MCLs. The attached table entitled "Summary of Risks, Institutional Controls, and Costs for Site-Wide Alternatives" summarizes the results. These specific discussions of supplemental standards for each site-wide alternative can be found in Sections 5.2.2.2, 5.2.3.2, 5.2.4.2, and 5.2.5.2.

Text has been added to Section 3.2 to clarify DOE's position on how invoking a supplemental standard relates to waiving an ARAR. For any location where accessible soil is left uncontrolled, the remediation would, for those locations, not be in compliance with ARARs, and an ARAR waiver process would be needed. Many DOE Orders contain provisions to waive or allow exceptions to be made for specified requirements as a means of providing field offices flexibility in the conduct of their operations and responsibilities. Although these waivers/exceptions may be analogous to the CERCLA statutory waivers for ARARs, the latter do not apply to DOE Orders. Depending on the

SUMMARY OF RISKS, INSTITUTIONAL CONTROLS, AND COSTS FOR SITE-WIDE ALTERNATIVES

Alternative	Above 10^{-4} Cancer Risk and Institutional Controls	Remediation							
		Evaluation/Construction		Transportation				Cost ($ x 10^6)	
		Injury	Death	Rad Nonaccident	Rad Acccident	Injury	Death	Total	Delta
1	Current and future user exposure: no controls	NA	NA	NA	NA	NA	NA	6.9	NA
2	Current: Worker/employee protection measures; recreational/trespasser institution control measures Future: Institutional control measures	NA	NA	NA	NA	NA	NA	17.4	10.5
3	Only needed for SLDS construction worker: worker protection measures	56	0.01	0.0004	0.00007	11	1.0	143	136
4	Only needed for SLDS construction worker: worker protection measures								
	Onsite	84	0.02	0.0005	0.00009	14	1.3	211	204
	Instate	82	0.02	0.02	0.001	23	1.2	350	343
	East	121	0.02	0.03	0.1	30	2.8	317	310
	West	121	0.02	0.03	0.1	30	2.8	352	345
	DOE	121	0.02	0.03	0.07	41	4.1	868	861
	Commercial	121	0.02	0.02	0.05	26	2.5	531	524
	Beneficial	84	0.02	0.04	0.008	69	0.8	206	199

SUMMARY OF RISKS, INSTITUTIONAL CONTROLS, AND COSTS FOR SITE-WIDE ALTERNATIVES (Cont.)

Alternative	Above 10^{-4} Cancer Risk and Institutional Controls	Remediation							
		Evaluation/Construction		Transportation				Cost ($ x 10^6)	
		Injury	Death	Rad Nonaccident	Rad Acccident	Injury	Death	Total	Delta
5	Only needed for SLDS construction worker until access restricted soil removed: worker protection measures								
	Onsite	87	0.02	0.0006	0.0001	15	1.4	226	219
	Instate	85	0.02	0.01	0.001	27	1.3	380	373
	East	125	0.02	0.03	0.1	35	3.3	342	335
	West	125	0.02	0.03	0.1	35	3.3	384	377
	DOE	125	0.02	0.04	0.08	51	4.7	994	987
	Commercial	125	0.02	0.03	0.06	30	2.8	599	592
	Beneficial	87	0.02	0.05	0.009	80	0.9	215	208

circumstances, it is possible under DOE Order 5400.5 to release a property that is above authorized limits without restrictions, if supplemental limits have been approved and achieved. Failure to meet DOE authorized limits or invoking supplemental standards would not require the invoking of a CERCLA waiver.

6. **The feasibility study is generally the document in which cleanup criteria are developed based upon an ARAR analysis in combination with an assessment of risks from residual contamination under the reasonable maximum exposure (RME) scenario. Due to the additive effects of multiple site contaminants and multiple exposure pathways, it is sometimes necessary to establish cleanup criteria which are more stringent than ARARs. The remediation goal should be to achieve a risk no greater than 1 x 10^{-6}. Justification should then be provided in cases where this goal cannot be achieved.**

The draft FS does not satisfy this process. Rather, an analysis is provided whereby residual risks are calculated after it is assumed that soils are remediated to DOE guidelines. The exposure scenario is not given. It is then concluded that the DOE cleanup guidelines are protective, because residual risks at all locations fall within EPA's target risk range.

