Closure, or Closure to Landfill Standards) based on the analyses in this EIS. A list of the existing HLW management facilities and the corresponding facility disposition alternatives ***analyzed in the EIS*** is provided in Table 3-***3***.

For the Tank Farm and bin sets, which together constitute the great majority of the total inventory of residual radioactivity, DOE analyzed all five facility disposition alternatives. These facilities would be the main contributors to the residual risk at INTEC. The level of residual risk would vary with the different facility disposition alternatives for the Tank Farm and bin sets.

The residual amount of radioactive and/or chemical contaminants associated with other INTEC facilities is much less than that of the Tank Farm and bin sets. Consequently, the overall residual risk at INTEC would not change significantly due to the contribution from these other facilities. For purposes of analysis, DOE assumed a single facility disposition alternative for the other INTEC HLW ***management*** facilities. ***In general, DOE selected the Closure to Landfill Standards alternative for analysis because it represents the maximum impacts for facility disposition. In some cases, the contaminants associated with a facility posed very small residual risk and DOE selected the Clean Closure Alternative for analysis to maximize the potential short-term impacts associated with facility disposition activities. T***he New Waste Calcining Facility and the Fuel Processing Building and related facilities ***present slightly higher residual risk than the remainder of the other INTEC HLW management facilities. DOE evaluated a second facility disposition alternative, Performance-Based Closure, for these two facilities to determine whether the potential impacts would vary between alternatives.***

For the new HLW ***management*** facilities identified in Table 3-***1***, DOE analyzed the Clean Closure alternative. This facility disposition assumption is ***consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, that all newly constructed facilities necessary to implement*** the waste processing alternatives would be designed ***and constructed consistent with measures that facilitate clean closure.***

3.3 Alternatives Eliminated from Detailed Analysis

This section identifies those alternatives that have been eliminated from detailed analysis in this EIS and briefly ***discusses*** why they have been eliminated [40 CFR 1502.14(a)]. CEQ regulations direct all ***federal*** agencies to use the NEPA process to identify and assess ***the*** range of ***reasonable*** alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment [40 CFR 1500.2(e)]. The CEQ guidance further states that: (1) reasonable alternatives include those that are practical or feasible from a technical, economic, or common sense standpoint; (2) the number of reasonable alternatives considered in detail should represent the full spectrum of alternatives meeting the agency's purpose and need; and (3) the EIS need not discuss every unique alternative when a large number of reasonable alternatives exists.

This section seeks to consolidate the alternatives that serve the same general purpose by eliminating from detailed study those alternatives that present strong cost, schedule, regulatory, and technical maturity or feasibility constraints and offer no significant advantages over alternatives selected for detailed analysis. While cost alone is not normally a criterion for eliminating an alternative from detailed study, it is a powerful discriminator when coupled with the existence of similar but more cost-effective alternatives. Appendix B describes the process DOE used to identify the set of reasonable alternatives for analysis in this EIS. For the reasons discussed below, DOE has decided to eliminate the following alternatives from detailed study:

- Separations Alternative – Transuranic Separations/Class A Type Grout Option
- Non-Separations Alternative – Vitrified Waste Option
- Non-Separations Alternative – Cement-Ceramic Waste Option
- Disposal of Low-Level Waste Class A or Class C Type Grout at the Hanford Site

- Vitrification at the West Valley Demonstration Project or the Savannah River Site

- Shipment of Mixed Transuranic Waste (SBW/Newly Generated Liquid Waste) to the Hanford Site for Treatment

- Treatment of Mixed Transuranic Waste/SBW at the Advanced Mixed Waste Treatment Project

- ***Grout-in-Place***

Subsequent to issuing the Draft EIS, several new waste processing methods were identified and evaluated. Most of these methods were variations on the waste processing alternatives presented in the Draft EIS. In addition, several new technologies and variations of previously studied treatment options were suggested. For the reasons discussed in Appendix B, these alternatives were eliminated from detailed evaluation in this EIS.

