CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 describes the environmental impacts of the alternatives evaluated in this *Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center*. A detailed discussion of each alternative is presented in Chapter 2. The impact analyses presented in Section 4.1 of this chapter address those areas of the environment where the potential exists for environmental impacts. Section 4.2 addresses cost-benefit considerations, and Section 4.3 discusses incomplete and unavailable information. Intentional destructive acts are described in Section 4.4. The cumulative impacts are presented in Section 4.5. Resource commitments, including unavoidable adverse environmental impacts, the relationship between short-term use of the environment and long-term productivity, and irreversible and irretrievable commitments of resources, are presented in Section 4.6. A summary comparison of the environmental impacts of the alternatives is presented in Chapter 2, Section 2.6.

This chapter presents the results of the analysis of consequences (impacts) of the alternatives described in Chapter 2 of this environmental impact statement (EIS). The analysis is organized by resource area. Site information for these resource areas is presented in Chapter 3 and provides the basis for the impact analyses.

The level of documentation provided in this EIS for each resource area is consistent with its significance, where significance includes the severity, nature, and extent of environmental impact and the potential for controversy. This approach is consistent with Council on Environmental Quality and U.S. Department of Energy (DOE) National Environmental Policy Act (NEPA) guidance to focus the presentation in an EIS on the impacts of significance.

The analysis of potential impacts of EIS alternatives addresses two different groups of site activities: those associated with *decommissioning* site facilities, and those associated with *site monitoring and maintenance* (including site access control), possibly including a *long-term stewardship* program under some alternatives. Decommissioning activities occur over finite periods of time and include construction and eventual disposition of temporary facilities, removal or stabilization of buried radioactive waste, and stabilization of the site against erosion. The impacts of decommissioning are quantified over the period of decommissioning for each decommissioning alternative. For purposes of this EIS, site monitoring and maintenance refers to those activities necessary to ensure protection of human health and the environment before closure of a site, while long-term stewardship refers to those activities (including engineered and institutional controls) necessary to ensure protection of human health and the environment following closure of a site.[1] Impacts from site monitoring and maintenance activities, and stewardship activities as appropriate for some alternatives, are quantified in this EIS on an annual basis.[2] These concepts are summarized for each alternative:

[1] *Long-term stewardship includes engineered and institutional controls designed to contain or to prevent exposure to residual contamination and waste such as monitoring and maintenance activities, record-keeping activities, inspections, groundwater monitoring and treatment, access control, posting signs, and periodic performance reviews.*

[2] *Data for much of the analysis in this chapter are drawn from a series of technical reports addressing each of the alternatives considered in this EIS (WSMS 2009a, 2009b, 2009c, 2009d). Data in the technical report for the Sitewide Removal Alternative are presented over a 60-year decommissioning period (WSMS 2009a). Data in the technical report for the Sitewide Close-In-Place and No Action Alternatives are presented over 60-year periods of decommissioning and/or site monitoring and maintenance (WSMS 2009b, 2009d) to facilitate comparisons with data presented in the technical report for the Sitewide Removal Alternative. Data in the technical report for the Phased Decommissioning Alternative are presented over the 30-year period analyzed for Phase 1 of this alternative (WSMS 2009c). (See Chapter 2, Figures 2–6 through 2–9.)*

- *Sitewide Removal Alternative* – Decommissioning is assumed to occur over 60 years, during which time site monitoring and maintenance activities would continue. Following decommissioning, the entire Western New York Nuclear Service Center (WNYNSC) would be available for release for unrestricted use, and there would be no need for a long-term stewardship program. There may be a need for a limited amount of site monitoring and maintenance associated with temporary onsite storage of orphan waste in the Container Management Facility pending the availability of offsite waste disposal capacity.

- *Sitewide Close-In-Place Alternative* – Decommissioning is assumed to occur over 7 years, although the Interim Storage Facility would operate for an additional 25 years before being decommissioned in year 33. Site monitoring and maintenance activities would continue during decommissioning activities. A long-term stewardship program would be put into place after decommissioning activities are complete and would last into perpetuity.

- *Phased Decisionmaking Alternative* – Phase 1 of this alternative, which for purposes of analysis is assumed to last up to 30 years, includes decommissioning activities for some of the waste management areas (WMAs), combined with characterization of site contamination and additional studies to help determine the best technical approach to complete decommissioning of the remaining facilities. Decommissioning activities during Phase 1 are assumed to occur over 8 years, although the Interim Storage Facility would operate for an additional 21 years before being decommissioned in year 30. Site monitoring and maintenance activities would also continue until Phase 2 is complete. Phase 2 actions for the Project Premises could range from in-place closure, after which a long-term stewardship program could be implemented, to removal of remaining waste and residual contamination. For the State-Licensed Disposal Area (SDA), Phase 2 actions that will be considered include at least: complete exhumation, close in place, and continued active management consistent with SDA permit and licensing requirements.

  The impacts for the entire Phased Decisionmaking Alternative are presented as a range. If the Phase 2 decision is removal of all remaining WMAs, the impacts for the entire Phased Decisionmaking Alternative (both Phase 1 and Phase 2) would be similar to those for the Sitewide Removal Alternative. If the Phase 2 decision is in-place closure of all remaining WMAs, the impacts for the entire Phased Decisionmaking Alternative would be bounded by a combination of the Sitewide Removal and Sitewide Close-In-Place Alternatives. For the SDA, if the Phase 2 decision is continued active management, certain impacts, such as potential radiation doses to an onsite intruder assuming loss of institutional controls, would be bounded by those for the No Action Alternative.

- *No Action Alternative* – There would be no decommissioning activities under this alternative, although there would be a continuing site monitoring and maintenance program that for purposes of analysis is assumed to last into perpetuity.

The comparison of alternatives in this EIS is organized into sections that present impacts for specific resource areas. Except for Section 4.1.10, Sections 4.1.1 through 4.1.13 address the potential short-term impacts resulting from implementing the three decommissioning alternatives, as well as impacts resulting from implementing the No Action Alternative. Section 4.1.10 addresses the potential long-term impacts that could result from leaving waste and residual contamination on site. Section 4.2 addresses cost-benefit considerations, Section 4.3 addresses incomplete and unavailable information, Section 4.4 addresses intentional destructive acts, Section 4.5 addresses cumulative impacts, and Section 4.6 addresses resource commitments.

Short-term refers to the active project under each alternative during which implementation (most of the construction, operation, and decommissioning activities) would take place.

Long-term is defined as the timeframe beyond implementation of each alternative.

With respect to long-term impacts, this EIS includes a detailed quantitative analysis of impacts associated with the Sitewide Close-In-Place and No Action Alternatives, because both alternatives would leave waste and residual contamination on site. Potential long-term impacts associated with the Sitewide Removal and Phased Decommissioning Alternatives are addressed in less detail. The quantitative analysis of long-term impacts includes assessments of impacts to individuals and populations assuming two different scenarios for institutional controls: (1) continued maintenance of institutional controls, and (2) future loss of institutional controls. Regarding the latter analysis, it is assumed that after 100 years, there would be no further site monitoring and maintenance efforts, possibly leading to unmitigated erosion, as well as breakdowns in access control measures so that persons could inadvertently intrude onto WNYNSC and be exposed to contamination. For purposes of analysis, it is furthermore assumed that, once lost, there would be no reinstatement of institutional controls or any measures taken to preclude or mitigate the calculated doses and risks. It is believed that neither situation would be likely given the expected continuance of regulatory and public health institutions, Federal and state regulations such as those for monitoring public water supplies, and the ability to detect radionuclides and hazardous constituents in water and other environmental media.

The assumed 100-year institutional control period is conservatively adapted from DOE Manual 435.1-1, which states that for performance assessments prepared by DOE for low-level radioactive waste disposal facilities, "institutional controls shall be assumed to be effective in deterring intrusion for at least 100 years following closure" (DOE 1999a). Unlike the DOE performance assessments, for which temporary loss of institutional controls is assumed (DOE 1999a); permanent loss of institutional controls is assumed for this EIS.

4.1 Analysis of Impacts

4.1.1 Land Use and Visual Resources

Land and visual resources could be impacted by decommissioning actions at WNYNSC. Indicators of land resource impact are land area disturbed during decommissioning and land area available for release for unrestricted use. The analysis of impacts on visual resources was conducted based on projected changes in visual resource classification using the Bureau of Land Management's Visual Resource Management (VRM) Class system (DOI 1986). VRM Class I provides for very limited management activity, where the level of change to the landscape should be very low and must not attract attention. Under VRM Class II, management activities may be seen, but should not attract the attention of the casual observer, such as solitary small buildings or dirt roads. Management activities under VRM Class III may attract attention, but should not dominate the view of the casual observer. Finally, under VRM Class IV, management activities may dominate the view and become the major focus of viewer attention.

A summary of the impacts of each alternative on land and visual resources is presented in **Table 4–1**.

Table 4–1 Summary of Land and Visual Resources Impacts

Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Land Disturbance (hectares)	An estimated 33.2 hectares of previously disturbed land would be affected. Additionally, 16.6 hectares of newly disturbed land would result from remediation of the Cesium Prong. Ultimately, all disturbed land (49.8 hectares) would be restored to a more natural state. Removal actions would occur over a 60-year period.	An estimated 18.6 hectares of previously disturbed land would be affected. Additionally, 10.1 hectares of non-disturbed land would be affected by erosion control measures. Not all disturbances would occur at once, but would take place over about 7 years.	An estimated 11.3 hectares of previously disturbed land would be affected under Phase 1 of this alternative over about 8 years. Under Phase 2, additional land disturbance could range from 17.4 to 38.4 hectares. There would be no change in the amount of land disturbed if the Phase 2 decision for the SDA is continued active management.	No additional land would be disturbed.
Land Available for Release (hectares)	Following completion of removal actions, the entire WNYNSC site (1,351 hectares) would ultimately be available for release for unrestricted use, except for about 24.3 hectares used for orphan waste storage in the Container Management Facility.	Ultimately, 1,118 hectares would be available for release for unrestricted use after completion of the in-place closure actions and decay of the Cesium Prong.	Under Phase 1, approximately 693 hectares would be available for release for unrestricted use. If the Phase 2 decision is removal of remaining waste and contamination, the total land available for release under this alternative would be about 1,351 hectares. Less land would be available for release if the Phase 2 decision for the SDA is continued active management. If the decision is in-place closure, the total land available for release would be about 1,118 hectares. The same amount of land would be available for release if the Phase 2 decision for the SDA is continued active management.	About 693 hectares would be available for release for unrestricted use.
Visual Resources	The disturbed portion of WNYNSC would retain its current VRM Class IV rating during decommissioning activities. Except for of the area around the Container Management Facility, the disturbed area would transition to a higher VRM Class II rating following completion of decommissioning activities.	The disturbed portion of WNYNSC would maintain its VRM Class IV rating following decommissioning activities. Land released for unrestricted use would retain its VRM Class II rating.	The disturbed portion of WNYNSC would maintain its VRM Class IV rating during and following completion of Phase 1. Land released for unrestricted use would retain its VRM Class II rating. Following Phase 2, the VRM rating of the site could range from the entire site being rated Class II to most of it being rated Class II, while that portion to be retained would be rated Class IV.	No change in the visual character of the site. The disturbed portion of WNYNSC would retain its VRM Class IV rating.

SDA = State-Licensed Disposal Area, VRM = Visual Resource Management, WNYNSC = Western New York Nuclear Service Center.
Note: To convert hectares to acres, multiply by 2.471.

4.1.1.1 Sitewide Removal Alternative

Land Use

Under the Sitewide Removal Alternative, all site facilities would be removed, soils and sediments would be decontaminated, and all radioactive, hazardous, and mixed low-level radioactive wastes would be shipped off site for disposal when disposal facilities become available. A number of new temporary facilities would be constructed to support removal activities.

Approximately 11.3 hectares (28 acres) of new temporary facilities and structures would be constructed in areas already in use. Land required for use as laydown areas, excavations for foundations, and other activities conducted in conjunction with construction of the new facilities would result in a total construction land disturbance of approximately 14.2 hectares (35 acres), all of which would be within existing disturbed areas.

Additional land disturbance would occur in association with excavation of the North Plateau Groundwater Plume and Cesium Prong. In total, these excavation actions would lead to the disturbance of approximately 35.6 hectares (88 acres). This total consists of about 19.0 hectares (47 acres) of previously disturbed land and about 16.6 hectares (41 acres) of the Cesium Prong located outside the disturbed portion of the site. Ultimately, all disturbed land (49.8 hectares [123 acres]) would be restored to a more natural state. These 49.8 hectares (123 acres) of disturbed land consists of 33.2 hectares (82 acres) of previously disturbed land and 16.6 hectares (41 acres) of newly disturbed land.

Following the removal of buildings and structures, the excavation of waste, and the remediation of the Groundwater Plume and Cesium Prong, all 1,351 hectares (3,338 acres) of WNYNSC would be available for release for unrestricted use. The exact amount and timing of land release from WNYNSC under this alternative would be the result of interactions among the New York State Energy Research and Development Authority (NYSERDA), the U.S. Nuclear Regulatory Commission (NRC), DOE (until completion of WVDP), and other Federal and state agencies having jurisdiction. About 24.3 hectares (60 acres) may need to be retained for operation of the Container Management Facility pending the availability of disposal capacity for orphan waste.

Visual Resources

Construction of new temporary buildings would not change the current VRM Class IV rating of the disturbed portion of the site. Most of the removal activities would take place within the disturbed portion of WNYNSC and would have minimal additional negative visual impact. However, actions to remediate areas of the Cesium Prong located outside the disturbed area, while temporary, would be visible from nearby public vantage points, Route 240, or higher elevations. Upon completion of all decommissioning activities, disturbed areas would be graded and revegetated to stabilize exposed soils. At this stage, except for the Container Management Facility which may be needed for orphan waste storage, WNYNSC would no longer appear industrial and would become more consistent with a higher VRM rating (Class II), where the natural landscape would play a more prominent role.

4.1.1.2 Sitewide Close-In-Place Alternative

Land Use

Under the Sitewide Close-In-Place Alternative, approximately 0.4 hectare (1 acre) of new temporary facilities and structures would be constructed in areas already in use. Adding land required for construction laydown and other purposes (i.e., 0.4 hectare [1 acre]) would result in a total land disturbance of approximately 0.8 hectare (2 acres), all of which would occur within the existing disturbed portion of the site. An additional 17.8 hectares (44 acres) of land would be required for the installation and maintenance of engineered barriers and multi-layer caps in previously disturbed areas. Overall, 18.6 hectares (46 acres) of previously disturbed land would be affected. Erosion control measures, including installation of water control structures and work in and adjacent to Quarry and Franks Creeks and Erdman Brook would newly disturb 10.1 hectares (25 acres) (WSMS 2009b). Overall, as much as 28.7 hectares (71 acres) of WNYNSC land could be disturbed under the Sitewide Close-In-Place Alternative, approximately two-thirds of which would be located within previously disturbed areas of the Project Premises.

Under the Sitewide Close-In-Place Alternative, a substantial portion of WNYNSC would be made available for reuse without restriction. After completion of decommissioning actions and decay of the Cesium Prong, more of the site would be available for unrestricted release. However, it is likely that land would need to be retained for access control, for use as buffer zones around facilities on the North and South Plateaus, and for maintenance and erosion control. Although the exact amount and timing of land release from WNYNSC under this alternative would be the result of interactions among NYSERDA, the NRC, and DOE (until completion of WVDP), and other Federal and state agencies having jurisdiction, the area ultimately available for release for unrestricted use is estimated to be about 1,118 hectares (2,762 acres) (see **Figure 4–1**).

Visual Resources

Construction of new temporary buildings at WNYNSC would not change the VRM Class IV rating of the disturbed portion of the site. Following completion of decommissioning activities, the visual character of the disturbed portion of the site would improve; however, it is likely that manmade features (e.g., the North and South Plateau caps would be rock covered) would still dominate much of the view. Thus, the VRM Class IV rating of the area would not change. The Class II rating of the less-developed balance of the site, much of which would be available for release for unrestricted use, would not change.

4.1.1.3 Phased Decisionmaking Alternative

Land Use

Phase 1 of the Phased Decisionmaking Alternative would result in removal of facilities such as the Main Plant Process Building and the Low-Level Waste Treatment Facility Area lagoons. Approximately 0.4 hectares (1 acre) of new temporary facilities and structures would be constructed in areas already in use. Adding land required for construction laydown and other purposes (0.4 hectare [1 acre]) would result in a total land disturbance of approximately 0.8 hectare (2 acres), all of which would occur within the existing disturbed portion of the site.

Additional land disturbance would occur in association with the actual removal of facilities and construction of engineered barriers in previously disturbed areas. These actions would involve approximately 10.5 hectares (26 acres). Overall, approximately 11.3 hectares (28 acres) of WNYNSC could be disturbed under Phase 1 of this alternative. Under Phase 1, approximately 693 hectares (1,712 acres) would be available for release for unrestricted use (see **Figure 4–2**). The exact amount and timing of land release from WNYNSC under this alternative would be the result of interactions among NYSERDA, NRC, DOE (until completion of the WVDP), and other Federal and state agencies having jurisdiction.

