Table 4-10. Annual doses from radiological air emissions from salt processing activities presented as 50-year committed effective dose equivalents.

	Maximum dose[a]			
	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout[b]
Maximally exposed offsite individual dose (millirem/year)	0.20	0.049	0.31	0.086
Offsite population dose (person-rem/year)	12.0	2.9	18.1	4.0
Noninvolved worker dose (millirem/year)	3.3	0.8	4.8	1.7
Involved worker dose (millirem/year)	15.7	3.9	22.8	10.1
Onsite population dose (person-rem/year)	4.3	1.1	6.5	2.3

Source: Based on emission values listed in Table 4-7 and Simpkins (1999 and 2000a,b).
a. For all scenarios under the No Action alternative, radiological air emissions would be similar to those from existing HLW Tank Farm operations, and would be represented by slight increases above the baseline. Therefore, under the No Action alternative, doses to all receptors would be minimal.
b. Includes building stack and ground-level vault doses.

alternatives have values that are similar to each other, but lower than the previous alternatives (2.9 and 4.0 person-rem per year, respectively). For all scenarios, the total offsite population dose is low.

Table 4-10 also reports doses to the noninvolved (onsite) worker, the involved worker, and the collective onsite population from the estimated annual radiological emissions. For each case, the highest estimated dose would occur under the Solvent Extraction alternative, with the Small Tank Precipitation alternative having similar results and the Ion Exchange and the Direct Disposal in Grout alternatives having lower doses. The maximum dose to the noninvolved and involved worker would be 4.8 millirem per year and 22.8 millirem per year, respectively, with radioactive cesium emissions contributing about 98 percent of the total dose. The maximum estimated dose to the onsite population would be 6.5 person-rem per year, with 94 percent of this total dose due to radioactive cesium emissions. In all cases these doses are low.

For ongoing tank space management activities and all subsequent scenarios under the No Action alternative, radiological air emissions would be similar to those from existing HLW Tank Farm operations, and would be represented by slight increases above the baseline. Therefore, under the No Action alternative, doses to all receptors would be minimal.

4.1.4 WORKER AND PUBLIC HEALTH

This section discusses potential radiological and nonradiological health effects to SRS workers and the surrounding public from construction and routine operation of the salt processing alternatives; it does not include impacts of potential accidents, which are discussed in Section 4.1.13. DOE based its calculations of health effects from radiological releases to air as doses with the corresponding impacts expressed as latent cancer fatalities (LCFs) to (1) the MEI; (2) the collective population within a 50-mile (80-kilometer) radius around SRS (approximately 620,000 people); (3) the maximally exposed noninvolved worker (i.e., an SRS employee who may work in the vicinity of the salt processing facilities, but is not directly involved with the work); (4) the involved worker; (5) the onsite population of involved workers (i.e., the workers directly involved in salt processing activities); and (6) the population of SRS workers (includes both involved and noninvolved workers). All radiation doses in this SEIS are committed effective dose equivalents. This section presents total impacts for the entire length of time necessary to implement each technology. The annual impacts attributable to each phase were multiplied by the duration of that phase. The impacts from all phases were summed to calculate the total impact for the technology. This discussion characterizes health effects to populations as additional lifetime LCFs likely to occur in the general population around SRS, the population of onsite workers, and the population of workers who would be associated with implementing the alternatives. Health effects to the MEI and the noninvolved and involved worker are characterized by the additional probability of an LCF to the exposed individual.

Nonradiological health effects discussed in this section include effects from nonradiological emissions to air of toxic and criteria pollutants. In addition to radiological and nonradiological health effects, common occupational health impacts are presented in terms of estimated work-related illness and injury events associated with each of the salt processing alternatives. There are no radiological or nonradiological releases to water from any of the action alternatives.

4.1.4.1 Nonradiological Health Effects

The Occupational Health and Industrial Hygiene programs at SRS deal with all aspects of worker health and the workers' relationships with their work environment. The objective of an effective Occupational Health program is to enable employees to work safely and to recognize unsafe work practices or conditions before an accident occurs.

The objective of an Industrial Hygiene program is to evaluate toxic or hazardous chemicals in the work environment and use established procedures and routine monitoring to prevent or minimize employee exposures to these chemicals. Exposure limit values are the basis of most occupational health codes and standards and are used to regulate worker exposure to hazardous chemicals.

OSHA permissible exposure limits (PELs) (29 CFR 1910.1000) are established limits that ensure the safety of the worker population. PELs are time-weighted average concentrations that a facility cannot exceed in any 8-hour work shift of a 40-hour work week. OSHA ceiling limits are concentrations of substances that cannot be exceeded during any part of the workday. Both of these exposure limits refer to airborne concentrations of substances and represent conditions under which nearly all workers could be exposed day after day without adverse health effects. However, because of the wide variation in individual susceptibility, a small percentage of workers could experience discomfort from some substances at concentrations at or below the permissible limits. The OSHA PEL standards for identified pollutants of concern during salt processing activities are listed in Table 3-18.

DOE evaluated the range of chemicals in facility air emissions to which the public and workers would be exposed due to salt processing activities and expects minimal health impacts from nonradiological exposures. Section 4.1.3 discusses onsite and offsite chemical concentrations from air emissions. DOE estimated noninvolved worker impacts and Site boundary concentrations to which a maximally exposed member of the public could be exposed. Site boundary concentrations were compared to the SCDHEC standards for ambient concentrations and DOE concluded that all air emission concentrations would be below the applicable standard. See Section 4.1.3 for comparison of estimated concentrations at the Site boundary with SCDHEC standards.

The noninvolved worker concentrations were compared to OSHA PELs or ceiling limits for protecting worker health, and the comparisons indicated that all criteria pollutant concentrations would be negligible compared to the OSHA standards.

Beryllium is a pollutant of concern for salt processing activities. A naturally occurring metal, beryllium is used primarily in electronic components and cellular network communication systems. It is also used in aerospace and defense applications. Most of the beryllium emissions in the United States are a result of beryllium-copper alloy production and burning of fossil fuels (e.g., coal and oil) to produce electricity. Beryllium is also a constituent of cigarette smoke (ATSDR 1988). The beryllium that would be emitted by the salt processing alternatives is primarily a constituent of the exhaust from the emergency generators (Hunter 2000), which were assumed to operate 250 hours per year for testing. Health concerns from beryllium exposure include excess lifetime cancer risk and chronic beryllium disease (CBD), which can be seriously debilitating and lead to premature death. The maximum excess lifetime cancer risks to the noninvolved worker and to the MEI from exposure to beryllium emissions were estimated to be 7.2×10^{-5} and 2.4×10^{-8}, respectively, based on the EPA's Integrated Risk Information System (IRIS) database (EPA 1998) unit risk factor for beryllium of 2.4×10^{-3} excess cancer risk per microgram per cubic meter. This excess cancer risk from beryllium emissions is the same for all given alternatives.

