TABLE 5.7.3–2. —*Peak Attenuated Noise Levels (in dBA) Expected from Operation of Construction Equipment*

Source	Peak Noise Level	Distance from Source						
		15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	100 m (400 ft)	305 m (1,000 ft)	518 m (1,700 ft)	762 m (2,500 ft)
Heavy trucks	95	84-89	78-83	72-77	66-71	58-63	54-59	50-55
Dump trucks	108	88	82	76	70	62	58	54
Concrete mixer	108	85	79	73	67	59	55	51
Jackhammer	108	88	82	76	70	62	58	54
Scraper	93	80-89	74-82	68-77	60-71	54-63	50-59	46-55
Bulldozer	107	87-102	81-96	75-90	69-84	61-76	57-72	53-68
Generator	96	76	70	64	58	50	46	42
Crane	104	75-88	69-82	63-76	55-70	49-62	45-48	41-54
Loader	104	73-86	67-80	61-74	55-68	47-60	43-56	39-52
Grader	108	88-91	82-85	76-79	70-73	62-65	58-61	54-57
Dragline	105	85	79	73	67	59	55	51
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Note: 1ft = 0.305 m
Source: Golden et al. 1980.

5.7.3.4 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Construction related noise impacts under Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) would result from relatively high and continuous levels of noise in the range of 89 to 108 dBA. Because of the distance between construction sites and locations relative to Y-12 facilities cumulative noise impacts to the Y-12 employee population would be mitigated to acceptable levels (approximately 70 dBA). Noise impacts to Y-12 workers would be further mitigated by the buildings in which employees were working. However, the number of Y-12 workers exposed to increased construction noise levels under this alternative would be larger (basically the west end of Y-12) than under Alternative 1B (No Action - Planning Basis Operations Alternative), Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative), or Alternative 3A (No Action - Planning Basis Operations Plus Construct and Operate Special Materials Complex). Potential construction activity locations under the alternative are at sufficient distance from the ORR boundary and the city of Oak Ridge to result in no change to background noise levels at these areas.

5.8 SITE FACILITIES AND SUPPORT ACTIVITIES

Changes to site facilities and support activities were assessed by comparing the support requirements of the No Action - Planning Basis Operations Alternative (continue Y-12 mission operations) and the proposed HEU Storage Mission Alternatives and Special Materials Mission Alternative with the existing Y-12 No Action - Status Quo Alternative and Y-12 Site infrastructure capacities and facilities. These assessments focus upon electrical power, fuel requirements, and water usage. Projections of electricity availability, site development plans, and other Y-12 mid- and long-range planning documents were used to project Site

infrastructure conditions for the evaluated alternatives. In addition, facilities that could be surplus to DP due to construction of new facilities were identified.

5.8.1 Alternative 1A (No Action - Status Quo Alternative)

The site facility and support requirements for this alternative are taken to be the same as those utilized during the most recent year when uranium operations were in stand-down and complete figures were available (i.e., 1999). Table 5.8.1-1 shows these requirements compared to the capacity of the Y-12 Site. The Site capacity in all cases is appreciably larger than requirements under the No Action - Status Quo Alternative. No adverse impacts are expected from operations under the No Action - Status Quo Alternative.

5.8.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Alternative 1B (No Action - Planning Basis Operations Alternative) would not result in major upgrades or new construction to DP facilities or operations. Under this alternative, DP and most site program missions would be performed in existing facilities. This alternative would require additional energy usage above that used under Alternative 1A (No Action - Status Quo Alternative) during 1999, principally due to the restart of uranium and other operations which were suspended in 1994. Table 5.8.2-1 shows the projected annual resource requirements for the No Action - Planning Basis Operations Alternative compared to usage under the No Action - Status Quo Alternative for the Y-12 Site.

5.8.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, a new HEU Materials Facility would be built on either candidate Site A or Site B as described in Section 3.2.3.2. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement. HEU materials storage operations currently located in Buildings 9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998 (shown in Figure 5.8.3–1) would be relocated to the new facility regardless of which site is selected. Areas in these buildings vacated by HEU storage operations would be available for other uses or could be declared as excess.

If the new facility is constructed at Site A, electrical and water utilities would be relocated and a sanitary sewer main would be extended to the new facility from a point just west of Building 9703-11. A new comprehensive storm sewer system would be provided with capacity for a 100-year storm; and the system would also accommodate the simultaneous failure of two 5.7 million L (1.5 million gal) water tanks on the south side of Pine Ridge.

If the new facility is constructed at Site B, Buildings 9831, 9720-15, 9814, 9819, 9429, 9420-1, 9626, and 9627 would be demolished. In addition, existing utilities would need to be relocated, including steam and condensate lines that serve the Y-12 WETF and Building 9114; overhead electrical lines, and a 143.8-kV line that runs along Old Bear Creek Road. New utilities would be extended to the new facility from existing tie points. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12.

TABLE 5.8.1–1.—*Y-12 Site Energy and Resource Requirements—Alternative 1A (No Action - Status Quo Alternative)*

Resource	Units	Alternative 1A No Action - Status Quo Usage (1999)	Y-12 Site Capacity
Electrical energy	MWh/yr	357,900	1,752,000
Natural gas	m^3/yr	2,750,000	As needed
Coal	t/yr	64,350	As needed
Steam[a]	kg/hr @ 250 psi	83,900	363,000
Raw water	L/day	17,900,000	20,820,000
Treated water	L/day	15,950,000	26,500,000
Demineralized water	L/day	7,400	545,110
Sanitary sewer	L/day	2,880,000	5,680,000
Compressed air	m^3/min	296	595
Nitrogen	m^3/yr	5,465,000	33,980,000
Oxygen	m^3/yr	94,000	1,388,000
Helium	m^3/yr	63,150	As needed (5,550 m^3 Storage)
Hydrogen	m^3/yr	8,774	As needed (2,550 m^3 Storage)

[a] Average steam load.

Source: BWXT 2001a, LMES 1999d, LMES 2000a.

TABLE 5.8.2–1.—*Y-12 Site Energy and Resource Requirements—Alternative 1B (No Action - Planning Basis Operations Alternative)*

Resource	Units	Alternative 1A No Action - Status Quo Usage (1999)	Alternative 1B No Action - Planning Basis Usage
Electrical energy	MWh/yr	357,900	565,710
Natural gas	m^3/yr	2,750,000	3,965,000
Coal	t/yr	64,350	81,000
Steam[a]	kg/hr @ 250 psi	83,900	103,000
Raw water	L/day	17,900,000	17,900,000
Treated water	L/day	15,950,000	20,200,000
Demineralized water	L/day	7,400	16,880
Sanitary sewer	L/day	2,880,000	2,650,000
Compressed air	m^3/min	296	420
Nitrogen	m^3/yr	5,465,000	8,380,000
Oxygen	m^3/yr	94,000	116,400
Helium	m^3/yr	63,150	67,110
Hydrogen	m^3/yr	8,774	10,100

[a] Average steam load.
Source: BWXT 2000a, LMES 2000a, LMES 1999d.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, a new two-story addition would be added to the north end of Building 9215 (see Section 3.2.2.3). HEU materials storage operations currently located in Buildings 9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998 (shown in Figure 5.8.3–1) would be relocated to the new storage addition of Building 9215. Areas in these buildings vacated by HEU storage operations would be available for other uses or could be declared as excess.

Construction of the new addition to Building 9215 would not involve removing any major permanent structures since the proposed site is occupied by trailers and temporary facilities. Existing on-site utilities and infrastructure would be tied into the new facility with minimal relocation and modification necessary.

Table 5.8.3–1 shows the construction-related estimated resource requirements for HEU Storage Mission Alternatives. These requirements are small when compared to No Action - Status Quo or No Action - Planning Basis Operations usage and are well within existing Y-12 Site capacity.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 5.8.3–1.—*Potentially Affected Facilities Due to Construction of Highly Enriched Uranium Materials Facility or Building 9215 Expansion.*

TABLE 5.8.3–1.—*HEU Storage Mission Alternatives Construction Requirements*

Requirements	New HEU Materials Facility	Upgrade Building 9215
Materials/Resource		
Electrical energy (MWh)	5,000	5,000
Concrete (m^3)	25,100	7,650
Steel (t)	2,100	1,100
Liquid fuel and lube oil (L)	568,000	265,000
Treated Water (L)	7,571,000	5,678,000
Land (ha)	5	1

Source: LMES 2000b.

Table 5.8.3–2 shows the long-term utility usage and resource requirements for the No Action - Planning Basis Operations Alternative along with the projected utility usage and resource requirements for the HEU Storage Mission Alternatives. The projected requirements in this table account only for the new facilities and do not account for potential reductions in utility usage or resource requirements due to demolition or reduced use of excess facilities. Because the existing utility and resource capacity at the Y-12 Site is sufficient to accommodate any projected changes resulting from the operation of a new storage facility, DOE expects no adverse impact on utilities or infrastructure due to the implementation of this alternative.

TABLE 5.8.3–2.— *Annual Operation Requirements for the Alternative 1B (No Action - Planning Basis Operations Alternative) and the HEU Storage Mission Alternatives*

Requirements	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	Alternative 2A HEU Materials Facility	Alternative 2B Upgrade Building 9215	Combined Alternatives 1B and 2A
Electrical energy (MWh)	357,900	565,710	5,900	10,900	571,610
Treated Water (L/day)	15,950,000	20,200,000	1,510	1,975	20,202,200

Source: BWXT 2001a, LMES 2000a, LMES 2000b.

5.8.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Under this alternative, a new facility would be constructed to fulfill the Special Materials Mission at one of three candidate sites as discussed in Section 3.2.4.2. Special Materials Operations currently located in Buildings 9202, 9731, 9201-5, 9201-5N, 9995, 9404-11, 9204-2, (shown in Figure 5.8.4–1) would be relocated to the new facility regardless of which site is selected. Y-12 storm sewer system, and water, electrical, and other utilities would be extended from within the Protected Area of Y-12. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. When completed, the new facility would have no overhead utilities. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

Source: Tetra Tech, Inc./LMES 2000b.

FIGURE 5.8.4–1. ***Potentially Affected Facilities Due to Construction of Special Materials Complex.***

If Site 2 is selected, Buildings 9720-16, 9720-24, 9720-53, 9824-1, and 9824-2 would be demolished. As with Site 1, a comprehensive storm sewer system would be installed, and utilities would tie into existing systems at Y-12.

If Site 3 is selected, Buildings 9831, 9720-15, 9814, 9819, 9420, 9420-1, 9626, and 9627 would be demolished. In addition, several trailers would be moved from the site. As with Sites 1 and 2, a comprehensive storm sewer system would be installed, and utilities would tie into existing systems at Y-12.

Table 5.8.4–1 shows the construction-related estimated resource requirements for the proposed new Special Material Complex for the three candidate sites. These requirements are small when compared to usage under the No Action - Planning Basis Operations or No Action - Status Quo Alternative and are well within existing Y-12 Site capacity.

TABLE 5.8.4–1.—*Special Materials Complex Construction Requirements*

Requirements	Site 1	Site 2	Site 3
Materials/Resource			
Electrical energy (MWh)	8,000	8,000	8,000
Concrete (m^3)	13,800	14,500	14,500
Steel (t)	3,000	3,200	3,200
Liquid fuel and lube oil (L)	984,200	1,582,300	1,582,300
Industrial gases (m^3)	5,700	5,700	5,700
Treated Water (L)	5,700,000	5,700,000	5,700,000
Land (ha)	8	5	5

Source: LMES 2000c.

TABLE 5.8.4–2.—*Annual Operation Requirements Special Materials Complex Annual Operation Requirements*

Requirements	Alterative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	Alternative 3 New Special Materials Complex	Combined Usage
Electrical energy (MWh)	357,900	565,710	30,400	596,110
Steam kg/hr	83,900	103,000	3,262	106,300
Demineralized Water (L/day)	7,400	16,880	5,393	22,270
Industrial gas				
Helium (m^3)	63,150	67,110	14,725	81,840
Oxygen (m^3)	94,000	116,400	396	116,800
Nitrogen gas (m^3)	5,465,000	8,380,000	1,500,800	9,881,000
Treated Water (L/day)	15,950,000	20,200,000	228,600	20,430,000

Source: BWXT 2001a, LMES 2000a, LMES 2000c.

Table 5.8.4–2 shows the long-term utility usage and resource requirements for Alternative 1B (No Action - Planning Basis Operations) along with the projected utility usage and resource requirements for the proposed new Special Materials Complex. The projected requirements in this table account only for the new facilities and do not account for potential reductions in utility usage or resource requirements due to demolition or reduced use of excess facilities. Because the existing Y-12 Site utility and resource capacity is sufficient to accommodate any projected changes resulting from the operation of a new Special Materials Complex, DOE expects no adverse impact on utilities or Y-12 infrastructure due to implementing this alternative.

5.8.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction and operation of the new HEU Materials Facility and the Special Materials Complex when combined with No Action - Planning Basis Operations would not have an appreciable impact on the utility usage and resource availability at the Y-12 Site. These combined values are shown in Table 5.8.5–1 which shows that they are all within the Y-12 Site capacities shown on Table 5.8.1–1. Appropriate traffic control and coordination measures would be implemented during construction activities to minimize Field Research Center worker access impacts to the NABIR program activities at Y-12. Appropriate measures would be implemented to minimize research worker access impacts to Field Research Center activities by any new Y-12 facility security requirement.

TABLE 5.8.5–1.—*Y-12 Site Energy and Resource Requirements—No Action - Planning Basis Operations Plus the HEU Storage Mission and Special Materials Mission*

Resource	Units	Alternative 1B No Action - Planning Basis Operations Usage	Alternative 4 Combined Usage
Electrical energy	MWh/yr	565,710	602,050
Natural gas	m^3/yr	3,965,000	3,965,000
Coal	t/yr	81,000	81,000
Steam[a]	kg/hr @ 250 psi	103,000	106,300
Raw water	L/day	17,900,000	17,900,000
Treated water	L/day	20,200,000	20,430,000
Demineralized water	L/day	16,880	22,300
Sanitary sewer	L/day	2,650,000	2,650,000
Compressed air	m^3/min	420	420
Nitrogen	m^3/yr	8,380,000	9,881,000
Oxygen	m^3/yr	116,400	116,800
Helium	m^3/yr	67,110	81,835
Hydrogen	m^3/yr	10,100	10,100

[a] Average steam load.
Source: LMES 2000a, LMES 1999b, LMES 2000c.

5.9 VISUAL RESOURCES

The visual resources analysis considers a ROI which includes those lands from which the Y-12 National Security Complex is visible (the viewshed). Impacts to the ROI include those associated with changes in the existing landscape character resulting from construction activities and operations under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives.

5.9.1 Alternative 1A (No Action - Status Quo Alternative)

Y-12's heavily industrialized development is consistent with BLM's VRM Class IV which has been designated for the SWEIS analysis. Structures at Y-12 are mostly low profile reaching heights of three stories or less, with the expectation of the East and West meteorological towers. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake and the bluffs on the opposite side of Clinch River. Views are limited are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric condition. Y-12 missions activities under the No Action - Status Quo Alternative are consistent with BLM's VRM Class 5 classification for developed areas of ORR. There are no impacts to visual resources expected under Alternative 1A (No Action - Status Quo Alternative).