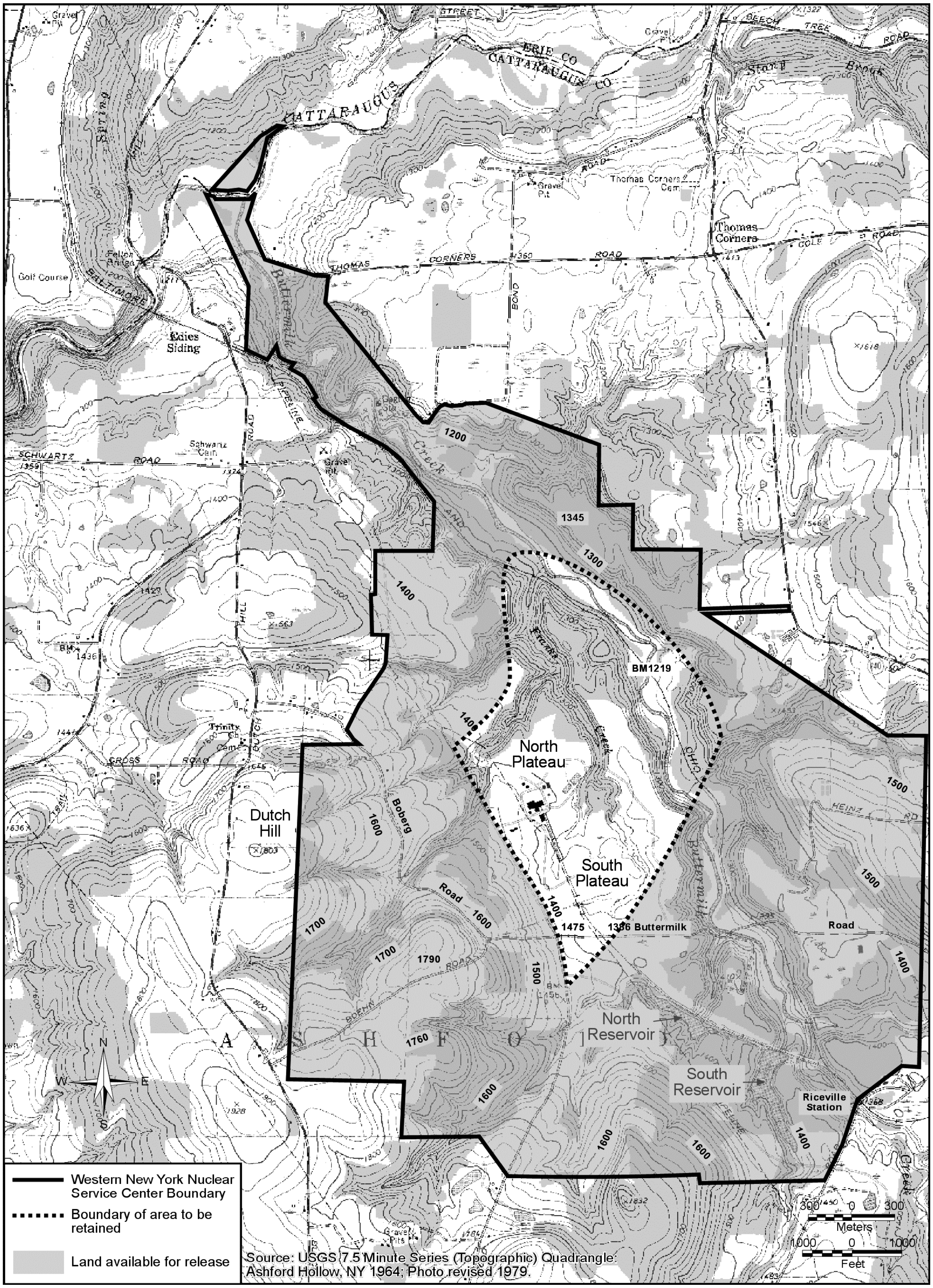

Figure 4–1 Estimate of Portion of the Western New York Nuclear Service Center Land Available for Release for Unrestricted Use After Decommissioning Actions Under the Sitewide Close-In-Place Alternative

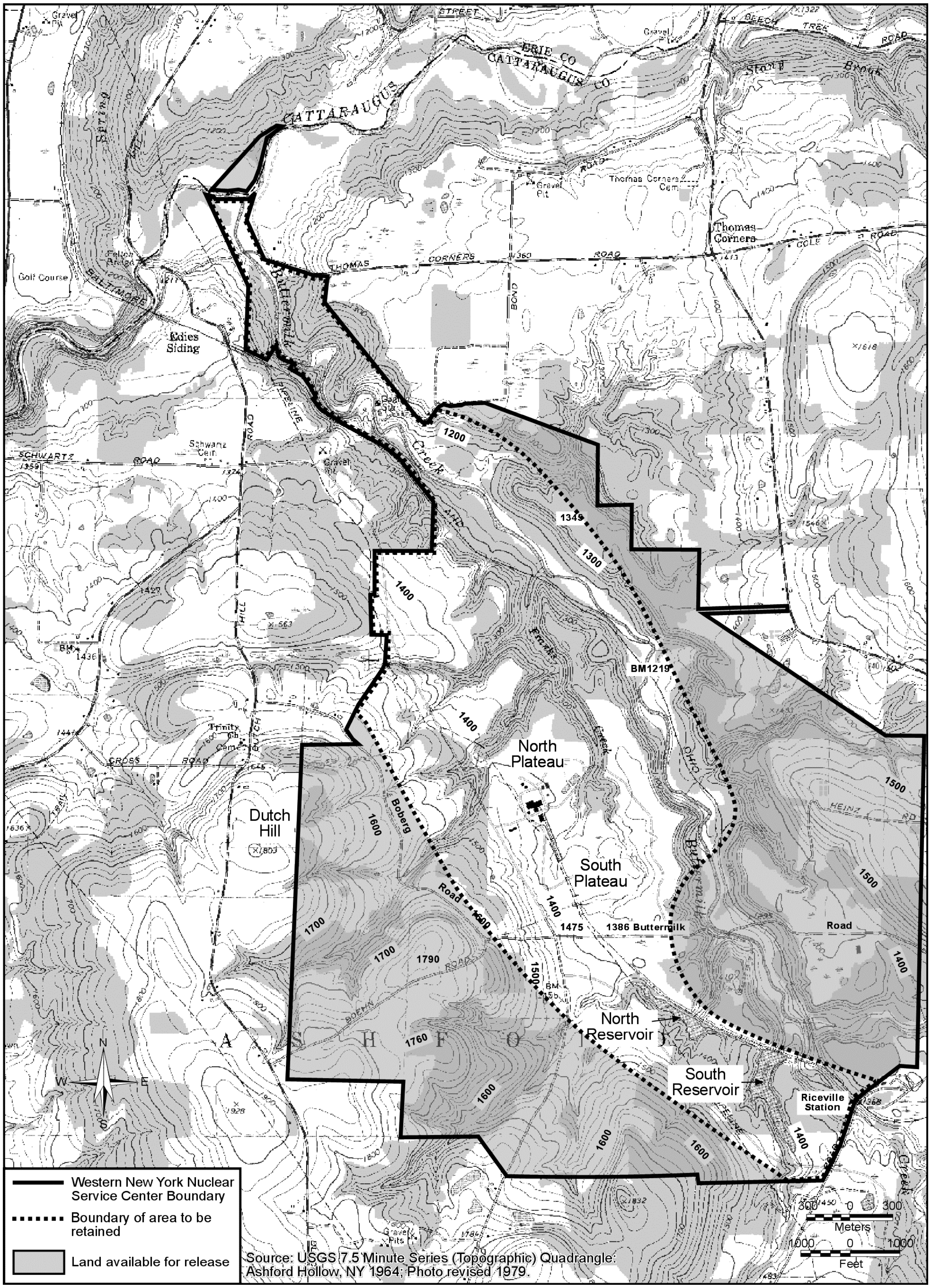

Figure 4–2 Estimate of Nonimpacted Portion of the Western New York Nuclear Service Center Land Available for Release for Unrestricted Use Under the Phased Decisionmaking (Phase 1) and No Action Alternatives

The amount of land impacted by Phase 2 activities, as well as the acreage potentially available for release following decommissioning, would depend on the specific approach taken. Thus, during Phase 2, additional land to be disturbed could range from 17.4 hectares (43 acres) to 38.4 hectares (95 acres), depending on whether decommissioning activities reflect those of the Sitewide Close-In-Place Alternative or the Sitewide Removal Alternative. A decision to continue active management of the SDA would not affect the amount of undisturbed land impacted by closure activities because the SDA is already in a disturbed state.

With regard to the amount of land potentially available for release for unrestricted use, if the Phase 2 decision is removal of remaining waste and contamination, the remaining 658 hectares (1,626 acres) of the site could be available (i.e., all 1,351 hectares [3,338 acres] of WNYNSC). Less land (approximately 6.1 hectares [15 acres], plus a buffer area) would be available for release, however, if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, approximately 425 hectares (1,050 acres) beyond those released during Phase 1 could be available for release for unrestricted use while 233 hectares (576 acres) would be retained indefinitely (i.e., as addressed in Section 4.1.1.2, a total 1,118 hectares [2,762 acres] would be available for release for unrestricted use). There would be no change in the amount of land that would be retained indefinitely or available for release if the Phase 2 decision for the SDA is continued active management.

Visual Resources

Removal of all North Plateau facilities, except the Waste Tank Farm and many of its supporting facilities, under Phase 1 of the Phased Decisionmaking Alternative, would result in a somewhat improved appearance for that portion of the site. However, due to the overall disturbed appearance of the area, its VRM Class IV rating would not change. The Class II rating of the less-developed balance of the site would not change.

Following Phase 2, the visual character of the site would depend on the actions taken during that phase. The appearance of the site would be consistent with a VRM Class II rating if decommissioning activities followed those of the Sitewide Removal Alternative. If they more closely reflected those of the Sitewide Close-In-Place Alternative, only those portions of the site to be released would have a more natural visual appearance consistent with a VRM Class II rating. The visual character of areas to be retained would be improved to some extent as a result of implementation actions, but would still present a disturbed appearance consistent with a VRM Class IV rating. If the Phase 2 decision for the SDA is continued active management, the appearance of the SDA would be consistent with a VRM Class IV rating whether the Phase 2 decision for the remaining waste and contamination is removal or in-place closure.

4.1.1.4 No Action Alternative

Land Use

The No Action Alternative would involve continued management and oversight of WNYNSC. No decommissioning decisions would be made, nor decommissioning actions taken. As such, no additional land would be required for construction of new facilities. However, under this alternative, it is estimated that it would be possible to release 693 hectares (1,712 acres) of land not needed for continued management and oversight (see Figure 4–2). The exact amount and timing of land release from WNYNSC under this alternative would be the result of interactions among NYSERDA, NRC, DOE (until completion of WVDP), and other Federal and state agencies having jurisdiction.

Visual Resources

Implementation of the No Action Alternative would not involve any new construction that would further impact the visual landscape of WNYNSC. Accordingly, the appearance of disturbed and undisturbed portions of the site from nearby public vantage points, Route 240, or higher elevations would remain unchanged. Thus, the VRM Class IV and Class II ratings of the disturbed and undisturbed portions of the site would remain unchanged (see Chapter 3, Section 3.1.2).

4.1.2 Site Infrastructure

For all alternatives considered in this EIS, the levels of utility use would be well within existing site capacities. Traffic volumes on local roads affected by the activities addressed in any of the alternatives in this EIS are expected to be comparable to or smaller than traffic volumes associated with WNYNSC activities in recent years. A summary of the impacts of each EIS alternative on infrastructure is presented in **Table 4–2**.

Site infrastructure includes the utility systems required to support construction, operations, decommissioning, removal, or stabilization of facilities. It includes electric power and electrical load capacities, natural gas and liquid fuel (i.e., fuel oil, diesel fuel, and gasoline) capacities, and water supply system capacity. Site infrastructure also includes local road networks such as those shown in Chapter 3, Figure 3–3.

This section addresses utility use and traffic congestion that could be associated with implementing the EIS alternatives. Radiological risks from transport of radioactive waste from WNYNSC are addressed in Section 4.1.12. Physical (nonradiological) risks from possible traffic accidents involving waste shipments and construction material deliveries are also addressed in Section 4.1.12.

Table 4–3 provides comparisons of the impacts of each alternative on utility resource use. Electrical power and natural gas uses are presented for the peak years of utility use, and are compared against site capacities for these resources. Peak potable water use is also presented, but the comparison against site capacity is conservatively presented for total water use rather than potable water use. Total water use is the sum of the projected use of potable, nonpotable, and augmentation water. Table 4–3 also presents, for each alternative, the total electrical power, natural gas, and potable water use for the entire decommissioning effort, the annual averages for these resources during the periods when decommissioning takes place, and the annual averages for these resources for the post-decommissioning monitoring and maintenance periods.

Liquid fuel use is not summarized in Table 4–3 because it is not considered a limiting resource in that supplies can be replenished as needed from offsite sources. Similarly, sanitary sewage demands would not impact site treatment capacity because peak employment levels for all alternatives are expected to be comparable to or smaller than employment levels in recent years.

Utility use varies by alternative, depending on the intensity of the decommissioning activities proposed for each alternative. None of the alternatives would use utility resources in annual quantities exceeding about 21 percent of available site capacities. Care is needed, however, in comparing utility resource use across the alternatives.

Utility resource use for the Phased Decisionmaking Alternative reflects Phase 1 activities, and additional utility resource use would be associated with Phase 2 activities as they are defined in the future (see Table 4–61). As an upper bound, however, the total utility resource use under the entire Phased Decisionmaking Alternative (Phase 1 plus Phase 2) could range up to that under the Sitewide Removal Alternative. Following decommissioning under Phase 2, the annual use of utilities would depend on the need to maintain any contamination left in place, on the need for operation of a facility such as the Container Management Facility for orphan waste storage, and on the possible Phase 2 decision to continue active management of the SDA. Also note that utility resource use would essentially end after completion of decommissioning activities for the Sitewide Removal Alternative, except for utilities used during operation of the Container Management Facility, but would continue indefinitely into the future under the Sitewide Close-In-Place Alternative after completion of decommissioning activities. Utility use would also continue indefinitely into the future under the No Action Alternative.

Table 4–2 Summary of Infrastructure Impacts

Infrastructure	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative***	***No Action Alternative***
Utility requirements: electrical power, natural gas, and water	The largest total [a] utility use for decommissioning among all alternatives. Peak annual utility use would represent 10 to 17 percent of the capacities of existing systems. There would be no utility use following decommissioning except for possible continued operation of the Container Management Facility.	Less total [a] utility use for decommissioning compared to the Sitewide Removal Alternative. Peak annual utility use would represent 13 to 21 percent of the capacities of existing systems. Following decommissioning, utilities would be required as part of a long-term stewardship program for the site.	Phase 1 of this alternative would require less total [a] utility use for decommissioning than the Sitewide Close-In-Place Alternative. Peak annual utility use would represent 8.4 to 14 percent of the capacities of existing systems. Including Phase 2, the total utility use for decommissioning under this alternative could range up to that for the Sitewide Removal Alternative. However, if the Phase 2 decision for the SDA is continued active management, the total utility use for decommissioning would be reduced; following Phase 2 decommissioning, annual utility use would be bounded by that for the No Action Alternative.	No decommissioning takes place for this alternative. Utilities would be required for site monitoring and maintenance. Peak annual utility use would represent 2.8 to 4.6 percent of the capacities of existing systems.
Traffic volume	Third largest number of peak daily vehicle trips to and from the site. Elevated traffic volumes would occur over the 60-year period of decommissioning, and would represent about 4.2 times the average daily traffic volume of the No Action Alternative.	Largest number of peak daily vehicle trips to and from the site, including about 8.9 times the peak daily number of trucks as the Sitewide Removal Alternative. Elevated traffic volumes would occur over 7 rather than 60 years. Represents about 6.9 times the average daily traffic volume of the No Action Alternative. Because traffic volumes are likely to be comparable to those in recent years, road capacity would likely not be exceeded.	Phase 1 of this alternative would have a larger number of peak daily vehicle trips to and from the site than the Sitewide Removal Alternative, but about the same number of peak daily truck trips. Elevated traffic volumes could occur over 8 rather than 60 years. Represents about 4.7 times the average daily traffic volume of the No Action Alternative. For Phase 2, the peak daily traffic volume could range up to that for the Sitewide Close-In-Place Alternative. Peak daily traffic volumes during Phase 2 would be reduced if the Phase 2 decision for the SDA is continued active management. Elevated traffic volumes could occur for several years, depending on the Phase 2 decision.	Less than one-quarter the number of total peak daily vehicle trips of other alternatives. Traffic volume would be composed almost totally of personnel vehicles.

SDA = State-Licensed Disposal Area.

[a] For the Sitewide Removal Alternative, total decommissioning utility use is for all activities over 60 years; for the Sitewide Close-In-Place Alternative, total decommissioning utility use is over 7 years, plus operation and decommissioning of the Interim Storage Facility; for Phase 1 of the Phased Decisionmaking Alternative, total decommissioning utility use is over 8 years, plus operation and decommissioning of the Interim Storage Facility.

Table 4–3 Utility Use and Peak Traffic Volumes for Each Alternative

Indicator	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)*	*No Action Alternative*
Electricity (megawatt-hours)				
Peak annual electricity use (percent of site capacity) [a]	18,000 (17)	22,000 (21)	14,000 (14)	4,800 (4.6) [b]
Total electricity use during decommissioning [c]	720,000	110,000	98,000	NA [d]
Average annual electricity use during decommissioning	12,000	16,000	12,000	NA [d]
Annual electricity use after decommissioning [e]	930	1,100	2,100	3,600 [d]
Natural Gas (cubic meters)				
Peak annual natural gas use (percent of site capacity) [a]	2,800,000 (10)	3,500,000 (13)	2,300,000 (8.4)	780,000 (2.8) [b]
Total natural gas use during decommissioning [c]	120,000,000	18,000,000	16,000,000	NA [d]
Average annual natural gas use during decommissioning	2,000,000	2,600,000	2,000,000	NA [d]
Annual natural gas use after decommissioning [e]	150,000	180,000	340,000	570,000 [d]
Water (liters)				
Peak annual potable water use (percent of site capacity is for total water use) [a, f]	15,000,000 (11)	19,000,000 (14)	13,000,000 (8.8)	4,300,000 (3.0) [b]
Total potable water use during decommissioning [c]	620,000,000	98,000,000	85,000,000	NA [d]
Average annual potable water use during decommissioning	10,000,000	14,000,000	11,000,000	NA [d]
Annual potable water use after decommissioning [e]	810,000	960,000	1,800,000	3,100,000 [d]
Traffic Volume (peak number of vehicles per day) [g]				
Trucks	38	340	39	Negligible [h]
Waste shipments	15	3	15	Negligible [h]
Material deliveries	23	340	24	Negligible [h]
Personnel vehicles [i]	600	700	660	150
Total [j]	630 (6.5 - 7.9)	1,040 (12 - 15)	700 (7.3 - 9.0)	150 [h]

NA = not applicable.

[a] The value is the peak annual utility resource demand for all activities, with the percent of site capacity in parentheses.

[b] Peak activities for the No Action Alternative occur at intervals of about 20 to 25 years.

[c] For the Sitewide Removal Alternative, total utility use is for all activities over 60 years; for the Sitewide Close-In-Place Alternative, total utility use is over 7 years, plus operation and decommissioning of the Interim Storage Facility; for Phase 1 of the Phased Decisionmaking Alternative, total utility use is over 8 years, plus operation and decommissioning of the Interim Storage Facility.