Exposure to respirable beryllium fumes, dusts, or powder can also cause CBD in individuals who are sensitized (allergic) to beryllium. One to six percent of workers engaged in operations producing or using beryllium and its compounds develop CBD over their lifetimes (National Jewish Medical and Research Center 2001). While some cases of CBD have been reported in individuals with no occupational exposure to beryllium, only one case has been reported since 1973. No cases of CBD have been associated with low atmospheric concentrations of beryllium, such as those observed in the vicinity of SRS (NIOSH 1986). Therefore, DOE believes that the excess CBD risk to workers and the public as a result of salt processing operations would be minimal for all salt processing alternatives.

Benzene is the pollutant of most concern for salt processing activities. The maximum excess lifetime cancer risks to the noninvolved worker and MEI from exposure to benzene emissions were estimated to be 6.6×10^{-3} and 1.7×10^{-5}, respectively, based on the EPA's IRIS database (EPA 1998) unit risk factor for benzene of 8.3×10^{-6} excess cancer risk per microgram per cubic meter. This excess cancer risk from benzene emissions is associated with the Small Tank Precipitation alternative. Because benzene emissions (primarily from the emergency generators) from the other salt processing alternatives are similar and would be much lower than the emissions from the Small Tank Precipitation alternative, they are expected to have considerably lower excess lifetime cancer risks. See Table 4-11 for additional nonradiological pollutant concentrations. Under the No Action alternative, air emissions from ongoing tank space management activities and all subsequent scenarios would be similar to air emissions from the HLW operations included in the SRS baseline. Therefore, incremental health affects would be minimal.

Engineered systems designed for the process facilities and tanks under the No Action alternative would ensure that there would be little possibility of involved workers in the proposed facilities being exposed to anything other than very small concentrations of airborne nonradiological materials that would be similar among all alternatives. Therefore, health effects from exposure to nonradiological material inside the facilities would be minimal for all alternatives.

4.1.4.2 Radiological Health Effects

Radiation can cause a variety of health effects in people. The major effect of environmental and occupational radiation exposures is a delayed cancer fatality, which is called an LCF, because the cancer can take many years to develop and cause death.

Table 4-11. Estimated maximum concentration in milligrams per cubic meter (mg/m^3) of air pollutants to the noninvolved worker from facility air emissions.[a,b]

	Averaging time[c]	OSHA Standard[c]	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Sulfur dioxide	8-hr TWA[d]	13	0.01	0.01	0.01	0.01
Total particulates	8-hr TWA	15	0.02	0.02	0.02	0.01
Particulates <10 microns	8-hr TWA	5	0.02	0.02	0.02	0.01
Carbon monoxide	8-hr TWA	55	0.2	0.2	0.2	0.2
Nitrogen dioxide	Ceiling[e]	9	7.0	7.0	7.0	7.0
Lead	8-hr TWA	0.5	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}
Beryllium	8-hr	0.002	3.0×10^{-6}	3.0×10^{-6}	3.0×10^{-6}	3.0×10^{-6}
	Ceiling	0.005	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}
Methyl alcohol	8-hr TWA	260	0.08	0.08	0.08	0.08
n-Propyl alcohol	8-hr TWA	500	0.08	0.08	0.08	0.08
Mercury	Ceiling	0.1	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}
Benzene	8-hr	3.1	0.1	3.0×10^{-4}	3.0×10^{-4}	3.0×10^{-4}
	Ceiling	15.5	0.8	0.004	0.004	0.004
Formic Acid[f]	8-hr	9	2.2×10^{-4}	None	None	None

Source: Hunter (2000).

a. For a noninvolved onsite worker at a distance of 640 meters from the process building stack and a 1.8-meter breathing height.
b. Under the No Action alternative, air emissions from all scenarios would be similar to air emissions from the HLW operations included in the SRS baseline. Therefore, incremental health effects would be minimal.
c. From 29 CFR 1910.1000.
d. TWA – Time-weighted average.
e. Ceiling limits are permissible exposure limits that a facility cannot exceed at any time.
f. Formic acid emissions would be shifted from DWPF to the Small Tank Precipitation facility, resulting in no net change.

To relate a dose to its effect, DOE has adopted a dose-to-risk conversion factor of 0.0004 LCFs per person-rem for workers and 0.0005 LCFs per person-rem for the general population (NCRP 1993) to estimate the number of LCFs that could result from the calculated exposure. The factor for the general population is slightly higher because infants and children are more sensitive to radiation than the adult worker population.

These dose-to-risk factors are consistent with the factors used by the NRC in its rulemaking *Standards for Protection Against Radiation* (10 CFR 20). The factors apply if the dose to an individual is less than 20 rem and the dose rate is less than 10 rem per hour. At doses greater than 20 rem, the factors used to relate radiation doses to LCFs are doubled. At much higher dose rates, prompt effects, rather than LCFs, would be the primary concern.

DOE expects minimal worker and public health impacts from the radiological consequences of salt processing activities under any of the technology alternatives. All alternatives are expected to result in similar radiological release levels. Public radiation doses would occur from airborne releases only (Section 4.1.3). Table 4-12 lists estimated radiation doses and corresponding incremental LCFs for the noninvolved worker (a worker not directly involved with implementing the alternative, but located 2,100 feet [640 meters] from the salt processing facility), the involved worker (a worker located 328 feet [100 meters] from the salt processing facility), the collective population of involved workers, the collective onsite (SRS) population, and the public (MEI and the collective offsite population) for each technology alternative.

Table 4-12. Estimated public and occupational radiological doses and health impacts from atmospheric emissions during operations.[a,b,c]

Receptor[d,e]	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout[f]
MEI dose (millirem/year)	0.20	0.049	0.31	0.086
Probability of an LCF from MEI dose[g]	1.3×10^{-6}	3.2×10^{-7}	2.0×10^{-6}	5.6×10^{-7}
Dose to population within 50 miles of SRS (person-rem/year)	12.0	2.9	18.1	4.0
Estimated number of project-phase LCFs in the population within 50 miles of SRS[g]	0.078	0.019	0.12	0.026
Noninvolved worker dose (millirem/year)	3.3	0.8	4.8	1.7
Probability of an LCF from noninvolved worker dose[g]	1.7×10^{-5}	4.2×10^{-6}	2.5×10^{-5}	8.6×10^{-6}
Annual number of radiological workers[h]	140	100	160	110
Involved worker dose (millirem/year)	16	3.9	23	10
Probability of an LCF from involved worker dose[g]	8.2×10^{-5}	2.0×10^{-5}	1.2×10^{-4}	5.3×10^{-5}
Annual dose to the population of involved workers (person-rem per year)	2.2	0.39	3.6	1.1
Project-phase dose to involved workers (person-rem)	29	5.0	47	14
Estimated number of project-phase LCFs to involved workers[g]	0.012	0.0020	0.019	0.0056
Annual dose to the population of SRS workers (person rem/year)	4.3	1.1	6.5	2.3
Estimated number of project-phase LCFs in the worker population at SRS[g]	0.022	0.0055	0.034	0.012

a. Source term is based on data from Pike (2000).
b. Doses represent increment above baseline values from existing SRS activities.
c. Under the No Action alternative, air emissions from all scenarios would be similar to emissions from the HLW operations included in the SRS baseline. Therefore, incremental health effects would be minimal.
d. The MEI is 11,800 meters from the facility stack(s). The noninvolved worker is located 640 meters from the facility stack(s). The involved worker is located 100 meters from the facility stack(s).
e. Doses presented here are based on emissions from a 46-meter stack elevation.
f. Includes dose from operations and vaults.
g. LCFs are calculated for the project duration only. (When facility operations cease, residual contaminant levels would be negligible.) Each of the four action alternatives would operate for 13 years.
h. Assumes 75 percent of operations staff are radiological workers (WSRC 1999c).