5.9.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Under Alternative 1B (No Action - Planning Basis Operations Alternative), activities associated with DP, Environmental Remediation, Fissile Materials, NE and Nonproliferation, Work-for-Others Program, and Technology Transfer would not affect local short-term or long-term visual resources.

Potential impacts to visual resources from the Environmental Management Waste Management Facility and the ORNL NABIR Program Field Research Center component included under the No Action - Planning Basis Operations Alternative are described below.

Construction and operation activities associated with the Environmental Management Waste Management Facility at the Y-12 Site would be visible from Bear Creek Road, Chestnut Ridge, and Pine Ridge. Since Bear Creek Road is not a public thoroughfare and both Chestnut Ridge and Pine Ridge are restricted within the ORR boundary and accessible only by dirt road or by foot, there should be no short-term visual impacts to the public. Since the site where the Environmental Management Waste Management Facility would be constructed is within an area currently used for waste management, no adverse visual impacts are expected.

If in the future, portions of ORR along Bear Creek Road are released by DOE, the most likely land use would be industrial. Given the industrial nature of the existing nearby DOE facilities and the probable future land use, the new disposal cell construction and operations would be generally consistent with visual impacts expected from other ORR and Y-12 Site land use.

After closure, the disposal facility would remain visible for the foreseeable future, although re-establishment of the forest would provide some visual buffer. The closed cell would be a flat-topped, low mound. Should institutional controls lapse, external reforestation of the cell area would reduce the contrast of the facility with the surrounding woodland, but the man-made form of the facility would remain distinctive.

The Field Research Center component of the ORNL NABIR Program at Y-12 (see Section 3.2.1.7) could result in short-term visual impacts.

Activities supporting the Field Research Center Site, including characterizations, obtaining research quality samples, and conducting in-situ research, could result in short-term visual impacts to aesthetic resources as a result of machinery used on the Site. These activities would involve drill rigs and support vehicles. There would also be an increase in site personnel. Visual/aesthetic resources at the contaminated area include waste management areas as well as storage yards for scrap metal and other materials. The only visual intrusion anticipated due to Field Research Center research would be the placement of a support trailer and the temporary placement of drilling rigs and other equipment near specific research sites in the contaminated background area. Efforts would be made to place trailers and equipment in areas previously disturbed to limit the potential for visual impacts. No long-term visual impacts are expected from Field Research Center activities.

5.9.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Construction of a new HEU Materials Facility will include an earthern berm which would cover the structure with cribbing walls on the North and West sides. The facility design calls for a single-story storage structure which is similar to the heights of surrounding facilities at both Site A and Site B. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new facility. Due to its industrial surroundings, the new HEU Materials Facility would not alter the visual character of the Y-12 National Security Complex, and long-range views would not be adversely affected.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, the existing Building 9215 would be expanded to accommodate a two-story addition that would be similar to the heights of surrounding facilities. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new Building 9215 addition. Due to its industrial surroundings, the new addition would not alter the visual character of the Y-12 National Security Complex and long-range views would not be adversely affected.

5.9.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

The Special Materials Complex would consist of a number of processing operations and support facilities requiring approximately 5 to 8 ha (12.4 to 20 acres) of land. These facilities would range in height from one- to three-story buildings. Construction lay-down areas for each Site would be located within or near the designated facility Site (see Figure 3.2.4–3).

Site 1 for the proposed new Special Materials Complex is an 8-ha (20-acre) area which is currently a 50/50 mixture of previously cleared and wooded vacant land. There are no structures currently located on this Site. The construction of the Special Materials Complex would affect the visual appearance of Site 1, however, its construction is consistent with the existing VRM IV Classification which has been designated for the SWEIS analysis. Short-term visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be limited to the construction lay-down area and the immediate construction site of the new facilities. Following construction activities, the construction lay-down area would be regraded and

incorporated into the landscape design of the Special Materials Complex. The maximum height of the buildings within the Special Materials Complex would be approximately three stories, which is comparable to existing facilities within the Y-12 Site area. Visibility of Site 1 outside the ORR is restricted by surrounding Chestnut and Pine Ridges. The Special Materials Complex would have minimal effect on the overall viewshed.

Site 2 is approximately 5 ha (12.4 acres) and is located in the area of the Y-12 Scrap Metal Yard. Site 3 is the same location as Site B under Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility). The construction lay-down area for Site 2 and Site 3 would be located on the existing S-3 Parking Lot. Adverse visual impacts associated with construction activities (dust, equipment exhaust, etc.) would be short-term and limited to the construction lay-down area and the immediate construction site of the new facilities. Following construction activities, this area would be repaved and the spaces would be relined for its original parking purposes. Construction of the Special Materials Complex at either Site 2 or Site 3 would not change the existing VRM IV Classification which has been designated for the SWEIS analysis and surrounding facilities. Since the maximum height of the buildings within the Special Materials Complex would be approximately three stories, which is comparable to existing facilities with the Y-12 Site area, there would be minimal effect on the overall viewshed.

Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Visual impacts resulting from construction of the HEU Materials Facility and the Special Materials Complex when combined with the No Action - Planning Basis Operations Alternative would be limited to short-term effects from activities in the immediate area of the proposed construction sites and lay-down areas. No long-term visual impacts are expected under this alternative. The HEU Material Facility and the Special Materials Complex would stand no more than the three-story average height of the surrounding Y-12 facilities. Facility design features would be incorporated to limit adverse visual impacts. Following construction activities, landscape previously disturbed would be returned to its natural state or incorporated into the new facility overall landscape setting. Construction of these facilities wold be consistent with BLM's VRM IV Classification which has been designated for the SWEIS analysis. Given the industrial nature of the surrounding facilities and probable future land use, construction and operation of these new facilities would be consistent with visual impacts from other ORR and Y-12 Site land use.

5.10 CULTURAL AND PALEONTOLOGICAL RESOURCES

Potential impacts to cultural resources are assessed by applying the criteria of adverse effect as defined in 36 CFR 800.5[a]. An adverse effect is found when an action may alter the characteristics of a historic property that qualifies it for inclusion in the National Register of Historic Places (NRHP) in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Some examples of adverse effect to cultural resources include: physical destruction or damage; alterations not consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a); relocation of a property; isolation and restriction of access; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect resulting in deterioration; or transfer, lease or sale of historic properties without adequate protections. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative. Activities conducted under the alternatives considered are measured against the criteria of adverse effect to determine the potential for and intensity of impacts to cultural resources.

While DOE, as the Federal agency, makes the determination of adverse effect, consultation with the State Historic Preservation Officer (SHPO) and other parties is required regarding the application of the criteria

of adverse effect and in mitigation efforts to avoid or reduce any impacts. For certain activities specifically outlined in the Cultural Resources Management Plan (CRMP), DOE-ORO may apply the criteria of adverse effect without consultation, but if there is an adverse effect, there must be consultation with the SHPO and other parties to resolve the adverse effect (36 CFR 800.6, Souza 1997).

5.10.1 Alternative 1A (No Action - Status Quo Alternative)

The Y-12 area includes a proposed historic district which encompasses the original Y-12 Site and consists of 92 contributing buildings and structures. Two buildings in the Y-12 National Security Complex have been proposed for National Historic Landmark status as individual properties. Much of Y-12 has been disturbed by past activities and the potential for discovery of archaeological resources eligible for listing on the NRHP is considered low. The remaining undisturbed areas are not considered likely locations for significant archaeological resources (DuVall and Associates 1999). One pre-World War II structure has been determined eligible for listing on the NRHP. No Native American traditional use areas or religious sites are known to be present in the Y-12 area and no artifacts of Native American religious sigificance are known to exist have or to have been removed from the Y-12 area (Souza 1997). Seven cemeteries associated with Euro-American use of the area prior to World War II are likely to have religious or cultural importance to descendants and the local community. No other traditional, ethnic or religious resources have been identified in the Y-12 area.

Under the No Action - Status Quo Alternative, some NRHP-eligible properties in the proposed historic district would continue to be actively used for DOE mission activities. The historic significance of the district is related to its association with the Manhattan Project, development as a nuclear weapons component plant within the overall post-World War II government sponsored scientific movement, early nuclear development activities, the engineering merits of many of the structures, and for its contributions to science. The continued use of these buildings in a mission compatible with their historic role would have a positive impact on the integrity of the historic properties present.

Some historic buildings, which are not currently being used in current missions activities, may be subject to the potential adverse effects of building abandonment and demolitions. Alternative 1A (No Action - Status Quo Alternative), however, would minimize the need for mission-related demolitions and modifications of historic buildings and the need for new construction. Historic buildings may also benefit from passive preservation, although ongoing minor impacts due to aging would continue. The remote possibility of encountering unanticipated cultural resources during construction would be minimized.

5.10.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

Alternative 1B (No Action - Planning Basis Operations Alternative) is the continuation of historical Y-12 missions operations at planned and required workload levels in existing facilities. No new major DP facility upgrades, modifications, or infrastructure improvements other than routine maintenance are included to accomplish the nuclear weapons complex support missions. However, included in this alternative is the Field Research Center and Environmental Management Waste Management Facility project activities as described in Section 3.2.2.

Under the No Action - Planning Basis Operations, NRHP- eligible properties in the proposed historic district encompassing the Y-12 National Security Complex would continue to be actively used for DOE mission activities. Planned production activities associated with assigned nuclear weapons support missions would contribute to the preservation of this aspect of the historical integrity of the district more than Alternative 1A (No Action - Status Quo Alternative). The continued use of these buildings in a mission compatible with their historic role would have a positive impact on the integrity of the historic properties present. This alternative would minimize potential adverse impacts of building abandonment, modifications, demolitions,

and new construction of the action alternative. Ongoing minor impacts due to aging of historic structures would continue.

The potential for impacts to cultural resources resulting from the Field Research Center activities and the development of the Environmental Management Waste Management Facility waste disposal cell has been assessed in consultation with the SHPO. No impacts to cultural resources are anticipated (DOE 1999j, DOE 2000b). Although there are no known archaeological resources in the project areas, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

5.10.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Site A. The Site A alternative includes the construction of a new HEU Materials Facility in the West Portal Parking Lot area with construction laydown north of Bear Creek Road. The planned removal of temporary structures, changes to utility and fence infrastructure, and facility construction would occur in the vicinity of the proposed Y-12 National Historic District. No structures which are contributing elements of the district or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with removal of current utility infrastructure and the construction of the new facility and utility infrastructure could impact previously undisturbed areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU Materials Facility, NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998) would no longer be used for the HEU storage mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU storage mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site B. The Site B alternative includes the construction of a new HEU Materials Facility at the current location of the Y-12 Scrap Metal Yard. Equipment laydown would be at the S-3 Ponds Parking Lot and temporary parking lots would be developed in the West Tank Farm area and south of old Post 17. Several trailers and structures would be removed or torn down. The planned demolition of structures, environmental clean-up activities, changes to utility infrastructure, and facility construction would occur in the vicinity of the proposed Y-12 National Historic District. No structures which are contributing elements of the proposed district or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with environmental cleanup of the Y-12 Scrap Metal Yard, new utility infrastructure, and facility construction could impact previously undisturbed areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU Materials Facility, NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9215, 9720-5, and 9998) would no longer be used for the HEU Storage Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU Storage Mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Actions proposed under this alternative include the construction of a two-story addition to the north end of Building 9215 to address long-term HEU storage requirements. Building 9215 is eligible for inclusion on the NRHP as a contributing element of the proposed Y-12 National Historic District for its historical association with the post-World War II government-sponsored scientific movement and early nuclear development. The property, which was constructed in 1956, also meets the criteria of "exceptional significance" required for listing properties less than 50 years old (Thomason 1999).

The expansion of Building 9215 under this alternative would be a major alteration of this historic property. If the proposed modifications are consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a) and the SHPO concurs, this alteration would not have an adverse effect on this historic building. This facility was renovated and enlarged in 1970, 1976, and 1986, and has had minor upgrades and modifications several times since construction (Thomason 1999). Since active facilities must constantly evolve if they are to continue making scientific or engineering advances, change is part of the historic significance of this kind of property. The proposed modifications could result in the positive impact of allowing the continued use of the facility in a mission closely aligned with its historic role. The SHPO and other parties must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

The proposed site for construction of the addition is currently occupied by trailers and temporary buildings. No structures which are contributing elements of the proposed Y-12 National Historic District or that have individual historic significance would be demolished or removed. Ground-disturbing activities associated with site preparation, new utility infrastructure, and facility construction could impact previously undisturbed

areas. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the new HEU storage addition to Building 9215, some NRHP- eligible buildings (9204-2, 9204-2E, 9204-4, 9720-5, and 9998) would no longer be used for the HEU storage mission. Depending on the disposition of these historic properties, there could be impacts associated with moving the HEU storage mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

5.10.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

This alternative includes the No Action - Planning Basis Operations Alternative that continues the use of existing buildings for Special Materials Operations or the construction of a Special Materials Complex on one of three sites currently under consideration.

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Site 1. The Special Materials Complex Site 1 alternative includes the construction of a new Special Materials Complex northwest of Building 9114 and north of Bear Creek Road. The Site is currently unoccupied and would not require removal of any structures. Portions of the Site have been disturbed by past construction lay-down activities but approximately 50 percent of the Site is a wooded slope which appears to be relatively undisturbed. Because use of this Site would probably involve ground disturbance in an undisturbed area and may involve disturbance exceeding the depth and extent of previous ground disturbances the DOE-ORO would consult with SHPO and other parties to determine whether an archaeological survey is warranted. If a survey is conducted, any resources found would be evaluated for NRHP-eligibility and the effects determined in consultation with the SHPO and other parties. Even if no resources are found during a survey, there would be a remote possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

The Special Materials Complex construction would occur in the vicinity of the proposed Y-12 National Historic District. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Upon completion of the Special Materials Complex, NRHP-eligible buildings (9201-5, 9202, 9731, and 9995) would no longer be used for the Special Materials Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving this mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be

consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site 2. The Special Materials Complex Site 2 alternative includes the construction of a new Special Materials Complex in the Y-12 Scrap Metal Yard area. No structures which are contributing elements of the Y-12 Site National Historic District or that have individual historic significance would be demolished or removed. The planned location, height, and style of the new construction would not be expected to impact the setting of the district as a whole or individual historic properties.

Ground-disturbing activities associated with removal of current utility infrastructure, environmental restoration activities and the construction of the new facility and utility infrastructure could impact previously undisturbed depths. Although no significant archaeological resources are known to occur in the Y-12 Site area, there would be a possibility of encountering buried cultural resources during ground-disturbing activities. Procedures for addressing the unanticipated discovery of cultural resources, including human remains and Native American cultural items, are outlined in the CRMP (Souza 1997). Compliance with these procedures addresses the requirements of applicable Federal and state laws and regulations with regard to unanticipated discoveries.

Upon completion of the Special Materials Complex, NRHP-eligible buildings (9201-5, 9202, 9731, and 9995) would no longer be used for the Special Materials Mission. Depending on the disposition of these historic properties, there could be impacts associated with moving this mission from these buildings. Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration. If adverse effects on historic properties could result from the change of mission or subsequent disposition of these buildings, the SHPO must be consulted regarding the application of the criteria of adverse effect and in mitigation efforts to avoid or reduce any impacts in accordance with 36 CFR 800.

