

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

The U.S. Department of Energy (DOE) proposes to select a salt processing technology and to design, construct, and operate the facilities required to process high-level waste (HLW) salt. The new technology must be compatible with existing facilities and processes for HLW storage and vitrification and for disposal of low-level waste at the Savannah River Site (SRS).

2.2 Inventory and Schedule for Processing of High-Level Waste Salt

DOE stores HLW in 49 tanks in the F-Area (20 tanks) and H-Area (29 tanks) Tank Farms. These tanks contain a total of approximately 34 million gallons of liquid waste with a radioactivity content of approximately 480 million curies. The HLW consists of a sludge component (2.8 million gallons) containing approximately 320 million curies and a salt component (31.2 million gallons) containing approximately 160 million curies. Approximately 158 million of the 160 million curies is cesium-137. The salt component includes a solid phase known as saltcake (15.2 million gallons) and the salt supernatant (16 million gallons). Waste volumes and curie content are subject to change because the supernatant is evaporated to reduce its volume, and sludge is being removed for processing and vitrification.

DOE has developed a program for disposal of the wastes currently stored in the waste tanks. In this program, HLW sludge is being converted to a glass waste form by vitrification in the Defense Waste Processing Facility (DWPF). DWPF has already processed approximately 30 million curies of the original 320 million curies of the sludge component. The glass waste, in stainless

steel canisters, is being stored onsite, pending shipment to a geologic repository for disposal. Processing the salt components of the wastes (saltcake and salt supernatant) for vitrification and disposal requires (1) dissolving the saltcake and combining it with the supernatant to form a salt solution and (2) separating the low-volume high-radioactivity fraction of the salt waste for incorporation, along with the sludge, into the glass waste form, leaving a high-volume low-radioactivity waste stream suitable for onsite disposal (see Figure 2-1).

Planning bases for the HLW disposal operations are presented in the periodically updated *High-Level Waste System Plan*. The latest version of the System Plan, Rev. 11, (WSRC 2000a) projects as a programmatic target case an average annual output of 200 HLW canisters for Fiscal Years (FY) 2001-2010 and 225 canisters annually for FY 2011 to program completion (FY 2023). This schedule for vitrifying HLW is critical to fulfilling planned HLW operations. Maintaining the waste removal schedule as described in the System Plan is necessary to meet mandates for removing the tanks from service.

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Milestones for Salt Processing Alternatives

These milestones serve as the target basis for preconceptual design of the alternatives, and are subject to change.

Salt processing facility operations initiated	FY 2010
Waste removed from non-compliant tanks (1-24) ^a	FY 2016
Salt and sludge processing operations completed	FY 2023

Source: (WSRC 2000a).

a. Non-compliant tanks have inadequate secondary containment and leak detection capabilities as defined by the Federal Facilities Agreement (FFA). Closure of these tanks is mandated by the year 2022.

Radionuclides in HLW Salts

Antimony (Sb)

Sb-125 (half-life 2.7 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Carbon (C)

C-14 (half-life 5,700 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Cesium (Cs)

Cs-137 (half-life 30 years), Cs-135 (half-life 2.3 million years), and Cs-134 (half-life 2 years) are the principal radioactive isotopes of this element present in the HLW tanks at SRS.

Iodine (I)

I-129 (half-life 16 million years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Plutonium (Pu)

Pu-238 (half-life 88 years) and Pu-239 (half-life 24,000 years) are the principal radioactive isotopes of this element present in the HLW tanks at SRS.

Ruthenium (Ru)

Ru-106 (half-life 372 days) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Selenium (Se)

Se-79 (half-life 65,000 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Strontium (Sr)

Sr-90 (half-life 29 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Technetium (Tc)

Tc-99 (half-life 200,000 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Tin (Sn)

Sn-126 (half-life 100,000 years) is the principal radioactive isotope of this element present in the HLW tanks at SRS.

Tritium (H-3)

In the HLW tanks at SRS, tritium is contained in water molecules, where it replaces one of the normal hydrogen atoms. H-3 has a half-life of 12.5 years.

Uranium (U)

U-235 (half-life 700 million years) and U-238 (half-life 4 billion years) are the principal radioactive isotopes of this element present in the HLW tanks at SRS.