3.3.1 TRANSURANIC SEPARATIONS/ CLASS A TYPE GROUT OPTION

This option is similar to the Full Separations Option, except the separation process under this option would result in three waste products:

- Transuranic waste

- Fission products (primarily strontium/ cesium)

- Low-Level Waste Class A type grout

In the Transuranic Separations/Class A Type Grout Option, the mixed transuranic waste/SBW would be sent directly to the Separations Facility for processing into high-level and low-level waste fractions. After the mixed waste transuranic waste/SBW was processed, the calcine would be retrieved from the bin sets, dissolved, and processed in the Separations Facility. Ion exchange columns would be used to remove the cesium from the waste stream. The resulting effluent would undergo the transuranic extraction process to remove the transuranic elements for eventual shipment to the Waste Isolation Pilot Plant. Then, strontium would be removed from the transuranic extraction effluent stream via the strontium extraction process. The cesium and strontium would be combined to produce a HLW fraction that would be vitrified into borosilicate glass. The transuranic fraction would be treated to produce a solid waste, and the low-level fraction would be grouted to form low-level waste Class A type grout.

The Transuranic Separations/Class A Type Grout Option was eliminated after comparison to the Transuranic Separations Option described earlier in Section 3.1.3.3. The Transuranic Separations (Class C Type Grout) Option process would create only two primary waste streams: (1) solidified transuranic fraction for disposal at the Waste Isolation Pilot Plant and (2) a low-level waste fraction to form Class C type grout for onsite disposal. The Transuranic Separations/Class A Type Grout Option would involve more separations steps than the Transuranic Separations (Class C Type Grout) Option and would require a higher capacity Waste Separations Facility. Also, the Transuranic Separations/Class A Type Grout Option would require a separate HLW Treatment (Vitrification) Facility and a HLW Interim Storage Facility that have an estimated total cost substantially greater than the Transuranic Separations (Class C Type Grout) Option.

Thus, the Transuranic Separations (Class ***A*** Type Grout) Option is similar, has ***more*** complex separations processing, and is ***more*** costly than the Transuranic Separations/Class ***C*** Type Grout Option. Moreover, the environmental impacts of this option are expected to be bounded by the remaining two options under the Separations Alternative. For these reasons, the Transuranic Separations/Class A Type Grout Option was eliminated from ***detailed analysis*** in this EIS.

3.3.2 NON-SEPARATIONS/ VITRIFIED WASTE OPTION

In the Vitrified Waste Option under the Non-Separations Alternative, ***the New Waste Calcining Facility would be upgraded to comply with the Maximum Achievable Control Technology emission requirements, and*** all the mixed transuranic waste/SBW in the Tank Farm

would be calcined. The calcine stored in the bin sets would be retrieved and vitrified in a Vitrification Facility to form a HLW borosilicate glass. The molten glass would be poured into canisters similar to those used by the Defense Waste Processing Facility at the Savannah River Site. These glass canisters would be stored at INEEL pending shipment to a geologic repository.

The facilities that would be constructed under the Vitrified Waste Option include a ***New Waste Calcining Facility upgrade to meet Maximum Achievable Control Technology requirements,*** Calcine Retrieval, High-Activity Waste Vitrification Plant (larger scale than for the Full Separations Option), HLW Interim Storage, and a New Analytical Laboratory.

The Early Vitrification Option described in Section 3.1.4.3 would be similar to the Vitrified Waste Option, except the Vitrified Waste Option requires calcination of the liquid mixed transuranic waste/SBW prior to its vitrification. Thus, in the Vitrified Waste Option, the additional calcine produced from mixed transuranic waste/SBW would be combined with the HLW calcine and then vitrified to produce a large number of canisters (14,000 canisters versus 11,700 canisters under the Early Vitrification Option) for disposal at a geologic repository. In the Early Vitrification Option the mixed transuranic waste/SBW would be vitrified directly without calcining to produce a transuranic waste product suitable for disposal at the Waste Isolation Pilot Plant.