Site 3. The Special Materials Complex Site 3 (Southwest) alternative includes the construction of the Special Materials Complex at the current location of the Y-12 Scrap Metal Yard. The potential impacts associated with the use of this Site are the same as described for Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility) Site B. Potential impacts associated with moving the Special Materials Mission from NRHP- eligible buildings (9201-5, 9202, 9731, and 9995) would be the same as described for Sites 2 and 3.

5.10.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

Construction of both the HEU Materials Facility and Special Materials Complex and continued support of assigned missions under the No Action - Planning Basis Operations Alternative could result in greater impacts to cultural resources than building one or the other facility. Potential impacts vary by site location and specific actions planned, but it is expected that no significant impacts would result, or that adequate mitigation measures would be developed to reduce any impacts to a level of non-significance. No structures which are contributing elements of the Y-12 National Historic District or that have individual historic significance would be demolished or removed for the construction. The storage expansion of Building 9215 is the only major alteration of a historic property under consideration among the alternatives. If both facilities are built there would be more ground disturbing among the alternatives; there would also be more activities associated with site preparation, new utility infrastructure, and facility construction which could result in the unanticipated discovery of cultural resources. There could be impacts associated with the disposition of many cultural resources. There could be impacts associated with the disposition of many historic properties when these mission operations are moved from existing buildings into the new facilities.

Potential impacts include changes in the character of the properties' use, the physical destruction of historic properties, and the neglect of properties leading to deterioration.

5.10.6 Mitigation Measures

The DOE-ORO, the Advisory Council for Historic Preservation, and the Tennessee SHPO entered into a Programmatic Agreement for the management of cultural resources at the ORR (DOE 1994c). This Programmatic Agreement mandated the preparation of a CRMP to provide detailed compliance procedures for future undertakings including preconstruction planning, consultation and documentation responsibilities, excluded actions, unanticipated discoveries, and avoidance of adverse effects (Souza 1997). The CRMP is currently used, although it is in draft form awaiting final approval and publishing. Therefore, provisions are in place to identify and resolve any potential adverse effects to cultural resources that may result from actions planned under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives under consideration. These provisions allow a large measure of discretion to the DOE-ORO in addressing the cultural resource issues unique to this kind of facility and emphasize early planning to avoid, reduce, and mitigate the adverse effects of undertakings. The CRMP does, however, require consultation for all undertakings which may have an adverse effect on historic properties.

The DOE-ORR has notified the Tennessee SHPO that undertakings resulting from the alternatives under consideration may have an adverse effect on historic properties. After review of the documentation provided, the SHPO agreed that there may be an adverse effect and requested further consultation (see Appendix C). Whether there would be impacts, and the context and intensity of these potential impacts, is dependent on the alternative(s) selected and the specific actions planned. It is expected that either no significant impacts would result, or that adequate mitigation measures would be developed to reduce any impacts to a level of nonsignificance.

Measures to minimize the potential adverse effects to unanticipated archaeological resources could include:

- Providing basic information to workers involved in ground-disturbing activities regarding the recognition of archaeological resources and Native American cultural items and the procedures to be followed upon discovery

- Assuring that discovery procedures detailed in Sections 5.1.6 and 5.4.2 of the CRMP are implemented in all applicable cases (Souza 1997). These procedures address the responsibilities of DOE-ORO under 36 CFR 800.13, 43 CFR 10.4, Section 3(d)(1) of *Native American Graves Protection and Repatriation Act* of 1990 and the State of Tennessee burial laws Tennessee Code Annotated (TCA) 11-6-116, 39-17-311 and TCA 39-17-312.

Measures to minimize the adverse effect of aging on historic properties could include:

- Providing information to responsible parties regarding maintenance of historic buildings in accordance with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a)

- Developing a building maintenance plan for the Y-12 National Historic District to address the issues of care for historic structures and ongoing aging issues

Measures to minimize the potential adverse effect of changes in the character of the use of historic properties could include:

- Consideration of upgrades and rehabilitation to allow continued use of the facility

- Consideration of the reuse of the facility for other similar mission-related activities

Measures to minimize the adverse effect of the physical destruction of historic properties by removal or demolition of buildings could include:

- Consideration of upgrades and rehabilitation in lieu of removal

- Salvage of architectural or scientific/engineering elements

- Detailed recording of the structures to the standards of the Historic American Buildings Survey or the Historic American Engineering Record (DOI 1990b) prior to removal (when all other mitigations are determined to be infeasible)

If a large number of individual contributing elements to the district are considered for removal, such that the integrity of the district as a whole would be threatened, DOE should consider entering into a Memorandum of Agreement for this specific action to identify the programmatic approach to mitigate this impact.

Measures to minimize the potential adverse effect of neglect or abandonment of historic properties could include:

- Consideration of the reuse and/or rehabilitation of the property for support or other functions

- The development of a maintenance and security plan to ensure that buildings are not allowed to deteriorate when not in use

Measures to minimize any potential adverse effects of the modification of historic structures such as Building 9215 could include:

- Designing building modifications that are consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (DOI 1990a)

- Consideration of changes in project design to avoid the adverse impacts of modification

- Salvage of architectural or scientific/engineering elements

- Detailed recording to the standards of the Historic American Buildings Survey or the Historic American Engineering Record (DOI 1990b) prior to modifying the facility (when all other mitigations are determined to be infeasible)

5.10.7 Paleontological Resources

Impacts to paleontological resources are considered significant if scientifically important resources are disturbed or damaged. Scientific importance for paleontological resources is based on the research potential of the resource, the quality of the fossil preservation in the deposit and on the numbers and kind of resources that could be affected. Resources with high research potential include deposits with poorly known fossil forms; fossils which originate from areas which are not well studied; well-preserved terrestrial vertebrates; unusual depositional contexts or concentrations; or assemblages containing a variety of different fossil forms. Paleontological materials in the Y-12 Site area consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

No scientifically important paleontological resources have been identified in the Y-12 Site area. Actions contemplated for the alternatives under consideration would require minor or no ground disturbance of

previously undisturbed areas. It is unlikely that any scientifically important paleontological resources would be impacted by the No Action - Planning Basis Operations, HEU Storage Mission, or Special Materials Mission Alternatives.

DOE has identified no potential impacts to paleontological resources and, therefore, no mitigation actions are required.

5.11 WASTE MANAGEMENT AND POLLUTION PREVENTION

Waste streams currently generated at the Y-12 National Security Complex may be broadly grouped to include: LLW, mixed LLW, hazardous waste, and sanitary/industrial (nonhazardous) waste. These waste streams would continue to be generated by implementation of each of the alternatives, however, quantities and relative proportions of the waste would vary by alternative. Waste generated during routine operations, under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives (Section 5.11.1), during implementation of the alternatives for the two missions (Section 5.11.2), and as a result of pollution prevention efforts and mitigation measures in relation to the alternatives (Section 5.11.3) are discussed here.

Some waste generated by activities at Y-12 are not included in this discussion. Many of the facilities at Y-12 are already considered surplus and will be subject to D&D. Per agreement among the DOE, the State of Tennessee and the EPA, D&D of facilities on the ORR will be primarily addressed as removal actions through the CERCLA process because they are often contaminated and present a risk to human health and the environment. This agreement allows DOE and the regulators to prioritize D&D of these facilities based on the level of risk posed by the facility and available funding. Waste generated by D&D of these surplus facilities under the Environmental Restoration Program is not associated with the alternatives being considered in this EIS and is, therefore, not discussed here. Other environmental restoration waste generated at Y-12 that is also addressed through the CERCLA process (Section 1.3) is not considered here. Per DOE's 1994 Secretarial policy on NEPA, the CERCLA process is relied upon for NEPA review, and NEPA values are incorporated into CERCLA documentation for these actions. CERCLA waste streams are, however, included in a discussion of cumulative impacts (Chapter 6).

As noted in Section 4.8.2.3, wastes containing residual radioactive materials below approved authorized limits are currently disposed at the on-site sanitary/industrial landfill and construction/demolition landfills. Potential radiological impacts to on-site workers and off-site members of the public must be evaluated during the development of such authorized limits per DOE Order 5400.5 and associated guidance (DOE 1995, DOE 1997). Requirements for the approval of authorized limits for any specified waste stream at these facilities include analyses demonstrating that: (1) the potential radiation dose to workers or the public would be as far below 25 mrem/yr as reasonably achievable (and typically below 1 mrem/yr); (2) groundwater would be protected in accordance with the Site Groundwater Protection Program and applicable Federal and state regulations (40 CFR 131.11 and *Rules of the TDEC Chapter 1200-4-3*); and (3) any future release of the landfill property would not be expected to require future remediation under DOE Order 5400.5 requirements. These requirements are designed to provide reasonable assurance that potential radiological impacts from residual radioactive materials below authorized limits at these facilities would be neglible. DOE is currently re-evaluating authorized limits for disposal of materials containing residual radioactivity at Y-12 disposal facilities. This is not expected to alter the type of wastes accepted at the Y-12 landfills and will not be discussed further in this section.

Implementation of an alternative for the HEU Storage Mission or the Special Materials Mission could result in associated D&D of facilities currently used to perform these missions or the disturbance of previously contaminated environmental media. The potential impacts from generation of D&D and environmental restoration waste directly associated with implementation of the alternatives for these two missions are included in this section of the EIS. D&D can range from performing a simple radiological survey to completely dismantling and removing a radioactively contaminated facility. The potential reuse of a facility

or the outcome of its disposition must be known to predict waste volumes for its D&D, but could be conservatively bounded by a demolition scenario and discussed on a relative basis.

5.11.1 Waste Generated During Routine Operations Under Alternative 1A (No Action - Status Quo Alternative) and Alternative 1B (No Action - Planning Basis Operations Alternative)

Under both No Action Alternatives, Y-12 would continue to generate and manage waste at the Site. Mixed LLW and LLW in solid form are currently stored on-site pending treatment and storage. Disposal of radioactive waste generated at Y-12 has been restricted by either a lack of on-site facilities or by administrative barriers to approval of transporting and disposing of radioactive waste off site since on-site disposal ceased in the 1980s. As a result, significant quantities of LLW and mixed LLW have accumulated in storage at Y-12. Limited quantities of accumulated, legacy mixed LLW and LLW are being shipped off site for treatment and disposal because some approvals have been obtained to use existing DOE or licensed-commercial facilities. The bulk of the waste remains stored at Y-12. DOE must meet milestones to disposition mixed LLW as set forth in an ORR Site Treatment Plan for Mixed Waste as mandated by a State Commissioner's Order and to comply with the *Federal Facilities Compliance Act* (FFCA). Liquid LLW and mixed LLW are either treated on site and disposed of, or treated and subsequently managed as solids (Appendix A.5.11).

Recently, DOE issued a ROD covering treatment and disposal of mixed LLW and LLW (65 FR 10061, February 25, 2000) as one of a series of RODs for the Waste Management PEIS. In the ROD, DOE decided to continue minimum treatment of LLW generated at ORR on-site and dispose of the LLW at the Nevada Test Site. For management of mixed LLW, DOE decided to treat the mixed LLW generated at ORR on-site and dispose of the mixed LLW at the Nevada Test Site. Adverse impacts related to storage of legacy mixed LLW and LLW are expected to be reduced as the goals for legacy waste set forth under the Site Treatment Plan and the ROD are met (by FY 2006).

No new adverse impacts to the environment are anticipated from the generation of hazardous and sanitary/industrial waste by continuing current operations at No Action - Status Quo levels or by bringing them up to No Action - Planning Basis Operations levels. RCRA-permitted units for the storage and treatment of hazardous waste would continue to operate in support of routine operations at Y-12. Adequate permitted and approved off-site facilities are available to meet any additional treatment requirements and for disposal of the hazardous waste. Sanitary and process waste liquids would continue to be treated by the city of Oak Ridge sewage treatment plant or Y-12 treatment facilities. Current facilities have a combined capacity to handle approximately 10 times the liquid waste volumes generated by current operations. The resultant solids would be disposed of with other nonhazardous waste in existing, permitted landfills with an adequate capacity to handle projected waste volumes. Landfill V, a sanitary/industrial landfill at Y-12, would continue to accept general refuse and asbestos, medical (non-infectious), and other special waste as approved on a case-by-case basis by the state regulatory authorities. Landfills VI and VII are permitted for disposal of construction and demolition waste and have ample disposal capacity for well beyond the 10-year planning period (Appendix A, Table A.5.11.3–1).

5.11.1.1 *Alternative 1A (No Action - Status Quo Alternative)*

Waste streams and volumes generated during routine operations under the No Action - Status Quo Alternative, (1999 baseline year) are presented in Table 5.11.2–1. No changes would be anticipated in activities that generate waste or management practices over the 10-year planning period for Alternative 1A (No Action - Status Quo Alternative). This alternative is provided for comparison only to the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives.

5.11.1.2 *Alternative 1B (No Action - Planning Basis Operation Alternative)*

Waste streams and volumes generated during routine operations under Alternative 1B (No Action - Planning Basis Operations Alternative) are presented in Table 5.11.2–1. Few changes are anticipated in waste generation and management over the 10-year planning period under this alternative. On-going pollution prevention and waste minimization activities could result in further reductions in waste generation and thus, lower the annual generation rates of LLW and non-hazardous waste when compared to 1999 No Action - Status Quo levels. Slight increases in the generation of hazardous and mixed waste could still result as some operations are restarted or ramped up. Environmental restoration activities that would cause temporary increases in waste generation levels are not included with the waste from routine operations that are being discussed in this section.

5.11.2 Waste Generated by the Alternatives for the HEU Storage Mission and the Special Materials Mission

Differences in waste generation between the HEU Storage Mission and Special Materials Mission alternatives are primarily related to waste generated by construction and D&D activities that would be temporary in nature (3 to 5 years). Waste generated from routine activities could also differ between the alternatives as a result of differences between building and process efficiencies, as well as from ongoing pollution prevention efforts at Y-12 (Section 4.11).

The volumes of waste generated during routine operations for Alternatives 2A, 2B, and 3 are presented in Tables 3.2.3–2, 3.2.3–4, and 3.2.4–2 and summarized for all alternatives (2A, 2B, 3 and 4) in Table 5.11.2–1. The anticipated volumes of construction waste generated by implementation of Alternatives 2A, 2B, and 3 are presented in Tables 3.2.3–1, 3.2.3–3, 3.2.4–1, 3.2.4–3, and 3.2.4–4 and summarized for action alternatives (2A, 2B, 3, and 4) in Table 5.11.2–2.