[d] Decommissioning does not occur under the No Action Alternative. Annual average utility resource use may be determined by averaging use over 60 years of projected annual site monitoring and maintenance, including periodic activities such as roof replacement, as analyzed in the No Action Alternative technical report (WSMS 2009d).

[e] For the Sitewide Removal Alternative, the value reflects the continued operation of the Container Management Facility for orphan waste storage. For the Sitewide Close-In-Place Alternative, the average was determined over 53 years of projected site monitoring and maintenance, not including operation and decommissioning of the Interim Storage Facility. For the Phased Decisionmaking Alternative (Phase 1), the average was determined over 22 years of projected site monitoring and maintenance, not including operation and decommissioning of the Interim Storage Facility. The averages include periodic activities such as replacement of permeable treatment wall media.

[f] Total water is the sum of potable water, nonpotable water, and augmentation water.

[g] Peak daily traffic volumes were estimated by averaging construction delivery and waste shipment traffic over the years when waste shipments and construction material deliveries would principally occur (see footnote i), and estimating personnel vehicles for peak employment years. The volumes reflect daily traffic to and from the site.

[h] Under the No Action Alternative, there would be an average of about 33 waste shipments per year, or an average of 1 waste shipment roughly every 7 to 8 working days, and few deliveries of construction materials.

[i] Waste shipments and construction material deliveries would principally occur over periods of 60, 7, and 8 years, respectively, under the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives. Peak two-way daily personnel traffic levels during these years are listed in the table. Average two-way daily personnel vehicle traffic levels during these years are, respectively, about 500, 640, and 470 trips.

[j] The values in parentheses represent the percent increase in total peak daily traffic on U.S. Route 219 compared to the average daily No Action Alternative traffic level, assuming all traffic to and from WNYNSC uses U.S. Route 219.

Notes: Utility and traffic projections given to 2 significant figures. Totals may not add because of rounding. To convert from cubic meters to cubic feet, multiply by 35.314; liters to gallons, multiply by 0.26418.

Sources: WSMS 2009a, 2009b, 2009c, 2009d.

Under all alternatives, as remaining utility connections and system components are shut down as decommissioning activities progress, utility resources could be provided by different means. Electrical power could be supplied by temporary service connections and by portable diesel-fired generators. Potable water could be trucked to the point of use. Portable sanitary facilities could be used by decommissioning personnel, which would constitute a relatively small percentage of the total water demand.

Table 4–3 also presents peak daily traffic volumes to and from WNYNSC in terms of WNYNSC personnel vehicles and trucks (waste shipments from WNYNSC to offsite facilities and deliveries of construction and other materials to WNYNSC). To provide a peak estimate of traffic volumes, all shipments and deliveries for this section were conservatively assumed to be by truck. Traffic volumes were estimated considering traffic both to and from WNYNSC (each vehicle entering WNYNSC was assumed to leave the same day). Personnel vehicle traffic volumes are listed for peak years of projected direct employment assuming one vehicle (car) per worker.[3] The percent increases in peak truck and total vehicle daily traffic volumes over those projected for the No Action Alternative are presented assuming all traffic to and from WNYNSC is routed through U.S. Route 219.

The Sitewide Close-In-Place Alternative would have the largest impact on roads providing access to WNYNSC. As shown in Table 4–3, the peak daily traffic volume under the Sitewide Close-In-Place Alternative would be about 1,040 vehicles, as opposed to about 630 vehicles under the Sitewide Removal Alternative and 700 vehicles under Phase 1 of the Phased Decisionmaking Alternative. Almost all of the truck traffic for the Sitewide Close-In-Place Alternative would be due to deliveries of construction and other material. The truck traffic would be spread over 7 years for the Sitewide Close-In-Place Alternative, but would occur over 60 years for the Sitewide Removal Alternative. Peak personnel vehicle traffic volumes would be somewhat larger under the Sitewide Close-In-Place Alternative than under the Sitewide Removal Alternative; however, peak personnel vehicle traffic would occur for only a few years under the Sitewide Close-In-Place Alternative, but the Sitewide Removal Alternative would continue at levels somewhat smaller than the peak for a longer period of time. The Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives would each result in more than four times the average daily traffic as the No Action Alternative.

The peak daily traffic under Phase 2 of the Phased Decisionmaking Alternative would depend on the scope of Phase 2 activities. If the Phase 2 decision is removal of remaining waste and contamination, the peak daily traffic volume would be comparable to that of the Sitewide Removal Alternative. If the Phase 2 decision is in-place closure, the peak daily traffic volume would be comparable to that of the Sitewide Close-In-Place Alternative. Regarding the second option, much of the daily traffic would consist of trucks making deliveries of construction and other materials. Reduced daily traffic would be expected if the Phase 2 decision for the SDA is continued active management. This is because no activities would be undertaken to either remove the SDA or close it in place, thereby eliminating the transport of waste and construction materials associated with these activities.

Chapter 3, Section 3.2.5, of this EIS discusses and illustrates (see Figure 3–3) the existing road networks near WNYNSC, including U.S. Route 219, which is a major arterial highway in the area and currently operates at Level of Service D near WNYNSC. Conservatively assuming all traffic to and from WNYNSC uses

---

[3] Although some workers may share rides with other workers, leading to fewer vehicles entering WNYNSC than the number of workers, some workers may also temporarily leave the site, to return the same day.

U.S. Route 219,[4] the peak daily traffic level associated with the Sitewide Removal Alternative would be about 6.5 to 7.9 percent larger on U.S. Route 219 than the average traffic volume associated with the No Action Alternative. A slightly larger increase is projected for Phase 1 of the Phased Decisionmaking Alternative. A still-larger increase (12 to 15 percent) is projected for the Sitewide Close-In-Place Alternative. The projected increase under the Sitewide Removal Alternative, however, would last about 60 years, while the projected increase under the Sitewide Close-In-Place Alternative would last about 7 years, and the projected increase under Phase 1 of the Phased Decisionmaking Alternative would last about 8 years.

Phase 2 of the Decisionmaking Alternative could result in increased traffic on U.S. Route 219 that could range up to that of the Sitewide Close-In-Place Alternative, assuming that the scope of activities for Phase 2 emphasizes in-place closure of facilities such as the SDA or NDA. This increased traffic, however, would be over a relatively short period of time, compared to that required for removing these facilities. In the latter case, the increase in daily traffic on U.S. Route 219 would be smaller (i.e., more comparable to that for the Sitewide Removal Alternative), but would last for a longer period of time.

Under any of the alternatives, however, traffic volumes should be comparable to or smaller than those associated with WNYNSC activities in recent years. Employment at WNYNSC was 1,054 workers in 1993 (DOE 1996a), about 500 in 2003 (DOE 2003e), and 384 as of August 2006 (see Chapter 3, Section 3.10.1). Conservatively discounting daily truck shipments and using the same assumptions for employee vehicles as those for the alternatives in this EIS, the daily traffic levels would have been about 2,100 in 1993, 1,000 in 2003, and 770 in 2006. The projected peak daily traffic level under the Sitewide Close-In-Place Alternative (1,040 vehicles), which is the projected largest of any of the alternatives, would be about half the assumed 1993 traffic level, about equal to the 2003 traffic level, and about 35 percent larger than the 2006 level.

Although implementing any alternative would likely not cause traffic levels to exceed those experienced in the past, if large enough to be of concern, traffic levels on roads such as U.S. Route 219 could be mitigated as addressed in Chapter 6, Section 6.10, of this EIS. Truck deliveries to the site or truck shipments off site could be timed to avoid peak traffic volume hours when work shifts change. Roads could be improved to increase the capacity of traffic entering or exiting the site, or realigned to reduce points of congestion; turning lanes could be created for entering and exiting WNYNSC; or traffic signals could be installed at important intersections. Employee programs and incentives for ridesharing could be implemented, as could employee programs that provide flexible hours or staggered work shifts. Shipment or delivery of some wastes or materials by rail would also mitigate traffic congestion.

If constructed, the planned extension of the U.S. Route 219 freeway from its current terminus at Route 39 in Springville, New York (a few miles north of WNYNSC), to Interstate 86 near Salamanca, New York, should also mitigate any local traffic pressures. The freeway extension will parallel existing U.S. Route 219, which will be retained (USDOT and NYSDOT 2003b). Completion of a 6.8-kilometer (4.2-mile) extension of the freeway to Peters Road in Ashford, New York (west-northwest of WNYNSC), is expected in winter 2009/2010 (NYSDOT 2008a). Completion of the entire 45-kilometer (28-mile) extent of the freeway is expected in winter 2014/2015 (NYSDOT 2008b).

It is not expected that traffic volumes in the two-county Region of Influence (ROI) would be substantially affected by implementing any of the alternatives. Projected direct and indirect employment levels (see Section 4.1.8) can be used as an indicator for likely regional traffic volumes. The average direct and indirect employment levels for the decommissioning periods under the Sitewide Removal, Sitewide Close-In-

[4] *A 2006 Environmental Assessment for the West Valley Demonstration Project estimated a daily total traffic volume of 6,100 to 7,500 vehicles along U.S. Route 219 between its intersection with New York Route 39 in Springville and the intersection with Cattaraugus County Route 12 (East Otto Road), of which approximately 18 percent (1,100 to 1,350 vehicles) was truck traffic (DOE 2006c).*

Place, and Phased Decisionmaking (Phase 1) Alternatives would be roughly 3 to 4 times as large as the average for the No Action Alternative (about 155 direct and indirect), and these increased employment levels would last longer under the Sitewide Removal Alternative than under the Sitewide Close-In-Place and Phased Decisionmaking Alternatives. Nonetheless, the levels for any alternative would represent only a tiny fraction of the population in the ROI, which comprised about 990,000 persons in 2008.[5] The average levels for the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternative decommissioning periods would respectively represent about 0.05 percent, 0.07 percent, and 0.05 percent of the 2008 population. Finally, the largest average direct and indirect employment level for any of the alternatives (660 for the Sitewide Close-In-Place Alternative) would be still smaller than WNYNSC employment levels as recently as 2006 (about 800 direct and indirect). Therefore, the impact on regional traffic volumes under any of the alternatives is expected to be small.[6] This conclusion is expected to be the same considering the peak employment levels that could be required under Phase 2 of the Phased Decommissioning Alternative.

4.1.2.1 Sitewide Removal Alternative

Implementing this alternative would enable the release of all WMAs for unrestricted use. Several new facilities would be constructed, operated, and ultimately closed in support of removal actions, requiring use of utility resources.

During decommissioning, removal of WMA 8 (the SDA) would have the largest demand of any activity for electricity, natural gas, and potable water. This is partly a reflection of the relatively long period of time over which WMA 8 removal would take place and the intensity of the removal activities required, including heavy equipment use and the construction, operations, and eventual demolition of environmental enclosures. Annual utility resource requirements for WMA 8 removal would range from about 2,700 to 8,200 megawatt-hours of electrical power, 430,000 to 1.3 million cubic meters (15 million to 46 million cubic feet) of natural gas, and 2.3 million to 7.1 million liters (610,000 to 1.9 million gallons) of potable water.

For purposes of this analysis, the Interim Storage Facility is projected to operate until it is demolished during years 36 through 38 of the alternative timeline. For each of these 3 years, demolition activities would require about 661 megawatt-hours of electrical power, 110,000 cubic meters (3.7 million cubic feet) of natural gas, and 570,000 liters (150,000 gallons) of potable water.

Considering all activities, electrical power, natural gas, and potable water use would each peak in year 20. Peak annual electricity, natural gas, and total water use would be about 17 percent, 10 percent, and 11 percent, respectively, of the capacities of WNYNSC utility systems.

Following completion of decommissioning activities, there could be some annual utility resource use associated with onsite storage of orphan waste. To estimate utility resource use in this event, it was assumed that the Container Management Facility would continue to operate following completion of removal activities. Annual electrical power, natural gas, and potable water requirements for Container Management Facility operations would be, respectively, about 930 megawatt-hours; 150,000 cubic meters (5.2 million cubic feet); and 810,000 liters (210,000 gallons) (WSMS 2009a).

---

[5] From Chapter 3, Section 3.10.2, the population in the ROI (Cattaraugus and Erie Counties) declined from 1,034,220 in 2000 to 989,533 in 2008. The largest projected average direct and indirect employment level for any of the alternatives (660 persons) would represent only about 1.5 percent of this population decline.

[6] Also see the conclusion of Section 4.1.8, Socioeconomics, of this chapter. None of the alternatives would have any appreciable impact on the demographic characteristics of the ROI. It is expected that the in-migration of workers, if any, to support closure or long-term management operations at WNYNSC under any of the alternatives would be small. This lack of worker in-migration supports the conclusion that regional traffic volumes would not be significantly affected by implementing any of the alternatives addressed in this EIS.

Shipments of waste and deliveries of construction materials under this alternative would generally occur throughout the life of the 60-year decommissioning period. The average two-way truck traffic over 60 years would be about 38 daily trips, representing 2.8 to 3.5 percent of the truck traffic reported on U.S. Route 219 in the 2006 *Environmental Assessment for the Decontamination, Demolition, and Removal of Certain Facilities at the West Valley Demonstration Project* (DOE 2006c). The two-way personnel vehicle traffic would peak at about 600 daily trips in year 26, experience a low of 74 daily trips in year 60, and average about 500 daily trips over the 60-year decommissioning period.

The combined two-way truck and personnel vehicle traffic would peak at about 630 daily trips. Assuming all truck and personnel traffic to and from WNYNSC would be routed through U.S. Route 219, daily truck and personnel traffic on U.S. Route 219 would increase by 6.5 to 7.9 percent compared to the daily traffic associated with the No Action Alternative. Trucks alone would increase by about 2.8 to 3.4 percent, while personnel vehicles alone would increase by about 7.3 to 8.9 percent.

4.1.2.2 Sitewide Close-In-Place Alternative

Decommissioning under this alternative would have reduced total utility resource requirements compared to the Sitewide Removal Alternative. Decommissioning would be largely completed in about 7 years, although for purposes of analysis the Interim Storage Facility was assumed to operate until year 32, and would be decommissioned in year 33. Long-term stewardship would ensue after decommissioning is complete and would last indefinitely into the future. For 4 of the 7 years that decommissioning would take place, the largest utility resource use would be associated with WMA 8 closure. Annual electrical power, natural gas, and potable water requirements for WMA 8 closure would be about 5,100 megawatt-hours; 810,000 cubic meters (29 million cubic feet); and 4.4 million liters (1.2 million gallons), respectively. Annual operation of the Interim Storage Facility would require about 140 megawatt-hours of electricity; 22,000 cubic meters (790,000 cubic feet) of natural gas; and 120,000 liters (32,000 gallons) of potable water. Decommissioning the Interim Storage Facility would require about 1,700 megawatt-hours of electricity; 270,000 cubic meters (9.4 million cubic feet) of natural gas; and 1.4 million liters (380,000 gallons) of potable water.

For all three utility resources, peak annual demands are projected to occur in year 6. Peak annual electricity, natural gas, and total water use would be about 21 percent, 13 percent, and 14 percent, respectively, of the capacities of WNYNSC utility systems. There would be no impact on site sanitary sewage treatment capacity because, although peak direct employment levels are the largest of any alternative in this EIS, they are smaller than site employment levels in the recent past.

Following the 7-year decommissioning period, annual utility requirements would be for site security, site environmental monitoring, and maintenance of erosion controls and the caps for WMA 7 (the NDA), WMA 8, and the North Plateau Groundwater Plume. In addition, utilities would be required about every 20 years to replace media for the North Plateau Groundwater Plume permeable treatment wall, and about every 35 years to replace security system equipment. Considering all these activities (but not operation and closure of the Interim Storage Facility), average annual utility use would include about 1,100 megawatt-hours of electricity; 180,000 cubic meters (6.3 million cubic feet) of natural gas; and 960,000 liters (250,000 gallons) of potable water. Each replacement of media for the permeable treatment wall would alone require about 220 megawatt-hours of electricity; 36,000 cubic meters (1.3 million cubic feet) of natural gas; and 190,000 liters (51,000 gallons) of potable water. Each replacement of security system equipment would alone require about 300 megawatt-hours of electricity; 48,000 cubic meters (1.7 million cubic feet) of natural gas; and 260,000 liters (69,000 gallons) of potable water.

Almost all of the waste shipments and construction material deliveries for this alternative would occur over the first 7 years of the implementation period when most decommissioning would take place, and would reflect the need for large quantities of soil, sand, gravel, and other materials (see Table 4-61). The average two-way truck traffic would be about 340 daily trips, almost all of which would be due to deliveries of construction materials, and would represent 25 to 31 percent of the truck traffic reported on U.S. Route 219 in the 2006 environmental assessment (EA) (DOE 2006c). The two-way personnel vehicle traffic would peak at about 700 daily trips in year 2, experience a low of 36 daily trips in year 34, and average 640 daily trips over the 7-year decommissioning period.

The combined two-way truck and personnel vehicle traffic would peak at about 1,040 daily trips. Assuming all traffic to and from WNYNSC would be routed through U.S. Route 219, the total daily truck and personnel vehicle traffic flow on U.S. Route 219 would increase by 12 to 15 percent compared to the daily traffic associated with the No Action Alternative. (Trucks alone would increase by about 25 to 31 percent, while personnel vehicles alone would increase by about 8.9 to 11 percent.) Peak daily truck traffic would be about 8.9 times greater than that estimated for the Sitewide Removal Alternative. Traffic volumes for all vehicles would be about 65 percent larger than those under the Sitewide Removal Alternative but would last for a far shorter time period. Impacts could be mitigated, if needed, by administrative controls such as those discussed above.

4.1.2.3 Phased Decisionmaking Alternative

Decommissioning under Phase 1 of this alternative is projected to occur over 8 years. Thereafter, for purposes of this analysis, the Interim Storage Facility was assumed to operate until year 29 and be decommissioned in year 30.

During the first 4 years, decommissioning of WMA 1 (the Main Plant Process Building and Vitrification Facility Area) would have the largest requirements for electrical power, natural gas, and potable water. Over 8 years, annual electrical power use for this activity would range from about 1,900 to 10,000 megawatt-hours; annual natural gas use would range from about 310,000 to 1.6 million cubic meters (11 million to 57 million cubic feet); and annual potable water use would range from about 1.7 million to 8.8 million liters (440,000 to 2.3 million gallons). Annual operation of the Interim Storage Facility would require about 140 megawatt-hours of electricity; 22,000 cubic meters (790,000 cubic feet) of natural gas; and 120,000 liters (32,000 gallons) of potable water. Decommissioning the Interim Storage Facility would require about 2,000 megawatt-hours of electricity; 320,000 cubic meters (11 million cubic feet) of natural gas; and 1.7 million liters (450,000 gallons) of potable water.