In summary, the Vitrified Waste Option would not retain the beneficial segregation of the mixed transuranic waste/SBW that would be achieved by the Early Vitrification Option. This nonsegregation would result in a larger quantity of vitrified HLW being shipped to a geologic repository for disposal. The Vitrified Waste Option would also require greater facility costs for calcining the liquid mixed transuranic waste/SBW with the Maximum Achievable Control Technology upgrades to the New Waste Calcining Facility. Therefore, this option offers no advantages over the Early Vitrification Option that otherwise contains the same treatment concepts. For these reasons, the Vitrified Waste Option was eliminated from ***detailed analysis*** in this EIS.

3.3.3 NON-SEPARATIONS/ CEMENT-CERAMIC WASTE OPTION

The Cement-Ceramic Waste Option under the Non-Separations Alternative is similar to the Direct Cement Option except the liquid mixed transuranic waste/SBW would not be calcined directly but would be mixed with the existing-mixed HLW calcine to form a slurry. In this option, all calcine would be retrieved and combined with the mixed transuranic waste/SBW. The combined slurry would be calcined in the New Waste Calcining Facility with the resulting calcine mixed into a concrete-like material. The concrete waste product would then be poured into drums, autoclaved (cured in a pressurized oven), and placed in an interim storage facility awaiting shipment to a geologic repository ***or a greater confinement disposal facility***. An estimated 16,000 concrete canisters would be produced. This option would require a major modification to the New Waste Calcining Facility to allow slurry calcination and the upgrade for compliance with the Maximum Achievable Control Technology rule, and a Grout Facility with autoclave. The final product (concrete or ceramic) would require an equivalency determination by EPA.

The rationale for initially considering the Cement-Ceramic Waste Option in the EIS was the anticipated potential for significant cost savings in using a greater confinement disposal facility (such as that at the Nevada Test Site) as the final repository for the resulting product. A basis for this assumption was that the cementitious waste form of the Cement-Ceramic Waste Option and the alluvial soil at the greater confinement facility would be chemically compatible, and the cement waste form would be the least likely to migrate in the surrounding soil. However, a greater confinement facility for HLW disposal has not been studied, approved, or constructed. In addition, if INEEL were the only site disposing HLW at a greater confinement disposal facility, the INEEL could potentially bear all costs associated with the development of the repository (e.g., site characterization and performance assessments associated with U.S. Nuclear Regulatory Commission licensing and EPA certification of compliance). Therefore, it is unlikely that significant cost savings at a greater

confinement facility (assuming it could be licensed) could be realized over a geologic repository, where INEEL would expect to pay only a prorated share of the development and operational costs based on its share of the waste disposed of.

Even if the Cement-Ceramic Waste Option had a high potential to reduce life cycle costs, the Direct Cement Waste Option has lower technical risk which eliminates the need to include the Cement-Ceramic Waste Option. The Cement-Ceramic Waste Option is based on calcination of liquid mixed transuranic waste/SBW and calcine slurry in the New Waste Calcining Facility, which is currently configured to process a liquid feed. Reconfiguring the New Waste Calcining Facility to process a liquid mixed transuranic waste/SBW and calcine slurry would present a potentially costly technical challenge. No prior research and development work has been conducted to verify the feasibility of such an operation. Thus, a significant technical risk would remain for this process. For these reasons the Cement-Ceramic Waste Option was eliminated from ***detailed analysis*** in this EIS.

3.3.4 DISPOSAL OF LOW-LEVEL WASTE CLASS A OR CLASS C TYPE GROUT AT THE HANFORD SITE

Each of the options under the Separations Alternative would produce a low-level waste grout. DOE initially considered the Hanford site a representative location for disposal of this grout at a non-INEEL DOE site. However, previous evaluations of low-level waste grout disposal at Hanford indicate the long-term (beyond 1,000 years) impacts of low-level waste grout disposal could exceed regulatory standards for groundwater protection (WHC 1993). Hanford's current HLW management strategy (62 FR 8693; February 26, 1997) calls for vitrifying the low-level waste fraction prior to onsite disposal. It is unlikely Hanford would be able to accept grouted INEEL low-level waste for disposal. Therefore, disposal of low-level waste grout at the Hanford Site was eliminated from ***detailed analysis*** in this EIS.