TABLE 5.11.2–1.— ***Summary of Annual Waste Generation During Routine Operations at Y-12 by Alternative***

Waste Type	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations	HEU Storage Mission: Alternative 2				Special Materials Mission: Alternative 3		Combined Alternatives: Alternative 4	
	Status Quo 1999	Planning Basis Operations	New HEU Facility 2A	2A plus Planning Basis	Building 9215 Expansion 2B	2B plus Planning Basis Operations	New Special Materials Complex	Special Materials Complex plus Planning Basis Operations	New HEU Facility + New Special Materials	New HEU Facility + New Special Materials + Planning Basis Operations
Low-level total										
Liquid m^3 (gal)	1,000 (264,172)	1,118.8 (295,556)	0.8 (200)	1,119.6 (295,756)	0.6 (160)	1,119.4 (295,716)	none	1,118.8 (295,556)	0.8 (200)	1,119.6 (295,756)
Solid m^3 (yd^3)	1,404 (1,836)	2,099 (2,745)	119.3 (156)	2,218 (2,901)	119.3 (156)	2,218 (2,901)	0.8 (1)	2,100 (2,746)	120 (157)	2,219 (2,902)
Total m^3	2,404	3,218	120	3,338	120	3,338	1	3,219	121	3,339
Mixed low-level										
Liquid m^3 (gal)	22.5 (5,944)	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)	none	936.8 (247,477)
Solid m^3 (yd^3)	69 (90)	162 (212)	none	162 (212)	none	162 (212)	none	162 (212)	none	162 (212)
Total m^3	91.5	1,099	0	1,099	0	1,099	0	1,099	0	1,099
Hazardous										
Liquid m^3 (gal)	3.3 (872)	810.4 (2,748)	2.5 (660)	12.9 (3,408)	2.5 (660)	12.9 (3,408)	12.5 (3,302)	22.9 (6,000)	15 (3,962)	25.4 (6,710)
Solid m^3 (yd^3)	1.85 (24)	26.1 (34.2)	1.5 (2)	27.7 (36.2)	1.5 (2)	27.7 (36.2)	9.2 (12)	35.3 (46.2)	10.7 (14)	36.9 (48.2)
Total m^3	21.8	37	4	41	4	41	22	58	26	62
Sanitary/industrial										
Liquid m^3 (gal)	1,406 (371,426)	2,318 (612,298)	781.3 (206,400)	3,099 (818,698)	1273.6 (336,450)	3,591 (948,748)	932.7 (246,400)	3,251 (858,698)	1,714 (452,800)	4,032 (1,065,098)
Solid m^3 (yd^3)	7,295 (9,541)	8,883 (11,619)	178.9 (234)	9,062 (11,853)	178.9 (234)	9,062 (11,853)	175.1 (229)	9,058 (11,848)	354 (463)	9,239 (12,082)
Total m^3	8,701	11,201	960	12,161	1,453	12,653	1,108	12,271	2,068	13,269

Source: LMES 1999a, LMES 2000b, LMES 2000c.

TABLE 5.11.2–2 —*Summary of Waste Generation from Construction[a] and Associated Decontamination and Decommissioning[b] (D&D) Activities During Implementation of the Action Alternatives in Cubic Meters*

Waste Type	HEU Storage Mission: Alternative 2		Special Materials Complex Mission: Alternative 3			Combined Alternatives: Alternative 4
	New facility Sites A and B	Building 9215 expansion	New facility Site 1	New facility Site 2	New facility Site 3	New HEU Facility + New SMC (upper limit)
Low-level						
Construction Liquid Solid Total	0	0	0	0	0	0
D&D estimate	10,542	2,103	45,580	45,580	45,580	56,122
Mixed low-level						
Construction Liquid Solid Total	0 22707[c] (29700), Site B 0	0	0	0 46867[c] (61300) 0	0 22707[c] (29700) 0	0 69574 (90999) 0
D&D estimate	0	0	0	0	0	0
Hazardous						
Construction Liquid Solid Total	3 (800) 38.2 (50) 41.2	1.1 (300) 15.3 (20) 16.4	11.4 (3000) 107 (140) 118.4	11.4 (3000) 107 (140) 118.4	11.4 (3000) 107 (140) 118.4	14.4 (3804) 145.2 (190) 159.6
D&D estimate	7,196	1,439	30,840	30,840	30,840	38,036
Nonhazardous						
Construction Liquid Solid Total	14347 (3970000) 3823 (5000) 18851	14347 (3970000) 3058 (4000) 17405	1448 (382400) 917.4 (1200) 2365.4	1448 (382400) 3420[d] (4470) 4866	1448 (382400) 3445[d] (4500) 4888	15995 (4172598) 7268 (9506) 23717
D&D estimate	1,680	336	7,200	7,200	7,200	8,880

[a] Waste generated by construction and site preparation activities, including contaminated soils eligible for disposal as CERCLA waste.
[b] Waste generated by complete decontamination and decommissioning of existing building (9215) or facilities (special materials complex).
[c] Waste from excavation of contaminated soil at site.
[d] Uncontaminated demolition waste from site preparation.

Source: LMES 2000b and LMES 2000c, DOE 1996e**.**

5.11.2.1 *Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)*

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

Under this alternative, waste would be generated as a result of facility construction and potentially as a result of D&D of the old facility. D&D waste volumes for complete demolition of the current HEU storage facility (Building 9206) were estimated from information provided in the SSM PEIS (DOE 1996c) and are shown in Table 5.11.2–2. Waste generated by site preparation for the facility would not differ between Sites A and B with the exception of 22,707 m^3 (29,700 yd^3) of mixed LLW at Site B (Table 5.11.2–1). This waste would be generated by the excavation and removal of soil contaminated by past practices at the Site and has been characterized in other CERCLA documentation. Site A would also require site preparation, but the excavated materials are not anticipated to be contaminated and would not be mixed LLW.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste for Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility) was developed by estimating waste generation through operation of a new HEU Materials Facility and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

Under this alternative, waste would be generated from construction of an addition to the facility and partial demolition of Building 9215. Liquid waste volumes would be the same as for new facility construction, but approximately 20 percent less nonhazardous waste would be generated by the construction activities. No mixed LLW would be generated as a result of construction. D&D waste generation would be only a small percent (estimated as 20 percent) of the D&D waste that would be generated from demolition under the alternative to construct a new facility, as shown in Table 5.11.2–2.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste was developed by estimating waste generation through operation of an expanded HEU storage facility and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

The relatively minor differences in waste generation between operation of a new HEU Materials Facility and operation of an expanded, existing facility are due too increased efficiencies expected from the new facility.

5.11.2.2 *Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)*

No Action - Planning Basis Operations Plus Construct and Operate a New Special Materials Complex

Under this alternative, waste would be generated as a result of facility construction and potentially as a result of D&D of the old facility. D&D waste volumes for complete demolition of the current Special Materials Operations facilities were estimated from information provided in the SSM PEIS (DOE 1996c) and are shown in Table 5.11.2–2. Waste generated by site preparation of the facility would differ between Sites 1, 2, and 3 because 46,867 m^3 (61,300 yd^3) at Site 2 and 22,707 m^3 (29,700 yd^3)at Site 3 of mixed LLW would be generated that would not be generated at Site 1 (Table 5.11.2–1). This waste would be generated by the excavation and removal of soil contaminated by past practices at the Site and has been in other characterized CERCLA documentation. Use of Site 1, Site 2, or Site 3 would also generate an additional 917.4 m^3 (1,200 yd^3), 3,420 m^3 (4,470 yd^3), and 3445 m^3 (4,500 yd^3) of solid non-hazardous waste respectively.

Waste would also be generated by routine operations under this alternative. A conservative estimate of anticipated waste was developed by estimating waste generation through operation of a new Special Materials Complex and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

5.11.2.3 *Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)*

Under this alternative, waste would be generated as a result of both facility construction and potentially as a result of D&D of the old facilities. Waste generated by the construction of both a new HEU storage facility (Alternative 2A) and a new Special Materials Complex (Alternative 3A) as well as D&D waste volumes for complete demolition of the current HEU storage facility (Alternative 2A) and Special Materials Complex were combined as a conservative estimate of waste that could result from implementing Alternative 4.

Waste would also be generated by routine operations under this alternative. A conservation estimate of anticipated operations waste for this alternative was developed by estimating waste generation from operation of an expanded HEU facility (Alternative 2B) together with waste from operations waste generated under Alternative 3, the new Special Materials Complex, and then adding it to Alternative 1B (No Action - Planning Basis Operations Alternative) (Table 5.11.2–1).

5.11.3 Pollution Prevention

5.11.3.1 *Alternatives 1A and 1B (No Action - Status Quo and No Action - Planning Basis Operations Alternatives)*

Under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, Y-12 would continue to manage LLW, mixed LLW, hazardous waste, and nonhazardous waste. The type of waste streams generated under both of the No Action alternatives would be nearly identical, thus, the same waste minimization and pollution prevention techniques would be appropriate for both alternatives. As observed in Section 5.11.1, little difference is anticipated in annual waste generation rates between Alternatives 1A and B. This lack of difference in anticipated waste generation rates is due, in part, to the expectation that current, successful waste minimization and pollution prevention practices would continue to off-set potential increases in waste generation.

Additional waste minimization and pollution prevention measures would depend upon the development and implementation of new pollution prevention and waste minimization techniques, because readily-implementable, existing techniques are already in practice. While DOE is committed to maximizing pollution prevention savings, it would not be appropriate to differentiate pollution prevention expectations between the two alternatives.

Cost savings/avoidance would be over $2 million over each of the next several years. Approximately 30 to 40 pollution prevention projects in each of the next several years would account for as much as 10,000 m^3 (353,150 ft^3) per year in waste reduction. The amount of cost savings/avoidance is expected to decline as the number of possible opportunities decline due to previous successes.

5.11.3.2 *Alternatives 2, 3, and 4 (HEU Storage Mission and Special Materials Mission Action Alternatives)*

Implementation of the HEU Storage Mission action alternatives and Special Materials Mission action alternatives would result in pollution prevention activities and beneficial impacts. Generally the prevention activities and beneficial impacts would be similar to the previously discussed. While the HEU Materials Facility does not represent a new activity, existing cost savings/avoidance knowledge would transfer to the new facility. Many of the older buildings at Y-12 are inefficient for use as HEU storage facilities. These structures have shortcomings with HVAC, fire protection (fire retardant), and natural phenomena protection requirements (seismic and tornadic). With the addition of the proposed Special Materials Complex, existing cost savings/avoidance knowledge would transfer to the new facilities and new cost savings/avoidance would likely occur as operating knowledge improves (an estimate is provided below).

The HEU Materials Facility Conceptual Design Report (Y-12 1999a) includes the general provisions for using current construction and equipment standards which should result in pollution prevention through design improvements. For example, lighting systems would use extended-life lamps and high-efficiency electronic ballasts to minimize O&M costs. In the event an accident sets off, or spills from the wet-pipe sprinkler system, the water collection system would permit monitoring and testing prior to discharge.

While no specific pollution prevention initiatives are currently identified for the Special Materials Complex, it is generally accepted that worker protection would be improved through engineering controls, which replace existing administrative controls and reduce the need for personal protective equipment, providing better comfort and reducing LLW generation. Utility upgrades would be implemented, resulting in improved efficiencies through reduced O&M costs.

While not specified, a reduction of 10 to 30 percent of the waste associated with Special Materials Complex as presented in Table 5.11.1–1 is a reasonable expectation. The waste reductions would amount to approximately 77 to 230 kg (170 to 507 lbs) of LLW, 2,160 to 6,450 kg (4,762 to 14,219 lbs) of hazardous waste, and 17,534 to 52,602 kg (38,655 to 115,966 lbs) of sanitary/industrial waste. Assuming a 30 percent reduction, this would represent an estimated cost savings/avoidance reduction by over $0.6 million (in today's dollars) over the next 10 years. Approximately two to four new pollution prevention projects in each of the next 10 years would account for as much as 3,100 m^3 (109,480 ft^3) total in waste reduction in the next 10 years.

5.12 Occupational And Public Health And Safety Impacts

This section describes potential human health impacts associated with radiation exposures, chemical exposures, and worker safety issues due to Y-12 current operations under Alternative 1A (No Action - Status Quo Alternative) and those proposed under Alternative 1B (No Action - Planning Basis Operations Alternative), Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternative), Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative). A comprehensive evaluation of the potential risks associated with human exposure to environmental media (air, surface water, soil, sediment, and groundwater) was conducted under the No Action - Status Quo Alternative. While contaminants of concern were detected in the evaluation of surface water, soil, sediment, and groundwater, their on-site concentrations were based on historical releases. The inhalation pathway is the primary pathway considered for evaluation the potential effects of current and proposed operations on the public and the involved and non-involved worker. The results of this evaluation are discussed in detail in Appendix D.

Under Alternative 1B (No Action - Planning Basis Operations Alternative), Y-12 National Security Complex facility operations would continue in support of assigned missions, but at an increased activity level. As

such, a review was conducted to determine what historical data were available that would most accurately represent the operations effluents for the projected workload in the 2001–2010 time period (LMES 2000a). The 1987 emissions data were determined to be the most appropriate and were modeled based on the assumption that 65 percent of the 1987 emissions are representative of the proposed 2001–2010 workload estimates (see Section 3.2.2).

5.12.1 Radiological Impacts

Public Health Impacts. The release of radioactive materials and the potential level of radiation doses to workers and the public are regulated by DOE for its contractor facilities. Environmental radiation protection is currently regulated contractually with DOE Order 5400.5. This Order sets annual dose standards to members of the public, as a consequence of routine DOE operations, of 100 mrem through all exposure pathways. The Order requires that no member of the public receives an EDE in a year greater than 10 mrem from inhalation of airborne emissions of radionuclides and 4 mrem from ingestion of drinking water. In addition, the dose requirements in the *Radionuclide National Emission Standards for Hazardous Air Pollutants* (Rad-NESHAP) limit exposure to the MEI of the public from all air emissions to 10 mrem/yr.

The EDE received by the hypothetical MEI for Y-12 under the No Action - Status Quo Alternative was calculated to be 0.53 mrem based on both monitored and estimated effluent data. This individual is postulated to be located about 1,120 m (0.7 mi) north-northeast of the Y-12 release point. The major radionuclide emissions from Y-12 are ^{234}U, ^{235}U, ^{236}U, and ^{238}U. The contribution of Y-12 emissions under the No Action - Status Quo Alternative to the committed collective EDE to the population residing within 80 km (50 mi) of the ORR was calculated to be about 4.5 person-rem. The potential radiological impacts to the MEI of the public and the population within 80 km (50 mi) are presented in Table 5.12.1–1 for the No Action - Status Quo Alternative, No Action-Planning Basis Operations Alternative, and the Preferred Alternative (Alternative 4).

The implementation of the HEU Storage Mission and the Special Materials Mission Alternatives would not effect the airborne emissions concentrations as determined for Alternative 1B (No Action - Planning Basis Operations Alternative). All activities projected to take place under each of these alternatives in the new facilities would have no higher, and possibly lower, emissions than the existing facilities they replace.

Under the No Action - Planning Basis Operations, HEU Storage Mission, and Special Materials Mission Alternatives, radiological emissions from existing sources would be expected to initially increase from No Action - Status Quo levels due to increased workload. However, all values remain below the annual dose limit of 10 mrem for all atmospheric releases (DOE Order 5400.5). The conservatively estimated dose to the MEI from radiological atmospheric releases would be 4.5 mrem pre year. The estimated collective dose to the off-site population residing within an 80-km (50-mi) radius would be 33.7 person-rem per year. For all the routine operation emissions, uranium would be the major dose contributor to both the MEI and the off-site population. The potential health risks associated with these alternatives are also summarized in Table 5.12.1–1.