Response: Your analysis of the FS approach taken is correct. The remediation goals were developed to be consistent with the relevant and appropriate standards, such as 40 CFR 192, DOE Order 5400.5, and EPA's 10^{-4} to 10^{-6} target risk range.

The following details of the residual risk exposure scenario have been added to the text in Section 5.2 and Table 5-3:

- Exposure pathways for a resident consisted of radon gas and particulate inhalation, soil and non-drinking water source ingestion, and plant and fish consumption.
- The scenario assumes a FUSRAP-presumptive remedial approach, which is cleanup to the DOE Clean-up Criteria and backfilled with clean soil. The DOE cleanup criteria is consistent with that of 40 CFR 192.
- Thorium and radium activity in all remaining accessible soils would be less than 5/15 pCi/g above background.
- Uranium is limited to less than 50 pCi/g of U-238 above background.
- Thorium-230 is the prime radiological contaminant of concern.

- Relative isotopic ratios are those established in Table 2-15 of the BRA unless specifically noted.

- On average, the depth of soil removed from the SLDS, SLAPS, Futura, and HISS sites is 3 m and is 1 m from the various vicinity properties.

- Where there are data (i.e., in the first 3 to 4 ft of soil), the contaminant concentration was limited to that measured (i.e., it was not artificially increased to the 5/15/50 pCi/g limit).

- For areas below 3 to 4 ft where limited contaminant concentration information is available, the radionuclide ratio was maintained, but the activity will be increased to the established 5/15/50 pCi/g limit.

- The cleanup always removes at least the first foot of contaminated soil so the surface contamination is gone.

- Concentrations less than natural background (Table 2-2 of the BRA) are considered zeros.

- Ingestion of water scenario uses an assumption of ingestion from a non-drinking water source on site, based on the Class IIIA designation. The use of shallow wells for watering landscape or industrial water would commonly occur. In use of this water, a small amount may be consumed (e.g. showering, washing, splash back, or even in some cases intentional drinking). The occurrence of such usage was projected to be <1 percent of total yearly water consumption.

- The duration of the exposure is assumed to be 30 years with the resident inside structures 60 percent of the time, 10 percent is spent outdoors at the site, and the balance spent elsewhere, which is consistent with EPA guidance and the characteristics of the site.

- Inhalation rate is assumed to be 7,000 m^3/yr, consistent with EPA guidance.

- Contaminated zone removed is assumed to be 2-m thick to ensure a conservative analysis.

- The maximum exposure is assumed to occur within the first 300 years after remediation; the largest exposure value during this period was used as the basis for risk calculations.

7. Throughout the document, text and figures are presented which purport to illustrate the extent of contamination, but which actually illustrate the extent of contamination above a DOE Guideline.

Response: Additional text has been added to Section 2.3 to further clarify for the reader that referral to an extent of contamination is relative to DOE guideline values.

8. With respect to Coldwater Creek, the treatment is not satisfactory, and the comments sent to you by letter dated February 11, 1993 still apply. The draft FS contains no discussion of data gaps. Discussion of the extent of contamination continues to refer to contamination "typically in the top 15 cm (6 in.) of sediment" where in fact, data for concentrations in underlying sediments do not exist. Remediation of creek sediments and soils is discussed in terms of a "supplemental risk assessment" which has not been submitted for review, and therefore, we are not in a position to concur with the conclusion that no remedial actions are required on Coldwater Creek under current and future land use and exposure assumptions.

Response: The discussion on Coldwater Creek in Section 2.3.2 has been revised to reflect the existing knowledge on the extent of contamination. Considering the susceptibility of the sediment to movement due to the dynamic conditions in the stream, the modeling analysis of the stream, the understanding of the nature and extent of the stream sediment contamination at the time of sampling, and the fact that dredging to remediate the stream will require new sampling, we feel the understanding of the stream is sufficient for the purposes of performing the FS analysis. Based on the recent sediment core analysis results given in Table 3-35 of the RI Addendum (23 additional sediment samples taken below the top 15 cm), it can be concluded that delineation of the underlying creek sediment contamination above DOE guidelines has been achieved to the point that is needed until the source term is removed and remedial action of the creek begins.

Responses to the comments in the February 11, 1993, letter are included with this transmittal and appropriately incorporated into the FS-EIS.

The supplemental risk assessment for Coldwater Creek entitled *The Risks Associated with Contaminated Sediments Present in Coldwater Creek* is included with this transmittal.