2.3 No Action Alternative

Under the No Action alternative, DOE would continue current HLW management activities, including tank space management and tank closure, without a process for sepa-

rating the high-activity and low-activity salt fractions. DWPF would vitrify only sludge from the HLW tanks. Saltcake and salt supernatant would be stored in the HLW tanks and monitoring activities would continue. Tank space would continue to be managed to ensure ade-

quate space to meet safety requirements and closure commitments. Current tank space management projections indicate that, after 2010, additional tank space would be needed to support continued operations (WSRC 1999a) and meet tank closure commitments under the No Action alternative.

DOE recognizes, however, that without a salt processing technology in place, current HLW storage operations cannot continue indefinitely. DWPF operations result in large volumes of waste, mostly water, that is returned to the HLW tanks. DOE uses evaporators to substantially reduce this volume but, until a salt processing alternative is on-line, DWPF operation will increase rather than decrease the volume of HLW that must be stored in the tanks.

To maintain tank space until about 2010, tank space management under the No Action alternative would include the following activities intended to enhance storage capacity in the HLW tanks (WSRC 2000a):

- Continue to evaporate water from liquid waste in the tanks
- Convert In-Tank Precipitation (ITP) processing tanks 49 and 50 to HLW storage
- Reduce the DWPF low-level liquid waste stream sent to the Tank Farms
- Implement several activities to gain small incremental storage volumes (e.g., optimize washwater use at Extended Sludge Processing)
- As 2010 approaches, reduce the available emergency space in the Tank Farms (presently 2,600,000 gallons) while maintaining the minimum emergency space required by the Authorization Basis for safe operation (1,300,000 gallons).

As soon as DOE were to determine that a salt processing facility would not be avail-

able by 2010, decisions about additional tank space would have to be made. The course of action that DOE would follow cannot be predicted at this time, but available options may include the following, either individually or in combination.

1. Identify additional ways to optimize tank farm operations
2. Reuse tanks scheduled to be closed by 2019
3. Build tanks permitted under wastewater treatment regulations
4. Build tanks permitted under RCRA regulations
5. Suspend operations at DWPF

The following sections qualitatively describe the actions that DOE could take, either individually or in combination, under the No Action alternative. Attempts at quantification are very preliminary and are offered in Chapter 4 only for purposes of comparison among these potential options. Should DOE need to implement the No Action alternative, the specific actions, costs, and quantities (e.g., number of tanks required) would then be determined.

2.3.1 IDENTIFY ADDITIONAL WAYS TO OPTIMIZE TANK FARM OPERATIONS

On February 26, 1999, the HLW Salt Processing Program Manager chartered a HLW Tank Space Management Team (SM Team) to identify potential ways to maximize available tank space. Detailed study by experienced engineers and scientists led to a list of 24 ideas, each of which was capable of increasing available tank space by more than 900,000 gallons. Based on this study, the SM Team recommended a strategy to ensure sufficient storage capacity through 2009 (WSRC 1999a). The strategy included optimizing tank farm operations, bypassing the tank farms by pretreating DWPF wastewater to meet the waste acceptance criteria for the Effluent Treatment Facility or Z-Area Saltstone Manufacturing and Disposal Facility, reducing DWPF

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production to reduce the amount of wastewater generated, installing evaporators at DWPF, reducing sludge washing, and using tanks outside the Tank Farms, such as in the reactor areas and offsite.

To optimize tank farm operations, DOE would need to divert funds that otherwise could support the development of the salt processing alternative. Managing leaks from the aging tanks and cleaning up resulting contamination would require additional funds. Although SRS would find it difficult to meet regulatory commitments, using some of the tank farm management strategies would enable DWPF operations to continue for some time beyond 2010.

2.3.2 REUSE TANKS SCHEDULED TO BE CLOSED BY 2019

This potential action would continue to use Tanks 4 through 8, which were built in 1953 and are to be closed by 2019. Utilization of these tanks would provide only an interim solution for management of newly generated HLW (and wastewater from DWPF) and, because of the age of the tanks, would increase the surveillance necessary to ensure safe and environmentally satisfactory performance of these tanks. Although the use of these tanks would provide 3.75 million gallons of HLW storage (more than 4 years of inflow), this option requires the use of the older tanks, increasing risks and delaying closure of the tanks.