3.3.5 VITRIFICATION AT THE WEST VALLEY DEMONSTRATION PROJECT OR THE SAVANNAH RIVER SITE

As previously described, DOE is evaluating transportation of HLW (calcine or separated HLW fraction) to DOE's Hanford Site for vitrification, with the borosilicate glass product being shipped back to INEEL for interim storage pending shipment to a geologic repository. DOE also considered shipment of the stabilized HLW to the West Valley Demonstration Project in New York or the Savannah River Site in South Carolina for vitrification. However, the West Valley Demonstration Project Vitrification Facility is not a candidate for treatment of INEEL HLW since the facility will be shut down according to Public Law 96-368 (1980) and DOE plans to cease ***vitrification*** operations at West Valley ***in 2002 (Sullivan 2002)***. Therefore, the West Valley facilities would not be available at the time when the INEEL HLW was ready for processing (Murphy and Krivanek 1998).

Earlier studies concluded that chemical incompatibilities with the Savannah River Site melter would exist because of the presence of fluorides (in calcine) or phosphate (in separated HLW fraction). Significant life cycle costs would be incurred to replace equipment that was beyond design basis life or constructed of materials that were incompatible with INEEL HLW.

Therefore, shipment of HLW to the West Valley Site or the Savannah River Site for vitrification was eliminated from ***detailed analysis*** in the EIS.

3.3.6 SHIPMENT OF MIXED TRANSURANIC WASTE (SBW/NEWLY GENERATED LIQUID WASTE) TO THE HANFORD SITE FOR TREATMENT

In this option, the existing mixed transuranic waste/SBW would be pumped from the INTEC Tank Farm to new permitted tank storage. Mixed transuranic waste (newly generated liquid wastes), after being concentrated, would be

stored in the new storage tanks with the existing mixed transuranic waste/SBW. The waste would remain in the new storage tanks until being sent to a new packaging facility where it would be solidified by absorption on a 90 percent silica matrix and placed into shipping containers. There would be a short period of onsite storage until enough containers accumulated to ship to the Hanford Site for treatment. DOE has evaluated several methods for processing the mixed transuranic waste (SBW/newly generated liquid waste) at Hanford: direct vitrification, chemical dissolution followed by separations, and mechanical separation of solid and liquid material. DOE has eliminated all of these methods from ***detailed*** analysis in this EIS for the reasons listed below.

Direct vitrification of the mixed transuranic waste (SBW/newly generated liquid waste) at Hanford poses several technical uncertainties that would need to be overcome before it could be implemented. First, the mixed transuranic waste ***would be*** acidic under the absorbed scenario, while the Hanford facilities are presently being designed and permitted for alkaline materials. Thus, this waste stream would be the only acid waste stream proposed for processing in the Hanford facilities***, which*** would require ***process*** modifications. Second, modifications to the off-gas systems at the Hanford HLW vitrification facility would be required to address higher concentrations of contaminants such as mercury and higher ***levels*** of nitrogen oxides associated with the mixed transuranic waste (SBW/newly generated liquid waste). Finally, direct vitrification of the mixed transuranic waste would result in the generation of approximately 1,500 Hanford HLW canisters, which would have an estimated disposal cost of $650 million [based on DOE (1996b)]. DOE has included for evaluation in this EIS several other methods for treatment of the mixed transuranic waste that do not result in this large disposal cost (e.g., treatment by cesium ion-exchange and grouting under the Minimum INEEL Processing Alternative).

DOE does not consider chemical dissolution of the solidified mixed transuranic waste (SBW/newly generated liquid waste) followed by separations to be a viable option because the only known dissolution agent for the absorbent material is highly concentrated hydrofluoric acid (Jacobs 1998). DOE's past experience with hydrofluoric acid dissolution processes has demonstrated it to be complex and to present health and safety risks (Jacobs 1998).