9. No mention was found of the contaminated sewers and drains that have been mentioned in several previous documents. Are these included among the access-restricted soils?

Response: Text has been added to Sections 2.1.1 and 2.3.1 to document the existing history and understanding of sewer and drain contamination. Sewers and process lines under buildings will only be remediated to the extent that they are part of the deconing of lines in accessible areas (i.e., internal deconing of lines). Sewer drain sediment is included among the volume estimates for accessible soils.

10. **A general weakness of discussion is that the inaccessible soils are considered in terms of removal in future years as they become accessible, yet no provision for a place to put those future-available soils is found. It should also be recognized that some contaminated soils, such as those under the levee, may never become more accessible than they are at the present time.**

Response: For Alternatives 3 (Section 5.2.3) and 4 (Section 5.2.4), the text has been revised to make it clear that the management of inaccessible soils, including disposal, would be the responsibility of the owner of the property unless the soil was to be made accessible, in a timely fashion, by the owner during the remediation. For Alternative 5, management of these soils for disposal, as discussed in Section 5.2.5.6, involves coordination between the property owner and DOE. As discussed in Sections 5.2.3.1 and 5.2.4.1, leaving inaccessible soil in place (e.g., indefinitely under the levee) would achieve protection of human health and the environment through institutional controls.

The phased approach for removal of access-restricted soil under Alternative 5 is a weakness for the alternative due to the need to control/coordinate property owner activities and plan future soil removal over a long time frame.

11. **In general, the draft FS doesn't seem to recognize any concern about encapsulated residual contamination in the Futura Coatings buildings. The discussion of building decontamination activities seems limited to SLDS buildings belonging to Mallinckrodt.**

Response: Text has been added to Section 2.3.2 on results from building surface surveys. The text on residual contamination in Section 5.2.3 has been clarified for the Futura buildings. It now states that there is currently no known evidence that encapsulated residual contamination exists in the Futura Coatings buildings. Data from recent surveys indicate all surfaces are well below the DOE guidelines for removable contamination. Surface readings indicate no gamma emitters are encapsulated. The results of air immersion and effective dose measurements were also found to be well below DOE guidelines. During future activities, if any contamination is discovered, it will be appropriately addressed. If any contamination was found, it would not be expected to significantly affect the remedial activities since the radiological composition would be the same as the rest of the contamination in the area and the volume would be small. Thus, there would not be any unusual conditions that would jeopardize planned remedial activities.

DETAILED COMMENTS:

1. **p. ES-4, 3rd para: Faulty rationale is used here to support an unclear and questionable conclusion. All contaminants identified at a given site through objective field study make up the character of waste materials at that site. A given contaminant or waste material is not eliminated as an "issue" because it is not RCRA hazardous, or is not used as a criteria for placing properties on the NPL.**

   Response: The text has been revised in the Executive Summary and Section 2.3 to explain that the approach being taken is to adhere to the FFA, including the scope of the agreement on radionuclide and chemical or nonradiological contamination. Considering the long history of non-MED/AEC uses of the St. Louis site areas, the FFA approach of remediating contaminated wastes resulting from or associated with uranium manufacturing or processing activities conducted at the SLDS is the only viable and defensible approach.

2. **p. 2-1: The Site Characterization discusses MED/AEC activities at the SLDS in terms of uranium enrichment, which hasn't been reported as a SLDS activity in any other site documents. This certainly appears to be an error, as association with uranium enrichment activities is not plausible.**

   Response: The text throughout the document has been revised to remove the word enrichment.

3. **p. 2-3, 3rd full para: SLDS discussion states that radon and radon daughter concentrations in two buildings exceed guidelines. This needs to be reconciled with previous documents, which haven't discussed two buildings in need of radon remediation.**

   Response: The RI report in Section 3.2.5 on page 3-19 and Section 5.1.4 on page 5-4 (BNI, January 1992) reports that the three SLDS buildings K1E, 25, and 101 exceed DOE guidelines.

4. **p. 2-4, 4th full para: We believe this is the first mention of a "contaminated vehicle" buried at SLAPS in a site document.**

   Response: The source of the contaminated vehicle information is the St. Louis site NPL finding documentation (NPL-U8-2-6, 10/89, Air Route Section, page 5). This reference has been added to the fifth paragraph of the FS Section 2.1.2.