TABLE 5.12.1–1.—*Radiation Doses and Health Impact to the Public for the Proposed Alternatives*

	Dose (mrem/yr)			Latent Cancer Fatality		
	Alternative 1A No Action - Status Quo	**Alternative 1B No Action - Planning Basis Operations**	**Alternative 4 No Action - Planning Basis Operations, HEU Materials Facility, and Special Materials Complex**	**Alternative 1A No Action - Status Quo**	**Alternative 1B No Action - Planning Basis Operations**	**Alterative 4 No Action - Planning Basis Operations, HEU Materials Facility, and Special Materials Complex**
MEI of the Public Dose (mrem/yr)	0.53	4.5	4.5	2.65×10^{-7}[a]	2.65×10^{-7}[a]	2.25×10^{-6}[a]
Population[b] (person-rem/yr)	4.5	33.7	33.7	2.15×10^{-6}[c]	2.15×10^{-6}[c]	1.69×10^{-5}[c]

[a]Represents risk of LCF for an individual of the public.
[b]Population residing within 80 km (50 mi) of ORR.
[c]This represents the number of LCFs for each year of exposure.
Note: The HEU Storage Mission and the Special Materials Mission Alternatives would not effect the airborne emissions concentrations as determined for Alternative 1B (No Action - Planning Basis Operations). All activities projected to take place under each of these alternatives in the new facilities would have no higher, and possibly lower, emissions than the existing facilities they replace. Impacts of Alternative 1B are cumulative with those of Alternative 1A.
Source: EPA 1999a, LMES 2000a, LMES 2000b, LMES 2000c.

Y-12 Worker Health Impacts. Occupational radiation protection is regulated by the Occupational Radiation Protection Rule (10 CFR 835). DOE has set occupational dose limits for an individual worker at 5,000 mrem per year. Accordingly, Y-12 has set administrative exposure guidelines at a fraction of this exposure limit to help enforce the goal to manage and control worker exposure to radiation and radioactive material ALARA. The Y-12 ALARA administrative control level for the whole body is 1,000 mrem per year for all other Y-12 workers. The worker radiation dose projected in this SWEIS is the total effective dose equivalent incurred by workers as a result of routine operations. This dose is the sum of the external whole body dose as monitored by personnel dosimeters, including dose from both photons and neutrons, and internal dose, as required by 10 CFR 835. The internal dose is the 50-year CEDE. These values are determined through the Y-12 National Security Complex External and Internal Dosimetry Programs.

For Alternative 1B (No Action - Planning Basis Operations Alternative), it was determined that annual enriched uranium emissions and other effluents for the 2001–2010 time period can be assumed to be 65 percent of the 1987 levels (LMES 2000a). However, internal dose reporting requirements were not in effect until 1989. Prior to that time, only external (deep) dose was reported. The average deep dose for all monitored Y-12 employees was 16 mrem in 1987, 12 mrem in 1989, and less than 5 mrem for subsequent years. Consequently, 1989 radiation doses provide the best available data for estimating radiation impacts to the worker for the No Action - Planning Basis Operations Alternative. The projected health impacts to workers for major production operations under the No Action - Planning Basis Operations Alternative are presented in Table 5.12.1–2.

TABLE 5.12.1–2.—*Radiological Health Effects for Workers for Major Production Operations Under Alternative 1B (No Action - Planning Basis Operations Alternative)*

All Workers (Radiological and Nonradiological)				
Organization	**No. of Workers**	**Individual Worker Average Dose (mrem)**	**Collective Average Dose (person-rem)**	**Latent Cancer Annual Fatalities**
Enriched Uranium	492	11.6	5.71	2.28×10^{-3}
Depleted Uranium	223	11.6	2.59	1.04×10^{-3}
Assembly/Disassembly/ Quality Evaluation	160	11.6	1.86	7.44×10^{-4}
Product Certifications	158	11.6	1.83	7.32×10^{-4}
Analytical Chemistry	180	11.6	2.09	8.36×10^{-4}
Y-12	5,128	11.6	59.48	2.38×10^{-2}

Source: LMES 2000a.

TABLE 5.12.1–3.—*Radiation Doses and Health Impacts to Workers Under the HEU Storage Mission Alternatives*

Alternative 1B (No Action - Planning Basis Operations)	
Dose (mrem)	33
No. of involved workers	35
Collective dose (person-rem)	1.16
No. of fatal cancers	4.62×10^{-4}
Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)	
Initial Relocation Operations	
Dose (mrem)	150
No. of involved workers	35
Collective dose (person-rem)	5.25
No. of fatal cancers	2.1×10^{-3}
Normal Operations	
Dose (mrem)	33
No. of involved workers	14
Collective dose (person-rem)	0.46
No. of fatal cancers	1.85×10^{-4}

Source: LMES 2000b.

The process operations projected for the HEU Materials Facility include loading, unloading, and storage of canned materials and general fissile containers; nondestructive evaluation activities; sampling, canning, and recontainerization of special nuclear materials; and materials inventory and tracking. Because these activities closely mirror current operations at the Building 9720-5 facility, monitored radiation doses from 9720-5 warehouse operations were used to estimate the projected health impacts to HEU workers. Table 5.12.1–3 presents the radiation dose and projected health impact to workers for Alternative 1B (No Action - Planning Basis Operations Alternative) and for the two HEU Storage Mission options (New HEU Materials Facility and Upgrade Expansion of Building 9215) under Alternative 2.

5.12.2 Hazardous Chemical Impacts

Airborne emissions of chemicals used at Y-12 occur as a result of plant production, maintenance, waste management operations, and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. Nonradionuclide emissions at Y-12 include chemical processing aids (hydrochloric and nitric acids), cleaning and cooling aids (methanol), refrigerants (Freon 11, 12, 22, 13, and 502), and emissions from the Y-12 Steam Plant (particulates, SO_2, carbon monoxide, VOCs and NO_2). More than 90 percent of the pollutants emitted from Y-12 are the result of Y-12 Steam Plant operations.

Airborne emissions, with the exception of mercury, are represented by modeled concentrations based on the purchases recorded and maintained in the Y-12 Hazardous Materials Inventory System (MMES 1998) and engineering calculations for emissions from the Y-12 Steam Plant. Modeled concentrations of noncarcinogenic and carcinogenic materials both on-site and at the Y-12 Site boundary were calculated for an MEI and an 8-hr worker exposure. On-site emissions concentrations are not available for the Y-12 Steam Plant because the stack height used in the modeling effort negates the possibility for the modeled plume to disperse prior to the facility boundary. With the exception of mercury, these data are considered representative of emissions of nonradionuclides under No Action - Status Quo operations at Y-12. Mercury is the only nonradionuclide for which actual air measurements were available**.**

The results of the air modeling of purchase data and engineering calculations for the Y-12 Steam Plant are presented in Tables 5.12.2–1 through 5.12.2–5. The contaminants and associated concentrations to which an on-site worker and an MEI located at the Y-12 Site boundary might be exposed, based on the modeled chemical inventory purchase data, are listed in Tables 5.12.2–1 through 5.12.2–4. Modeled concentrations of Y-12 Steam Plant emissions data are listed in Table 5.12.2–5 for the MEI at the Site boundary. On-site emissions concentrations are not available for the Y-12 Steam Plant because the stack height used in the modeling effort negates the possibility for the modeled plume to disperse prior to the facility boundary.

TABLE 5.12.2–1.—*Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Noncarcinogenic Chemical Hazard Quotients*

Chemical	Maximum Boundary Concentration Fg/m^3	Inhalation RfC - Chronic (mg/m^3)[a]	Hazard Quotient
Cobalt & Compounds	3.31×10^{-2}	[b]	[c]
Lead Compounds	3.43×10^{-2}	[b]	[c]
Methylene Biphenyl Isocyanate	9.82×10^{-2}	6.00×10^{-4}	1.64×10^{-1}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.
Note: RfC - reference concentration.

TABLE 5.12.2–2.—*Y-12 Facility Operations Maximum Boundary Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risk*

Chemical	Maximum Boundary Concentration (Fg/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Cadmium & Compounds	1.42×10^{-5}	1.8	2.56×10^{-8}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.2–3.—Y-*12 Facility Operations Maximum On-Site Hazardous Air Pollutants Noncarcinogenic Chemical Hazard Quotients*

Chemical	Maximum On-site Concentration (Fg/m^3)	Inhalation RfD - Chronic (mg/m^3)[a]	Hazard Quotient
Cobalt & Compounds	5.88×10^{1}	[b]	[c]
Lead Compounds	6.10×10^{1}	[b]	[c]
Methylene Biphenyl Isocyanate	1.75×10^{2}	1.71×10^{-4}	6.68×10^{1}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.
Note: RfD - reference dose.

TABLE 5.12.2–4.—*Y-12 Facility Operations Maximum On-Site Hazardous Air Pollutants Carcinogenic Chemical Excess Cancer Risks*

Chemical	Maximum On-site Concentration (Fg/m^3)	Inhalation Slope Factor (mg/kg-day)$^{-1}$[a]	Excess Cancer Risk
Cadmium & Compounds	2.52×10^{-2}	6.10	5.72×10^{-6}

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.2–5.—*Y-12 Steam Plant Maximum Boundary Hazardous Air Pollutant Carcinogenic Chemical Concentrations*

Chemical	Maximum Boundary Concentration (Fg/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Arsenic	3.40×10^{-5}	4.3	1.46×10^{-7}
Beryllium	5.1×10^{-6}	2.4	1.22×10^{-8}
Nickel	8.14×10^{-5}	[b]	[c]

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).
[b]Toxicity values are not currently available.
[c]Not calculated due to lack of toxicity values.

The hazard quotients and excess cancer risks for the chemicals and compounds that were determined to be of concern as a result of the air quality screening of purchase data (see Section 5.7.1) are listed in Tables 5.12.2–1 through 5.12.2–4. Two exposure scenarios were evaluated: MEI (residential), and on-site worker (industrial). The hazard quotients and excess cancer risks for contaminant concentrations modeled to the MEI of the public were all below levels of concern. Thus, no adverse health impacts to the public are anticipated from exposure to airborne nonradiological contaminants emitted from Y-12 normal operations. The hazard quotient for the on-site worker exposed to the maximum on-site concentration of methylene biphenyl isocyanate was determined to be greater than 1.0. Therefore, methylene biphenyl isocyanate is considered to be a baseline contaminant of concern for on-site workers. Cadmium and cadmium compounds under the on-site exposure scenario were also determined to pose an excess cancer risk within the EPA's range of concern and are also considered a baseline contaminant of concern for the on-site worker.

No noncarcinogenic contaminants exceeded the preliminary air quality screening of Y-12 Steam Plant emissions data (see Section 5.7.1). As such, no noncarcinogenic chemicals were included in the evaluation of public exposures. The carcinogenic contaminants and their associated excess cancer risks resulting from Y-12 Steam Plant emissions are presented in Table 5.12.2–5. No excess cancer risks were determined to fall within the EPA's range of concern. Thus, no noncarcinogenic or carcinogenic contaminants of concern were determined to be associated with Y-12 Steam Plant emissions.

Average mercury vapor concentrations in 1999 for the four sites currently monitored are comparable to those reported for the last 2 years. In 1999, ambient mercury concentrations at the two monitoring sites near Building 9201-4 were still elevated above natural background, but are lower than the concentrations measured during the first 3 years of the monitoring program and are well below the ACGIH threshold limit value of 25 Fg/m^3 and the EPA reference concentration of 0.3 Fg/m^3 for chronic inhalation exposure. Hazard quotients were calculated for each location in an effort to demonstrate that the measured concentrations are below (i.e., Hazard Quotient<1.0) both the threshold for continuous public and occupational exposure.

Nonradiological airborne discharges from Y-12 mission facilities under Alternative 1B (No Action - Planning Basis Operations Alternative) consist of those criteria and chemical pollutant emissions from the Y-12 Steam Plant and chemical emissions from Y-12 operations. Because no air quality standards would be exceeded, no adverse direct or indirect air quality impacts are expected from normal operations associated with the continuation of Y-12 missions under the No Action - Planning Basis Operations Alternative (see Section 5.7).

The emission data for Alternative 1B (No Action - Planning Basis Operations Alternative) is assumed to include all the emissions from the storage of HEU in existing facilities. The impacts associated with the criteria and toxic pollutants presented would be the same as described for the No Action - Planning Basis Operations Alternative environmental consequences. Chemical emissions are considered to be the same as those under Alternative 1A (No Action - Status Quo Alternative). Criteria, toxic pollutant, and chemical emissions contributions from the current HEU Storage Mission facilities are reflected in the emissions from the Y-12 Steam Plant which supplies steam to the facilities (see Section 5.7.1). In addition, the environmental emissions for Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives) are expected to be equal to or less than the No Action - Status Quo Alternative levels due to administrative and engineered controls. Risks to the public from environmental emissions would remain the same as were presented for the Alternative 1B (No Action - Planning Basis Operations Alternative).

No criteria pollutant emissions would be generated from the new Special Materials Complex facilities. Chemical emissions are considered to be the same as those under No Action - Status Quo and No Action - Planning Basis Operations Alternatives (current special materials operations). The relocation of beryllium operations to the new facility would result in a positive impact on beryllium emissions at Y-12. The new Beryllium Facility would be equipped with process gloveboxes and a 99.5 percent pre-filtration system through which process exhausts would be filtered prior to passing through a HEPA filtration system and

subsequent exhausting through the building stacks. The new filtration system is estimated to reduce No Action - Planning Basis Operations emissions of beryllium by 90 percent (LMES 2000c).

5.12.3 Detailed Evaluation: Beryllium

Because of the heightened sensitivity and awareness associated with worker exposure to beryllium, a detailed evaluation of the impact of exposure to beryllium is presented below.

Since the 1950s, the processing of beryllium metals and alloys has been an important part of the Y-12 mission. Beryllium-containing compounds have been used for R&D, testing, and manufacturing operations at multiple locations throughout the plant. Included in the beryllium operations have been melting and molding, grinding, and machine tooling of parts. Recent studies and experience with the manufacture of beryllium-containing compounds have indicated a potential significant hazard to employees. As such, much emphasis has been placed on evaluating, communicating, and mitigating the health effects of occupational exposure to ensure worker protection and public safety.

Beryllium and beryllium compounds enter the environment as a result of the release and or disposal of beryllium contaminated wastewater, dust, or as a component of solid wastes. Once beryllium has been released to the environment, exposure to beryllium can occur by breathing air, eating food, or drinking water that contains beryllium. Dermal contact with metal containing beryllium or water containing dissolved beryllium salts will result in only a small fraction of the beryllium actually entering the body. A portion of beryllium dust breathed into the lungs will dissolve and eventually result in the transfer of the beryllium into the bloodstream; some may be transferred to the mouth then swallowed, and the rest will remain in the lungs for a long time. Of the beryllium ingested via contaminated foodstuffs or water, or swallowed subsequent to inhalation, about 1 percent will pass from the stomach and intestines into the bloodstream. Therefore, most of the beryllium that is swallowed leaves the body through the feces without entering the bloodstream. Of the beryllium that enters the bloodstream, some is routed to the kidneys and is eliminated from the body in urine. Some beryllium can also be carried by the blood to the liver and bones where it may remain for a long period of time. If beryllium is swallowed, it leaves the body in a few days. However, if beryllium is inhaled, it may take months to years before the body rids itself of beryllium.