As shown in Table 4-12, the highest radiological impacts to both involved and noninvolved workers and to the public would be associated with the Solvent Extraction alternative. The Small Tank Precipitation alternative would have impacts similar to Solvent Extraction, and the Ion Exchange and Direct Disposal in Grout alternatives would result in slightly lower impacts. The radiological doses from the Solvent Extraction alternative airborne emissions are higher than those for the other alternatives, and would result in an estimated additional 0.12 LCF for the general population surrounding SRS (50-mile radius) over the period of operation. Emissions from the Solvent Extraction alternative would also result in the highest impact to workers at SRS, an estimated 0.034 LCF for the collective SRS worker population (includes both involved and noninvolved workers) over the 13-year life of the project.

As expected, the collective involved worker doses and total project-phase doses shown in Table 4-12 are similar for all four action alternatives. The Solvent Extraction project-phase collective worker dose is the highest of the alternatives at 47 person-rem over the life of the project, and would result in 0.019 LCF. All doses are well within the administrative control limits for SRS workers (500 millirem per year).

The estimated number of LCFs in the public (Table 4-12) due to airborne emissions from each action alternative can be compared to the projected number of fatal cancers (approximately 140,000) in the public around the SRS from all causes (as discussed in Section 3.8.1). Similarly, the estimated number of fatal cancers in the involved worker population can be compared to the percent of the general population that succumbs from cancer regardless of cause (approximately 23.3 percent; see Section 3.8.1). In all cases, the incremental impacts from the alternatives would be minimal.

4.1.4.3 Occupational Health and Safety

The established method of determining a company or facility's safety record is by using its historic number of total recordable cases (TRCs) and lost workday cases (LWCs). Table 4-13 provides estimates of the number of TRCs and LWCs that would occur during a year and during the facility life cycle for the estimated number of involved workers for each alternative. The projected injury rates are based on historic SRS injury rates over a four-year period (1995 through 1999) multiplied by the employment levels and years for each alternative and the appropriate TRC and LWC rates.

The TRC rate includes work-related deaths, illnesses, or injuries that resulted in loss of consciousness, restriction from work or motion, transfer to another job, or required medical treatment beyond first aid. The LWC rate represents the number of workdays, beyond the day of injury or onset of illness, the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

The results in Table 4-13 indicate that each action alternative has similar TRCs and LWCs, but the Solvent Extraction alternative would have the highest TRCs and LWCs. The higher number of injuries for this alternative is due to the larger number of workers needed to operate the facility. The number of TRCs and LWCs would remain at current levels during continuation of tank space management activities under the No Action alternative. Up to 65 new workers would be employed for operation of any new tanks built under No Action. This small increase in employment levels would result in 11 TRCs and 5 LWCs over the 13-year operations phase of the new tanks.

Tables 3-19 and 3-20 demonstrate that the SRS health and safety program has resulted in lower incidences of injury and illness than those in the general industry and manufacturing workforces.

These lower injury and illness rates for a proposed workforce ranged between 135 and 220 workers annually and for a period of 14.3 years are represented in Table 4-13. Considering the improvements the SRS safety program has made and continues to make in lowering the TRC and LWC rates, the numbers presented in Table 4-13 are conservative and future safety rates are expected to be much lower than the rates currently presented.

4.1.5 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs each Federal agency to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." The Presidential Memorandum that accompanied Executive Order 12898 emphasized the importance of using existing laws, including the

Table 4-13. Estimated total recordable cases and lost workdays annually and for the life cycle of each alternative.[a]

Incident rate	No Action[b]	Small Tank Precipitation[c]	Ion Exchange[c]	Solvent Extraction[c]	Direct Disposal in Grout[c]
Total recordable cases (annual)	0.8	2.2	1.7	2.7	1.8
Total lost workday cases (annual)	0.35	1.0	0.72	1.2	0.77
Total recordable cases (facility life cycle)	11	32	24	39	25
Total lost workday cases (facility life cycle)	5	14	10	17	11

Source: WSRC (1998b, 1999d), DOE (2000b).
a. Based on working 8 hours per day, 250 days per year.
b. Based on 65 new workers for a period of 13 years to operate any new tanks built under the No Action alternative.
c. Facility life cycle includes 1.3 years for startup and 13 years of full operations.

National Environmental Policy Act (NEPA), to identify and address environmental justice concerns, "including human health, economic, and social effects, of Federal actions."

The Council on Environmental Quality (CEQ), which oversees the Federal government's compliance with Executive Order 12898 and NEPA, subsequently developed guidelines to assist Federal agencies in incorporating the goals of Executive Order 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed."

As part of this process, DOE identified (in Section 3.6.2) minority and low-income populations within a 50-mile radius of the SRS (plus areas downstream of the Site that withdraw drinking water from the Savannah River), which was defined as the region of influence for the environmental justice analysis. The following section discusses whether implementing the alternatives described in Chapter 2 would result in disproportionately high and adverse impacts to minority or low-income populations.

DOE referred to the Draft Guidance on Environmental Justice and NEPA (DOE 2000c) in preparing this section.

4.1.5.1 Background

The CEQ issued guidance on assessing potential environmental justice impacts. No standard formula has been issued on how environmental justice issues should be identified or addressed. However, the following six principles provide general guidance (CEQ 1997):

- The composition of the area should be considered to determine whether minority populations, low-income populations, or Indian tribes are present in the area affected by the proposed action and, if so, whether there may be disproportionately high and adverse human health or environmental effects on those populations.

- Relevant public health data and industry data concerning the potential for multiple or cumulative exposures to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards should be considered.

- The interrelated cultural, social, occupational, historical, and economic factors that may amplify the natural and physical environmental effects of the proposed action should be recognized.

- Effective public participation strategies should be developed.

- Meaningful community representation in the process should be ensured.

- Tribal representation in the process should be sought in a manner that is consistent with the government-to-government relationship between the United States and tribal governments.