5. **p. 2-61, 5th para: No supporting rationale accompanies the conclusion that no materials are expected to require management as hazardous or mixed wastes. The referenced report concludes this on the basis that, once excavated, the few areas that failed the extraction procedure test will be mixed with larger volumes of material that did not fail the test, making it unlikely that the resulting waste will exhibit any hazardous waste characteristics.**

Response: To clarify the conclusion that no materials are expected to require management as hazardous or mixed wastes, text has been added to Section 2.3 to make it clear that the rationale for the conclusion is the absence of RCRA wastes at the St. Louis site based on testing and the large volume of waste materials to be handled.

It should be noted that: (1) When it is determined that wastes are not RCRA listed, and do not exhibit RCRA characteristics, it has only been demonstrated that RCRA is not applicable to the management of these wastes. The presence of hazardous substances in these wastes necessitates a determination as to whether or not certain RCRA requirements should be considered relevant and appropriate to any aspects of the management of these wastes; (2) some discussion should be provided as to whether or not the sampling effort was sufficiently representative of the entire waste volume; and (3) under Superfund, it is often deemed to be appropriate to manage discrete volumes of material separately from the larger volume of waste material based on differing characteristics, rather than relying on mixing materials to achieve uniform characteristics. What other types of chemical analyses were performed?

Response: (1) Text has been added to Section 2.3 to clarify that RCRA requirements are not considered relevant and appropriate to the management of these wastes, based on the BRA analyses results for chemical exposures to current receptors, the low concentrations of the chemical contaminants observed, the nondiscrete nature of the soils containing chemicals (i.e., co-located with radiologically contaminated soil), and the management of contaminated soil as by-product waste. Management of the soils in accordance with 40 CFR 192 will ensure protection of human health and the environment including any synergistic effects of radiological and chemical contaminants. Worker protection will be attained during remediation by complying with OSHA regulations.

(2) Text has been added to Section 2.3 to clarify that the sampling effort consisted of spatial coverage sufficient to represent the entire waste volume. That is, 26 sample locations at SLDS out of a possible 404 (based on a 100 ft by 100 ft grid), 21 sample locations at SLAPS out of a possible 280 (based on a 100 ft by 100 ft grid), and 5 sample locations at HISS out of a possible 99 (based on a 100 ft by 100 ft grid) were sampled. These extents of sampling are analogous to those cited in the SW-846 Chapter 9 guidance.

(3) Text has been added to Section 2.3 to clarify that the analyses performed during characterization activities included Th-230, Th-232, Ra-226, U-238, VOCs, BNAEs, metals, RCRA hazardous waste characteristics, pH, specific conductivity, TOX, and TOC. Specific chemical results may be found in the following reports:

Document	Section
Remedial Investigation Report for the St. Louis Site, St. Louis, Missouri, DOE/OR/21949-280, Jan. 1992	3.2.1, p. 3-9 to 3-11 3.2.2, p. 3-12 to 3-16 3.4.1, p. 3-39 to 3-40 3.4.2, p. 3-41 to 3-42 3.4.5, p. 3-48 to 3-49 3.5.11, p. 3-68 to 3-70 3.6.1, p. 3-93 to 3-95 3.6.2, p. 3-95 to 3-96 3.7.1, p. 3-104 to 3-105 5.1.1, p. 5-1 to 5-3
Radiological and Limited Chemical Characterization Report for the St. Louis Airport Site, St. Louis, Missouri, DOE/OR/20722-163, August 1987	5.2, p. 21 to 23, p. 100
Preliminary Geological, Hydrogeological, and Chemical Characterization Report for the Ball Field Area, Hazelwood and Berkeley, Missouri, DOE/OR/20722-211, February, 1989	4.4, p. 46 to 67
Chemical Characterization Report for the St. Louis Airport Site and Latty Avenue Properties, St. Louis, Missouri, DOE/OR/20722-206, Revision 1, July 1990	5, p. 32 to 66 6, p. 67 to 68
St. Louis Airport Site Environmental Report for Calendar Year 1989, St. Louis, Missouri, DOE/OR/20722-262, May 1990	3.4.2, p. 36 to 42