As with any contaminant, the health effects resulting from exposure to beryllium are dependent on the exposure concentration, frequency and duration. Inhalation of large amounts of soluble beryllium compounds can result in acute beryllium disease. Acute beryllium disease results in lung damage that resembles pneumonia with reddening and swelling of the lungs. Lung damage may heal provided exposure does not continue or the exposed individual may become sensitive to beryllium. The increased sensitivity of some individuals to beryllium results in an immune or inflammatory reaction when subsequent low level exposures occur. This condition is called chronic beryllium disease. This disease can occur long after exposure to either the soluble or the insoluble forms of beryllium. Studies linking exposure to beryllium or beryllium compounds with an increased incidence of cancer (in particular, lung cancer) have been performed on laboratory animals. However, these studies are not considered reliable predictors of human health effects and ongoing efforts are currently underway to evaluate workers who have been known to be exposed.

In 1997, DOE initiated an Interim Chronic Beryllium Disease Prevention Program. The purpose of the program was to enhance, supplement, and integrate a worker protection program to reduce the number of current workers exposed, minimize the levels of beryllium exposure and the potential for exposure to beryllium, and to establish medical surveillance protocols to ensure early detection of disease. In December of 1999, DOE published a final rule to establish the chronic beryllium disease prevention program that became effective on January 7, 2000 (10 CFR 850). The final rule establishes:

- An airborne beryllium concentration action level as 0.2 Fg/m^3
- A requirement for employers to ensure that workers use respirators in areas where the concentration of beryllium is at or above the action level and to provide a respirator to any employee who requests one regardless of the concentration of airborne beryllium
- Criteria and requirements governing the release of beryllium-contaminated equipment and other items at DOE sites for use by other DOE facilities or the public
- Requirements for offering medical surveillance to any "beryllium-associated worker"
- Medical removal protection and multiple physician review provisions

An estimate of beryllium emissions was presented in the *Environmental Surveillance of the U. S. Department of Energy Oak Ridge Reservation and Surrounding Environs During 1987* and was obtained from actual stack sampling data on six exhaust stacks. This stack data indicated that <0.005 kg/year of beryllium are released to the atmosphere from the Y-12. Modeling of this volume of material results in an emission rate of $6.94x10^{-7}$ g/s for beryllium. This emission rate was multiplied by the maximum modeled concentrations from a centrally located stack at Y-12 assuming a 1 gram per second emission rate (see Table E.3.1–3) to determine the maximum boundary and on-site concentration. The concentrations as well as the associated hazard quotients and excess cancer risks are included in Tables 5.12.3–1 through 5.12.3–4.

TABLE 5.12.3–1.—*Y-12 Beryllium Operations Maximum Boundary Hazard Quotient*

Chemical	Maximum Boundary Concentration ug/m^3	Inhalation RfC - Chronic (mg/m^3)[a]	Hazard Quotient
Beryllium	$2.7x10^{-7}$	$2.0x10^{-5}$	$1.35x10^{-2}$

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–2.—*Y-12 Beryllium Operations Maximum Boundary Excess Cancer Risk*

Chemical	Maximum Boundary Concentration (ug/m^3)	Inhalation Unit Risk (mg/m^3)$^{-1}$[a]	Excess Cancer Risk
Beryllium	$2.7x10^{-7}$	2.4	$6.48x10^{-7}$

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–3.—*Y-12 Beryllium Operations Maximum On-Site Hazard Quotient*

Chemical	Maximum On-site Concentration (ug/m^3)	Inhalation RfD - Chronic (mg/m^3)[a]	Hazard Quotient
Beryllium	$4.81x10^{-7}$	$5.71x10^{-6}$	$8.4x10^{-2}$

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 1999a).

TABLE 5.12.3–4.—*Y-12 Beryllium Operations Maximum On-Site Excess Cancer Risks*

Chemical	Maximum On-site Concentration (ug/m^3)	Inhalation Slope Factor (mg/kg-day)$^{-1}$[a]	Excess Cancer Risk
Beryllium	$4.81x10^{-7}$	8.4	$4.04x10^{-6}$

[a]Toxicity values were obtained from the EPA's Integrated Risk Information System (EPA 2000).

The hazard quotient and excess cancer risk for exposure of the public to beryllium emissions from current operations at Y-12 are below 1.0 and less than the EPA range of concern (10^{-4} to 10^{-6}), respectively. Thus, no adverse public health impacts are associated with normal beryllium operations. The hazard quotient for worker exposure assuming that exposure occurs continually for 8 hours per day, 5 days per week, 50 weeks per year is less than 1.0. The excess cancer risk for such an exposure is within the EPA range of concern.

Extensive efforts have been made to reduce risk to the involved worker through the use of personal protective equipment, engineered controls, and other administrative controls such as:

- Initial and periodic exposure monitoring (currently includes monitoring of all beryllium workers)
- Hazard assessment
- Posting of beryllium work areas
- Medical surveillance, respiratory protection
- Training
- Counseling for the sensitized workers
- Warning signs
- Waste disposal

To evaluate the beryllium-contaminated areas and to protect worker health, the Y-12 Industrial Hygiene Department has developed a sampling and analysis plan to identify the areas within Y-12 where beryllium was once used. Approximately 300 legacy areas were identified in 39 buildings. These beryllium legacy areas were defined to protect the workers at risk, including beryllium-sensitized individuals, to provide data for modernization projects and to reduce the number of beryllium-contaminated areas.

One such project is the proposed Special Materials Complex, which is designed to house all production operations that must currently be performed in a beryllium control area. This will allow the enclosure of all operations within gloveboxes, hoods, or other inert environments so as to isolate workers from beryllium. In addition, HEPA-filtered exhaust systems from these enclosures will be provided. An estimated 90 percent of current beryllium emissions would be reduced as a result of the increased health and safety protocols for production activities associated with the Special Materials Complex.

Design Mitigation Measures

The facilities being constructed would be equipped with appropriate alarm and emergency notification systems to alert and inform workers of accidents and emergency response requirements. Layered engineered and administrative controls would be designed to protect the worker by providing primary, secondary, and tertiary confinement of the effects of an accident, thus providing the protection for the worker and the environment. Process changes, engineered confinement controls, and the use of gloveboxes would reduce worker exposures to beryllium from Alternative 1A (No Action - Status Quo Alternative) or Alternative 1B (No Action - Planning Basis Operations Alternative) by an estimated 75 to 90 percent in the new Special Materials Complex.

5.12.4 Worker Safety

The Y-12 worker non-fatal injury/illness rates presented in Table 5.12.4–1 were used to calculate the 5-year average (1995-1999) injury/illness rate for 100 workers (or 200,000 hours). The 5-year average injury/illness rate and the 5-year average Y-12 worker population size were then used to calculate the total number of Y-12 worker non-fatal injury/illness per year for the entire Y-12 workforce under Alternative 1B (No Action - Planning Basis Operations Alternative). It was assumed that the 5-year average rate would remain constant.

TABLE 5.12.4–1.—*Y-12 5-Year Average (1995-1999) Illness/Injury Rate per 100 Workers*

Parameter	1995	1996	1997	1998	1999	5-Year Average
Annual Y-12 Worker Population	5,777	5,034	5,034	5,105	5,128	5,216
Annual Y-12 Nonfatal Occupational Injury/Illness Rate	8.03	9.14	9.53	7.58	7.02	8.26

Source: LMES 1999; Y-12 2001b.

The estimated Y-12 worker population under each alternative was multiplied by the 5-year averaged non-fatal injury/illness rate (per 100 workers) to obtain the total number of non-fatal injuries/illnesses per year for the entire Y-12 workforce for each alternative (Table 5.12.4–2).

The additional number of injuries/illnesses posed by the construction of new facilities is projected in Tables 5.12.4–3 and 5.12.4–4. The No Action - Planning Basis Operations plus the construction and operation of a new HEU Materials Facility would result in a calculated non-fatal injury/illness of 427 per year. The No Action - Planning Basis Operations plus the Special Materials Complex would result in a calculated non-fatal injury/illness of 427 per year.

Under Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex) the number of non-fatal injuries/illness would be 430 per year.

TABLE 5.12.4–2.—*Calculated Nonfatal Injuries/Illnesses per Year for Y-12 Workforce by No Action - Status Quo and No Action - Planning Basis Operations*

Parameter	5-Year Average	Alternative 1A No Action - Status Quo	Alternative 1B No Action - Planning Basis Operations
Y-12 Worker Population	5,216	5,128	5,128[a]
Y-12 Nonfatal Occupational Injury/Illness (per 100 workers) 4-year average (1995-98)	8.26	8.26	8.26
Total Number of Nonfatal Occupational Injuries/Illnesses for the Y-12 Workforce	431	424	424

[a]Worker population is assumed to remain the same as current level of 5,128.

TABLE 5.12.4–3.—*Calculated Non-Fatal Injuries/Illnesses for Construction of the HEU Materials Facility*

Total employment (worker years)	145
Peak employment (workers)	200
Construction period (years)	4
Calculated injury rate (4-year average)	8.26
Projected No. of injuries (annually)	3
Projected Total injuries (4-year construction period)	12

TABLE 5.12.4–4.—*Calculated Non-Fatal Injuries/Illnesses for Construction of the Special Materials Complex*

Total employment (worker years)	125
Peak employment (workers)	210
Construction period (years)	3.5
Calculated injury rate (4-year average)	8.26
Projected No. of injuries (annually)	3
Projected Total injuries (3.5 year construction period)	11

5.13 ENVIRONMENTAL JUSTICE

Pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations from the alternatives included in this SWEIS. Adverse health effects may include bodily impairment, infirmity, illness, or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Environmental justice guidance provided by the CEQ defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997b). Minority populations are identified when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is substantially greater than the minority population percentage in the general population in the surrounding area or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census (defined in 1990 as 1989 income less than $12,674 for a family of four). Minority population and income data at the census tract level are only available from the decennial census. The most recent data available is from 1990.

Environmental justice impacts occur if the proposed activities result in disproportionately high and adverse human and environmental effects to minority or low-income populations. Disproportionately high and adverse human health effects are identified by assessing these three factors:

- Whether the adverse health effects, which may be measured in risks or rates, are significant or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.

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

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

The Department has conducted aerial surveys to measure radiation levels in the Scarboro Community since 1959. These surveys, which measure for gamma radiation, have identified no radiation levels over those found in the natural background environment. DOE began working with the Scarboro Community beginning in 1997 with a public meeting to discuss the aerial surveys. Since then DOE staff has worked closely with the residents in developing plans for conducting radiological and chemical surveys. In 1997, the residents of the Scarboro Community asked the DOE to examine if there is contamination in the soil and water from ORR operations. In response DOE initiated environmental sampling activities in 1998 on soil, surface sediment, and water from over 40 locations in the Scarboro Community to examine for the presence of mercury and uranium. DOE awarded a grant to the Joint Center for Political and Economic Studies that focuses on issues of concern to African Americans and has special expertise in health policy issues affecting black and minority populations, to assist Scarboro residents in interpreting data resulting from the DOE sampling and other Scarboro Community related studies. The Joint Center completed the work in October 2000 with the issuance of five summary publications. While these summaries generated no new epidemiological analyses, they served to help the community understand the purpose and results of the various environmental and health studies involving the community which indicated disproportionately high and adverse health impacts for the Y-12 operation.

5.13.1 Alternative 1A (No Action - Status Quo Alternative)

The EDE received by the MEI under this alternative would be 0.53 mrem which is below the 10 mrem NESHAP standard. As discussed in Section 4.13 (Environmental Justice) minority and low-income populations comprise a relatively small proportion of the total population in both an 80-km (50-mi) radius of the Y-12 Site and in the socioeconomic ROI. For environmental justice impacts to occur, there must be disproportionately high and adverse human health or environmental impacts on minority populations or low-income populations.

As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12) routine operations would pose no significant health risks to the public. The EDE received by the MEI would be 0.53 mrem, significantly lower than the 10 mrem limit set by DOE Order 5400.5. In addition, results from the ORR ambient air monitoring program show that the potential EDE received within the Scarboro Community (Monitoring Station 46) was 0.16 mrem/yr, lower than the level of the reference sample from an area not affected by releases from the ORR (DOE 2000d). Because the Scarboro Community includes the largest concentration of minority or low-income populations in the area, there would therefore be no disproportionately high and adverse effects on minority populations or low-income populations. In addition, no special circumstances exist that would result in disproportionately high and adverse impact on monitory or low-income populations from any exposure pathway, such as subsistence dependence on fish or hunting.

5.13.2 Alternative 1B (No Action - Planning Basis Operations Alternative)

The conservatively estimated EDE received by the MEI from radiological atmospheric releases from Y-12 under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP standard. As discussed in the preceding analyses, the resumption of the remaining Y-12 operations from the 1994 stand down would not cause disproportionately high and adverse human health or environmental impacts on minority or low-income populations. Therefore, there would be no environmental justice impacts.

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem DOE Order 5400.5 standard. There would be no environmental justice impacts from either the Environmental Management Waste Management Facility or the ORNL NABIR Program Field Research Center being implemented under the No Action - Planning Basis Operations Alternative.

5.13.3 Alternative 2 (No Action - Planning Basis Operations Plus HEU Storage Mission Alternatives)

Alternative 2A (No Action - Planning Basis Operations Plus Construct and Operate a New HEU Materials Facility)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received within the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

Alternative 2B (No Action - Planning Basis Operations Plus Upgrade Expansion of Building 9215)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.13.4 Alternative 3 (No Action - Planning Basis Operations Plus Special Materials Mission Alternative)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.13.5 Alternative 4 (No Action - Planning Basis Operations Plus HEU Materials Facility Plus Special Materials Complex)

The EDE received by the MEI under this alternative would be 4.5 mrem which is below the 10 mrem NESHAP and DOE Order 5400.5 standard. As discussed in the Occupational and Public Health and Safety Impacts analyses (Section 5.12), this alternative would pose no significant health risks to the public and radiological emissions would remain below the 10 mrem/year NESHAP standard. Results from the ORR ambient air monitoring program show that the hypothetical EDE received with in the Scarboro Community (Monitoring Station 46) is typically lower (0.16 mrem/yr) than at other monitoring stations to the south (Monitoring Station 48) and west (Monitoring Station 35) of Y-12 where the hypothetical EDE would be 0.18 mrem/yr (Monitoring Station 48) or 0.19 mrem/yr (Monitoring Station 35) (DOE 2000d). There are no special circumstances that would result in any greater impact on minority or low-income populations than the population as a whole. As discussed in Section 5.3, the short-term socioeconomic impacts during construction of the facilities would be positive and not result in any disproportionately high and adverse effects on minority populations or low-income populations. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations would be expected.

5.14 ACCIDENTS

This section summarizes the potential impacts to workers and the public from accidents involving the release of radioactive and/or chemical materials, explosions, and other hazards associated with Y-12 operations. The methods used to estimate the accident impacts and additional details on the accident analyses and impacts are described in Appendix D.7.

Most of the accidents analyzed in this SWEIS do not vary by alternative because the same facilities are potentially involved in the accidents and subsequent consequences; therefore, this SWEIS presents first, the accident analysis that pertains to all the alternatives. A section is also included which discusses the consideration of accidents unique to the HEU Storage Mission and the Special Materials Mission Alternatives compared to the No Action - Status Quo Alternative.