Environmental justice guidance developed by CEQ defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (CEQ 1997). The Council identifies these groups as minority populations when either (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of Census Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, a community may be considered either as a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effects.

Environmental justice impacts can result if the proposed activities cause disproportionately high and adverse human health or environmental effects to minority or low-income populations. DOE assesses three factors to the extent practicable to identify disproportionately high and adverse human health effects:

- Whether the health effects are significant (as used by NEPA) or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.

- Whether the risk or rate of exposure by a minority or low-income population to an environmental hazard is significant (within the meaning of NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.

- Whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

4.1.5.2 Methodology

First, DOE assessed the impacts of the proposed action and alternatives to the general population which, near the SRS, includes minority and low-income populations. No special considerations, such as unique exposure pathways or cultural practices, contribute to any discernible disproportionate impacts. The only identified cultural practice (or unusual pathway) potentially associated with minority and low-income populations is use of the Savannah River for subsistence fishing. For the Final *Accelerator Production of Tritium for the Savannah River Site Environmental Impact Statement* (EIS) (issued in 1999), DOE reviewed the limited body of literature available on subsistence activities in the region.

DOE concluded that, because the identified minority or low-income communities are widely distributed, and the potential impact to the general population is not discernible, there would be no potential for disproportionate impacts among minority or low-income populations. Second, having concluded that the potential offsite consequences to the general public of the proposed action and the alternatives would be small, DOE concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations.

These conclusions are based on the comparison of salt processing actions to past actions for which environmental justice issues were evaluated in detail. In 1995, DOE conducted an analysis of economic and racial characteristics of the population potentially affected by SRS operations within a 50-mile radius of the Site (DOE 1995). In addition, DOE examined the population downstream of the Site that withdraws drinking water from the Savannah River. The economic and racial characterization was based on 1990 census tract data from the U.S. Census Bureau. More recent census tract data are not available. The nearest minority and low-income populations to SRS are south of Augusta, Georgia, northwest of the Site.

This environmental justice analysis was based on the assessment of potential impacts associated with the various HLW salt processing alternatives to determine if there would be high and adverse human health or environmental impacts. In this assessment, DOE reviewed potential impacts arising under the major disciplines and resource areas, including: socioeconomics; cultural, air, water, and ecological resources; and public and worker health over the short term (approximately the years 2001 to 2023) and long term (approximately 10,000 years after saltstone was placed in vaults). Regarding health effects, both normal facility operations and postulated accident conditions were analyzed, with accident scenarios evaluated in terms of risk to workers and the public.

Although no high and adverse impacts were predicted for the activities analyzed in this SEIS, DOE nevertheless considered whether there were any means for minority or low-income populations to experience disproportionately high and adverse impacts. The basis for making this determination would be a comparison of areas predicted to experience human health or environmental impacts with areas in the region of influence known to contain high percentages of minority or low-income populations.

The environmental justice analysis for the HLW salt processing alternatives was assessed for a 50-mile area surrounding SRS (plus downstream areas), as discussed in Section 3.6.2.

Short-Term Impacts

For environmental justice concerns to be initiated, high and adverse human health or environmental impacts must disproportionately affect minority or low-income populations.

None of the proposed alternatives would produce appreciable short-term impacts to surface water (see Section 4.1.2.1) or groundwater (see Section 4.1.2.2). With the exception of VOCs, emissions of nonradiological and radiological air pollutants from HLW salt processing activities would be below regulatory limits (see Section 4.1.3) and would result in minimal impacts to workers and the public (see Section 4.1.4.2). The estimated radiological doses and health impacts to the noninvolved worker and the public are small (highest dose is 4.8 millirem per year to the noninvolved worker, under the Solvent Extraction alternative).

Because all salt processing activities would take place in an area that has been dedicated to industrial use for more than 40 years, no short-term impacts to ecological resources (see Section 4.1.6), existing land uses (see Section 4.1.7), or cultural resources (see Section 4.1.9) are expected.

Relatively small numbers of workers would be required to carry out salt processing activities, regardless of the alternative selected (see Section 4.1.8); as a result, none of the alternatives would affect socioeconomic trends (i.e., unemployment, wages, housing) in the region of influence.

As noted in Section 4.2, no long-term environmental justice impacts are anticipated.

Because short-term impacts would not substantially affect the surrounding population, and no means were identified for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected for minority or low-income populations under any of the alternatives.

Subsistence Consumption of Fish, Wildlife, and Game

Section 4-4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." There is no evidence to suggest that minority or low-income populations in the SRS region of influence are dependent on subsistence fishing, hunting, or gathering. DOE nevertheless considered whether there were any means for minority or low-income populations to be disproportionately affected by examining levels for contaminants in vegetables, fruit, livestock, and game animals collected from the SRS or adjacent lands. In addition, DOE assessed concentrations of contaminants in fish collected from SRS waterbodies and from the Savannah River up- and downstream of the Site.

Based on recent monitoring results, concentrations of radiological and nonradiological contaminants in vegetables, fruit, livestock, game animals, and fish from the SRS and surrounding areas are generally low, in virtually all instances below applicable DOE standards (Arnett and Mamatey 1998a,b). Consequently, no disproportionately high and adverse human health impacts would be expected in minority or low-income populations in the region that rely on subsistence consumption of fish, wildlife, or native plants.

It should be noted that mercury, which is present in relatively high concentrations in fish collected from SRS and the middle reaches of the Savannah River, could pose a potential threat to individuals and populations that rely on subsistence fishing. This mercury in fish has been attributed to upstream (non-DOE) industrial sources and natural sources (DOE 1997a). The salt processing alternatives under consideration would not affect mercury concentrations in SRS waterbodies or the Savannah River.

4.1.6 ECOLOGICAL RESOURCES

Construction

Depending on the salt processing alternative selected by DOE, construction of several new facilities would be required in either S or Z Area. Process buildings for the Small Tank Precipitation, Ion Exchange, or Solvent Extraction alternatives would be built in S Area, while the process building for the Direct Disposal in Grout alternative would be built in Z Area. Regardless of the salt processing alternative (thus, process facility configuration) chosen, support facilities, including a service building, office building, and an electrical substation would be constructed in close proximity to the main process building (see Chapter 2 and Appendix A for details). New salt disposal vaults would be built in Z Area under all of the salt processing action alternatives.

As shown in Table 4-1, construction of process facilities for the Small Tank Precipitation, Ion Exchange, Solvent Extraction, and Direct Disposal in Grout alternatives would require the excavation of approximately 77,000, 78,000, 82,000 and 23,000 cubic yards of soil, respectively. The total land area that would be cleared in S area (see Figure 3-1) for the Small Tank Precipitation, Ion Exchange, or Solvent Extraction alternative is 23 acres or 0.12 percent of SRS land dedicated to industrial use. Approximately 15 acres or 0.078 percent of SRS land dedicated to industrial use would be cleared for the Direct Disposal in Grout facility in Z Area (see Figure 3-2). Land in Z Area would also be required for construction of new saltstone vaults. All land-disturbing activity would be within the fenced boundaries of S and Z Areas, areas currently devoted to industrial use (waste management facilities).