DOE does not consider mechanical separation of solid and liquid material to be a viable option. While the majority of liquid could be removed through a vacuum-extraction process, DOE's past experience in removing materials from natural or geologic matrices (e.g., soil washing studies, soil partitioning studies) indicates it would be difficult to remove enough of the transuranic material (bound with covalent bonds or trapped in pore spaces) to dispose of the absorbent as low-level waste.

For these reasons, the option of shipment of mixed transuranic waste (SBW/newly generated liquid waste) to the Hanford Site for treatment was eliminated from ***detailed analysis*** in this EIS.

3.3.7 TREATMENT OF MIXED TRANSURANIC WASTE/SBW AT THE ADVANCED MIXED WASTE TREATMENT PROJECT

In this option the mixed transuranic waste/SBW would be shipped to the INEEL ***British Nuclear Fuels Limited*** Advanced Mixed Waste Treatment Project for treatment, with the resulting waste form then being shipped to the Waste Isolation Pilot Plant for disposal. The Advanced Mixed Waste Treatment Project could treat up to 120,000 cubic meters of alpha-contaminated and transuranic wastes from INEEL or other DOE sites. The Advanced Mixed Waste Treatment Project employs multiple treatment technologies (including supercompaction, macroencapsulation, and microencapsulation) to produce final waste forms that ***can*** be certified for disposal at the Waste Isolation Pilot Plant.

The Advanced Mixed Waste Treatment Project treatment units can accommodate contact handled wastes only. As currently designed, all wastes destined for thermal treatment at the Advanced Mixed Waste Treatment Project would be required to be in a dry solid form, as the facility is not configured to process liquid wastes. The mixed transuranic waste/SBW is a liquid. Thus, the mixed transuranic waste/SBW would require pre-treatment (i.e., cesium ion

exchange) before shipment to the Advanced Mixed Waste Treatment Project.

Several modifications to the Advanced Mixed Waste Treatment Project to process liquids would be required. These modifications include liquid waste storage and feed systems and additional control systems. Modifications to accept mixed transuranic waste/SBW could disrupt the ongoing Advanced Mixed Waste Treatment Project design and permitting activities, jeopardizing compliance with the Settlement Agreement/Consent Order and increasing costs. In addition, because of the highly acidic nature of the mixed transuranic waste/SBW, modifications to the Advanced Mixed Waste Treatment Project offgas system to remove the additional nitrogen oxides would be necessary.

This EIS contains an alternative (Minimum INEEL Processing) that processes the mixed transuranic waste/SBW into a waste form suitable for disposal at the Waste Isolation Pilot Plant. Using this non-thermal technology would allow the mixed transuranic waste/SBW to be placed into a final form acceptable for disposal using fewer pretreatment or treatment steps and generating less secondary waste than treatment at the Advanced Mixed Waste Treatment Project. Therefore, use of the Advanced Mixed Waste Treatment Project does not fulfill a regulatory or operational need that is not otherwise met by other options evaluated in this EIS.

For these reasons, the option of treatment of mixed transuranic waste/SBW at the Advanced Mixed Waste Treatment Project was eliminated from ***detailed analysis*** in this EIS.

3.3.8 GROUT-IN-PLACE

This alternative would grout the mixed transuranic waste/SBW in the tanks and the calcine in the bin sets. For the mixed transuranic waste/SBW, the grout/waste mixture would be entombed directly in the tanks. The calcine would either be mixed with grout and entombed in the bin sets, or the vaults surrounding the bin sets could be filled with clean grout. This alternative was eliminated from detailed analysis for the following reasons:

- ***Tests on simulated acidic waste (i.e., a nonradioactive equivalent to mixed transuranic waste/SBW) revealed that attempting to transform the waste into a stable in situ solid form in the tanks could result in waste stratification and precipitation. Although it may be possible to stabilize the waste by adding a grout mixture directly to the tanks without exceeding their capacity (assuming a 30 percent waste loading and tanks completely filled), there are technical uncertainties related to the solidification of such a large volume of waste in this manner. Therefore, no credit could be taken for the performance of this method of grouting as a means to meet disposal requirements. As a result, it was determined that it would be necessary to remove the mixed transuranic waste/SBW from the tanks and treat it in a new remote handled grouting facility to neutralize and stabilize the waste to avoid stratification and precipitation. The resultant waste and grout slurry could then be placed into the tanks. For the calcine, there is not enough capacity in the bin sets to grout the calcine in place. If the calcine were encased in clean grout around the bin sets, the potential long-term impacts would be similar to the Continued Current Operations and No Action Alternatives. For long-term impact analysis (Section 5.3.5.2 of this EIS), DOE assumed that any structure was vulnerable to degradation failure after 500 years in accordance with the Nuclear Regulatory Commission position for long-term storage facilities (NRC 1994).***
- ***Although NEPA requirements allow agencies to consider alternatives that may not be consistent with applicable laws, regulations, and enforceable agreements, DOE does not regard disposal of all the mixed transuranic waste/SBW in the tanks or calcine in the bin sets to be reasonable, primarily because it would not meet RCRA regulatory disposal requirements for mixed waste at the INEEL.***

3.3.9 OTHER TECHNOLOGIES EVALUATED

New technologies and variations of previously studied treatment options were suggested by the public, the National Academy of Sciences, and subject matter experts. These options were evaluated and eventually eliminated from further detailed analysis. Section B.8.3 of Appendix B includes a summary of these technologies and variations, and discusses why they were eliminated from detailed analysis. In addition, operating the calciner in its present interim status configuration was evaluated and eliminated from detailed analysis in the Final EIS. Based on programmatic considerations, DOE has determined that operating the calciner in its current configuration is not a reasonable alternative.

3.4 Preferred Alternatives

When the Draft EIS was published, DOE and the State of Idaho, as a cooperating agency, had not selected a preferred alternative. Subsequently, DOE and the State of Idaho have selected their Preferred Alternatives for this EIS. The process used to select the Preferred Alternatives is described in Appendix B.

3.4.1 WASTE PROCESSING

The State of Idaho's preferred waste processing alternative - The State of Idaho's Preferred Alternative for waste processing is the Direct Vitrification Alternative described in Section 3.1.6. This alternative includes vitrification of mixed transuranic waste/SBW and vitrification of the HLW calcine with or without separations.

Under the option to vitrify the mixed transuranic waste/SBW and calcine without separations, the mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository.

The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected if separations were shown to be technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and chemically separated into a HLW fraction and transuranic or low-level waste fractions, depending on the characteristics of the waste fractions. The HLW fraction would be vitrified. The vitrified product from both the SBW and HLW fraction would be stored at INTEC pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility outside of Idaho.

In addition, under the Direct Vitrification Alternative, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW, or DOE could construct a separate treatment facility for newly generated liquid waste.

DOE's preferred waste processing alternative - DOE's preferred waste processing alternative is to implement the proposed action by selecting from among the action alternatives, options and technologies analyzed in this EIS. Table 3-1 identifies DOE's preferred options, and also identifies options contained within the action alternatives that DOE does not prefer. Options not included in DOE's Preferred Alternative are, storage of calcine in the bin sets for an indefinite period under the Continued Current Operations Alternative, the shipment of calcine to the Hanford Site for treatment under the Minimum INEEL Processing Alternative, and disposal of mixed low-level waste on the INEEL under any alternative. The selection of any one of, or combination of, technologies or options used to implement the proposed action would be based on performance criteria that include risk, cost, time and compliance factors. The selection may also be based on the results of laboratory and demonstration scale evaluations and comparisons using actual wastes in proof of process tests. The elements of the proposed action and how they would be addressed under Preferred Alternative are identified below.