5.14.1 Accident Screening

The potential for facility accidents and the magnitudes of their consequences are important factors in evaluating the alternatives addressed in this SWEIS. The health risk issues are twofold:

- The potential accidents that could occur at Y-12 facilities and the risks that these postulated accidents could pose to workers or the general public

- The reduction in existing public or worker health risks when HEU Storage Mission and Special Materials Mission Alternatives in this SWEIS are compared to the existing facilities. (These reduced risks may arise either from modernized, improved facility systems that better protect the workers or public, or from design and construction of facilities built to higher seismic resistance standards.) NEPA Guidance for preparing an EIS (40 CFR 1522.22) requires the evaluation of impacts which have low probability of occurrence but high consequences if they do occur; thus facility accidents must be addressed to the extent feasible in this SWEIS. Further, public comments received during the scoping process clearly indicated the public's concern with facility safety and consequent health risks and the need to address these concerns in the comparison-making process.

For both the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, potential accidents are defined in existing facility documentation, such as safety analysis reports, bases for interim operation, hazards assessment documents, and NEPA documents. From an accident analysis standpoint,

there is no difference in the analyzed accidents in the two No Action alternatives. The accidents include radiological and chemical accidents that result in high consequences but have a low likelihood of occurrence, and a spectrum of other accidents that have a higher likelihood of occurrence, and lower consequences. Additional data on accident selection, the source document, and methodologies can be found in Section D.7.2. Events with major consequences such as a fire-induced release due to the crash of a large aircraft are not separately analyzed due to the very small frequency (less than 10^{-7} per year) and the consequences of these events would be bound by the consequences of the site-wide earthquake (DOE 1996e). For proposed new or expanded facilities, the identification of accident scenarios and associated data would normally be based on analysis reports performed on completed facility designs. However, facility designs have not been completed for the HEU Storage Mission and Special Materials Mission Alternatives analyzed in this SWEIS. Accordingly, the accident information developed for this SWEIS has been developed based upon the best available existing information for similar facilities.

This analysis also includes semiquantitative or qualitative estimates of the differences in likelihood for accident initiation at new facilities. For example, the proposed new HEU Materials Facility, built at a higher elevation, would have a reduced potential for flooding. Also qualitatively discussed, are the opportunities for risk reduction afforded by the potential incorporation of new technologies, processes, or protective features in the newly constructed facilities. These would improve public health and safety compared to the existing facilities.

5.14.2 Methodology

The MELCOR Accident Consequence Code System (MACCS) was used to estimate the radiological consequences for the population of workers and the public for all accidents. Doses to a maximally exposed collocated worker or to a member of the public at the Y-12 Emergency Response Boundary were derived from facility safety documentation. A discussion of how the collocated workers and the public population doses were calculated using the MACCS code is provided in Section D.7.2.5. A detailed description of the MACCS model is available in a three volume report: *MELCOR Accident Consequence Code System (MACCS)* (NUREG/CR-6613).

MACCS models the off-site consequences of an accident that releases a plume of radioactive materials to the atmosphere. Should such an accidental release occur, the radioactive gases and aerosols in the plume would be transported by the prevailing wind while dispersing in the atmosphere. The environment would be contaminated by radioactive materials deposited from the plume, and the population would be exposed to radiation. The objectives of a MACCS calculation are to estimate the range and probability of the health effects induced by the radiation exposures not avoided by protective actions.

In previous NEPA documentation (DOE 1994a) for Y-12, detailed MACCS modeling was performed for several hypothetical accidents. The results and assumptions for these MACCS models are documented in the report, *An Assessment of the Radiological Doses Resulting from Accidental Uranium Aerosol Releases and Fission Product Releases from a Postulated Criticality Accident at the Oak Ridge Y-12 Plant* (Fisher 1995). This assessment provides results for releases of fission product gases resulting from a criticality accident and releases of HEU aerosols. This report contains detailed information for the Site as well as a wind rose. This assessment provides dose consequences for theoretical accidents and was used for estimating the radiological population doses presented in the accidents in this analysis. Conservative assumptions were made in estimating the source terms for the releases. The Site boundary selected for estimating doses to the MEI was the Y-12 Emergency Response Boundary. Public dose estimates are based upon census data and site meteorological data. Additional information on methodology for radiological accidents can be found in Section D.7.2.5.

Accidental chemical releases were estimated using the HGSYSTEM. The HGSYSTEM code is a suite of codes, including a modification of the HEGADAS dense gas dispersion code. HEGADAS was modified to

better model the dispersion of anhydrous hydrogen fluoride after test results in Nevada showed that existing models did not properly match the results of the outdoor testing. The modification incorporated several attributes: (1) the ability to account for HF/H_20/air thermodynamics and plume aerosol effects on plume density (both positive and negative effects); (2) the ability to model both pressurized (jet) and unpressurized (pool) releases; (3) the ability to predict concentrations over a wide range of surface roughness conditions; (4) the ability to predict concentrations at specific locations for user-specified averaging periods (sampling times) that are consistent with release duration; (5) the ability to consider steady-state, time-varying, and finite-duration releases; and (6) the ability to compute crosswind and vertical concentration profiles. After the HGSYSTEM development was completed, the computer model was validated against the data from the Nevada testing series.

Especially near the source of a release, actual short-term gas concentrations will depart markedly from average model values in response to random turbulent eddies and are therefore unpredictable. As the actual released material moves downwind, concentrations within the plume become more similar to HGSYSTEM model calculations. HGSYSTEM shows concentrations that represent averages for time periods of 15 minutes and predicts that average concentrations will be highest near the release point and along the center line of the release (this is typical plume modeling). The concentration is modeled as dropping off smoothly and gradually in the downwind and crosswind directions. HGSYSTEM is the only dispersion code that can model releases of anhydrous hydrogen fluoride and account for the unique thermochemistry of depolymerization and hydrolysis.

Moreover, HGSYSTEM models the dispersion of heavy gases assuming the terrain is flat. Thus, if a ridge is located between the release point and a potential receptor, HGSYSTEM models the scenario as though the ridge were absent. This is a conservative approach because potential receptors are offered some protection from heavy gases by intervening ridges. Under the most stable atmospheric conditions (most commonly found late at night or very early in the morning), there is little wind, reduced turbulence, and less mixing of the released material with the surrounding air. High gas concentrations can build up in small valleys or depressions and remain for long periods of time. HGSYSTEM does not account for gas accumulations in low-lying areas. Additional information regarding HGSYSTEM is provided in Section D.7.2.5.

5.14.3 Accident Scenarios

5.14.3.1 *Wildfires*

A wildfire could be initiated by lightning, an aircraft crash, a burning cigarette, the sun shining on a piece of glass, or even a “controlled burn” during windy conditions. Fires on the ORR are not common but they do occur. Records indicate that nine wildfires have occurred on the ORR since 1966. The largest area burned by a wildfire was 162 to 202 ha (400-500 acres). This wildfire occurred April 7, 1966 and originated in the Y-12 burning pits. Another significant wildfire occurred February 21, 1977. This wildfire burned uncontrolled on the Reservation on Pine Ridge, immediately west of a 500-kv transmission line. This wildfire resulted from brush piles being burned by a TVA contractor clearing the Watts Bar-Roane transmission line right-of-way on the northwest slopes of Pine Ridge. The total area burned by this fire was approximately 20 ha (49 acres).

Although wildfires are not expected to reach Y-12 facilities, hot embers from such a fire could blow onto roof tops, potentially initiating a building fire. Depending on the proximity of the fire and wind conditions, ash and other byproducts from a wildfire could plug fresh intakes and exhaust filters for the Y-12 facilities. Heavy smoke could cause the filters to become clogged or “loaded”, which could lead to failure in the filtering system.

5.14.3.2 *Site-Wide Earthquake*

For many DOE facilities, due largely to their age and the absence of safety documentation, the original design bases, including those for safety-related features, are severely lacking or non-existent. In recognition earthquakes are part, are referred to in Y-12 Site safety documentation as evaluation basis earthquakes. Evaluation basis accidents are developed based upon existing documentation, engineering assessments, and evaluations of facility capabilities . These derivative design basis accidents are then documented in a facility safety evaluation.

To assure conservative consequence estimates, the beyond-evaluation basis earthquake estimated for the Y-12 Site is a seismic event with a frequency of less than 5×10^{-4}/yr but greater than 1×10^{-6}/yr. This beyond-evaluation basis earthquake is based on guidance in DOE-STD-1020, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, for high hazard facilities. DOE-STD-1020 provides guidance on appropriate frequency and intensity for the evaluation of natural phenomena hazards at DOE facilities. In DOE-STD-1020, event frequencies provide a baseline for natural phenomena strength. Seismic events of greater magnitudes than those suggested in DOE-STD-1020 were selected for evaluation to ensure that beyond evaluation basis effects were being examined. Further conservatism was included by a three-distinct-event criterion, where the natural phenomena initiator itself is considered the first distinct event. Two additional distinct events, defined as events which pre-suppose an abnormal facility/equipment condition or response, were assumed to maximize the consequences of the earthquake. The probability of a fire following a beyond-evaluation basis seismic event is high and was assumed to be one for this analysis.

For the beyond-evaluation basis earthquake, structural collapse was postulated to be accompanied by the most significant internal events, including fire and explosions. This practice, coupled with the short site boundary distances at Y-12, results in overly conservative values for maximum doses to the public and site workers. Based on a review of facility Basis of Interim Operations (BIOs) and Safety Analysis Reports, the Y-12 facilities that have the potential for such significant internal events are Buildings 9204-4, 9206, 9212, and 9215. In general, a beyond-evaluation basis earthquake is bounding as it destroys building confinement and includes all significant individual fire and explosion scenarios.

If a beyond-evaluation basis earthquake accident were to occur, there would be an estimated 0.21 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200m (660 ft) from the accident, there would be an increased incidence of cancer fatality of 0.012. For the MEI located at the Site boundary, there would be an increased incidence of cancer fatality of 0.008. The risks for the beyond-evaluation basis earthquake accident, reflecting both the probability of the accident occurring and the consequences, are shown in Table 5.14–1 (at the end of Section 5.14). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 1.2×10^{-6}, 8×10^{-7}, and 2.1×10^{-5} cancer fatalities per year, respectively. A summary of the beyond-evaluation basis earthquake consequences for Y-12 is provided in Table 5.14–1. A detailed summary by facility of the potential consequences for the public and collocated workers is presented in Appendix Table D.7.4–4.

5.14.3.3 *Facility Hazards*

Some of the facilities at Y- 12 contain occupational hazards with the potential to endanger the health and safety of workers in the vicinity of an accident. Some of the facilities also contain hazardous materials that, in the event of an accident, could endanger the health and safety of people outside the immediate vicinity of an accident and beyond. These people include collocated workers as well as the public.

Potential accidents associated with facility hazards such as radiological, fissile, chemically toxic, and explosive materials have been analyzed and discussed in the following sections. Potential accidents associated with other facility hazards such as lasers, electricity, x rays, noise, and compressed gases could affect the health and safety of the involved workers. However, the impacts to collocated workers and the

public from these other accidents would be lower than the impacts from the radiological, fissile, chemically toxic, and explosive materials accidents described in Appendix D.7.

DOE recognizes the potential adverse effects for workers, the public, and the environment that could result from the deterioration of Y-l2 equipment, structures, and facilities. However, the analysis of potential accidents discussed in this section assumes that equipment, structures, and facilities would be properly maintained and repaired to meet their analyzed purpose. The basis for this assumption is the DOE safety analysis process, as specified in the ES & H requirements identified in Chapter 18 "Facility (Nuclear) Safety," of the *Standards/Requirements Identifications Document* and the *Engineering Design and Construction Work Smart Standards*. The Unreviewed Safety Question Determination process also applies to ensure changes remain within the DOE-approved authorization basis.

Explosion Accidents

Materials that could lead to an explosion are stored, handled, transported, and used in some Y-12 facilities. Explosion hazards are analyzed to identify the need for controls to prevent or mitigate the hazards.

Authorization basis documents for Buildings 9212, 9206, 9204-2E, 9215, 9204-4, 9720-5, 9201-5 and 9720-38 identified postulated explosion events. All of the dominant explosion scenarios resulted in significant consequences to the worker but did not produce any significant radiological consequences to the collocated worker or off-site public. The conclusions were based upon the determination that HEU materials subject to the event are present in small amounts of respirable forms in the susceptible areas and, in most cases, shielded from the force of the blast by equipment. The dominant explosion scenarios identified are associated with organic chemical and nitrate reactions resulting in nitrated organic compounds (red oil) explosions and fume-off reactions; flammable gas leaks from hydrogen, natural gas, and oxygen; thermal or chemical reactions and steam and dust explosions. A summary of the postulated explosion accident consequences to the public and collocated workers is presented in Appendix D (Table D.7.4–3).

Criticality Accidents

Postulated criticality events have been evaluated for Y-12 facilities that store or process enriched uranium. The four main categories of criticality initiating events are those resulting from administrative error (procedural non-compliance), solutions being introduced into unfavorable geometries, holdup in fissile materials equipment, and natural phenomena events.

The consequences associated with a solution criticality event have been evaluated using the prompt dose equations and those associated with the committed effective dose equivalence (CEDE). The predicted prompt dose for a solution criticality with an initial pulse of 10^{18} fissions (taking no credit for attenuation due to concrete, steel, or other intervening shielding material that might provide a significant dose reduction) drops below 100 rem within 19 m (62 ft), below 25 rem at 35 m (115 ft) from the accident, and below 1 rem at 142m (466 ft). Acute lethal exposures can be received by unshielded persons who are within 5 to 10 m (16 to 33 ft) of an accident. Due to subsequent pulses over the next 24 hours following the initial accident, the total fissions would approach 10^{19} (solution criticality accidents often involve an initial critical pulse followed periodically by other pulses of energy). Fatalities could occur absent prompt evacuation by workers. Because of the potential for operator fatality, the consequence rating is "High". No credit was taken for shielding that would be available for any criticality that occurs inside the building, and the analysis assumes a ground-level release of fission products. The dose rates, based on an unmitigated release, were calculated to be those received by a hypothetical MEI at the Site boundary.

If a criticality accident were to occur, there would be an estimated 0.0043 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200 m (660 ft) from the accident, there

would be an increased incidence of cancer fatality of 0.0032. For the MEI located at the Site boundary, there would be an increased incidence of cancer fatality of 0.0015. The risks for the criticality accident, reflecting both the mitigated frequency of the accident occurring and the consequences, are shown in Table 5.14–2 (at end of Section 5.14) (note: mitigated frequency assumes that administrative and engineering controls are implemented to prevent accidents). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 3.2×10^{-7}, 1.5×10^{-7}, and 4.3×10^{-7} cancer fatalities per year, respectively.

Fire Accidents Involving Radioactive Materials

For the fire accident involving radioactive materials of concern at Y-12 are enriched uranium, uranium compounds, and thorium that present a radiological hazard based on large, airborne respirable releases. The typical enriched uranium (93.5 percent ^{235}U) that is present has a specific activity of 7.0×10^{-5} Ci/g and an inhalation dose conversion factor of 1.23×10^{8} rem/Ci CEDE. Higher enrichments do exist in limited activities; however, they will not significantly impact the consequences of the postulated accidents. Small quantities of radioisotopes of elements such as plutonium, niobium, technetium, cesium, cerium, and neptunium may also be present at Y-12. Depleted uranium is present in large quantities at Y-12. However, the toxicological effects outweigh the radiological effects for depleted uranium. The consequences of a radiological fire in the facilities at Y-12 include potential exposure to airborne releases of various forms of enriched elemental uranium, uranium compounds, and thorium.