As noted in Section 3.4.1, the preferred site (Site B) for salt processing facilities in S Area is approximately one-quarter mile south of DWPF (an active industrial facility) and, as a result, is within an area with relatively high levels of noise and activity. Because the Saltstone Manufacturing and Disposal Facility has not operated since 1998, the preferred site in Z Area has lower levels than S Area of noise and activity, limited for the most part to security patrols and an occasional tour.

There is the potential to disturb wildlife in both S and Z Areas and in adjacent woodlands during the construction phase of the project (approximately four years for site preparation and facility construction). Construction would involve the movement of workers and construction equipment and would be associated with relatively loud noises from earth-moving equipment (including backhoes, bulldozers, and graders), portable generators, and air compressors. Although noise levels in construction areas could be as high as 110 decibels (dBA), these high local noise levels would not extend far beyond the boundaries of the proposed project sites.

Table 4-14 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction sites, construction noises would range from approximately 55 to 85 dBA. Golden et al. (1980) suggest that noise levels higher than 80 to 85 dBA are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing birds and small mammals outside a 400-foot radius of the construction sites.

Although noise levels would be relatively low outside the immediate construction areas, the combination of construction noise and human activity probably would displace small numbers of animals (e.g., songbirds and small mammals) that forage, feed, nest, rest, or den in the woodlands to the east of S Area and to the south and east of Z Area. An access road and a railroad spur (Z Line) separate Site B in S Area from woodlands to the east (see Figure 3-1), reducing the value of Site B and adjacent woodlands as wildlife habitat. The identified site in Z Area (see Figure 3-2) is farther removed from roads and the railroad spur (and heavy industrial facilities in H and S Areas) and is presumed to have marginally higher value as wildlife habitat. Construction-related disturbances in both areas are likely to create impacts to wildlife that would be small, intermittent, and localized. Some animals could be driven from the area permanently, while others could become accustomed to the increased noise and activity and return to the area. Species likely to be affected (e.g., gray squirrel, opossum, white-tailed deer) are common to ubiquitous on SRS.

Under the No Action alternative, DOE would use approved siting procedures to ensure that any new tanks would be built in a previously disturbed industrial area. Studies and continued monitoring would also be performed to determine the presence of any threatened or endangered species and ensure that critical habitats would not be affected.

Operations

Operation of salt processing facilities would be less disruptive to wildlife than construction activities, but would entail movement of workers and equipment and noise from public address systems (e.g., testing of radiation and fire alarms), air compressors, pumps, and HVAC-related equipment. These activities would be similar under all alternatives, including No Action. With the possible exception of the public address systems, noise levels generated by these kinds of sources are not expected to disturb wildlife outside of facility boundaries.

As noted in Section 3.4, no threatened or endangered species or critical habitats occur in or near S or Z Areas, which are industrial sites surrounded by roads, parking lots, construction shops, and construction lay-down areas that are continually exposed to high levels of human disturbance. Proposed salt processing activities(and Tank Farm operations under No Action) would not disturb any threatened or endangered

Table 4-14. Peak and attenuated noise (in dBA) levels expected from operation of construction equipment.

Source	Noise level (peak)	Distance from source			
		50 feet	100 feet	200 feet	400 feet
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. (1980).

species, would not degrade any critical or sensitive habitat, and would not affect any wetlands. DOE would continue to monitor the areas around S and Z Areas for the presence of threatened or endangered species. If a listed species were found, DOE would determine if salt processing activities would affect that species. If DOE were to determine that adverse impacts could occur, DOE would initiate consultation with the U.S. Fish and Wildlife Service, as required by Section 7 of the Endangered Species Act.

4.1.7 LAND USE

The *Savannah River Site Future Use Plan* (DOE 1998) provides an Integral Site Model that lays out intended future land use policies. DOE determined that this model most realistically accommodates development during the next 50 years. The model divides the SRS into three zones: industrial, industrial support, and restricted public use. The future use plan does not contemplate DOE relinquishing ownership of or institutional control over any portion of the SRS. The industrial zone surrounds facilities that: process or store radioactive liquid or solid waste, fissionable materials, or tritium; conduct separations operations; or conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations. The new salt processing facility would be constructed in areas (S or Z) designated as industrial. As shown in Table 4-1, approximately 23 acres (0.12 percent of SRS land dedicated to industrial use) would be cleared and graded for salt processing facilities at the selected site in S Area (see Figure 3-1), should the Small Tank Precipitation, Ion Exchange, or Solvent Extraction alternative be selected. Approximately 15 acres (0.078 percent of SRS land dedicated to industrial use) would be cleared and graded for salt processing facilities in Z Area (see Figure 3-2), should the Direct Disposal in Grout alternative be selected. All land-disturbing activity would be within the fenced boundaries of S and Z Areas, areas currently devoted to industrial use (waste management facilities).

DOE would use the approved siting process to ensure that any new tanks under the No Action alternative would be constructed in a previously disturbed industrial area with a deep groundwater table. Due to the speculative nature of the No Action alternative, DOE has not determined how much land would be cleared for construction of any new HLW storage tanks. However, a

Type III HLW tank and associated equipment would occupy about one acre. Construction and operation of the proposed salt processing facility, including ongoing tank space management activities and building new tanks under the No Action alternative, would be consistent with the current SRS land use plans (DOE 1998).

4.1.8 SOCIOECONOMICS

Socioeconomic impact assessments are performed to determine the effects changes in local economic variables (e.g., number of jobs in a particular industry, wage rates, or increases in capital investment) may have on other economic measures (total regional employment, population, and total personal income).

New economic information was not developed for this SEIS. However, in 1999, DOE issued its *Accelerator Production of Tritium for the Savannah River Site Final Environmental Impact Statement* (DOE 1999). This EIS proposed a large accelerator for the SRS, and a full array of socioeconomic impact assessments was performed for the EIS. Based on these assessments, DOE concluded that the potential impacts attributed to construction and operation of the accelerator were relatively small in comparison with historical economic trends in the region and were not expected to stress existing regional infrastructures or result in an economic "boom."

Construction

During the construction phase of this project, based on preliminary design information, each salt processing alternative would employ approximately 500 construction workers annually, or about 50 percent fewer than the accelerator in its peak year of construction. Additionally, the estimated construction phase for the salt processing alternatives would be about 4 years, rather than 11 years for the accelerator, so potential construction impacts would be shorter in duration than those for the accelerator would have been.

Table 4-15 presents the estimated employment levels for each salt processing action alternative. The construction workforce is assumed to be constant over the life of the construction phase. The construction phase, expected to last approximately 4 years for each action alternative, would require less than 3.6 percent of the existing SRS workforce.