Peak utility resource use during closure, considering all activities, would be concentrated in year 1. Peak annual electricity, natural gas, and total water use would be about 14 percent, 8.4 percent, and 8.8 percent, respectively, of the capacities of WNYNSC utility systems.

Following the 8-year decommissioning period, utilities would be used for site security, site environmental monitoring, and site maintenance including maintenance of WMA 3 (Waste Tank Farm Area), WMA 7, and WMA 8. Utilities may also be required for one-time replacements of media for the North Plateau Groundwater Plume permeable treatment wall and the geomembrane covering WMA 8. Considering all these activities (but not operation and closure of the Interim Storage Facility), average annual utility use would include about 2,100 megawatt-hours of electricity; 340,000 cubic meters (12 million cubic feet) of natural gas; and 1.8 million liters (490,000 gallons) of potable water. Each replacement of the WMA 8 geomembrane would alone require about 1,200 megawatt-hours of electricity; 190,000 cubic meters (6.7 million cubic feet) of natural gas; and 1.0 million liters (270,000 gallons) of potable water. Each replacement of media for the permeable treatment wall would alone require about 220 megawatt-hours of electricity; 36,000 cubic meters (1.3 million cubic feet) of natural gas; and 190,000 liters (51,000 gallons) of potable water.

Utility use under Phase 2 of this alternative would depend on future decisions. As a first approximation, the total utility use for decommissioning under the Phased Decisionmaking Alternative (Phase 1 plus Phase 2) could range up to that under the Sitewide Removal Alternative. Following decommissioning under Phase 2, use of utilities would depend on the need to maintain any contamination left in place, on the need for operation of a facility such as the Container Management Facility for storage of orphan waste, and on the possible Phase 2 decision to continue active management of the SDA. A Phase 2 decision to continue active management of the SDA would reduce the total decommissioning utility use for this alternative. Following decommissioning, annual utility use at the site would be bounded by that for the No Action Alternative.

Most waste shipments and construction material deliveries for Phase 1 of this alternative would occur over an 8-year period when decommissioning takes place. Assuming all waste shipments and construction material deliveries occur during these 8 years, the two-way truck traffic would be about 39 daily trips, representing 2.9 to 3.5 percent of the truck traffic reported on U.S. Route 219 in the 2006 environmental assessment (DOE 2006c). The two-way personnel vehicle traffic would peak at about 660 daily trips in year 3, experience a low of 98 daily trips in year 9, and average about 470 daily trips over the 8-year decommissioning period.

The combined two-way truck and personnel vehicle traffic volume would peak at about 700 daily trips. Assuming all traffic to and from WNYNSC would be routed through U.S. Route 219, the total daily truck and personnel vehicle traffic flow on U.S. Route 219 would increase by 7.3 to 9.0 percent compared to the daily traffic associated with the No Action Alternative. (Trucks alone would increase by about 2.8 to 3.5 percent, while personnel vehicles alone would increase by about 8.3 to 10 percent.) The peak daily impacts for Phase 1 would be slightly larger than those for the Sitewide Removal Alternative. Additional impacts could occur from implementation of Phase 2, and would depend on the extent of the Phase 2 activities and the timing for their implementation. Conservatively discounting waste and material removed from the site during Phase 1, peak daily traffic volumes for Phase 2 could range up to that for the Sitewide Close-In-Place Alternative. Peak daily traffic volumes would be reduced if the Phase 2 decision for the SDA is continued active management, due to the elimination of the need to transport waste and construction materials associated with removal or close-in-place activities at the SDA.

4.1.2.4 No Action Alternative

Annual activities would include sitewide monitoring and maintenance. Assumed periodic replacement of building roofs and permeable treatment wall media and refurbishment of the geomembrane covers for the SDA and NDA would result in increased utility resource use about every 20 to 25 years. Considering all activities, annual average utility demands would include about 3,600 megawatt-hours of electricity; 570,000 cubic meters (20 million cubic feet) of natural gas; and 3.1 million liters (830,000 gallons) of potable water. Each Main Plant Process Building roof replacement would alone require about 1,300 megawatt-hours of electricity; 200,000 cubic meters (7.2 million cubic feet) of natural gas; and 1.1 million liters (290,000 gallons) of potable water. Each SDA geomembrane refurbishment would alone require about 1,400 megawatts-hours of electricity; 230,000 cubic meters (8.1 million cubic feet) of natural gas; and 1.2 million liters (330,000 gallons) of potable water. Each NDA geomembrane refurbishment would alone require about 530 megawatt-hours of electricity; 85,000 cubic meters (3.0 million cubic feet) of natural gas; and 450,000 liters (120,000 gallons) of potable water. Considering all activities, peak annual electricity, natural gas, and total water use would be about 4.6 percent, 2.8 percent, and 3.0 percent, respectively, of the capacities of WNYNSC utility systems.

Under this alternative, there would be an annual average of about 33 offsite shipments of waste, or 1 shipment roughly every 7 to 8 working days. There would be a small increase in construction material shipments during the periods of roof replacement and SDA and NDA geomembrane refurbishment, but the construction effort would not be large. (Construction materials would be dominated by roofing materials, geomembranes, and similar materials.) Assuming all traffic to and from WNYNSC would be routed through U.S. Route 219, the average daily truck traffic would represent about 0.02 percent of the truck traffic reported on U.S. Route 219 in the 2006 environment assessment (DOE 2006c). The direct employment level would be about 75 persons, resulting in an average employee traffic level of about 150 daily trips.

4.1.3 Geology and Soils

Decommissioning activities at WNYNSC would impact geologic and soil resources. Geologic and soil resources within Cattaraugus County (see Chapter 3, Section 3.3.1.3) consist predominantly of commercial aggregate (sand and gravel) mining and oil and gas production. Oil and gas resources are developed within Cattaraugus County. In the Town of Ashford, for example, wells have been developed to depths of up to about 2,300 meters (7,500 feet) below land surface (NYSDEC 2009).

The geology and soil resources that could be impacted by decommissioning activities would represent a limited portion of WNYNSC (approximately 49.8 hectares [123 acres] of the 1,351 hectares [3,338 acres]) and a very small fraction of Cattaraugus County resources. Two measures were used to assess the impact of the alternatives on geologic and soil resources. The first measure was the consumption of geologic resources (e.g., soil, sand, gravel, and clay/bentonite), under a given alternative, to replace or restore removed or contaminated materials. The second measure considered the impact of changes in the distribution of the geologic resources within WNYNSC. Resource consumption or redistribution volumes under all levels of removal or restoration were considered to impact the overall availability of materials over the WNYNSC and Cattaraugus County region. Impacts on geologic resources by alternative are summarized in **Table 4–4**.

The preliminary engineering analysis conducted for each of the alternatives developed estimates of the volumes of geologic material that would be required to implement each alternative (WSMS 2009a, 2009b, 2009c, 2009d). **Table 4–5** presents a summary of the estimated volumes that would be required to fill areas of exhumation for the Sitewide Removal and Phased Decisionmaking (Phase 1) Alternatives and to construct the engineered caps for the Sitewide Close-In-Place Alternative.

An evaluation was also completed to determine the availability of rock, aggregate, soil, and products derived from rock and mineral resources to support construction, operations, and closure activities under each of the alternatives (NYSDEC 2008b). The land area to be disturbed and geologic resources consumed, the depth and extent of required excavation work, and the land areas occupied during operations were calculated. Specifically included in this analysis was the provision for borrow materials from onsite quarries and borrow pits. Based on the volume requirements for the different alternatives and limited onsite resources, supplemental borrow materials would be needed from offsite regional sources.

4.1.3.1 Sitewide Removal Alternative

Under the Sitewide Removal Alternative, contaminated soil would be removed and replaced from offsite sources. Approximately 1.2 million cubic meters (1.6 million cubic yards) of soil, sand, gravel, and clay/bentonite would be required, along with concrete, cement, and some grout. The greatest requirements are for soil, concrete, clay, sand, and gravel. Permitted sand and gravel resources in Cattaraugus County consist of approximately 710 hectares (1,750 acres), with an estimated 3,984 life-of-mine acreage (NYSDEC 2008b). Life-of-mine acreage is the total number of acres of mineral reserves that will be mined over the duration of mining at a location, including lands previously reclaimed, areas currently affected by mining, and areas to be affected in the future. Substantial sand and gravel resources are located east of WNYNSC along the Highway 16 corridor in Cattaraugus County (Martin 2000). Clay and till resources are not extensively mined in Cattaraugus County (NYSDEC 2008b); therefore, a borrow area for clay backfill would need to be located.

Table 4–4 Summary of Geology and Soil Resource Impacts

Impact	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Consumption of Geologic Resources	The Sitewide Removal Alternative would require use of a moderate amount of geologic resources (1,211,000 cubic meters of soil, sand, gravel, and clay/bentonite) to replace excavated areas of waste and contamination and to restore local hydrogeologic properties and topography.	The Sitewide Close-In-Place Alternative would require use of a greater amount of geologic resources (2,192,000 cubic meters of soil, sand, gravel, and clay/bentonite) to construct the onsite engineered caps.	Phase 1 would require use of a smaller amount of geologic resources (167,000 cubic meters of soil, sand, gravel, and clay/bentonite) to replace excavated areas of waste and contamination and to restore local hydrogeologic properties and topography. Depending on the Phase 2 decision, impacts of this alternative would be bounded by those for the Sitewide Removal and Sitewide Close-In-Place Alternatives because of the possible combination of removals, treatments, and engineered cap construction. Impacts would be reduced if the Phase 2 decision for the SDA is continued active management.	Contaminated soil aggregate resources would remain contaminated. There would be no impact on aggregate resource needs because no backfill materials would be required.
Redistribution of Geologic Resources	There is short-term potential for material movement due to erosion as areas are being excavated and filled before the re-establishment of ground cover. Natural erosion would also occur after area restoration is complete.	There is short-term potential for material movement due to exposed geologic material while the engineered caps are being constructed. Some natural erosion would also occur after the area is contoured and vegetated, but it should be less than the Sitewide Removal Alternative because there would be active erosion control measures.	There is short-term potential for material movement due to erosion as the Phase 1 areas are excavated and backfilled before the re-establishment of ground cover. Depending on the Phase 2 decision, the nature of longer-term geological resource redistribution by erosion would be bounded by those for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives. Fully restored areas would erode naturally following establishment of ground cover. Areas associated with cap construction could experience slightly accelerated erosion surrounding the caps because of the topographic contouring of the caps (to minimize ponding), relatively impermeable membrane layers in the cap constructions, and the presence of erodible soils outside the caps. If the Phase 2 decision for the SDA is continued active management, best management practices would be required indefinitely to minimize erosion for the SDA.	Over the short-term, there would be a slower erosion rate than for the other alternatives because of the lack of land disturbance activities under the No Action Alternative. Best management practices would be required indefinitely.

Note: To convert from cubic meters to cubic feet, multiply by 35.314.

Table 4–5 Major Geologic and Soil Resource Requirements

Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)*	*No Action Alternative*
Soil (cubic meters)	1,107,000	917,000	95,300	Negligible
Sand and gravel (cubic meters)	31,700	1,099,000	1,150	Negligible
Clay/bentonite (cubic meters)	72,200	176,000	70,100	Negligible
Total	1,211,000	2,192,000	167,000	Negligible

Note: Totals may not add precisely due to rounding. To convert from cubic meters to cubic feet, multiply by 35.314.
Sources: WSMS 2009a, 2009b, 2009c, 2009d.

The construction activities to support removal actions, as well as the removal actions themselves, would create a potential for temporarily accelerated runoff and soil erosion in the disturbed portions of the site. The use of best management practices for runoff and erosion control during construction and WMA closure would be effective in minimizing short-term effects of landscape alteration. Surface runoff and drainage from disturbed areas would be controlled, collected, and conveyed to sediment basins. Areas susceptible to erosion from surface flows would be protected through the use of sediment ponds, rip-rap, silt fences, or other techniques. Mitigation measures are described in Chapter 6 of this EIS. Over the longer term, vegetative cover would be re-established over the areas of removal, and erosion would proceed at a near-natural rate in the previously disturbed areas.

4.1.3.2 Sitewide Close-In-Place Alternative

Under the Sitewide Close-In-Place Alternative, surface topography on the North and South Plateaus would be impacted by the construction of layered engineered caps. Approximately 2.2 million cubic meters (2.9 million cubic yards) of soil, sand, gravel, and soil/bentonite would be required, along with less concrete and cement than for the Sitewide Removal Alternative, but substantially greater amounts of grout. Most of the material would be used for construction of engineered caps. The major requirements for geologic material (soil, sand and gravel, and rock) could be met from local sources. The requirements for grout to stabilize wastes and residual radioactive waste in piping and other equipment; stabilize disposal holes and trenches at the NDA and the SDA, respectively; and stabilize equipment and structures within the Waste Treatment Facility and Main Plant Process Building could be met through commercial sources. Concrete demands would be less under this alternative, commensurate with reduced need for new surface facilities construction (WSMS 2009b).

Subsidence associated with cap construction over the burial areas would be minimized through grout injection to fill voids around the buried waste in the NDA and SDA.

Construction of the engineered caps would create the potential for temporarily accelerated runoff and soil erosion in the disturbed portions of the site. The use of best management practices for runoff and erosion control during construction of the cap would minimize short-term erosion. Surface runoff and drainage from disturbed areas would be controlled, collected, and conveyed to sediment basins. Areas susceptible to erosion from surface flows would be protected through the use of sediment ponds, rip-rap, silt fences, or other techniques. Mitigation measures are described in Chapter 6 of this EIS. Over the longer term, erosion would proceed at a rate lower than the natural rate as a result of engineered measures that would be taken to reduce the rate of erosion and, where possible, repair damage caused by erosion.

4.1.3.3 Phased Decisionmaking Alternative

Geologic and soil resource use under Phase 1 of the Phased Decisionmaking Alternative would be substantially less than that for the Sitewide Removal and Sitewide Close-In-Place Alternatives (see Table 4–5). Construction activities supporting removal actions, as well as the removal actions themselves, would create a potential for temporarily accelerated runoff and soil erosion in the disturbed portions of WNYNSC. Disturbed areas, however, would be smaller than those for the other two alternatives because the removal actions of Phase 1 would be localized. Impacts would be mitigated using similar mitigation measures as those discussed in Sections 4.1.3.1 and 4.1.3.2. Impacts and mitigation measures for the remaining facility areas, including the South Plateau, would be similar to those described in Section 4.1.3.4 for the No Action Alternative.

The Phase 2 decision may result in removal of remaining contamination and structures, in-place closure, or, in the case of the SDA, continued active management. Depending on the Phase 2 decision, geologic resource use under this alternative would be bounded by those for the Sitewide Removal and Sitewide Close-In-Place Alternatives because of the possible combination of removals, treatments, and engineered cap construction.

There would be reduced geologic resource use if the Phase 2 decision for the SDA is continued active management.

Depending on the Phase 2 decision, the nature of longer-term geological resource redistribution by erosion would be bounded by those for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives. Fully restored areas would erode naturally following establishment of ground cover. Areas associated with cap construction could experience slightly accelerated erosion surrounding the caps because of the topographic contouring of the caps (to minimize ponding), relatively impermeable membrane layers in the cap constructions, and the presence of erodible soils outside the caps. If the decision for the SDA is continued active management, best management practices would be required indefinitely to minimize erosion for the SDA.

4.1.3.4 No Action Alternative

Under the No Action Alternative, contaminated geologic resources, including sand and gravel and clay till on the North Plateau and clay till on the South Plateau beneath WNYNSC WMAs, would remain in place and contaminated. Under this alternative, mineral resource requirements (e.g., soil, sand, gravel, and clay/bentonite) would be negligible.

In the short term, there would be less potential for erosion than for the other alternatives because of the lack of land disturbing activities. Use of best management practices for runoff and erosion control would minimize erosion. These actions would continue indefinitely.

4.1.4 Water Resources

Water resource impacts would occur as a result of some of the decommissioning actions at WNYNSC. Construction and excavation activities could lead to increased stormwater runoff, erosion and/or sedimentation, and short-term changes in surface water flow paths. Direct impacts on surface water could result from temporary or permanent grading, rerouting, or filling of surface water resources. Indirect impacts could result from potentially increased or impeded surface flows or be caused by flooding. Groundwater quality could be affected if there are localized changes to groundwater flow or changes in infiltration rates with consequent changes to recharge rates of surface water to the groundwater system. Unplanned spills or releases during the construction and operations phases of planned activities could impact surface water and groundwater quality.

A summary of impacts of each alternative on water resources is presented in **Table 4–6**.

Table 4–6 Summary of Impacts on Water Resources

Potential Short-term Impacts Affecting Water Quality	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative***	***No Action Alternative***
Floodplain	The Interim Storage Facility may extend into the probable maximum flood floodplain. Only temporary removal actions would occur in the 100-year floodplain.	The Interim Storage Facility may extend into the probable maximum flood floodplain. Engineered barriers on the South Plateau and erosion control features would intrude into the 100-year and PMF floodplain.	For Phase 1, the Interim Storage Facility may extend into the probable maximum flood floodplain. Only temporary removal actions would occur in the 100-year and PMF floodplain. Overall impacts (Phase 1 and Phase 2) would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives. Similar or smaller impacts would result if the Phase 2 decision for the SDA is continued active management.	No impact.