Implementing this option would compromise major mission goals of safety and regulatory commitment.

2.3.3 BUILD TANKS PERMITTED UNDER WASTEWATER TREATMENT REGULATIONS

About 340,000 of the 800,000-gallons-per-year tank space requirement is required to store DWPF wastewater. DWPF wastewater could be safely stored in new tanks with designs similar to those of the older (Type I) HLW tanks. These tanks have 5-foot-high

secondary annulus “pans” and active cooling, but do not have the full-height secondary containment tank design used in the newest tanks (Type III). Such tanks would not be used for storage of newly generated HLW. The net capacity of each wastewater storage tank would be about 800,000 gallons. Based on scheduled completion of sludge-only processing in 2023, about six tanks would be needed to hold the DWPF wastewater. The tanks would be built in a previously disturbed area near existing waste transfer lines. DOE has estimated that about 4 years would be required to design, permit under wastewater treatment regulations, and construct six wastewater treatment tanks. This activity would be initiated about 2006. Nearly all of the resources evaluated in Section 4.1 of this SEIS would be impacted by this option. Implementing this option also would delay the regulatory commitments for tank closure and stabilization of HLW. It would increase Site restoration requirements. Further, this option could accommodate less than half (460,000) of the 800,000-gallons-per-year requirement. South Carolina Department of Health and Environmental Control (SCDHEC) would be actively involved in the design and permitting processes.

2.3.4 BUILD TANKS PERMITTED UNDER RCRA REGULATIONS

Resource Conservation and Recovery Act (RCRA)-permitted tanks require double liners, leachate collection systems, and other characteristics designed to ensure tank integrity. The Type III tanks in the F- and H-Area Tank Farms are RCRA-compliant. They were constructed between 1969 and 1978. They have a full-height secondary tank, active cooling systems, and are above the water table. Each of these tanks has a net usable storage capacity of about 1,000,000 gallons. To accommodate newly generated HLW and the waste that would be generated at DWPF, approximately 10 new tanks would be required. They could be located in a previously disturbed area in or near the F- and H-Area Tank Farms (associated land use impacts are presented in Chapter 4, Section 4.1). SCDHEC would be actively involved in the design, permitting and construction of any new tanks.

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As with the wastewater-permitted tanks, nearly all of the resources evaluated in Section 4.1 would be impacted by implementation of this option. This option would compromise regulatory commitments for stabilization of HLW. This option would not provide a permanent solution for management of newly generated HLW and wastewater from DWPF.

2.3.5 SUSPEND OPERATIONS AT DWPF

In the event that a salt processing technology is not available by the year 2010, DOE could suspend operation of DWPF. This would not jeopardize the environment or human health. However, if the suspension of operations at this facility was not temporary, it could result in a workforce reduction, which could have a substantial negative impact on the communities surrounding SRS. This option would seriously delay processing HLW in DWPF for eventual disposal in a geologic repository. In addition, DOE would eventually have to commit a large sum of money to restart these facilities to resume operations necessary to stabilize HLW. Finally, suspending operations could result in loss of technical expertise (core competency) and, depending on the length of time the facilities are shutdown, the ability to recapture these core competencies would diminish.

2.4 Selection of Salt Processing Technologies for Evaluation as Alternatives

A comprehensive program conducted by Westinghouse Savannah River Company (WSRC) to identify, evaluate, and recommend alternative technologies for conversion of HLW salt to acceptable final waste forms resulted in the selection of the following four options for additional development.

- Small Tank Tetraphenylborate Precipitation (Small Tank Precipitation)

- Crystalline Silicotitanate (non-elutable) Ion Exchange (Ion Exchange)
- Caustic Side Solvent Extraction (Solvent Extraction)
- Direct Disposal (of cesium) in Grout (Direct Disposal in Grout).

Following review by a WSRC Review Panel Team, WSRC recommended to DOE the Small Tank Precipitation process as the most reasonable replacement salt processing technology and the Ion Exchange technology as a backup (WSRC 1998a).