Under the No Action alternative, up to 500 construction workers may be employed to construct new HLW tanks. Tank construction would be expected to last 4 or more years (DOE 1980).

Operations

The Small Tank Precipitation alternative would require approximately 180 operations employees. The Ion Exchange alternative would require approximately 135 operations employees.

Table 4-15. Estimated salt processing employment by alternative.

Project phase	No Action	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Construction	500[a]	500	500	500	500
Operations	65[b]	180	135	220	145

Source: (WSRC 1998a, 2000a)
a. Up to 500 construction workers could be employed if new HLW tanks were built under the No Action alternative.
b. Up to 65 operations workers could be employed if new HLW tanks were built under the No Action alternative. However, a workforce reduction could occur if operations at the DWPF were suspended under No Action.

The Solvent Extraction alternative would require approximately 220 operations employees, and the Direct Disposal in Grout alternative would require approximately 145 operations employees, (WSRC 1998a, 2000a). During the operations phase, the Solvent Extraction alternative would require the most workers, but would still require less than 1.5 percent of the existing SRS workforce.

DOE believes staffing requirements for construction and operations of any salt processing action alternative could be filled with existing SRS employees. Given the size of the local economy, any supplemental workforce requirements could be met without measurable impacts or the influx of large workforces. Therefore, DOE does not expect any salt processing action alternative to have measurable socioeconomic impacts.

Under the No Action alternative, DOE would continue tank space management activities for a period of approximately 10 years and employment would remain at the current level. Subsequent activities under No Action could impact employment levels. DOE could suspend operations at DWPF. Suspension of operations at these facilities could result in a workforce reduction, which would have a negative impact on the communities surrounding SRS. Alternatively, up to 65 new employees would be needed for the operation of any new HLW tanks constructed under No Action (DOE 1980).

4.1.9 CULTURAL RESOURCES

Depending on the salt processing alternative selected by DOE, construction of new facilities would be required in either S (Site B) or Z Area. Process buildings for the Small Tank Precipitation, Ion Exchange, or Solvent Extraction alternatives would be built in S Area, while the process building for the Direct Disposal in Grout alternative would be built in Z Area. Regardless of the salt processing alternative (thus, facility configuration) chosen, support facilities including a service building, office building, and an electrical substation would also be constructed in close proximity to the main process building (see Chapter 2 and Appendix A for details). New salt disposal vaults would be built in Z Area under any of the salt processing alternatives.

Because no important archaeological resources were discovered during the S Area surveys conducted in support of the *Final Environmental Impact Statement Defense Waste Processing Facility Savannah River Plant* (DOE 1982), DOE believes additional construction within this area would not adversely impact cultural resources. Most of Z Area also has been surveyed in the past, and no important cultural resources were discovered (DOE 1994). Both areas have been disturbed repeatedly by construction activity over the last 15 to 20 years, and the likelihood of undiscovered cultural or historic resources is small.

DOE would use the approved siting process to ensure that any new tanks for the No Action alternative would be constructed in a previously disturbed industrial area. DOE would ensure that any tank construction would not impact cultural or historic resources.

If any archaeological or cultural resources were discovered in the course of developing the previously described facilities in S and Z Areas or new tanks for the No Action alternative, DOE would contact the Savannah River Archaeological Research Program and the State Historic Preservation Officer in compliance with Section 106 of the National Historic Preservation Act for guidance on mitigating potential impacts to these resources.

4.1.10 TRAFFIC AND TRANSPORTATION

SRS is served by more than 199 miles of primary roads and more than 995 miles of unpaved secondary roads. The primary highways used by SRS commuters are State Routes 19, 64, and 125; 40, 10, and 50 percent of the workers, respectively, use these routes. Traffic congestion can occur during peak periods onsite on SRS Road 1-A, State Routes 19 and 125, and U.S. Route 278 at SRS access points. Vehicles associated with this project would use these same routes and access points. None of the routes would require additional traffic controls or highway modifications, as explained below.

Construction

As shown in Table 4-16, concrete premix would be required during construction of the facilities under all action alternatives. Assuming that these materials are supplied by vendor facilities in Jackson and New Ellenton (for a round-trip distance of 18 miles), implementation of the alternatives would result in 55,000 to 61,000 freight miles traveled. Using Federal Highway Administration roadway composite statistics for South Carolina for the 1994 to 1996 period of record (Saricks and Tompkins 1999), these shipments would result in a maximum occurrence of 0.05 accidents, no fatalities, and 0.03 injuries as a result of material transport activities during construction. These projections are similar for all action alternatives. Therefore, it is highly unlikely that material transport activities during construction would lead to any accidents, fatalities, or injuries, regardless of the alternative selected.

As shown in Table 4-17, approximately 500 workers would travel to the Site 5 days a week (250 round trips per year for each worker) for 45 to 50 months during the construction phase of the project. Assuming no ride sharing and a round-trip commute distance of 50 miles, up to 26 million commuter miles would be traveled during the construction phase. Using 1998 national transportation statistics (BTS 1998), as many as 98 vehicle accidents could occur with this mileage, resulting in a maximum of 0.4 fatalities and 43 injuries. These projections are similar for all action alternatives.

Building new HLW tanks under the No Action alternative would require a similar number of material shipments as that required for construction of the action alternatives. DOE anticipates that the construction workforce under the No Action alternative would also be similar to the number of workers employed for construction of the action alternatives.

Operations

As shown in Table 4-16, saltstone premix and process reagents would be required during operation of the facilities under all action alternatives. Assuming that these materials are supplied by vendor facilities in Jackson and New Ellenton (for a round-trip distance of 18 miles), implementation of the alternatives would result in 340,000 to 470,000 miles traveled. Using Federal Highway Administration roadway composite statistics for South Carolina for the 1994 to 1996 period of record (Saricks and Tompkins 1999), these shipments would result in a maximum occurrence of 0.4 accidents, 0.02 fatalities, and 0.3 injuries as a result of material transport activities during construction. These projections are similar for all action alternatives. Therefore, it is very unlikely that material transport activities during construction would lead to any accidents, fatalities, or injuries, regardless of the alternative selected.

As shown in Table 4-17, between approximately 135 and 220 workers, depending on the alternative selected, would travel to the Site 5 days a week (250 round trips per year for each worker) for the 14.3-year startup and operation phase of the project. Assuming no ride sharing and a round-trip commute distance of 50 miles, up to 39 million commuter miles would be traveled during the operations phase. Using 1998 national transportation statistics (BTS 1998), as many as 148 vehicle accidents could occur with this mileage, resulting in a maximum of 0.6 fatalities and 65 injuries. The projections are similar for all action alternatives.

For the No Action alternative, up to 65 new employees would be needed for the 13-year operation phase (2010-2023) for any tanks constructed (DOE 1980). Therefore, approximately 39 vehicle accidents could occur under the No Action alternative, resulting in a maximum occurrence of 0.2 fatalities and 17 injuries.