If a fire event involving radioactive materials were to occur, there would be an estimated 9×10^{-5} to 0.28 cancer fatalities in the population within 80 km (50 mi) of Y-12. For a non-involved worker located 200 m (660 ft) (site boundary) from the accident, there would be an increased incidence of cancer fatality of 4×10^{-6} to 0.023. For the MEI located at the site boundary, there would be an increased incidence of cancer fatality of 5×10^{-6} to 0.008. The risks for the fire accidents involving radioactive materials, reflecting both the mitigated frequency of the accident occurring and the consequences, are shown in Table 5.14–3 (at end of Section 5.14). For the same worker, the MEI, and the population, the risks, taking into account the probability of accidents, would be 4×10^{-10} to 2.3×10^{-6}, 5×10^{-10} to 8×10^{-7}, and 9×10^{-9} to 2.8×10^{-5} cancer fatalities per year, respectively. A detailed listing of the potential consequences to the public and collocated workers of the dominant postulated accident scenarios are presented in Appendix Table D.7.4–2.

Chemical Accidents

Many Y-12 facilities store and use a variety of hazardous chemicals. The quantities of chemicals vary, ranging from small amounts in individual laboratories to bulk amounts in processes and specially designed storage areas. In addition, the effects of chemical exposure on personnel would depend upon its characteristics and could range from minor to fatal. Minor accidents within a laboratory room, such as a spill, could result in injury to workers in the immediate vicinity. A catastrophic accident such as a large uncontrolled fire, explosion, earthquake, or aircraft crash could have the potential for more serious impacts to workers and the public (See Appendix D.7.5.1 for a discussion of the December 8, 1999 accident involving sodium-potassium in Building 9201-5). A catastrophic accident could also release various chemicals from multiple release points and increase the potential for human exposure and serious injury.

To assess the impacts of chemical accidents in a bounding manner, a multiple step review of the facilities was performed. The nuclear facility accidents were reviewed for potential chemical accidents related to the nuclear facilities. In addition, the annual *Emergency Planning and Community Right-to-Know Act* (hereafter known as *Superfund Amendments and Reauthorization Act* [SARA]) Section 311 and Section 312 reports were reviewed (Evans 1999a, Evans 1999b). The list of chemicals ascertained from this multiple step review was further screened to identify chemicals that were also listed as highly hazardous chemicals by OSHA in 29 CFR 1910.119 or as a regulated substance by EPA under 40 CFR 68.130. Additionally, chemicals

determined to require further evaluation met all of the following criteria as defined in DOE/EIS-0238 (DOE 1999l).

- Has a time-weighted average (TWA) less than 2 ppm (for chemicals without TWAs, the temporary emergency exposure limit [TEEL]-0 was used)
- Is found in a readily dispersible form (i.e., a gas or liquid)
- Has a boiling point of less than 100EC (212EF) and a vapor pressure greater than 0.5 mm mercury

Mercury, a chemical of local interest, was added to the list of chemicals identified for further analysis.

A fire involving mercury could result in the exposure of some members of the public to Emergency Response Planning Guidelines (ERPG)-2 concentrations. The consequences of exposures to fires involving other chemicals were exposures of ERPG-2 concentrations to on-site personnel. The fires could expose between 80 and 190 workers to ERPG-2 or higher concentrations of toxic chemicals. A summary of the results of a release of toxic material in the event of fire is presented in Appendix D (Table D.7.5–1).

The exposures to toxic chemicals due to a loss of containment (leak of a container or spill from a tank) were evaluated. Nitric acid, hydrochloric acid, or sulfuric acid or sodium hydroxide spills are not expected to expose the pubic to ERPG-2 concentrations. Toxic gas releases could expose between 80 and 310 workers to ERPG-2 concentrations or greater. Exposures from a release of hydrogen flouride from Building 9212 could exceed ERPG-2 levels 60 m beyond the Y-12 Emergency Response Boundary, but would not reach the closest residential area. A summary of the evaluation is presented in Appendix D (Table D.7.5–2).

5.14.4 Accidents for the HEU Storage Mission and Special Materials Mission Alternatives Compared to the No Action - Status Quo Alternative

A new HEU Materials Facility or Building 9215 addition is proposed in this SWEIS as an alternative to the existing facilities currently performing the HEU Storage Mission at Y-12. The conceptual design analysis of the HEU Materials Facility indicates that the frequency of fire would be reduced by limiting combustible materials in the facility. The new facility would be constructed of noncombustive materials and the contents would provide extremely low combustible material loading. Considering the segmentation of the inventory, the use of fire barriers as proposed in the new HEU Materials Facility or Building 9215 addition, and the noncombustible building construction, the consequences of any release and the likelihood of a large fire would be expected to be below the results presented in Table 5.14–3 for the existing facilities.

New facilities such as the proposed HEU Materials Facility or Building 9215 addition would be constructed to current building design standards. New buildings for the Y-12 Site would be designed and built to withstand higher seismic accelerations and thus would be more resistant to earthquake damage. These new facilities would experience earthquake damage less frequently. The new HEU Materials Facility or the Building 9215 addition would be designed to PC-3 and constructed to PC-2 standards (see DOE-STD-1021-93). The frequency of a beyond-design basis earthquake would be less than 5×10^{-4}/yr. The new HEU Materials Facility or the Building 9215 addition would also be built at a higher elevation, precluding flooding of HEU storage with the potential for increasing the likelihood of a postulated criticality accident.

A new Special Materials Complex is proposed for construction to consolidate the existing special materials operations described under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives. This proposed complex would be built to current codes and standards. Additionally, the proposed Special Materials Complex would make use of engineered controls in lieu of some administrative controls used in existing operations; thus, the controls that prevent or mitigate accidents would be more reliable. The proposed complex would be composed of several buildings that would provide segmentation

of inventories and would generally be constructed from noncombustible materials (see Section 3.2.4). Therefore, the likelihood of accidents involving the chemicals stored in the new complex would decrease with the new facilities over the present special material processing facilities. The likelihood of these accidents is expected to be significantly lower. The candidate locations that are being considered for the Special Materials Complex show that Site 1 is located north of Bear Creek Road and much closer to the closest Y-12 Emergency Response Boundary and closest to the location of an MEI member of the public. This location would increase the likelihood of exceeding ERPG-2 (or TEEL-2) concentrations at the Y-12 Emergency Response Boundary if the same inventories of chemicals are stored at all of the candidate sites, and no compensating design improvements were made to decrease the risk. New facilities are designed specifically to process hazardous materials; however, the facilities can be expected to incorporate modern features to prevent the occurrence of accidents with the materials, as well as mitigate the accident consequences. Specific examples must await the final facility design, but would include material containment systems, ventilation filter systems, fire protection systems, and improved material handling and storage.

TABLE 5.14–1.—*Summary of Beyond Evaluation Basis Earthquake Composite Consequences for Y-12*

Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
$<1 \times 10^{-4}$	15.85 of HEU	17	30	0.008	0.012	404	26,500	0.21	11
Risk (LCF/yr)				8×10^{-7}	1.2×10^{-6}			8.1×10^{-5}	1.1×10^{-3}

Source: Appendix Section D.7.4.

TABLE 5.14–2.—*Summary of Criticality Consequences for Y-12*

Mitigated Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
10^{-4} to 10^{-6}	1×10^{19} fissions	3	8	1.5×10^{-3}	3.2×10^{-3}	8.6	870	4.3×10^{-5}	0.35
Risk (LCF/yr)				1.5×10^{-7}	3.2×10^{-7}			4.3×10^{-7}	3.5×10^{-5}

Source: Appendix Section D.7.4.

TABLE 5.14–3.—*Summary of Fire Consequences Involving Radioactive Materials for Y-12*

Mitigated Frequency (yr^{-1})	Source Term (kg)	Maximum Individual (rem)		Maximum Individual Latent Cancer Fatalities		Population (person-rem)		Population Latent Cancer Fatalities	
		Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers	Public	Collocated Workers
10^{-4} to 10^{-6}	0.007 to 22 of HEU	0.01 to 16	0.01 to 57	5×10^{-6} to 0.008	4×10^{-6} to 0.023	0.18 to 570	12 to 3,300	9×10^{-5} to 0.28	0.005 to 1.3
Risk (LCF/yr)				5×10^{-10} to 8×10^{-7}	4×10^{-10} to 2.3×10^{-6}			9×10^{-9} to 2.8×10^{-5}	5×10^{-7} to 1.3×10^{-4}

Source: Appendix Section D.7.4

5.15 RESOURCE COMMITMENTS

This section describes the potential impacts of the Y-12 HEU Storage Mission and Special Materials Mission Alternatives on the commitment of resources in terms of unavoidable adverse impacts, short-term uses verses long-term productivity, and the irreversible or irretrievable commitments of resources.

The section presents information drawn from the previous sections of Chapter 5 (Environmental Consequences) and the Comparison of Alternatives and Environmental Impacts (Section 3.5 and Table 3.5–1). The resource commitment assessment focuses on those potential impacts, which cannot be mitigated, and would result in a loss or long-term commitment of the resource.

Unavoidable Adverse Impacts. Current operations at Y-12 use approximately 5.7 billion L/yr (1.5 billion gal/yr) of treated water. The water usage required for each of the HEU Storage Mission and Special Materials Mission Alternatives would be relatively small compared to current usage or water usage under the No Action - Planning Basis Operations Alternative; about 7.4 billion L/yr (2 billion gal/yr). The operation of a new HEU Materials Facility would require about 550,000 L/yr (145,000 gal/yr); the addition to Building 9215 operations would require about 720,000 L/yr (190,000 gal/yr) of water. The Special Materials Complex would need about 84 million L/yr (22 million gal/yr). Over the life of the construction period, the new HEU Materials Facility would have total water requirements of about 7.6 million L (2 million gal); the Building 9215 Upgrade Expansion requires less water, about 5.7 million L (1.5 million gal) in the construction period. The Special Materials Complex construction would require about 5.7 million L (1.5 million gal).

New construction activities would require the potential redesign or relocation of discharge channels. The adverse impacts would be short-term in nature as natural plants are re-established and wildlife returns to the area.

The candidate sites for the proposed HEU Materials Facility are within the existing industrialized Y-12 Site boundary and are all previously disturbed to some degree. Consequently, the use of either site would not result in an adverse change to existing Y-12 land use patterns and plans.

The candidate sites and Y-12 Site areas that may be affected are inhabited primarily by urban-type wildlife species. There are no areas providing substantial habitat support. Adverse impacts to biological resources therefore would not constitute major habitat modifications or long-term loss of species.

Unavoidable radiation and chemical exposures, which include continued occupational exposures and exposures to the general public from normal Y-12 operations, while an adverse impact, would be well below regulatory limits.

As DOE continues operations under the No Action - Status Quo and No Action - Planning Basis Operations Alternatives, the potential for injuries and fatalities of workers exists. Engineered controls and training and safety programs would reduce but not eliminate the potential for worker injuries or fatalities.

Short-term Uses Versus Long-term Productivity. The proposed actions could require short-term use of the environment that would affect long-term environmental productivity. This section describes possible consequences to long-term environmental productivity for short-term environmental uses. The terms “short-term” and “long-term” commonly used in NEPA analyses do not have specific definitions. For purposes of this SWEIS, the short-term refers to the time from the present out to 10 years. Long-term refers to the time frame out to 30 years, or the estimated operating life of a facility.

In general, Alternative 1B (No Action - Planning Basis Operations Alternative) and proposed actions for the Y-12 HEU Storage Mission and Special Materials Mission would benefit long-term national security by fulfilling an integral role in maintaining a safe, secure, and reliable nuclear weapons stockpile over the next 10 years and beyond. Y-12, through the implementation of the HEU Materials Facility and Special Materials Complex projects, would contribute to the safe, secure, and consolidated storage of HEU and the dismantling of weapon components and special materials operations. Additionally, proposed new construction would increase operational efficiency while reducing maintenance costs.

Up to 5 to 8 ha (12.4 acres) of land would be committed to host the construction of the new HEU Materials Facility and Special Materials Complex. In the short-term, this would remove the land from existing or other future uses. In the long-term, however, the land would be the site of a state-of-the-art HEU Materials Facility and a Special Materials Complex.

Short-term uses that could cause impacts to biological resources and soils would be associated with the construction and operation of Y-12 facilities; those activities could lead to long-term productivity loss in disturbed areas. The loss would be limited to approximately 4 ha (10 acres) per facility in addition to minimal areas disturbed by infrastructure modifications. The areas likely to be disturbed are in existing industrialized areas of the Y-12 Site. Biological resources would be affected by land disturbances. The overall impact, however, would be limited because the areas disturbed and the individuals affected would be small in relation to the regional populations.

Small occupational and public radiation exposures would continue in the short-term from existing Y-12 operations. With proposed new construction, expected exposures should be less due to the installation of the state-of-the-art equipment and engineered barriers. In the long-term, the modernization efforts would represent a positive impact through reduced risk and decreased occupational and public exposure to radiation. Short-term employment, expenditures, and tax revenues during the new construction period would benefit the local economy. The longer-term operational workforce impacts would be negligible. Employment associated with new construction would help retain workers that would otherwise be lost through downsizing.

Irreversible or Irretrievable Resource Commitments. Resources that could be irreversibly or irretrievably be committed during the construction of Y-12 facilities include:

- Resources that cannot be recovered or recycled
- Resources consumed or reduced to unrecoverable forms

The commitment of a resource is irreversible if its primary or secondary impacts limit future options for the resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for later use by future generations.

The land requirements for support of Y-12's new construction would be small and would represent an irreversible commitment. Because of the aboveground construction, the land would not be restored to its original condition. Consequently, the land would not be available for other uses.

The commitment of capital, labor, material, and energy during the construction and operation of the facilities would be irretrievable. Energy would be consumed in the form of diesel fuel, gasoline, and oil for construction equipment and vehicles, and as electricity and raw materials for construction and operations.

Materials used for construction would include wood, aggregate, plastics, metals (steel, copper, aluminum, and stainless steel), concrete, and small amounts of other materials. Waste generation estimates can be found in Sections 3.2.3 and 3.2.4. Some of these materials (e.g., copper and stainless steel) could be salvaged when facilities are decontaminated and decommissioned.

In general, the Special Materials Complex would consume the most resources. Table 5.15–1 provides resource requirements by alternatives.

TABLE 5.15–1.—*Commitment of Construction Resources for the Highly Enriched Uranium Storage Mission and Special Materials Mission Alternatives*

Requirements	HEU Materials Facility Sites A or B	Building 9215 Addition	Special Materials Complex		
			Site 1	Site 2	Site 3
Materials/Resource					
Electrical Energy (MWh)	5,000	5,000	8,000	8,000	8,000
Concrete (m^3)	25,100	7,650	13,800	14,500	14,500
Steel (t)	2,100	1,100	3,000	3,200	3,200
Liquid Fuel and lube oil (L)	568,000	265,000	984,200	1,582,300	1,582,300
Water (L)	7,571,000	5,678,000	5,700,000	5,700,000	5,700,000
Land (ha)	5	1	8	5	5

Source: Tables 5.8.3–1 and 5.8.4–1.