Potential Short-term Impacts Affecting Water Quality	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative***	***No Action Alternative***
Surface water flow	Construction or contaminant removal activities of short duration may result in short-term impact on surface flows. Surface water flow patterns would be reestablished upon completion of the alternative.	Installation of engineered barriers and erosion control features would result in small-scale, localized changes in surface water flow patterns.	Stream sediments would not be remediated for Phase 1, with no impact on surface water flow. Overall impacts (Phase 1 and Phase 2) would range between those for the Sitewide Close-In-Place and Sitewide Removal Alternatives. If the Phase 2 decision for the SDA is continued active management, overall short-term impacts would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives while long-term impacts would be bounded by those for the No Action Alternative.	No change in flow.
Surface water quality	Construction and excavation activities would increase sediment generation that would be locally intercepted and managed to minimize sediment discharges to surface streams. Contaminated water would be treated prior to permitted discharge to surface streams.	Construction activities would increase sediment generation that would be locally intercepted and managed to minimize sediment discharges to surface streams. Surface water quality would be improved following decommissioning and would be monitored over the long term.	Phase 1 excavation activities would increase sediment generation that would be locally intercepted and managed to minimize sediment discharges to surface streams. Surface water quality would be improved following Phase 1 decommissioning actions. Overall impacts (Phase 1 and Phase 2) would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives. If the Phase 2 decision for the SDA is continued active management, overall short-term impacts would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives while long-term impacts would be bounded by those for the No Action Alternative.	Contaminated water would be treated prior to permitted discharge to surface streams. No change in impact.
Groundwater flow	Existing groundwater flow patterns would be re-established upon completion of the alternative.	Groundwater flow patterns would be modified because of installation of engineered barriers designed to increase the hydrogeologic isolation of contaminated material.	For Phase 1, groundwater flow patterns would be modified slightly in the immediate area of the Main Plant Process Building and Waste Tank Farm as a result of the local groundwater barrier designed to limit groundwater flow between the Main Plant Process Building excavation area and the remaining portion of the North Plateau Groundwater Plume. Overall impacts (Phase 1 and Phase 2) would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives If the Phase 2 decision for the SDA is continued active management, overall impacts would be bounded by those for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives.	No change in flow.
Groundwater quality	Groundwater quality would improve as a result of removal actions.	General groundwater quality would be improved as a result of increased hydrologic isolation of radionuclides and hazardous materials. Long-term groundwater quality would be monitored.	Groundwater quality in the immediate areas of the Phase 1 removal actions would improve as a result of the removal activities. Overall impacts (Phase 1 and Phase 2) would be bounded by those for the Sitewide Close-In-Place and Sitewide Removal Alternatives. If the Phase 2 decision for the SDA is continued active management, overall impacts would be bounded by those for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives.	No change.

PMF = probable maximum flood, SDA = State-Licensed Disposal Area.

4.1.4.1 Sitewide Removal Alternative

Surface Water Flow and Quality

Contamination removal actions in and around surface streams would result in temporary localized changes in surface water flow patterns. Streamflow would be temporarily diverted from stream sections where contaminated sediment would be removed. Surface water flow patterns would be reestablished upon completion of the alternative. Sediment removal in or potentially affecting surface water would be performed in accordance with NYSDEC regulations and guidance for the management of dredged material. These requirements would be specified in a site-specific control plan before beginning such operations.

Impacts as a result of construction and contamination removal actions across the developed portion of the site would be minimal. Construction and contamination activities under this alternative would result in exposed soils across the site, especially during decommissioning. Proper controls and construction practices would be applied to mitigate potential impacts from stormwater runoff, such as erosion and deposition of exposed soils. The following mitigation controls could minimize impacts from runoff: runoff interceptor trenches or swales, filter or silt berms/fences, sediment barriers or basins, rock-lined ditches/swales, slope-shaping and retaining fences, surface water runoff management, stormwater drainage structures, and waste management systems (NYSDEC 2005c). The restoration of stream areas would also include the installation of geotextiles, which would assist the reduction of the amount of soil carried away by stream flow and stormwater runoff (WSMS 2009a). As a result of the effectiveness of these mitigation methods, long-term impacts to channel morphology, stream flow and quality are not expected to occur. Upon completion of removal actions, topsoil would be applied as necessary to restore the preexisting surface contour. Native vegetation would also be restored to minimize exposed soils.

Construction and contamination removal operations would create the potential for spilled materials from construction equipment, including diesel fuel or petroleum, oils, and lubricants. The impacts of fuel, oil, or lubricant spills could be minimized by keeping the equipment in good repair and conducting maintenance operations in areas designed for such operations. In the event of a spill, New York State responds to reports of petroleum and other hazardous material releases through the Spill Response Program maintained by NYSDEC (NYSDEC 2009).

Nonhazardous sanitary wastewater (i.e., domestic sewage) would be managed via the existing sanitary wastewater collection and treatment system during the construction and operations phases of this alternative, and then via portable sanitary facilities during infrastructure removal. Routine operational impacts on surface water quality would be minimal as there would be no untreated discharge of effluents to surface water during operations.

Liquid effluents from the new Waste Tank Farm Waste Processing Facility would be released to Lagoons 4 and 5, emptied into Lagoon 3, and discharged in accordance with a State Pollutant Discharge Elimination System (SPDES) permit (see Chapter 3, Section 3.6.1, of this EIS). Treated leachate from the new Leachate Treatment Facility would be conveyed to treated water storage tanks where it would be sampled and analyzed for retreatment or discharge in accordance with an SPDES permit. The volume of contaminated water produced would be monitored and limited, to the extent practicable, and treated prior to discharge. Surface water quality impacts from the operation of these two process systems would be minor.

Long-term surface water quality would be improved by implementing the Sitewide Removal Alternative because less residual contamination would be on site and natural features to prevent erosion would be restored.

Floodplains

Preliminary analysis using current topography indicates the only facility near the probable maximum floodplain (PMF) would be the planned Interim Storage Facility. A more-detailed analysis would be required as part of detailed design of the Interim Storage Facility to minimize potential impacts, if any, to the floodplain. (For more information on PMF, see Appendix M of this EIS.) There would be no construction in the 100-year floodplain under this alternative. There would be temporary stream flow diversion in Erdman Brook and Franks Creek, however, to allow for the excavation of stream sediment. Runoff controls would also be installed to prevent the migration of disturbed sediment downstream of this excavation (WSMS 2009a).

No adverse impacts to the 100-year or PMF floodplain areas in the WNYNSC vicinity would result from implementation of the Sitewide Removal Alternative, and the peak flowrate within the flood plain would not be affected.

Groundwater Flow and Quality

There would be no adverse impacts to groundwater flow or quality under the implementation of the Sitewide Removal Alternative. Existing groundwater flow patterns would resume upon completion of the alternative. Groundwater quality would improve as a result of removal actions.

Contamination removal operations, particularly on the North Plateau, would include use of engineered barriers to control local groundwater flow during removal operations. Groundwater in the area of the North Plateau Groundwater Plume would be isolated using a sheet pile barrier installed around the perimeter of the area to be excavated. Plume dewatering would be initiated using several groundwater sumps and a series of interconnected subsurface drains.

Area excavations would be backfilled with clean soils and graded to restore the area to an appearance that approximates natural conditions for the site. Over the long term, implementing the Sitewide Removal Alternative would have a positive impact on groundwater quality. Waste and contamination would be sufficiently removed to allow for unrestricted use of WNYNSC groundwater (see Section 4.1.10.2 of this chapter).

4.1.4.2 Sitewide Close-In-Place Alternative

Surface Water Flow and Quality

Construction of the multi-layer caps would result in localized changes in surface water flow patterns around the North and South Plateau caps.[7] Multi-layer cap construction activities would be coordinated with the installation of stream erosional controls, to mitigate the impacts of cap construction on adjacent stream banks (WSMS 2009b). There would also be changes in the localized flow pattern in Erdman Brook and Franks Creek as a result of proposed erosion control features and the extension of the multi-layered engineered caps on the South Plateau. The objectives of the erosion control structures are to control surface water runoff to mitigate gully erosion progress and to reduce streambed erosion. The erosion control structures would be regularly inspected to ensure that they are functioning as designed and to identify signs of blockage and/or physical damage. Corrective maintenance would be performed in response to the inspections and would include clearing debris and silt blocking erosion control structures and performance of local regrading, where necessary. Once the erosion control system installation is complete, temporary erosion and sediment controls, the bypass pumping system (to bypass the stream sections being worked on), surface water diversion systems,

[7] Multi-layer caps or engineered barriers are physical controls designed to isolate or contain wastes or hazardous materials (e.g., caps, entombment of facilities, contaminant immobilization).

and other temporary construction facilities would be removed (WSMS 2009b). Surface water flow patterns would be re-established upon completion of these activities.

The construction of close-in-place features such as the slurry walls and multi-layer caps would result in exposed soils that would be a source for sedimentation in Quarry Creek, Erdman Brook, and Franks Creek following precipitation events (WSMS 2009b). Sedimentation can have adverse ecological impacts, as well as impacts on the channel hydraulics and geomorphology (see Appendix M, Section M.2.1, Floodplains). Sedimentation would create an adverse impact to water quality, but would be localized and of short duration. However, these impacts would be minimized by limiting exposed surfaces and intercepting and treating runoff from exposed areas prior to release. Erosion and sediment controls could include runoff interceptor trenches or swales, filter or silt berms/fences, sediment barriers or basins, rock-lined ditches/swales, slope-shaping and retaining fences, surface water runoff management, stormwater drainage structures, and waste management systems (NYSDEC 2005c). After close-in-place actions are complete for a specific area, rock and vegetated soils would be used to reduce sedimentation to natural rates. Sitewide, surface water quality would be improved following completion of close-in-place actions because there would be less industrial activity at WNYNSC with fewer surfaces that would be exposed to erosion.

Close-in-place actions would create the potential for spilled materials from construction equipment, including diesel fuel or petroleum, oils, and lubricants. The impacts of fuel, oil, or lubricant spills would be minimized by keeping the equipment in good repair and conducting maintenance operations in areas designed for such operations. In the event of a spill, New York State responds to reports of petroleum and other hazardous material releases through the Spill Response Program monitored by NYSDEC (NYSDEC 2009).

Surface waters would be monitored as part of the long-term stewardship program to detect any transport of radiological and hazardous constituents from the WNYNSC WMAs through groundwater to onsite streams (Erdman Brook, Franks Creek, and Buttermilk Creek), with ensuing flow into Cattaraugus Creek. The long-term impacts that could result from this transport process, assuming no mitigation, are analyzed in this EIS and reported in Section 4.1.10. Based on a review of reasonably foreseeable scenarios, transport of contaminants from the WMAs through groundwater is not expected to have a major effect on long-term surface water quality under this alternative (see Section 4.1.10). If unmitigated erosion is assumed to occur, however, there could be long-term impacts to surface water quality such as increased sedimentation.

Floodplains

Preliminary analysis indicates that the proposed location for the Interim Storage Facility is near the PMF floodplain, and additional analysis would be necessary during detailed design for this facility. In addition, the multi-layer caps for the NDA and SDA on the South Plateau would intrude into the 100-year floodplain, and the conceptual design for long-term erosion control features extends into the 100-year floodplain of Erdman Brook and Franks Creek (see Appendix M, Figure M–8, of this EIS). These erosion control structures would increase water flow around two sides of WMA 8 in the proximity of the floodplain. This redirection of water to Franks Creek would increase the potential for erosion from the increased flow. Additional analysis on the impact of these facilities on the floodplain would have to be developed during the detailed design phase if this alternative were selected.

Groundwater Flow and Quality

No impacts on groundwater quality would be expected to result from implementing decommissioning actions. Engineered barriers installed as part of the Interim End State would be maintained to slow the movement of the North Plateau Groundwater Plume while the radionuclides in the plume decay. Similarly, during decommissioning, engineered barriers including barrier walls and engineered caps would be installed over the larger inventories of radioactive and nonradioactive contamination in WMAs 1, 2, 3, 7, and 8. These barriers would be designed to direct local groundwater flow away from these inventories, thereby reducing transport of surface and subsurface contamination into groundwater. In addition, the radionuclides would decay over time. Groundwater monitoring would be a major component of the long-term stewardship program, which is intended to ensure the effectiveness of engineered barriers and other controls in isolating and retarding the movement of contamination..

4.1.4.3 Phased Decisionmaking Alternative

Surface Water Flow and Quality

Phase 1 removal actions would not impact surface water flow patterns or quantity. Stream sediments would not be remediated during Phase 1, but would be monitored and maintained (WSMS 2009c).

Phase 1 removal actions would result in exposed soils that would be a source of sediment following precipitation events. The impacts of sediment generation would be minimized by limiting exposed surfaces and intercepting and treating runoff from exposed surfaces prior to permitted discharge. Erosion and sediment controls could include runoff interceptor trenches or swales, filter or silt berms/fences, sediment barriers or basins, rock-lined ditches/swales, slope-shaping and retaining fences, surface water runoff management, stormwater drainage structures, and waste management systems (NYSDEC 2005d). After removal actions are complete for a specific area, topsoil would be applied as necessary, and the preexisting surface contour would be re-established along with native vegetation to restore natural sediment minimization features. Sitewide, surface water quality would be improved following completion of Phase 1 actions because there would be less industrial activity at WNYNSC and fewer surfaces that would be exposed to erosion.

Phase 1 removal actions would create the potential for spilled materials from construction equipment, including diesel fuel or petroleum, oils, and lubricants. The impacts of fuel, oil, or lubricant spills could be minimized by keeping the equipment in good repair and conducting maintenance operations in areas designed for such operations. In the event of a spill, New York State responds to reports of petroleum and other hazardous material releases through the Spill Response Program maintained by NYSDEC (NYSDEC 2009).

Nonhazardous sanitary wastewater (i.e., domestic sewage) would be managed by the existing sanitary wastewater collection and treatment system during facility construction and operation, and then by portable sanitary facilities during infrastructure removal. Routine operational impacts on surface water quality would be minimal as there would be no untreated discharge of effluents to surface water during operations (WVNS 2004a).

The overall impact of the Phased Decisionmaking Alternative would depend on the Phase 2 decision. If the Phase 2 decision is for total removal of all remaining waste and contamination, overall impacts on surface water flow and quality would be similar to those under the Sitewide Removal Alternative. If the Phase 2 decision is continued active management of the SDA and removal of remaining waste and contamination for the rest of the site, short-term impacts would be less because of reduced decommissioning activities; long-term impacts would be bounded by those for the No Action Alternative (see Section 4.1.4.4). If the Phase 2 decision in-place closure of all remaining waste and contamination, overall impacts would be closer to those under the Sitewide Close-In-Place Alternative because of the presence of the engineered multi-layered caps and erosion control features that would extend into Erdman Brook and Franks Creek. If the Phase 2 decision is continued active management of the SDA and removal of remaining waste and contamination for the rest of the site, short-term impacts would be less because of less exposed soil due to fewer construction activities; long-term impacts would be bounded by those for the No Action Alternative.

Floodplains

No construction proposed under Phase 1 of this alternative (the Interim Storage Facility) would be located in the 100-year floodplain. The Cesium Prong would be managed in place, dams and reservoirs would be monitored and maintained, and contaminated sediment would not be removed from Erdman Brook and Franks Creek. Most of the impacts on the PMF floodplain due to implementation of Phase 1 would be similar to those identified for the 100-year floodplain; preliminary analysis using current topography indicates the only facility in or near the PMF floodplain would be the planned Interim Storage Facility. A more-detailed analysis would be required as part of detailed design of the Interim Storage Facility to minimize potential impacts, if any, on the floodplain.

The overall impacts of the Phased Decisionmaking Alternative would depend on the Phase 2 decision. If the Phase 2 decision is removal of remaining waste and contamination, overall impacts would be similar to those under the Sitewide Removal Alternative (no long-term impacts on the floodplain except for potential impacts from the Interim Storage Facility). Similar impacts would result if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, overall impacts would be closer to those under the Sitewide Close-In-Place Alternative because the engineered multi-layered caps and erosion control features would extend into the 100-year floodplain. If the Phase 2 decision is continued active management of the SDA and in-place closure of the remaining waste and contamination, impacts would be less than those for the Sitewide Close-In-Place Alternative because there would be no multi-layer cap and erosion control features constructed at the SDA that could intrude into the 100-year floodplain.

Groundwater Flow and Quality

The downgradient portion of the subsurface hydraulic barrier installed to control groundwater during removal of the Main Plant Process Building would remain in place after the excavated area is backfilled (WSMS 2009c). In addition, there would be a barrier on the western side of the present location of Lagoons 1 through 3. These barriers would result in localized changes of the groundwater flow on the North Plateau (see Appendix C, Sections C.3.1.1.7 and C.3.1.1.8). The removal of the source area for the North Plateau Groundwater Plume would improve local water quality.

The overall impact of the Phased Decisionmaking Alternative on groundwater flow would depend on the Phase 2 decision. If the Phase 2 decision is removal of remaining waste and contamination, total impacts would be similar to those under the Sitewide Removal Alternative. If the Phase 2 decision for the SDA is continued active management, impacts on groundwater flow caused by its configuration under the No Action Alternative, including the presence of the geomembrane cover, would continue in the vicinity of the SDA (see Section 4.1.4.4). If the Phase 2 decision is in-place closure of remaining waste and contamination, the total effect on groundwater flow would be similar to those under the Sitewide Close-In-Place Alternative, although the impacts would be less extensive because the Main Plant Process Building, North Plateau Groundwater Plume source area, and Lagoons 1 through 3 would have been removed. If the Phase 2 decision for the SDA is continued active management, there would be fewer impacts on groundwater flow because of the absence of a multi-layer cap over the SDA. The impact of the SDA on groundwater flow would be similar to that for the No Action Alternative.

The continued maintenance of some facilities, while decontaminating and decommissioning others, could result in some short-term groundwater quality impacts under Phase 2 of the Phased Decisionmaking Alternative. If the Phase 2 decision is removal of all remaining waste and contamination, long-term groundwater quality would be expected to improve as a result of contamination removal actions during Phase 1 that would continue during Phase 2. If the Phase 2 decision for the SDA is continued active management, long-term groundwater quality would be bounded by that for the No Action Alternative (see Section 4.1.4.4). If the Phase 2 decision is in-place closure of all remaining waste and contamination, groundwater quality impacts are expected to be less extensive than those identified for the Sitewide Close-In-Place Alternative for the remaining Phase 2 in-place closure actions. If the Phase 2 decision for the SDA is continued active management, long-term groundwater quality would be bounded by the No Action Alternative.

4.1.4.4 No Action Alternative

Surface Water Flow and Quality

Because no decommissioning or long-term management actions would take place under the No Action Alternative, surface water flow and quality would not change over the near term, assuming continued monitoring and maintenance activities. Groundwater flow would continue to be affected by the existing barrier walls and geomembrane covers over the NDA and SDA. Contaminated water would be treated prior to permitted discharge of surface streams. Repair and maintenance of facilities would not result in additional impacts to surface water quality.

Section 4.1.10 reports an analysis of the No Action Alternative impacts that could result from the long-term transport, assuming no mitigation, of radiological and hazardous constituents from the WNYNSC WMAs through groundwater to onsite streams (Erdman Brook, Franks Creek, and Buttermilk Creek), with ensuing flow into Cattaraugus Creek. Based on a review of reasonably foreseeable scenarios, transport of contaminants from the WMAs through groundwater is not expected to significantly affect long-term surface water quality (see Section 4.1.10). If unmitigated erosion is assumed to occur, however, there could be long-term impacts to surface water quality such as increased sedimentation.