Table 4-16. Material shipments (totals for the construction and operation phases) and transportation impacts associated with the salt processing alternatives.

Material use impact categories		Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Construction					
Structural concrete premix shipments[a,b]		3,000	3,000	3,000	3,400
Total round-trip shipment distance (miles)		55,000	55,000	55,000	61,000
Number of	Accidents	0.04	0.04	0.04	0.05
	Fatalities	0	0	0	0
	Injuries	0.03	0.03	0.03	0.03
Operations[c]					
Saltstone premix[d]		25,500	21,100	23,800	19,000
Sodium hydroxide[d]		6	56	416	4
Oxalic acid[d]		1	1	1	1
Tetraphenylborate[d]		710	NA	NA	NA
Monosodium titanate[d]		1	1	1	1
Crystalline Silicotitanate[d]		NA	11	NA	NA
90% Formic acid[d,e]		66	NA	NA	NA
15% Cupric nitrate[d,e]		45	NA	NA	NA
Nitric Acid[d]		NA	NA	9	NA
Isopar®L[d]		NA	NA	40	NA
Trioctylamine[d]		NA	NA	1	NA
Calixarene[d]		NA	NA	1	NA
Cs-7SBT[d]		NA	NA	1	NA
Total number of shipments		26,000	21,000	24,000	19,000
Total round-trip shipment distance (miles)		470,000	380,000	440,000	340,000
Number of	Accidents	0.4	0.3	0.3	0.3
	Fatalities	0.02	0.02	0.02	0.01
	Injuries	0.3	0.2	0.2	0.2

a. Data for structural concrete use adapted from Attachments 9.2, 9.3, 9.4, and 9.5 of the life cycle cost estimate report (WSRC 1998a) using an assumed blended concrete premix density of 3,934 lb/yd^3 and a truck load capacity of 50,000 pounds.
b. Concrete requirements for construction of any new tanks under the No Action alternative would be similar to those required for the action alternatives.
c. For operations under the No Action alternative, material shipments would remain at current levels.
d. Number of shipments.
e. Corresponding decrease at DWPF.
NA = not applicable. The chemical would not be used in that particular alternative.

Table 4-17. Worker transportation impacts associated with the salt processing alternatives.

Worker travel impact categories		No Action	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Construction worker travel						
Number of workers		500[a]	500	500	500	500
Total number of Site trips		500,000[a]	500,000	520,000	500,000	480,000
Total round-trip distance (million miles)		25[a]	25	26	25	24
Number of	Accidents	95[a]	95	98	95	91
	Fatalities	0.4[a]	0.4	0.4	0.4	0.4
	Injuries	42[a]	42	43	42	40
Operations worker travel						
Number of workers		65[b]	180	135	220	145
Total number of Site trips		210,000[b]	640,000	480,000	780,000	510,000
Total round-trip distance (million miles)		11[b]	32	24	39	26
Number of	Accidents	39[b]	122	91	148	97
	Fatalities	0.2[b]	0.5	0.4	0.6	0.4
	Injuries	17[b]	53	40	65	42

a. Based on 500 construction workers over a 4-year construction period. The construction period could be longer, depending on the number of tanks built.
b. Up to 65 workers would be required for operation of any new tanks built under No Action.

The surrounding area already has a certain volume of truck and car traffic associated with SRS logging, agriculture, and industrial activity. The amount of traffic associated with any of the alternatives (including No Action) is not expected to substantially increase traffic volume.

4.1.11 WASTE GENERATION

4.1.11.1 Wastes From Salt Processing

Each of the action alternatives would produce a low-activity salt waste stream that would be grouted for disposal in vaults in Z Area. The characteristics and volumes of grout produced from the low-activity salt solutions would vary among the alternatives. In addition, the high-activity materials separated from the salt solution would be transferred to DWPF for processing to borosilicate glass. Details of the wastes from salt processing under each of the action alternatives are discussed below.

Under the Small Tank Precipitation alternative, the low-activity salt solution would be transferred to the existing Saltstone Manufacturing and Disposal Facility in Z Area for disposal as grout. New cement silos would be built to accommodate saltstone production. Sixteen new vaults would be needed to accommodate the expected grout volume (188 million gallons). The grout would be equivalent to Class A LLW, as defined in 10 CFR 61.55 (see Appendix A for Class A limits). Approximately 2.9 million gallons of slurry, containing monosodium titanate (MST) solids and precipitate hydrolysis aqueous (PHA) product, would be transferred to DWPF. Treatment of this material by adding it to the HLW sludge to be vitrified in DWPF would produce HLW canisters that would be included in the total of approximately 5,700 HLW canisters destined for a geologic repository. Processing the precipitate in the Small Tank Precipitation Facility would create a benzene waste stream that is unique to this salt processing alternative. The management of this benzene waste is described in Section 4.1.11.2.

Under the Ion Exchange alternative, the low-activity salt solution would be transferred to the existing Saltstone Manufacturing and Disposal Facility in Z Area for disposal as grout. No modifications to the existing grouting process would be required. Thirteen new vaults would be needed to accommodate the expected grout volume (156 million gallons). The grout would be equivalent to Class A LLW, as defined in 10 CFR 61.55. Approximately 2 million gallons of slurry containing MST solids and 600,000 gallons of cesium-loaded crystalline silicotitanate (CST) resin would be transferred to DWPF. Treatment of this material by adding it to the HLW sludge to be vitrified in DWPF would produce HLW canisters that would be included in the total of approximately 5,700 HLW canisters destined for a geologic repository.

Under the Solvent Extraction alternative, the low-activity salt solution would be transferred to the existing Saltstone Manufacturing and Disposal Facility in Z Area for disposal as grout. No modifications to the existing grouting process would be required. Fifteen new vaults would be needed to accommodate the expected grout volume (175 million gallons). The grout would be equivalent to Class A LLW, as defined in 10 CFR 61.55. Approximately 2 million gallons of slurry containing MST solids and 6.8 million gallons of cesium-loaded strip solution would be transferred to DWPF. Treatment of this material by adding it to the HLW sludge to be vitrified in DWPF would produce HLW canisters that would be included in the total of approximately 5,700 HLW canisters destined for a geologic repository. The Solvent Extraction process would also generate a liquid organic solvent. Management of this solvent waste is described in Section 4.1.11.2.

Under the Direct Disposal in Grout alternative, radioactive cesium would not be separated from salt solutions. Because of the shielding requirements for handling the cesium-containing salt solution, this material could not be processed in the existing Z Area Saltstone Manufacturing and Disposal Facility. After treatment with MST and filtration to remove strontium, uranium, plutonium, and entrained sludge, the clarified salt solution would be transferred to a new grouting facility located in Z Area. Thirteen new vaults would be needed to accommodate the expected grout disposal volume (141 million gallons). Because of its cesium content, the grout would be equivalent to Class C LLW, as defined in 10 CFR 61.55 (see Appendix A for Class C limits). Approximately 2 million gallons of slurry containing MST solids would be transferred to DWPF. Treatment of this material by adding it to the HLW sludge to be vitrified in DWPF would produce HLW canisters that would be included in the total of approximately 5,700 HLW canisters destined for a geologic repository.