A DOE Savannah River (SR) Review Team evaluated the WSRC recommendation and concluded that the remaining technical uncertainties for both alternatives were too significant to justify selection of a preferred technology. The DOE-SR Review Team recommended that additional research and development be conducted to address the key technical uncertainties associated with the two technologies, so that one could be identified as the most reasonable. A DOE-Headquarters Independent Review Team concluded that both the Small Tank Precipitation and the Ion Exchange technologies were feasible, and recommended that further research and technology development be pursued (DOE 1998). Advances in the technology for Solvent Extraction were also noted by DOE and, coupled with recommendations from the National Academy of Sciences (NAS 1999), led to DOE's reconsideration of the potential for developing and implementing this technology in time to support waste processing needs.

DOE also considered the Direct Disposal in Grout alternative, based on demonstrated technology, safety, operational feasibility, and potential to reduce construction and operating costs.

2.5 Salt Processing Facility Site Identification

WSRC prepared a site selection study to identify a suitable location at the SRS for the construction and operation of a salt processing facility in

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S or H Areas (WSRC 2000b). The study sought to optimize siting for engineering requirements, sensitive environmental resources, and applicable regulatory requirements. The goal of the study was to evaluate alternative siting options for site building and support facilities for either the Small Tank Precipitation technology, the Ion Exchange technology, or the Solvent Extraction technology.

Siting of the salt processing facility would be constrained by an operational requirement that it be located near the HLW processing facilities (in F, H, and S Areas, see Figure 2-2). In order to transfer the solids slurry at the proper solids concentration from the salt processing facility to the DWPF, the salt processing facility would have to be located within 2,000 feet of the DWPF or an auxiliary pumping facility. This constraint identified general areas suitable for construction and operation. Thirteen areas with sufficient acreage for the buildings, construction laydown, and support facilities were identified. Subsequent evaluation of these areas resulted in the identification of four candidate sites (A [subsequently excluded because of its potential to interfere with the expansion of an existing facility and the possible intrusion into a known waste unit], B, C, and D) in S Area (Figure 2-2). A comparative analysis of the sites provided a suitability rating, based on geologic, ecologic, human health, and engineering considerations. No notable differences were identified between the four sites on geologic, ecologic, or human health grounds. Therefore, because there were no notable differences and Site B was representative of the four candidate sites, DOE assumed for purposes of analysis and comparison that facilities for the Small Tank Precipitation, the Ion Exchange, or the Solvent Extraction technologies would be located at Site B in S Area. Floor plans of the facilities for alternatives that would be located in Site B are presented in Appendix A, Figures A-10, A-12, and A-14.

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The Direct Disposal in Grout technology was not considered in the siting study because the grout manufacturing facility would be located in Z Area, near the saltstone vaults and existing infrastructure that could support the grout production operation (Figure 2-3).

2.6 Salt Processing Alternatives

This SEIS describes and assesses the potential environmental impacts of the construction and operation of four alternatives for HLW salt processing to replace the ITP process. Each of the alternatives could accomplish the purpose and need for action described in Section 1.2, in contrast to the No Action alternative (Section 2.3), which does not include a method for salt processing.

The alternatives, as described below and detailed in Appendix A, are based on preconceptual designs (WSRC 1998b). As conceptual designs are developed, the components of the process could be modified to optimize the efficiency, safety, environmental protection, and economics of the process. For example, DOE may need to increase the capacity of process or storage vessels to ensure continuous operation of the salt processing facility, which would receive batch input from the Tank Farms and transfer its clarified waste stream and HLW products, respectively, to batch operations in the Saltstone Manufacturing and Disposal Facility and DWPF. DOE will consider whether any modification that develops during conceptual or final design requires further environmental review under the National Environmental Policy Act (NEPA).

DOE, with the help of independent experts, has performed research on each of the four process alternatives to establish the technological risk(s) involved in implementing each one. The results of the research were reviewed by independent scientists (DOE 1998). DOE has also evaluated the life-cycle cost and schedule for construction and operation for each alternative (WSRC 1998c). This Supplemental Environmental Impact Statement (SEIS) assesses the potential en-

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vironmental impacts of each alternative, which are evaluated in Chapter 4 and compared in Section 2.9.

DOE would conduct pilot scale testing of the alternative selected in a Record of Decision (ROD) before implementing the selected alternative. The Pilot Plant facility proposed for use in the testing is described in Section 2.7.6 and in Appendix A. Environmental impacts of the Pilot Plant are discussed in Chapter 4.