Floodplains

No decommissioning activities would take place under the No Action Alternative; therefore, no floodplain impacts would occur.

Groundwater Flow and Quality

Implementing the No Action Alternative would not entail new activities that could cause additional groundwater contamination. The Groundwater Recovery System would continue to operate. Engineered barriers installed as part of the Interim End State would be maintained to contain the North Plateau Groundwater Plume while the radionuclides constituting the plume decay. The quality of the groundwater impacted by this plume would thus slowly improve. Otherwise, there would be no reductions in existing rates of transport of surface and subsurface contamination into site groundwater. Groundwater monitoring would continue as part of existing programs.

4.1.5 Air Quality and Noise

Air quality and levels of noise would be affected by decommissioning actions. Indicators of impacts on nonradiological air quality include exceedance of Federal or state ambient air quality standards for criteria air pollutants, hazardous air pollutants, or other toxic pollutants. Indicators for noise are an increase in day or night average sound level at sensitive receptors. A summary of the impacts on air quality and noise under each alternative is presented in **Table 4–7**. None of the alternatives would annually release greenhouse gases in the form of carbon dioxide exceeding 5,700 metric tons (6,300 tons), which represents about 0.00009 percent of the U.S. release in 2005 (EPA 2007d).

Table 4–7 Summary of Air Quality and Noise Impacts

Environmental Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Air Quality	Peak year activity meets ambient standards, except possibly $PM_{2.5}$ for 24-hour standard.	Peak year activity meets ambient standards, except possibly $PM_{2.5}$ and PM_{10} for 24-hour standards.	For Phase 1, peak year activity meets ambient standards, except possibly $PM_{2.5}$ for 24-hour standard. For the entire alternative (Phase 1 and Phase 2), impacts would be bounded by those for the Sitewide Removal and Sitewide Close-In-Place Alternatives. These impacts would bound the sitewide impacts that could result if the Phase 2 decision for the SDA is continued active management.	Peak year activity meets ambient standards, except possibly $PM_{2.5}$ for 24-hour standard.
Noise	Temporary elevated noise levels at nearest residences when equipment activity is near the site boundary.	Temporary elevated noise levels at nearest residences when equipment activity is near the site boundary.	For both Phase 1 and Phase 2, temporary elevated noise levels at nearest residences when equipment activity is near the site boundary. Sitewide noise levels would be reduced for Phase 2 if the Phase 2 decision for the SDA is continued active management.	Negligible increase in noise levels at nearby residences.

$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns, PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns, SDA = State-Licensed Disposal Area.

4.1.5.1 Air Quality – Nonradiological Releases

Closure activities; construction, operations, and demolition of facilities used for closure; and monitoring and maintenance activities would result in emissions of nonradiological criteria and toxic pollutants from construction equipment, trucks, treatment facilities, and employee vehicles. Particulate emissions from wind and equipment disturbance of soil would also occur. Criteria pollutant emissions were compiled for the activities occurring under each alternative to determine total emissions by year of implementation. Air pollutant concentrations were modeled for carbon monoxide, nitrogen dioxide, particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and sulfur dioxide for the year with the highest emissions (see Appendix K of this EIS). Concentrations were modeled at the WNYNSC boundary and along public roads passing through WNYNSC.

Description of Affected Resources—Air pollution refers to the introduction, directly or indirectly, of any substance into the air that could:

- Endanger human health,
- Harm living resources and ecosystems,
- Damage material property, or
- Impair or interfere with the comfortable enjoyment of life and other legitimate uses of the environment.

For the purpose of this EIS, only outdoor air pollutants were addressed. They may be in the form of solid particles, liquid droplets, gases, or a combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with appropriate standards. Ambient air quality standards have been established by Federal and state agencies, allowing an adequate margin of safety for the protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards are considered acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air compounds. Criteria air pollutants are those listed in Title 40 of the *Code of Federal Regulations* (CFR), Part 50 (40 CFR 50), "National Primary and Secondary Ambient Air Quality Standards." Hazardous air pollutants and other toxic compounds are those listed in Title I of the Clean Air Act, as amended (42 United States Code [U.S.C.] 7401 *et seq*.), those regulated by the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61), and those that have been proposed or adopted for regulation by the applicable state or are listed in state guidelines. States may set ambient standards that are more stringent than the National Ambient Air Quality Standards (NAAQS). The more stringent of the Federal or state standards is shown in this document. For the purpose of this EIS, carbon monoxide, nitrogen dioxide, PM_{10}, $PM_{2.5}$, and sulfur dioxide were evaluated because they are the primary pollutants emitted from diesel construction equipment and from earth-moving activities (fugitive dust). Ozone precursors, nitrogen dioxide, and volatile organic compounds were considered or discussed in Appendix K of this EIS. Lead would be emitted in such small quantities under the alternatives that it was not considered in this analysis. Toxic pollutants are emitted from diesel equipment. For the purpose of this EIS, benzene was evaluated as one of the primary toxic pollutants from diesel equipment.

Emissions of airborne radionuclides are regulated by the U.S. Environmental Protection Agency (EPA) under 40 CFR Part 61, Subpart H, "National Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." These emissions and compliance with this standard are discussed in Section 4.1.9 of this chapter. DOE activities on the Project Premises must comply with handling and reporting requirements of the NESHAP for asbestos (40 CFR Part 61, Subpart M).

Areas having air quality that meets the NAAQS for criteria air pollutants are designated as "attainment areas," while areas having air quality that does not meet the NAAQS for such pollutants are designated as "nonattainment areas." Areas may be designated as "unclassified" when sufficient data for attainment-status designation are lacking. Attainment-status designations are assigned by county, metropolitan statistical area, consolidated metropolitan statistical area (or portions thereof), or air quality control regions. Air quality control regions designated by EPA and attainment-status designations are listed in 40 CFR Part 81, "Designation of Areas for Air Quality Planning Purposes."

For locations that are in an attainment area for criteria air pollutants, Prevention of Significant Deterioration (PSD) regulations limit pollutant emissions from new or modified sources and establish allowable increments of pollutant concentrations. Three PSD classifications are specified, with the criteria for classification established in the Clean Air Act. Class I areas include national wilderness areas; memorial parks larger than 2,020 hectares (5,000 acres); national parks larger than 2,430 hectares (6,000 acres); and areas that have been redesignated as Class I. Class II areas are all areas not designated as Class I. No Class III areas have been designated (42 U.S.C. 7472 *et seq.*).

The ROI for air quality encompasses an area surrounding a candidate site that is potentially affected by air pollutant emissions caused by implementation of the alternatives. The air quality impact area normally evaluated is the area in which concentrations of criteria pollutants would increase more than a significant amount in a Class II area (on the basis of averaging period and pollutant: 1 microgram per cubic meter for the annual average for sulfur dioxide, nitrogen dioxide, and PM_{10}; 5 micrograms per cubic meter for the 24-hour average for sulfur dioxide and PM_{10}; 500 micrograms per cubic meter for the 8-hour average for carbon monoxide; 25 micrograms per cubic meter for the 3-hour average for sulfur dioxide; and 2,000 micrograms for the 1-hour average for carbon monoxide [40 CFR 51.165]). Generally, this covers a few kilometers downwind from the source. Further, for sources within 100 kilometers (60 miles) of a Class I area, the air quality impact area evaluated would include the Class I area if the increase in concentration of any air pollutants for which there are PSD increments is greater than 1 microgram per cubic meter (24-hour average). The area of the ROI depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For the purpose of this nonradiological air quality analysis, impacts were evaluated at the WNYNSC boundary and along roads within WNYNSC to which the public has access.

Baseline air quality is typically described in terms of pollutant concentrations modeled for existing sources and background air pollutant concentrations measured near the site. For this EIS, monitoring data are presented for the nearest state air pollutant monitors discussed in Chapter 3, Section 3.7.

Description of Impact Assessment—The impacts of pollutant emissions from construction, operations, and closure activities on air quality were evaluated for each alternative. This assessment included a comparison of pollutant concentrations under each alternative with applicable Federal and state ambient air quality standards. If both Federal and state standards exist for a given pollutant and averaging period, compliance was evaluated using the more stringent standard. Air pollutant emissions data for each alternative were based on conservative engineering analyses (see Appendix K of this EIS). Diesel emissions from trucking shipments are also presented in Appendix K for comparison among the alternatives.

For each alternative, contributions to offsite air pollutant concentrations were modeled on the basis of guidance presented in EPA's "Guideline on Air Quality Models" (40 CFR Part 51, Appendix W). The EPA ISCST3 computer model was selected as an appropriate model. The modeling analysis incorporated conservative assumptions, which tend to overestimate pollutant concentrations as discussed in Appendix K of this EIS. Modeled concentrations for each pollutant and averaging time were compared with the applicable standards. The concentrations presented were the maximum occurring at or beyond the WNYNSC boundary, the highest sixth-high 24-hour concentration for PM_{10}, and the average eighth highest 24-hour concentration for $PM_{2.5}$, which represents the 98^{th} percentile value used to evaluate compliance with the 24-hour $PM_{2.5}$ standard. The highest sixth-high 24-hour concentration for PM_{10} is the value that EPA recommends for evaluating compliance with the 24-hour PM_{10} standard. This value is the highest of the sixth-high values at all the receptors during a 3-year period. For the purpose of this analysis, 5 years of modeling results were used.

Sitewide Removal Alternative

The concentrations appropriate for comparison to ambient standards and guidelines under the Sitewide Removal Alternative for each pollutant and averaging time and the corresponding ambient standards are presented in **Table 4–8**. The highest concentrations at the WNYNSC boundary or public road for PM_{10} for the annual and 24-hour averaging periods were identified in year 55 to the north-northwest and west-southwest. The annual concentration would be less than 29 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be less than 39 percent of the standard if a background concentration were added to the modeling results. The concentrations at the WNYNSC boundary for $PM_{2.5}$ for the annual and average eighth highest 24-hour average concentration were identified in year 55 to the north-northwest and west-southwest, respectively. The annual concentration would be less than 2 percent of the standard and less than 75 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be less than 14 percent of the standard and about 110 percent of the standard if a background concentration were added to the modeling results. The primary contributor to these particulate matter concentrations is North Plateau Groundwater Plume exhumation. The annual average emissions of carbon dioxide over the 60-year period would be about 5,700 metric tons (6,300 tons), representing about 0.00009 percent of the U.S. emissions of carbon dioxide in 2005 (EPA 2007d). Concentrations of other pollutants would be well below ambient standards and guidelines.

Air pollutant emissions from operation of the three new facilities (Soil Drying Facility, Leachate Treatment Facility, and Container Management Facility) under this alternative would be small and not subject to PSD regulations. Therefore, a PSD increment analysis is not required.

Table 4–8 Nonradiological Air Pollutant Concentrations by Alternative

Criteria Pollutant	*Averaging Period*	*Most Stringent Standard or Guideline (micrograms per cubic meter)* [a]	*Background (micrograms per cubic meter)* [b]	*Maximum Incremental Concentration (micrograms per cubic meter)* [c]			
				Sitewide Removal Alternative	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)* [d]	*No Action Alternative*
Carbon monoxide	8 hours 1 hour	10,000 [f] 40,000 [f]	3,500 7,000	304 1,070	223 1,270	141 621	39.4 214
Nitrogen dioxide	Annual	100 [f]	30	0.64	1.49	0.511	0.163
PM_{10}	Annual 24 hours	45 [g] 150 [h]	13 28	1.37 29.7	7.02 262 [e]	0.607 24.5	0.411 16.6
$PM_{2.5}$	Annual 24 hours	15 [h] 35 [h]	11 34	0.23 4.65 [e]	1.1 40.2 [e]	0.119 4.09 [e]	0.0651 2.43
Sulfur dioxide	Annual 24 hours 3 hours	80 [f] 365 [f] 1,300 [f]	7.9 34 94	0.00195 0.109 0.442	0.0042 0.127 0.759	0.00156 0.0974 0.431	0.00041 0.0364 0.203
Benzene	Annual 1 hour	0.13 [i] 1,300 [i]	NR NR	0.00204 1.3	0.00154 1.29	0.0005 0.538	0 0

NR = not reported, PM_n = particulate matter less than or equal to n microns in diameter.

[a] The more stringent of the Federal and state standards is presented if both exist for the averaging period. Other than those for ozone, particulate matter, and lead, and those based on annual averages, the NAAQS are not to be exceeded more than once per year (40 CFR Part 50). The annual arithmetic mean PM_{10} standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The 24-hour PM_{10} standard is met when the expected number of exceedances is 1 or less over a 3-year period. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the 98^{th} percentile 24-hour averages is less than or equal to the standard. The annual $PM_{2.5}$ standard is met when the 3-year average of the annual mean is less than or equal to the standard. Standards and monitored values for pollutants other than particulate matter are stated in parts per million. Values have been converted to micrograms per cubic meter.

[b] Based on ambient monitoring data from Chapter 3, Section 3.7.2.1.

[c] Concentrations were analyzed at locations to which the public has continual access and at the WNYNSC boundary.

[d] Air quality impacts under the entire Phased Decisionmaking Alternative, including Phases 1 and 2, would be expected to be bounded by the impacts under the Sitewide Removal and Sitewide Close-In-Place Alternatives (see discussion in the text).

[e] Standard could be exceeded when background is added to the modeled increment for this alternative.

[f] Federal and New York State standard.

[g] New York State standard.

[h] Federal standard.

[i] New York State air toxic guidance.

The Final Rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR Parts 51 and 93) requires a conformity determination for certain-sized projects in nonattainment areas. A conformity determination is not necessary to meet the requirements of the conformity rule for the alternatives considered in this EIS, because WNYNSC is located in an attainment area for all criteria pollutants (DOE 2000).

Sitewide Close-In-Place Alternative

Under the Sitewide Close-In-Place Alternative, the highest concentrations at the WNYNSC boundary or public road for PM_{10} for the annual and 24-hour averaging periods were identified in year 6 to the southeast and south-southeast. These concentrations would be attributable primarily to WMA 8 closure and erosion control system replacement and would be about 175 percent of the 24-hour ambient standard. The 24-hour concentration would be about 193 percent of the standard if a background concentration were added to the modeling results. The annual concentration would be less than 45 percent of the standard if a background concentration were added to the modeling results. The concentrations at the WNYNSC boundary or nearest public road for $PM_{2.5}$ for the annual and 24-hour concentrations were identified in year 6 to the southeast and south-southeast. These concentrations would be attributable primarily to WMA 8 closure and erosion control system replacement. The annual concentration would be about 7 percent of the standard and about 81 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be about 115 percent of the standard and about 212 percent of the standard if a background concentration were added to the modeling results. The annual average emissions of carbon dioxide would be about 1,850 metric tons (2,040 tons), representing about 0.00003 percent of the U.S. emissions of carbon dioxide in 2005 (EPA 2007d). Concentrations of other pollutants would be well below the ambient standards and guidelines.

Phased Decisionmaking Alternative

Under Phase 1 of the Phased Decisionmaking Alternative, the highest 24-hour concentrations at the WNYNSC boundary or public road for PM_{10} for the annual and 24-hour averaging periods were identified in year 15 to the southeast and south-southeast. These concentrations would be attributable primarily to SDA geomembrane replacement. These concentrations would be less than 17 percent of the 24-hour ambient standard. The annual concentration would be less than 28 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be 35 percent of the standard if a background concentration were added to the modeling results. The concentrations at the WNYNSC boundary or nearest public road for $PM_{2.5}$ for the annual and 24-hour concentrations were identified in year 7 to the northwest and west-southwest. These concentrations would be attributable primarily to WMA 10 closure. The annual concentration would be about 1 percent of the standard and about 74 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be about 12 percent of the standard and about 109 percent of the standard if a background concentration were added to the modeling results. The annual average emissions of carbon dioxide over a 30-year period would be about 2,570 metric tons (2,830 tons), representing about 0.00004 percent of the U.S. emissions of carbon dioxide in 2005 (EPA 2007d). Concentrations of other pollutants would be well below the ambient standards and guidelines.

Air quality impacts under the entire Phased Decisionmaking Alternative (both Phase 1 and 2) is expected to be bounded by the impacts under the Sitewide Removal and Sitewide Close-In-Place Alternatives. If the Phase 2 decision for the SDA is continued active management, air quality impacts for the entire alternative would be less because there would be fewer decommissioning activities resulting in release of air pollutants. This assessment assumes that the rate at which activities are performed would be similar to that under these alternatives and result in similar emission rates. Some variation of actual emissions during any year would result from variations in the schedule and overlap of activities. Concentrations of air pollutants are expected to be below the ambient standards and guidelines, except for PM_{10} and $PM_{2.5}$.

No Action Alternative

Under the No Action Alternative, the highest concentrations at the WNYNSC boundary or public road for PM_{10} for the annual and 24-hour averaging periods were identified in year 15 to the southeast and south-southeast. These concentrations would be attributable primarily to SDA geomembrane replacement. The 24-hour concentration would be less than 12 percent of the 24-hour ambient standard. The 24-hour concentration would be less than 30 percent of the standard if a background concentration were added to the modeling results. The annual concentration would be less than 1 percent of the ambient standard. The annual concentration would be less than 27 percent of the standard if a background concentration were added to the modeling results. The highest concentrations at the WNYNSC boundary or nearest public road for $PM_{2.5}$ for the annual and 24-hour concentration were identified in year 15 to the southeast and south-southeast. The annual concentration would be less than 1 percent of the standard and about 74 percent of the standard if a background concentration were added to the modeling results. The 24-hour concentration would be about 7 percent of the standard and about 104 percent of the standard if a background concentration were added to the modeling results. The annual average emissions of carbon dioxide would be about 73 metric tons (80 tons), representing about 0.000001 percent of the U.S. emissions of carbon dioxide in 2005 (EPA 2007d). Concentrations of other pollutants would be well below the ambient standards and guidelines.

4.1.5.2 Radiological Releases

Radiological releases to air and water are addressed in Section 4.1.9.

4.1.5.3 Noise

Noise, or sound, results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise can disrupt normal activities (e.g., hearing and sleep), damage hearing, or diminish the quality of the environment.

Noise-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (i.e., frequency) of the human ear. Noise levels are expressed in decibels, or in the case of A-weighted measurements, decibels A-weighted. EPA has developed noise-level guidelines for different land use classifications (EPA 1974). EPA guidelines identify a 24-hour exposure level of 70 decibels, as the maximum level of environmental noise that will prevent any measurable hearing loss over a lifetime. Likewise, maximum levels of 55 decibels outdoors and 45 decibels indoors are identified as preventing activity interference and annoyance.