Document	Section
Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri, DOE/OR/20722-258, Volumes I and II Revision 1, September 1990	5.3, p. I-25 to I-42 6.2, p. I-102 to I-124 Data tables: 6-11, p. II-173 6-14, p. II-175 6-15, p. II-188 6-17, p. II-209 6-19, p. II-212
Hazelwood Interim Storage Site Environmental Report for Calendar Year 1989, Hazelwood, Missouri, DOE/OR/20722-263, May 1990	3.4.2, p. 33 to 40
Remedial Investigation Addendum Report for the St. Louis Site, St. Louis, Missouri, DOE/OR/21950-132, Final, May 1993	2.2, p. 2-14 to 2-15 Tables 3-11, 3-20, 3-29, 3-36, 3-37, 3-38, 3-39, 3-40, and 3-41

6. **p. 2-62, 1st para: The criteria used to make the distinction between areas contaminated through MED/AEC uranium processing activities, which are within the scope of the project, and areas contaminated through Mallinckrodt's other activities, which are outside the scope of this project, should be provided.**

Response: The text in Section 2.3 has been modified to clarify that the criteria used to distinguish between areas contaminated through MED/AEC uranium processing and related activities and areas contaminated through Mallinckrodt's other activities are:

- Areas having elevated levels of radioactivity where the extent of contamination can be traced to MED/AEC uranium processing activities,
- Elevated radiation areas where the extent of contamination can be traced to non-MED/AEC uranium processing activities (i.e., Mallinckrodt's columbium-tantalum operation,)
- Areas exhibiting background levels of radioactivity (these areas are considered free of any residual associated with uranium processing activities),
- Areas containing elevated levels of organic and non-radioactive inorganic chemicals traceable to known MED/AEC uranium processing activities (no areas have been identified based on history and sampling data), and

- Elevated levels of radiation along haul roads and associated vicinity properties traceable to known MED/AEC transportation activities.

7. **p. 2-62, 2nd para: This does not describe the process by which contaminants of concern should be identified. Total excess lifetime carcinogenic risk for a reasonable maximum exposure (RME) from all contaminants and all pathways should provide the basis for comparison with EPA's target risk range. Also, the sum of all hazard quotients calculated for the RME should provide the basis for comparison with a hazard index of 1.0. A list of contaminants of concern is developed according to factors such as frequency of occurrence and relative toxicity prior to any calculations of risk.**

   Response: The text in Section 2.3 has been revised to be consistent with the BRA definition of contaminants of concern which is based on the EPA guidelines for data evaluation in Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A); Interim Final, EPA/540/I-89/002, December 1989, and data usability in risk assessment from Guidance for Data Usability in Risk Assessment, Interim Final EPA/540/G-90-008, October 1990. Based on the extensive sampling efforts completed to date, DOE is unaware of any MED-related non-radiological contamination that is present in the absence of radiological contamination. Language in the FS has been modified in an attempt to clarify DOE's position on this matter. The text has also been modified to clarify the use of EPA's target risk range and hazard index as the criteria being used to determine the MED/AEC COCs, which would require dispositioning under the remedial action.

8. **p. 2-64, 2nd para, and elsewhere: What are the major assumptions and the likely margin of error associated with these volume estimates?**

   Response: Text has been added to Section 2.3 to clarify that the maximum volumes of soil to be excavated include conservative assumptions. These conservative estimating assumptions as well as constructability factors provide assurance that the volume estimates are bounded on the maximum side. Volume estimates stated in the FS-EIS are based on radiological characterization data.

   The BRA and associated contaminants of concern were approved by EPA (EPA letter from Greg McCabe, EPA Region VII to David Adler, FSRD-OR, dated July 28, 1992).

   Characterization data were evaluated against DOE soil cleanup criteria. The depth of contaminated soil selected for volume estimates was the deepest contaminated sample interval, even when non-contaminated layers of soil were present above it. The data were then input into Surfer (a volume estimating software package) and volume estimates were calculated. Volumes of contaminated soil were estimated using the Kriging method.

Kriging uses geostatistical techniques to calculate the autocorrelation between data points and produces a minimum unbiased estimate. This method depends upon the selection of various parameters that are estimated within the Surfer program. The appropriate selection of numerous options in the program as well as in the quantity (spacing) and quality of the characterization data, affect the accuracy of the volume estimate. At this time, this method is considered the best engineering practice because boundaries of contamination are based on complex statistical algorithms rather than on arbitrary boundaries placed one-half of the distance between contaminated and non-contaminated data points. In addition, all of the known contamination was adequately bounded with non-contaminated data points based on the characterization effort.