The following sections briefly describe each salt processing alternative, its products and waste streams, and the facilities in which the process would operate. A comparison of the process stages for the salt processing alternatives is presented in Table 2-1.

Common features of all processes include initial separation of low-concentration soluble radioactive strontium and actinides (including plutonium) by **sorption** (bolded terms are found in Table 2-2 and Table 1-1) on granular solid monosodium titanate (MST), followed by filtration. Essential differences in the alternatives are represented by technologies for removal of the relatively high concentrations of radioactive cesium, except for the Direct Disposal in Grout alternative in which cesium is not removed.

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The final waste forms are similar for each alternative (except Direct Disposal in Grout) with the high-activity salt fraction extracted from the salt and incorporated into the DWPF glass waste form for eventual repository disposal, and the low-activity salt fraction immobilized as saltstone for onsite disposal. In the Direct Disposal in Grout alternative strontium and actinides are removed from one salt solution and vitrified for eventual repository disposal, but the cesium remains in the fraction immobilized as saltstone for onsite disposal. Greater detail is provided in Appendix A, Technology Descriptions.

DOE believes that it would be able to demonstrate that the low-activity salt fraction processed under any action alternative could appropriately be managed as low-level waste (LLW) under the waste incidental to reprocessing criteria of DOE Manual 435.1-1. The Manual identifies procedures for implementing DOE Order 435.1, Radioactive Waste Management, which provides a process for determining if a waste stream is waste incidental to reprocessing. The waste incidental to reprocessing determination process is described in detail in Chapter 7.

DOE has continued to perform research on each of three cesium-removal technology alternatives (PNNL 2001). Independent scientists and subject matter experts have reviewed the results of the research and assessed the potential impacts associated with each of the identified risks (WSRC 2001). These impacts were considered in the evaluation of life cycle costs and schedules for the design, construction, and operation of each alternative. In addition to, and in consideration of this research, analysis, and independent review, DOE conducted a final management review (DOE 2001) that comparatively evaluated each of the action alternatives against a list of criteria that included cost, schedule, technical maturity, technology implementability, environmental impacts, facility interfaces, process simplicity, process flexibility, and safety. On the basis of this final review, DOE has identified the solvent extraction technology as the preferred alternative.

Solvent Extraction was selected as the preferred salt processing alternative primarily because it presents the least technical risk for successfully removing cesium from radioactive waste. Although Solvent Extraction uses a complex four-component solvent system, laboratory testing has clearly shown that component concentration and process flow can be maintained to effectively remove cesium from the wastes. Other key strengths identified for the Solvent Extraction technology include: (1) maturity of and experience within the DOE Complex for processing nuclear material; (2) simplicity with which the Solvent Extraction product stream

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Table 2-1. Comparison of salt processing alternatives.

Salt processing alternatives	Process stages			
	Strontium and actinide (Pu) removal from salt solution	Cesium removal from salt solution	Final waste form	
			DWPF glass (HLW)	Saltstone (LLW)
Small Tank Precipitation	MST sorption	TPB Precipitation	MST/TPB solids	Low activity salt solution
Ion Exchange	MST sorption	CST Ion Exchange	MST solids, CST resins	Low activity salt solution
Solvent Extraction	MST sorption	Organic extractant	MST solids, aqueous cesium solution	Low activity salt solution
Direct Disposal in Grout	MST sorption	None	MST solids only	Cesium salt solution

LLW = Low-level waste, MST = Monosodium Titanate, TPB = Tetraphenylborate, CST = Crystalline Silicotitanate, HLW = high-level waste.

TC could be incorporated into the current Defense Waste Processing Facility vitrification process; and (3) the ability to rapidly start up and shut down the Solvent Extraction **centrifugal contactors**. Solvent Extraction is comparable to the other action alternatives with regard to short-term and long-term environmental impacts.

2.6.1 SMALL TANK PRECIPITATION

The Small Tank Precipitation alternative would use tetraphenylborate precipitation, the same chemical reaction as ITP, to remove the radioactive cesium from the HLW salt solution. The process would be conducted as a continuous operation using a small, temperature-controlled reaction vessel to inhibit tetraphenylborate decomposition and benzene generation. The vessel and operating conditions would be designed to minimize benzene emissions and flammability hazards by maintaining an inert gas (nitrogen) atmosphere within the reaction vessel. In contrast, the ITP process used a very large batch waste tank as a reac-

tion vessel with limited temperature control and incomplete nitrogen gas inerting.