Noise from construction, operations, and closure of the closure facilities and associated traffic could affect human and animal populations. The ROI for WNYNSC includes the site and surrounding areas, including transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few kilometers of the site boundary that carry most of the site's employee and shipping traffic.

No noise-level data representative of site environs were available. The acoustic environment was briefly described in terms of existing noise sources and nearby land uses. (See Chapter 3, Section 3.7.3.)

Impact Assessment

Noise impacts associated with the alternatives may result from construction, operations, and closure activities, including increased traffic. Impacts of proposed activities under each alternative were assessed according to the types of noise sources and the location of the activities relative to the site boundary and noise-sensitive receptors (Table 4–7). Potential noise impacts of traffic were assessed based on the likely increase in traffic volume. Possible impacts on wildlife were evaluated based on the possibility of sudden loud noises occurring during site activities under each alternative.

Construction, operations, and demolition of facilities used for closure would result in some increase in noise levels near the area from construction and demolition equipment and activities. Equipment that is expected to be used includes front-end loaders, bulldozers, graders, compactors, trucks, and lifts. Several pieces of such equipment could operate at one time. Equipment would operate closest to the WNYNSC boundary while removing sediment of the South Reservoir during WMA 12 closure and would be within 801 meters (2,670 feet) of the nearest residence. During activity at the Cesium Prong, equipment would be operated 519 meters (1,730 feet) from the nearest residence; during activities at the North Plateau Groundwater Plume, equipment would be operated 1,182 meters (3,940 feet) from the nearest residence. If five pieces of equipment were operating at the same time (two trucks, grader, dozer, and loader), the noise level at these residences would be about 59, 63, and 56 decibels A-weighted, respectively (WSMS 2009e). This noise would be audible above the background sound levels in the area. Noise from this activity and other activities near the WNYNSC boundary would occur during daytime hours and could be a source of annoyance to nearby residents. Some disturbance of wildlife within WNYNSC could occur as a result of the operation of earth-moving equipment and other equipment. During many of the closure activities, there would be no change in day/night average sound levels and noise impacts on the public outside of WNYNSC, except for noise attributable to construction employee vehicles and trucks hauling materials and waste.

The duration of noise-producing activities would vary under the different alternatives. The Sitewide Removal Alternative would have heavy diesel construction equipment in operation over a period of 60 years. Under the Sitewide Close-In-Place Alternative, heavy diesel construction equipment would be in operation over a period of 7 years, with additional activity at intervals. The Phased Decisionmaking Alternative would have one 8-year period of heavy equipment operation during Phase 1, with occasional additional activity thereafter. During Phase 2, similar heavy diesel construction equipment operation is expected, assuming either removal or in-place closure of all remaining waste contamination. Sitewide noise impacts from either of these activities would bound the sitewide noise impacts that would result if the Phase 2 decision for the SDA is continued active management. This is because there would be less heavy diesel construction equipment operation at the SDA.

Monitoring and maintenance activities and construction activities, such as geomembrane replacement under the No Action Alternative, would result in some increase in noise levels near the activity area, primarily from construction equipment. Several pieces of equipment could operate at one time. Equipment is expected to operate closest to the WNYNSC boundary while in the SDA. This activity would occur about 1,500 meters (5,000 feet) from the nearest residences. If two pieces of equipment were operating simultaneously, the noise level at these residences would be about 43 dBA. This noise would be barely audible above background sound levels in the area. Noise from this activity and other construction-type activities would occur during daytime hours, and, based on the EPA guidelines, is not expected to be a source of annoyance to nearby residents. Some disturbance of wildlife within WNYNSC could occur as a result of equipment operation. During routine monitoring and maintenance, there would be no change in day/night average sound levels and noise impacts on the public outside of WNYNSC as a result of these activities, except for noise attributable to employee vehicles and trucks.

4.1.6 Ecological Resources

Impacts on ecological resources may occur as a result of land disturbance, water use, human activity, or noise resulting from the construction, operations, and removal of facilities associated with the decommissioning or long-term management of WNYNSC. Likely impacts would include habitat loss (including wetlands) and increased mortality of wildlife, as well as indirect impacts such as displacement of wildlife from the affected area. Habitat loss was measured quantitatively in terms of the extent of plant community loss or modification. Indirect impacts were evaluated qualitatively. Impacts on threatened and endangered species during construction of facilities were determined in a manner similar to that for other terrestrial and aquatic resources.

A summary of the impacts under each alternative on ecological resources is presented in **Table 4–9**. Potential measures to mitigate impacts on ecological resources are addressed in Chapter 6, Section 6.5, and throughout this section, as appropriate.

Table 4–9 Summary of Ecological Resources Impacts

Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Terrestrial Resources (Habitat)	Loss of about 16.6 hectares of woodlands and fields as a result of remediation of that portion of the Cesium Prong located outside the disturbed portion of the site.	Minimal impacts as most development would take place on disturbed portions of the site. However, erosion control measures would disturb 10.1 hectares of woodlands and fields.	Minimal impacts under Phase 1, as only developed portions of the site would be impacted. During Phase 2, the loss of terrestrial habitat could range from 10.1 to 16.6 hectares. This range would bound the loss of habitat that could result if the Phase 2 decision for the SDA is continued active management.	No change in terrestrial habitat resources.
Wetlands	Direct impact on 2.8 hectares and potential indirect impacts on other wetland areas.	Direct impact on 4.2 hectares and potential indirect impacts on other wetland areas.	No direct or indirect impacts on site wetland areas under Phase 1. Direct impacts on wetlands under Phase 2 could range from 2.8 hectares to 4.2 hectares. Although fewer wetlands would be disturbed, this range would essentially bound the sitewide direct impact on wetlands if the Phase 2 decision for the SDA is continued active management.	No change in wetland resources.
Aquatic	Direct and indirect impacts on site streams, ponds, lagoons, and reservoirs.	Direct and indirect impacts on site streams and lagoons.	Minimal impacts on aquatic resources during Phase 1. During Phase 2, impacts could range from few additional impacts over Phase 1 to direct and indirect impacts on aquatic resources associated with work in streams and reservoirs. This range would essentially bound the sitewide impacts on aquatic resources if the Phase 2 decision for the SDA is continued active management.	No change in aquatic resources.

Resource	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative***	***No Action Alternative***
Threatened and Endangered Species	No impacts are expected on Federal or state-listed endangered, threatened, or candidate species. Potential direct and indirect impacts on two New York State Natural Heritage Program–ranked species of tiger beetle.	No impacts are expected on Federal or state-listed endangered, threatened, or candidate species. Minimal potential for indirect impacts on two New York State Natural Heritage Program–ranked species of tiger beetle.	No impacts are expected on Federal and state threatened and endangered species during either Phase 1 or 2. During Phase 1, minimal indirect impacts on two New York State Natural Heritage Program–ranked species of tiger beetle. During Phase 2, impacts on the two species of tiger beetle could range from no impact to potential direct and indirect impacts. This range would bound the sitewide impacts on these two species if the Phase 2 decision for the SDA is continued active management.	No impacts (no change to baseline conditions).

SDA = State-Licensed Disposal Area.
Note: To convert hectares to acres, multiply by 2.471.

4.1.6.1 Sitewide Removal Alternative

Under the Sitewide Removal Alternative, a number of new temporary facilities would be built to support decommissioning activities. Decommissioning would also involve the decontamination and removal of all site facilities and the removal or alteration of numerous manmade and natural water bodies. Additionally, the North Plateau Groundwater Plume and Cesium Prong would be remediated by removing contaminated soil to levels allowing for unrestricted use.

Terrestrial Resources

Construction of new temporary facilities and structures would disturb approximately 11.3 hectares (28 acres). However, because all construction would take place within the disturbed portion of the site, there would be no direct loss of habitat. Wildlife in adjacent habitat could be disturbed by noise and increased human presence, which could cause some animals to temporarily move from the area, while others are more tolerant of human activities. Proper maintenance of equipment and restricting workers to the work zone would help minimize this impact.

Impacts on terrestrial resources would also result from demolition, excavation, and land-clearing activities, including those associated with remediation of the North Plateau Groundwater Plume and the Cesium Prong. As most activities are associated with the removal of existing structures in disturbed areas, impacts would be minimal. However, remediation of the Cesium Prong would involve the clearing of about 16.6 hectares (41 acres) of woodlands and fields located outside of the disturbed portion of the site. Following the removal of contaminated soil to levels permitting unrestricted use, disturbed areas would be regraded and revegetated using native species according to a sitewide revegetation plan that would be approved by the State of New York.

Impacts of clearing operations associated with the remediation of the undisturbed portion of the Cesium Prong would include the loss of less-mobile species (e.g., salamanders, toads, frogs, mice, rabbits, snakes, and squirrels), as well as displacement of more-mobile species (e.g., birds and large mammals). Depending on whether the areas to which displaced animals moved were at or below their carrying capacity (i.e., the maximum number of animals of a particular species that the area could support), the ecosystem dynamics could be altered, possibly leading to the loss of the relocated animals. Prior to land-clearing operations, the areas to be disturbed would be surveyed for nests of migratory birds in accordance with the Migratory Bird Treaty Act. For example, to avoid disturbing resident breeding bird populations, many of which are migratory, it might be necessary to undertake clearing operations during the non-breeding season (i.e., August 1 through March 15). In addition to protecting bird populations in general, conducting land clearing activities during the non-breeding season would meet the requirements of the Migratory Bird Treaty Act by protecting adults, their nests, and young. Upon restoration of the site, it would once again be available to wildlife, although the species composition would likely be different.

Wetlands

No wetlands would be affected during construction of temporary facilities, because none are present on the proposed construction sites. However, wetlands would be directly and indirectly impacted by demolition and remediation activities, particularly during remediation of the Cesium Prong. Indirect impacts could include the alteration or destruction of wetlands resulting from sedimentation following earthmoving activities and the removal of contaminated sediments from streams. Stormwater runoff control measures, including erosion and sediment controls, would be installed, inspected, and maintained to prevent indirect impacts. Noise and human presence could also impact wildlife present within wetland areas, with impacts and mitigation measures similar to those addressed earlier for terrestrial species.

Overall, about 2.8 hectares (7.0 acres) of wetlands could be directly affected under this alternative. Direct impacts on wetlands would occur in connection with remediation of the Cesium Prong, where six delineated wetland areas (W31, W37, W38, W40, W44, and W45) totaling 2.1 hectares (5.1 acres) are located in and around WMAs 3, 4, and 5. Removal of the SDA would directly impact three jurisdictional wetlands (W33, W65, and W66) totaling 0.04 hectare (0.1 acre). Removal of the SDA also has the potential to impact the 30.5-meter (100-foot) adjacent area around the New York State Freshwater Wetlands (W10 and W11) that border the SDA to the east and south (see Appendix M, Figure M–6). Any work within the adjacent area would require a permit from the state. Additionally, five other wetland areas (W4 – W8) measuring a total of 0.7 hectare (1.8 acres) would be affected as a result of altered water levels and siltation during closure of the dams and reservoirs in WMA 12. The largest of these wetlands is located at the head end of the North Reservoir, while the other four smaller wetlands are located just downstream from the discharge point from the North Reservoir. Impacts on affected wildlife would be similar to those for terrestrial wildlife discussed previously in this section.

If needed, prior to the disturbance of any jurisdictional wetland, a Section 404 permit would be acquired from the U.S. Army Corps of Engineers, and in the case of a New York State freshwater wetland, a permit would be acquired from the New York State Department of Environmental Conservation (NYSDEC). Additionally, a mitigation plan would be developed that would fully address the compensation mechanism selected (i.e., compensatory mitigation, mitigation bank, or in-lieu fee mitigation) to mitigate wetland impacts (73 FR 19594). Best management practices, including erosion and sediment controls, would be implemented during all remediation work potentially affecting wetlands.

Aquatic Resources

Direct impacts on aquatic resources during construction and operation of new temporary facilities would not occur because no such resources are located within the construction sites. Indirect impacts would be limited because best management practices, including implementation of a soil erosion and sedimentation plan, would be followed.

Manmade aquatic features (i.e., lagoons, ponds, and reservoirs) would be directly impacted by decommissioning activities when lagoons and ponds are excavated and backfilled and dams and reservoirs are demolished and removed. The active lagoons contain wastewater or treated water. Periodically, treated wastewater from Lagoon 3 is discharged to Erdman Brook through an SPDES-permitted discharge. The reservoirs drain into Buttermilk Creek. Fish, amphibians, and reptiles associated with the ponds and reservoirs would be lost during implementation activities. The sunfish population would be particularly affected, because it is the most common species observed in the North Reservoir and the only species of fish seen in the South Reservoir. The dams and reservoirs would be closed in accordance with applicable Federal and state regulations and approvals from EPA, NYSDEC, and the New York State Department of Health. Specific requirements for fish management at the time of closure would be developed as part of the approval process.

Aquatic populations associated with site streams would also be affected during the removal of contaminated sediment in Quarry Creek, Erdman Brook, Franks Creek, Buttermilk Creek from its confluence with Franks Creek downstream to its confluence with Cattaraugus Creek, and the portion of Cattaraugus Creek near its confluence with Buttermilk Creek. This action would result in the direct loss of aquatic species and indirect loss due to downstream sedimentation. Additionally, the removal of vegetation along streambeds would increase stream temperatures, thereby altering ecosystem dynamics. Removal of soil from the 16.6 hectares (41 acres) of the Cesium Prong that are located outside the disturbed portion of the site would directly impact Quarry Creek and several small ponds with the loss of associated aquatic species. Remediation of the Cesium Prong (and North Plateau Groundwater Plume) also has the potential to indirectly affect streams through erosion and sedimentation. Impacts on wildlife associated with ponds and stream channels would also occur as a result of remediation activities. Appropriate erosion controls would be installed and best management practices would be implemented to minimize soil erosion and sedimentation. As with the dams and reservoirs, specific requirements for fish management would be developed as part of the approval process prior to any actions taking place.

Threatened and Endangered Species

No Federal or state threatened, endangered, or candidate species have been found to reside on WNYNSC (see Chapter 3, Section 3.8.4); thus, there would be no impact on any listed species from the Sitewide Removal Alternative. Further, no critical habitat for any such species, nor critical environmental areas for state rare or endangered species are known to exist on WNYNSC; therefore, none would be affected under the Sitewide Removal Alternative.

Remediation work under this alternative would involve removal of sediments in Quarry Creek, Erdman Brook, Franks Creek, Buttermilk Creek from its confluence with Franks Creek downstream to its confluence with Cattaraugus Creek, and the portion of Cattaraugus Creek near its confluence with Buttermilk Creek. These activities could impact the Appalachian tiger beetle (*Cinindela ancocisconensis*) (New York State rank: imperiled) and cobblestone tiger beetle (*Cinindela marginipennis*) (New York State rank: critically imperiled). Although neither species is legally protected, both would be fully considered during the planning and implementation phases should this alternative be selected. Because the Appalachian tiger beetle is present in the vicinity of the confluence of Buttermilk and Cattaraugus Creeks, remediation work is likely to adversely impact local populations of this species. The cobblestone tiger beetle is located downstream from the confluence of these two streams, and although this species would not be directly impacted, careful implementation of the erosion and sediment control plan would be necessary to prevent indirect impacts.

Long-Term Impacts

Implementing the Sitewide Removal Alternative would remove essentially all the contamination and would result in low residual contamination levels that would result in human exposure of less than 25 millirem per year. These low residual contamination levels would not result in long-term ecological consequences for aquatic or terrestrial receptors.

4.1.6.2 Sitewide Close-In-Place Alternative

Similar to the Sitewide Removal Alternative, a number of new temporary facilities would be built to support decommissioning activities, and key site facilities would be closed in place. Site ponds, lagoons, and reservoirs would be taken out of service. No effort would be made to remediate contaminated streambed sediment or soils within the North Plateau Groundwater Plume or Cesium Prong.

Terrestrial Resources

Direct and indirect impacts from the construction of new temporary facilities to support decommissioning, including remediation activities, would be similar to those discussed under the Sitewide Removal Alternative in Section 4.1.6.1; however, the total affected area for these facilities (located in previously disturbed areas) would be 0.8 hectare (2 acres). In addition, 17.8 hectares (44 acres) of previously disturbed land would be affected by the installation and maintenance of engineered barriers and multi-layered caps. Mitigation measures would also be similar to those described under the Sitewide Removal Alternative. As part of this alternative, a number of erosion control measures would be taken, including installation of water control structures and work in and adjacent to Quarry Creek, Franks Creek, and Erdman Brook. These actions would disturb about 10.1 hectares (25 acres) of woodlands and fields, with impacts similar to the other ground-disturbing activities addressed in Section 4.1.6.1.

Decommissioning activities under this alternative would take place throughout WNYNSC, with the exception of WMAs 4, 10, and 11. In general, demolition of facilities would have minimal direct impact on terrestrial resources. Indirect impacts would be possible, however, and could include disturbance and displacement of wildlife due to noise and increased human presence (see Section 4.1.6.1). Both the NDA and SDA would receive robust multi-layer caps under this alternative. These caps would offer little habitat for wildlife, as they would be rock covered. The areas would also be fenced, thus preventing use by larger mammals.

At the conclusion of decommissioning activities, as well as decay of the Cesium Prong, much of the site (see Figure 4–1) would be available for release for unrestricted use. Regrading and revegetation of remediated areas with native species would allow those areas to be used by wildlife.

While the North Plateau Groundwater Plume source area would be closed in an integrated manner with the Main Plant Process Building and other facilities, the radioactive contaminants in the nonsource area would be allowed to decay in place. Similarly, the Cesium Prong would be managed by implementing restrictions on use until in-place decay results in contaminant levels allowing for unrestricted use. Because activities would take place within disturbed areas of WNYNSC, terrestrial resources would not be affected.

Wetlands

Overall, up to 4.2 hectares (10.4 acres) could be directly affected under this alternative.