For these reasons, the margin of error associated with the maximum volume estimate is low. A 20 percent constructability factor was included in the estimated volume of contaminated soils. The final volume of the disposal cell will be slightly less than the estimated volumes due to compaction of the soil during placement in the cell.

9. **p. 2-64, 3rd para: An explanation which accounts for the differing results from the two different toxicity tests should be provided.**

Response: Out-dated EP-TOX results were included to be thorough in explaining what analyses have been performed. The explanation of the differing results is a moot point since the regulations have replaced EP-TOX with TCLP as the required toxicity procedure. The complexity of the chemistry for the two toxicity procedures (EP-TOX and TCLP) and the diverse chemical makeup of the soil matrix are so great that specific comparison of the two procedures is not considered feasible.

10. **p. 2-64, Section 2.3.1 in general: Given the nature and duration of industrial activities at the Mallinckrodt facility (i.e., chemical production and packaging since the mid-1800s), the reader might expect sampling at SLDS to show a much greater degree of chemical contamination. Is information available which would help explain?**

Response: DOE is not aware of any information beyond that which has already been reported (see response to specific comment 5) which would add further to understanding the nature and extent of chemical contamination at Mallickrodt. The text in Section 2.3 has been modified to clarify that the analyses performed during characterization activities were Th-230, Th-232, Ra-226, U-238, VOCs, BNAEs, metals, RCRA-hazardous waste characteristics, pH, specific conductivity, TOX, and TOC. The characterization activities focused on areas contaminated as a result of MED/AEC uranium processing activities (see response to specific comment 6). Any MED/AEC activities that utilized volatile organics or non-metal nonhazardous inorganics would not have been detected during characterization because the volatiles would have escaped to the air (particularly when you consider the time span between any MED/AEC activity and the taking of the sample) and testing did not cover the non-metal, nonhazardous inorganics.

Groundwater monitoring for chemical indicator parameters at SLAPS and HISS, including pH, specific conductance, TOX, and TOC, has been conducted since 1987.

11. **p. 2-66, 2nd para: If groundwater at SLDS were contaminated as a result of uranium processing activities, it might be expected that fluorides, nitrates, and sulfates would be among the most widespread contaminants. What evaluations have been made regarding these potential contaminants?**

Response: Nitric and hydrofluoric acid were used in the uranium processing activities and barium sulfate was a by-product of the processing. Results for fluoride, nitrate, and sulfate in SLAPS/ball field, and HISS/Futura soils are summarized in Table 2-8 of the BRA and reported in Section 4.4.2 of *Preliminary Geological, Hydrogeological, and Chemical Characterization Report for the Ball Field Area, Hazelwood and Berkeley, Missouri*, DOE/OR/20722-211, February 1989; and Section 5.0 of *Chemical Characterization Report for the St. Louis Airport Site and Latty Avenue Properties, St. Louis, Missouri*, DOE/OR/20722-206, July 1990. The results indicated that none of the fluoride results for soil exceeded the average background concentration of 270 mg/kg for fluoride in soil. Local background concentrations for sulfate and nitrate are not available. Results for fluoride and nitrate in groundwater at SLDS are summarized in Table 2-11 of the BRA and are reported in Section 6.2.3 of *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri*, DOE/OR/20722-258, September 1990. The results indicated that groundwater exceeded the MCL only for fluoride of 6,200 μg/L by 1,800 μg/L. Text has been added to Section 2.3 to give the nature and extent of contamination for fluoride, nitrate, and sulfate at the St. Louis site.

12. **p. 2-75, 2nd full para: Contaminants of Concern are described as Ra-226, Th-232, Th-230, and U-238 (and daughter products), and do not seem to include uranium-235 decay products. The BRA has shown that the contributions from U-235 decay products are not insignificant.**

Response: The text in Section 2.3.3 has been revised to include the U-235 decay series.

13. **p. 2-78: The FUSRAP remediation strategy outlined here may not be consistent with the DOE's obligations under CERCLA. DOE's characterization and remediation efforts must address all wastes and all contamination resulting from or associated with MED/AEC processing activities at the St. Louis Downtown Site. Although a good generalization, it is not necessarily true that all areas and all media impacted**

by MED/AEC activities will be contaminated with residual radioactive material. Also, the fourth sentence in the last paragraph probably overstates the standard of proof necessary for non-radioactive contaminants to be considered within the scope of this project.