Under the No Action alternative, DOE would continue current HLW management activities, including tank space management and tank closure, without a process for separating the high-activity and low-activity salt fractions. DWPF would vitrify only sludge from the HLW tanks. HLW salt would be stored in existing tanks and monitoring activities would continue. Current tank space management projections indicate that, after 2010, additional tank space would be needed to support continued operations (WSRC 1999d). The course of action that DOE would follow cannot be predicted at this time but, regardless of which option DOE would pursue, waste generation rates under No Action would not be expected to increase from current levels.

4.1.11.2 Secondary Waste

This section presents the secondary waste generation estimates for each salt processing alternative that DOE considers in this SEIS. Unlike wastes from salt processing that are the direct result of processing the salt solutions, secondary wastes are those wastes generated as a result of construction, operation, and maintenance of the salt processing facilities under the action alternatives. Impacts are assessed in terms of the amount of secondary waste projected for each of the alternatives, relative to the quantity of waste that would otherwise be managed at SRS during the period of analysis. Table 4-18 provides estimates of the maximum annual waste generation. Table 4-19 provides the total waste volumes that would be generated over the life cycle of each of the salt processing alternatives.

Waste generation under the No Action alternative would be similar to waste generation rates at the existing HLW Tank Farms and would therefore constitute a slight increase over the baseline. Baseline forecasts are provided in Table 5-4.

Liquid Waste

The radioactive wastewater that would be generated as a result of salt processing activities is produced during the DWPF vitrification process. The incremental increase in DWPF radioactive liquid waste would be associated with processing the high-activity waste (e.g., MST slurry, PHA product, loaded CST resin, cesium strip solution) from the various salt processing action alternatives, and would vary from about 150,000 gallons per year for the Direct Disposal in Grout alternative to 900,000 gallons per year for the Solvent Extraction alternative. The Small Tank Precipitation and the Ion Exchange alternatives would generate 300,000 and 250,000 gallons per year, respectively. The DWPF radioactive wastewater would be returned to the Tank Farm to be processed in the waste evaporators. Evaporator overheads would be treated in the ETF and discharged to Upper Three Runs via NPDES outfall H-16. DOE currently is examining options to ensure sufficient capacity in the Tank Farms to accommodate the DWPF radioactive liquid waste stream and other projected influents to the SRS HLW management system (WSRC 1999d).

Transuranic waste

DOE would not expect to generate transuranic wastes as a result of the proposed salt processing activities.

LLW

Under each of the action alternatives, DOE would expect to generate approximately 71 cubic meters per year of LLW. The projected volume represents about 0.5 percent of the forecasted SRS LLW generation through 2029 (Halverson 1999). Compactible LLW would be segregated from non-compactible LLW and processed in a volume reduction facility before disposal. Currently all LLW is disposed of onsite, but DOE is investigating the possibility of sending some LLW offsite for commercial treatment and disposal (DOE 2000d).

Hazardous waste

Under each of the action alternatives, DOE would expect to generate approximately 23 cubic meters per year of hazardous waste as a result of startup activities. This waste would consist of nonradioactive chemicals used to test the new facilities prior to actual waste processing. An additional 1 cubic meter per year of hazardous waste is expected during operations. The projected volume represents about 0.7 percent of the forecasted SRS hazardous waste generation through 2029 (Halverson 1999). This waste would be shipped offsite to commercial facilities for treatment and disposal (DOE 2000d).

Mixed LLW

Under each of the action alternatives, DOE would expect to generate small amounts (about 1 cubic meter per year) of mixed waste. These projected volumes represent about 0.4 percent of the forecasted SRS mixed LLW generation through 2029 (Halverson 1999). This waste would be treated onsite or at other DOE sites. Disposal would be at offsite facilities (DOE 2000d).

Table 4-18. Maximum annual waste generation for the salt processing action alternatives[a].

	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Radioactive liquid waste (gallons)	300,000	250,000	900,000	150,000
Nonradioactive liquid waste (gallons)	Negligible[b]	34,000[b,c]	Negligible[b]	Negligible[b]
Transuranic waste (m^3)	negligible	negligible	negligible	negligible
LLW (m^3)	71	71	71	71
Hazardous waste (m^3)	Startup – 23[d] Operations – 1	Startup – 23[d] Operations – 1	Startup – 23[d] Operations – 1	Startup – 23[d] Operations – 1
Mixed LLW (m^3)	1	1	1	1
Mixed low-level liquid waste (gallons)	60,000	None	1,000	None
Industrial waste (metric tons)	Startup – 30[d] Operations – 20	Startup – 30[d] Operations – 20	Startup – 30[d] Operations – 20	Startup – 30[d] Operations – 20
Sanitary waste (metric tons)	Startup – 62[d] Operations – 41	Startup – 62[d] Operations – 41	Startup – 62[d] Operations – 41	Startup – 62[d] Operations – 41

Source: WSRC (1999b, 2000b).
a. Under the No Action alternative, waste generation rates would be similar to those at the existing HLW Tank Farms. Therefore, waste generation rates would not be expected to increase from current levels.
b. Assumes continuous operation.
c. CST resin pretreatment generates a spent 1 M NaOH solution and CST fines slurry.
d. Assumes a 1.3-year duration for startup activities under each action alternative.

Table 4-19. Total estimated waste generation for the salt processing action alternatives[a].

	Small Tank Precipitation	Ion Exchange	Solvent Extraction	Direct Disposal in Grout
Radioactive liquid waste (million gallons)	3.9	3.3	12	2.0
Nonradioactive liquid waste (million gallons)	negligible	0.49	negligible	negligible
Transuranic waste (m^3)	negligible	negligible	negligible	negligible
LLW (m^3)	920	920	920	920
Hazardous waste (m^3)	Startup – 30[b] Operations – 13	Startup – 30[b] Operations – 13	Startup – 30[b] Operations – 13	Startup – 30[b] Operations – 13
Mixed LLW (m^3)	13	13	13	13
Mixed low-level liquid waste (gallons)	780,000	None	13,000	None
Industrial waste (metric tons)	Startup – 39 Operations – 260	Startup – 39 Operations – 260	Startup – 39 Operations – 260	Startup – 39 Operations – 260
Sanitary waste (metric tons)	Startup – 81 Operations – 530	Startup – 81 Operations – 530	Startup – 81 Operations – 530	Startup – 81 Operations – 530

a. Under the No Action alternative, waste generation rates would be similar to those at the existing HLW Tank Farms. Therefore, waste generation rates would not be expected to increase from current levels.
b. Assumes a 1.3-year duration for startup activities and 13 years of operation for each of the action alternatives.