Radioactive cesium would be separated from the salt solution by precipitation as an insoluble tetraphenylborate solid. Radioactive strontium and actinides would be removed concurrently by sorption onto a granular solid, monosodium titanate. These solids would be separated from solution and concentrated by filtration, then treated chemically by a **precipitate hydrolysis** process to decompose the tetraphenylborate precipitate and remove the benzene formed. The solids slurry containing the separated radioactive constituents is called **Precipitate Hydrolysis Aqueous (PHA)**. This slurry would be transferred to DWPF for vitrification. The low-activity salt solution would be transferred to the Saltstone Manufacturing and Disposal Facility for disposal as grout in onsite vaults.

Process flows for the Small Tank Precipitation alternative are shown in Figure 2-4.

Small Tank Precipitation Features	
Several important features have been incorporated into the design of the Small Tank Precipitation alternative to avoid the benzene production problems encountered in the original ITP process.	
<u>Small Tank Precipitation</u>	<u>ITP</u>
Continuous, small volume process	Batch process; very large volume
Temperature-controlled process vessels	Limited temperature control
Continuous agitation	Intermittent agitation
Short processing time (hours)	Longer processing time (months)
Pressure-tight process vessels for effective nitrogen gas inerting	Incomplete nitrogen gas inerting

Table 2-2. Primer of technical terms (other scientific terms are defined in the glossary).***Back extraction***

Process for transfer of constituent from organic phase to secondary aqueous phase; used to recover radioactive cesium from organic phase in solvent extraction process.

Cement

A building material made by grinding calcined limestone and clay (silica, lime, and other mineral oxides), to a fine powder, which can be mixed with water and poured to set as a solid mass or used as an ingredient in making mortar or concrete; used as an ingredient in saltstone.

Centrifugal contactor

A device used in Solvent Extraction salt processing alternative to separate cesium from HLW salt solution. Aqueous waste enters a contactor and is mixed with an organic solvent, which extracts the cesium. The two liquids are then separated by centrifugal force in a rapidly rotating inner chamber of the device. Cesium is recovered from the organic phase by back extraction into a secondary aqueous phase in another centrifugal contactor.

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Extractant

A component of the solvent used in the Solvent Extraction process to facilitate the removal of a constituent from aqueous solution, as in the separation of radioactive cesium from HLW salt solution.

Flyash

Fine particulate ash produced by the combustion of a solid fuel, such as coal, and discharged as an airborne emission or recovered as a byproduct for various commercial uses; used as an ingredient in saltstone to limit water infiltration by decreasing porosity.

Hydrolysis

Decomposition of a chemical compound by reaction with water, as in the treatment of a tetraphenylborate precipitate to eliminate benzene.

Nitrate

Any member of a class of compounds derived from nitric acid. Nitrate salts are ionic compounds containing the negative nitrate ion, NO_3^- , and a positive ion, such as sodium (Na) in sodium nitrate (NaNO_3). Sodium nitrate is a major constituent of the salt component in the HLW tanks.

Precipitate Hydrolysis

A chemical process in which tetraphenylborate precipitate is catalytically decomposed to benzene and an aqueous stream of waste constituents to be fed DWPF.

Precipitate Hydrolysis Aqueous

An aqueous slurry stream, produced by the precipitate hydrolysis process, containing radioactive cesium in solution with strontium and actinides sorbed into monosodium titanate for transfer to DWPF.

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Slag

The vitreous material left as a residue by the smelting of metallic ore; used as an ingredient in saltstone.

Solvent

A substance in which another substance is dissolved, forming a solution. It may also refer to the substance, usually a liquid, capable of dissolving another substance.

Solvent Extraction

Process for separation of constituent from aqueous solution by transfer to an immiscible organic phase; used to separate radioactive cesium from HLW salt solution.

Sorption

Assimilation of one substance by a material of a different phase. Adsorption (sorption on a surface) and absorption (sorption into bulk material) are two types of sorption phenomena.

Strip effluent

Aqueous cesium solution resulting from the back extraction of cesium from the organic phase in the Solvent Extraction salt processing alternative.