Response: DOE has extensively investigated the extent of both the radiological (see for example, the data in the RI Addendum) and nonradiological (see response to item 3 of the second part of specific question 5) contamination at the St. Louis site. Based on the extensive sampling efforts completed to date, DOE is unaware of any MED-related non-radiological contamination that is present in the absence of radiological contamination. Language in the FS has been modified in an attempt to clarify DOE's position on this matter. If there are any specific areas of concern on this matter, please convey them to DOE.

14. **pp. 2-82 and 2-83: The conclusions based on the supplemental risk assessment conducted for Coldwater Creek will be evaluated after the supplemental RI and risk assessment have been submitted for review. A review of Figure 2-7 did not indicate the locations of Areas B & C referred to in the text.**

Response: The RI Addendum has previously been forwarded to EPA and the Coldwater Creek Risk Assessment entitled *The Risks Associated with the Contaminated Sediments Present in Coldwater Creek* is being included with this transmittal. Figure 2-7 has been revised to include the locations of Areas A through D.

15. **p. 3-7, 2nd full para: We are not aware of anything under the Price Anderson Amendments Act of 1988 from which one would conclude that DOE Orders are ARARs.**

Response: The text in Section 3.2.1.1 has been modified to make it clear that DOE Orders are now classified as TBC. The promulgation of DOE Orders as regulations is being pursued (see the response to the second part of general comment 3).

16. **p. 3-8, Table 3-1: The uranium residual contamination guideline of 100 pCi/g total, 50 pCi/g U-238, is still referred to as "being developed" though it is clearly being used. The process by which it is being developed is not provided here. Cleanup criteria should be explicitly developed in the FS in accordance with the general process outlined in the general comments above.**

Response: The text in Section 3.2.1.1 (under Soils) has been revised to explain that the uranium action levels have been set by the DOE Office of Environmental Restoration memorandum, Uranium Cleanup Guidelines for St. Louis, Missouri, FUSRAP Sites, November 1990. A copy of the memorandum is attached. Detailed information on the process employed to set this guideline were transmitted to EPA on July 5, 1991 (a copy of the EPA transmittal letter is attached).

17. **pp. 3-10 and 3-11, Groundwater and Surface Water: The EPA's groundwater classification system discussed here has been superseded by a new system.**

Federal Water Quality Criteria should be discussed as a potential ARAR.

In some circumstances, SDWA requirements may be ARAR, not only to current or potential sources of drinking water, but to waters that discharge to current or potential sources of drinking water.

Response: According to the U.S. EPA Ground Water Protection Office (GWPO), the EPA Superfund aquifer classification system provided in the document titled *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (1988) still applies to CERCLA sites. The more recent EPA groundwater protection guidance manual titled *Final Comprehensive State Ground Water Protection Program Guidance* (1992) is not a Superfund document, and therefore does not supersede the 1988 Superfund document. The GWPO showed that this point is covered by the "NOTE TO THE READER" provided in the front of the 1992 document, which states that this document "does not establish or affect legal rights or obligations." In contrast, the 1988 document assists the establishment of legal obligations because it provides an objective method for aquifer classification. The recommendation given by the GWPO is to cite both documents in the FS-EIS. The text in Section 3.2.1.1 under Groundwater and Surface Water has been modified to reflect this recommendation.

As discussed in detail in Section 2.2.4.2, application of the 1988 guidance manual analysis leads to a Class IIIA designation, because the water-bearing units at the St. Louis site feed a surface water body that could be used as a drinking water source and because the aquifer is surrounded by an airport and/or industrial activities. According to the 1988 guidance, a Class IIIA aquifer is not considered a potential source of drinking water and is of limited beneficial use. Consequently, Federal Water Quality Criteria, such as Safe Drinking Water Act (SDWA) MCLs, are not considered ARARs. The circumstance that "SDWA requirements may be ARARs, not only to current or potential sources of drinking water, but to waters that discharge to current or potential sources of drinking water" does not apply to the St. Louis site since the contamination in groundwater is naturally attenuated to levels below SDWA MCLs in the surface waters based on monitoring results for surface water from the *Hazelwood Interim Storage Site Annual Report for Calendar Year 1991*, DOE/OR/21949-340, September 1990 and *St. Louis Airport Site Annual Environmental Report for Calendar Year 1990*, DOE/OR/21949-288, August 1991. Thus, no contamination of a potential drinking water source above MCLs is occurring.

18. **p. 3-24: Discussion of disposal cell technology appears to have been omitted from the section on containment.**

Response: The discussion of the disposal cell technology applicable to the St. Louis site has been added to Section 3.4.3.

19. **p. 3-27, Section 3.4.4 Treatment: The first paragraph of this section states that treatability testing would be required to evaluate the effectiveness of any treatment process on the St. Louis site soils, and yet, the potentially applicable treatment technologies are eliminated from consideration based on very cursory analysis.**

Response: The FS-EIS Section 3.4.4 states that extensive treatability testing would be required. Coupling this extensive effort with the other limitations of treatment presented in the FS (see response to item 5 of general comment 1) justifies the elimination of treatment at this time. Consistent with EPA Section 5.1.2 guidance, the door is left open for treatability should future developments warrant further consideration.

This analysis should recognize that certain site wastes may be more amenable to treatment than others. An attempt should be made to differentiate site wastes on this basis.

Response: Soil is by far the largest viable waste stream candidate for treatment. The St. Louis soil would not show a significant difference in treatment properties between locations. Groundwater treatment is not viable due to the aquifer properties. The FS text has been clarified to make it clear that decontamination of building surfaces is a form of treatment in that it is a volume reduction technique versus dismantlement or demolition. In this manner, the FS did differentiate site wastes for treatment consideration.

20. **p. 3-28, 2nd para: What is the basis for concluding that stabilization of soils provides minimal realized benefit?**

Response: The basis for this statement in the FS-EIS is:

- increased disposal volume,
- increased disposal cost,
- no change in waste classification as radioactive waste,
- no change in waste toxicity, and

- no justifiable advantage is gained in terms of contaminant migration/mobility because these are currently low in the soil.

Text has been added to Section 3.4.4 under solidification/stabilization to clarify this last point.

21. **p. 3-29, top of page: What is the basis for concluding that vitrification is cost prohibitive on a large scale?**

    Response: It is estimated that the cost just to do vitrification would be $200 million. This is based on applying $300/m^3$ ($230/yd^3$) for vitrification (M-K Ferguson and Company and Jacobs Engineering Group, 1992a, *Engineering Analysis of Remedial Action Alternatives, Phase I,* DOE/OR/21548-269, Rev. 0) to the 669,000 m^3 (876,000 yd^3). Text has been added to Section 3.4.4 to include this information.

22. **p. 4-19, 1st sentence: What "similar" RU alternatives are being referred to?**

    Response: The text in Section 4.3.3.3 has been clarified to indicate the comparison is to the other two Coldwater Creek RU alternatives, CC1 and CC2.

23. **p. 4-19, Section 4.3.4 Buildings and Structures: A general discussion on the results of radiological surveys is the extent of characterization information provided. The reader is left to wonder if there is other relevant information. No structure specific information is provided and no discussion is provided regarding the presence or absence of other potential contamination problems, e.g., asbestos, PCBs, which might be expected to occur in these buildings. Will any process structures be involved and have they been characterized? What requirements will apply to waste stream disposal? Such information is necessary to fully support decision-making and ARAR analysis with regard to dismantlement, decontamination, and disposal activities.**

    Response: The text has been revised in Sections 2.3.1 and 4.3.4.5 to further explain the information available regarding other potential contamination problems and the requirements that will apply to waste stream disposal. That is, through evidence from historical information, interim removal actions, and the nature of the industry at SLDS, the potential for asbestos and PCBs could exist. The relevant and appropriate requirements under 40 CFR 61 and 40 CFR 761 would be considered. The ARAR analysis (Section 3.2.1) and Appendix A have been revised to include asbestos and PCB ARARs.

Response: The cap discussion in Section 5.2.3 has been expanded to more clearly reflect that this design includes a slurry wall keyed to the cap and the underlying naturally occurring high clay content Unit 3 zone. Section 4.3.5.3 discusses the slurry wall details, effectiveness, implementability, and cost aspects. The constructability of slurry walls is covered in Section 5.4.3 under the Groundwater and Surface Water subsection. Costing details for the slurry wall are covered in Appendix B, Section B.4.

29. **p. 5-57, 2nd para: Are these siting criteria considered ARAR for disposal of St. Louis site wastes? If so, how does the area contemplated for onsite disposal compare against these requirements?**

Response: The text in Section 5.3 has been clarified to make it clear that the NRC regulations are not ARARs for siting a DOE radwaste facility although they may be TBC guidance.

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