No wetlands would be affected during construction of new facilities, because none are present on the proposed construction sites. However, construction of erosion control measures under this alternative would directly impact two jurisdictional wetlands (W34 and W39) totaling approximately 0.1 hectare (0.3 acre), while placement of the multi-layer cap over the NDA and SDA would directly impact five jurisdictional wetlands (W10 and W11 [both also New York State Freshwater Wetlands] and W33, W65, and W66) totaling 3.4 hectares (8.4 acres). The actual disturbance to the jurisdictional wetlands would be less than half their total area. Impacts on these wetlands would be similar to those addressed in Appendix M, Section M.3.1.2. Additionally, placement of the multi-layer caps has the potential to cause indirect impacts (sedimentation) on those portions of the New York State wetlands not directly impacted. Placement of the multi-layer caps would impact the 100-foot (30.5-meter) adjacent area around the New York State wetlands. Any work within the state wetlands (and adjacent area) would require a permit from the state, as well as the U.S. Army Corps of Engineers. Mitigation measures such as those addressed in Appendix M, Section M.4.2, and Chapter 6 of this EIS would be implemented to address direct and indirect impacts.

Similar to the Sitewide Removal Alternative, five wetland areas measuring 0.7 hectare (1.8 acres) could be affected during closure activities associated with the dams and reservoirs. Direct and indirect impacts resulting from remediation and closure activities, as well as mitigation requirements, would be similar to those addressed under the Sitewide Removal Alternative. Because the North Plateau Groundwater Plume and Cesium Prong would not involve removal of soils in nonsource areas, there would be no indirect impacts on wetlands in those areas of the site.

Aquatic Resources

Under the Sitewide Close-In-Place Alternative, impacts on aquatic resources generally would be fewer than those under the Sitewide Removal Alternative. Thus, while streambeds and associated aquatic resources would be temporarily disturbed during the installation of erosion control features (see earlier discussion of terrestrial resources in this section), streams would not be remediated through sediment removal. Because soil in nonsource areas of the North Plateau Groundwater Plume and Cesium Prong would not be disturbed under this alternative, there would be no direct or indirect impacts on ponds or streams from this activity. Also, although the reservoirs would be taken out of service, they would not be removed. This would leave intact the aquatic populations of these water bodies.

Threatened and Endangered Species

Similar to the Sitewide Removal Alternative, impacts on Federal or state threatened or endangered species are not expected from any of the actions taken under the Sitewide Close-In-Place Alternative. Although there would be some temporary disturbance to streams during the placement of erosion control structures, implementation of the site soil erosion and sediment control plan would minimize potential indirect impacts on both the Appalachian tiger beetle and cobblestone tiger beetle.

Long-Term Impacts

To understand the potential for local adverse ecological impacts from possible long-term release of radionuclides at the site for the Sitewide Close-In-Place Alternative, a screening-level ecological risk assessment was performed that compared projected concentrations against published DOE Biota Concentration Guides (BCGs), which are concentration limits for radionuclides to protect biota (DOE 2002d). BCGs are based on threshold doses for the protection of ecological receptors of 1 rad per day for aquatic biota, 1 rad per day for plants and terrestrial invertebrates, and 0.1 rad per day for terrestrial animals. These dose limits meet the requirements of DOE Order 5400.5, "Radiation Protection of the Public and Environment" (DOE 1990), and DOE Order 450.1A, "Environmental Protection Program" (DOE 2008c); they equal the dose limits for protection of biota recommended by the National Council on Radiation Protection and Measurements and the International Atomic Energy Agency (DOE 2002d). BCGs are calculated using conservative exposure assumptions and parameter values and are thus "appropriately conservative limiting concentrations of radionuclides in environmental media" (DOE 2002d).

The models used for the long-term performance assessment, which are described in Section 4.1.10 and Appendix H, project radionuclide concentrations in surface water and in sediments as a result of groundwater and surface water transport processes. This screening analysis considered two potential receptor locations: (1) Buttermilk Creek below the confluence of Franks Creek and Buttermilk Creek, and (2) Franks Creek above the point where Quarry Creek enters Franks Creek. The Buttermilk Creek location receives more contamination but with greater dilution. The Buttermilk Creek location is in the center of the site and is exposed to contaminated water discharged to Franks Creek as well as contaminated water that enters Buttermilk Creek upstream from seeps on the western bank. The Franks Creek position receives less contamination but the contamination may have higher concentrations as a result of the lower flow rate of Franks Creek. The Franks Creek receptor location was added for this Final EIS.

The screening analysis compared projected radionuclide concentrations in surface water and sediment in the two locations against DOE BCGs for terrestrial vertebrates and aquatic biota exposed to water and sediment. The projected water concentrations for the Buttermilk Creek location were about 9 percent of the DOE screening-level concentration limits for aquatic biota and about 0.05 percent of the screening-level concentrations for terrestrial vertebrates. The projected sediment concentrations were about 0.02 percent of the DOE screening-level concentration limits for aquatic biota and less than 0.7 percent of the screening-level concentration limits for terrestrial vertebrates.

The projected water concentrations for the Franks Creek location slightly exceeded the DOE screening-level concentration limits for aquatic biota and were about 1 percent of the screening-level concentrations for terrestrial vertebrates. The projected sediment concentrations were about 0.3 percent of the DOE screening-level concentration limits for aquatic biota and about 9 percent of the screening-level concentrations for terrestrial vertebrates.

On the basis of this screening analysis, it is concluded that long-term releases from the Sitewide Close-In-Place Alternative (assuming no unmitigated erosion) would not result in long-term ecological consequences for receptors along Buttermilk Creek and terrestrial receptors along Franks Creek. Aquatic biota exposed to surface water in Franks Creek are unlikely to experience unacceptable risk of long-term adverse effects because BCGs are conservative benchmarks and conservative estimates of maximum strontium-90 concentrations in the North Plateau Groundwater Plume only slightly exceed its BCG.

4.1.6.3 Phased Decisionmaking Alternative

Under Phase 1 of this alternative, some new temporary facilities would be built to support closure activities and some key site facilities would be removed (see Chapter 2, Section 2.4.3.5, and Appendix C, Section C.4, of this EIS). This alternative would initially remove all North Plateau facilities, except for the Waste Tank Farm and many of its supporting facilities, and the CDDL. Site ponds and lagoons would also be taken out of service; however, reservoirs would be maintained. No effort would be made to remediate contaminated streambed sediment or soils within the nonsource area of the North Plateau Groundwater Plume and Cesium Prong. Under Phase 2, actions could range from no removal to complete removal of all remaining site facilities.

Terrestrial Resources

Under Phase 1 of this alternative, direct and indirect impacts from the construction of new temporary facilities to support decommissioning, including remediation activities, would be similar to those discussed in Section 4.1.6.1; however, the total area impacted would be about 0.8 hectare (2 acres) of previously disturbed land. In addition, about 10.5 hectares (26 acres) of previously disturbed land would be affected as part of actual removal of facilities and construction of engineered barriers. Mitigation measures for new temporary facilities would also be similar to those described for the Sitewide Removal Alternative. Because the nonsource area of the North Plateau Groundwater Plume and Cesium Prong would not be remediated under Phase 1 and radioactive contaminants would be allowed to decay in place, there would be no impact on terrestrial resources.

If the Phase 2 decision is removal of remaining waste and contamination, impacts on terrestrial resources would be similar to those for the Sitewide Removal Alternative, as described in Section 4.1.6.1. The major impact would be the loss of 16.6 hectares (41 acres) of terrestrial habitat resulting from remediation of the Cesium Prong. If the Phase 2 decision for the SDA is continued active management, there would ultimately be less terrestrial habitat (6.1 hectares [15 acres]) available for wildlife because the area would not be revegetated. If the Phase 2 decision is in-place closure, impacts would be similar to those for the Sitewide Close-In-Place Alternative described in Section 4.1.6.2. There would be no impacts from remediation of the Cesium Prong; however, 10.1 hectares (25 acres) of terrestrial habitat would be lost from construction of erosion control measures. A Phase 2 decision to continue active management of the SDA would not affect terrestrial resources because, whether the SDA remained covered with a geomembrane cover or was closed in place with a multi-layered cap, it would remain in a non-vegetated state.

Wetlands

During Phase 1 of this alternative, no wetlands would be affected by construction of temporary facilities, because no wetlands are present on the proposed construction sites. Further, remediation and closure activities planned under this alternative would not directly impact wetlands, because none are present in the associated WMAs. However, the removal of existing facilities could lead to indirect impacts on nearby wetlands as described for the Sitewide Removal Alternative. Mitigation requirements would be similar to those discussed for the Sitewide Removal Alternative. Because the nonsource area of the North Plateau Groundwater Plume and the Cesium Prong would not be remediated and radioactive contaminants would be allowed to decay in place, there would be no impacts on wetlands in this area.

If the Phase 2 decision is removal of remaining waste and contamination, impacts on wetlands would be similar to those for the Sitewide Removal Alternative. Thus, direct (2.8 hectares [7.0 acres]) and indirect impacts are possible and would result largely from the remediation of the North Plateau Groundwater Plume and Cesium Prong, and removal of the north and south reservoirs. If the Phase 2 decision is in-place closure, direct (4.2 hectares [10.4 acres]) and indirect impacts on wetlands would be similar to those for the Sitewide Close-In-Place Alternative. In this case, impacts would largely result from the installation of a number of erosion control measures and the placement of multi-layer caps over the NDA and SDA. If the Phase 2 decision for the SDA is continued active management while the remaining waste and contamination at the site is either removed or closed in place, there would be fewer wetlands disturbed (i.e., W10, W11, W33, W65, and W66), because the SDA and the immediately surrounding area would remain in its current condition.

Aquatic Resources

Under Phase 1 of this alternative, the only manmade aquatic features to be directly impacted would be a number of lagoons and the demineralizer sludge ponds which would be exhumed and backfilled. This would have a negligible impact on aquatic resources. The dams and reservoirs in WMA 12 would remain and no action would be taken on contaminated stream sediments. Also, because soil in the nonsource area of the North Plateau Groundwater Plume and Cesium Prong would not be excavated, there would be no direct or indirect impacts on ponds or streams.

If the Phase 2 decision is removal of remaining waste and contamination, direct and indirect impacts on aquatic resources would be similar to those for the Sitewide Removal Alternative. Direct impacts on aquatic resources would primarily be associated with remediation of the nonsource area of the North Plateau Groundwater Plume, remediation of the Cesium Prong, sediment removal in streams, and closure of the reservoirs. If the Phase 2 decision is in-place closure, fewer impacts on aquatic resources would occur because those activities noted earlier would not take place. However, streambeds and associated aquatic resources would be temporarily disturbed during the installation of erosion control features. If the Phase 2 decision for the SDA is continued active management while the remaining waste and contamination is either removed or closed in place, there would be somewhat less potential for erosion and sedimentation, because there would be no new land disturbance within the disposal area.

Threatened and Endangered Species

Impacts on Federal or state threatened or endangered species would not be expected from any of the actions taken under Phase 1 of this alternative. As noted for aquatic resources, soil disturbance, and hence, the potential for stream sedimentation, would be minimized under this alternative because soil in the nonsource area of the North Plateau Groundwater Plume and Cesium Prong would not be excavated. Contaminated stream sediments would not be removed during Phase 1. These factors, plus the implementation of a site soil erosion and sediment control plan, would minimize potential indirect impacts on the Appalachian tiger beetle and cobblestone tiger beetle.

As is the case under Phase 1, Phase 2 of the Phased Decisionmaking Alternative would not be expected to impact any Federal or state threatened or endangered species. However, if Phase 2 activities reflect those of the Sitewide Removal Alternative, impacts from stream remediation activities on the Appalachian tiger beetle and cobblestone tiger beetle would be similar to those addressed in Section 4.1.6.1. If Phase 2 activities are similar to those undertaken under the Sitewide Close-In-Place Alternative, potential impacts on these two species would be similar to those under this alternative but minimized through the implementation of the site erosion and the sediment control plan (see Section 4.1.6.2). If the Phase 2 decision for the SDA is continued active management while other onsite waste and contamination is either removed or closed in place, there would be little change in impacts to threatened or endangered species, although there could be slightly less potential for sedimentation. This could also lessen impacts on the Appalachian tiger beetle and cobblestone tiger beetle.

Long-Term Impacts

Long-term ecological consequences after implementation of Phase 2 of this alternative would depend on the Phase 2 decision. If the Phase 2 decision is removal of all remaining waste and contamination, the low residual contamination would not result in long-term ecological consequences for aquatic or terrestrial receptors (see Section 4.1.6.1). If the Phase 2 decision is to close in place all remaining waste and contamination, long-term ecological consequences would be bounded by the screening analysis performed for the Close-In-Place Alternative (Section 4.1.6.2). Because Phase 1 would remove some site waste and contamination, and the remaining contamination would be isolated, long-term releases would not result in long-term consequences to aquatic or terrestrial receptors. If the Phase 2 decision for the SDA is for continued active management, then long-term consequences to aquatic or terrestrial receptors would be expected to be somewhat larger than those for the Sitewide Removal or Close-In-Place Alternatives; these consequences would be nonetheless bounded by those analyzed for the No Action Alternative (see Section 4.1.6.4).

4.1.6.4 No Action Alternative

Under the No Action Alternative, no decommissioning actions would be taken. It is estimated, however, that, a portion of the site (693 hectares [1,713 acres]) could be released for unrestricted use, while remaining portions would continue to be monitored and maintained as required by Federal and state regulations. There would be no decommissioning impacts on terrestrial resources, wetlands, aquatic resources, or threatened and endangered species under this alternative.

Long-Term Impacts

As described in discussion for the Sitewide Close-In-Place Alternative of this chapter (Section 4.1.6.2), a screening-level ecological risk assessment was performed to understand the potential for local adverse ecological impacts from long-term releases of radionuclides at the site. The screening analysis for the No Action Alternative compared projected radionuclide concentrations within surface water and sediment against DOE BCGs for terrestrial vertebrates and aquatic biota along Buttermilk Creek below the point where

Franks Creek discharges into Buttermilk Creek, and along Franks Creek above the point where Quarry Creek enters Franks Creek. The Franks Creek receptor was added for this Final EIS.

The projected water concentrations for the Buttermilk Creek location exceeded the DOE screening-level concentration limits for aquatic biota by a factor of 2 but did not exceed the screening-level concentrations for terrestrial vertebrates. The projected sediment concentrations were about 0.5 percent of the DOE screening-level concentration limits for aquatic biota and less than 16 percent of the screening-level concentrations for terrestrial vertebrates.

The projected water concentrations for the Franks Creek location exceeded the DOE screening-level concentration limits for aquatic biota by a factor of 12 but did not exceed the screening-level concentrations for terrestrial vertebrates. The projected sediment concentrations were about 3 percent of the DOE screening-level concentration limits for aquatic biota and about 90 percent of the screening-level concentrations for terrestrial vertebrates.

On the basis of this screening analysis, it was concluded that long-term releases from the No Action Alternative (assuming no unmitigated erosion) could result in long-term ecological consequences for aquatic biota.

4.1.7 Cultural Resources

Cultural resources include prehistoric, historic, and traditional cultural properties. Prehistoric resources are physical remains of human activities that predate written records. They generally consist of artifacts that may alone or collectively yield information about the past. Historic resources consist of physical properties that postdate the emergence of written records. In the United States, they are architectural structures or districts, archaeological objects, or archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made if the sites are of particular importance, such as structures associated with Cold War themes. Traditional cultural properties include sites, areas, and materials that have a cultural significance to American Indians and other ethnic groups. A traditional cultural property is associated with cultural practices or beliefs that are rooted in history and are important in maintaining the continuing cultural identity of the community for religious or heritage-related reasons. Such resources may include geographic features, plants, animals, cemeteries, battlefields, trails, or sacred/ceremonial sites.

Decommissioning activities are not likely to have an impact on prehistoric resources, historic resources, or traditional cultural properties in or near WNYNSC. The analysis of potential impacts on cultural resources under each alternative is summarized in **Table 4–10**.

To determine whether cultural resources were present, previous surveys of facility locations were examined. Potential indirect impacts include those associated with reduced access to a resource site, as well as impacts associated with increased traffic and visitation to sensitive areas. Direct impacts include those resulting from ground-disturbing activities associated with demolition, construction, and operations. Avoidance of identified cultural resources would be a primary goal wherever practical. To avoid loss of cultural resources during construction, cultural resource surveys would be conducted in the area of interest. Although no alternative is expected to affect significant cultural resources, the potential for inadvertent discovery of prehistoric or archaeological resources exists, especially in areas that are not presently disturbed. Consultations to comply with Section 106 of the National Historic Preservation Act were conducted with the New York State Office of Parks, Recreation, and Historic Preservation. Correspondence offering consultation was sent to the Seneca Nation of Indians (see Appendix O of this EIS). There will be ongoing correspondence with the Seneca Nation of Indians to discuss any issues or concerns that arise.

Table 4–10 Cultural Resources Impacts

Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Prehistoric	None expected; lack of existing prehistoric resources on site. This alternative would have a greater potential for impact due to land disturbance and the possibility of unearthing archaeological resources. If prehistoric resources are found, they would most likely be in areas that are not presently developed.	None expected; lack of existing prehistoric resources on site. If prehistoric resources are found, they would most likely be in areas that are not presently developed.	None expected for Phase 1; lack of existing prehistoric resources on site. If Phase 2 involves removal activities, there would be greater potential for land disturbance with the possibility of unearthing archaeological resources. If prehistoric resources are found, they would most likely be in areas that are not presently developed. Continued active management of the SDA would not affect currently undeveloped land.	None expected; lack of existing prehistoric resources on site.
Historic	None expected; no sites of historical significance were identified on site in previous surveys. This alternative would have a greater potential for impacts due to the land disturbance and the possibility of unearthing archaeological resources. If historic resources are found, they would most likely be in areas that are not presently developed.	None expected; no sites of historical significance were identified on site in previous surveys. If historic resources are found, they would most likely be in areas that are not presently developed.	None expected for Phase 1; no sites of historical significance were identified on site in previous surveys. If Phase 2 involves removal activities, there could be greater potential for impacts due to land disturbance and the possibility of unearthing archaeological resources. If historic resources are found, they would most likely be in areas that are not presently developed. Continued active management of the SDA would not affect currently undeveloped land.	None expected; no sites of historical significance were identified on site in previous surveys.
Traditional Cultural Properties	None expected; decommissioning activities would occur in previously disturbed areas or areas lacking traditional cultural properties. There is ongoing consultation with the Seneca Nation of Indians regarding possible impacts. This alternative would have a greater potential for impact due to land disturbance and the possibility of unearthing archaeological resources. If traditional cultural properties are found, they would most likely be in areas that are not presently developed.	None expected; decommissioning activities would occur in previously disturbed areas or areas lacking traditional cultural properties. There is ongoing consultation with the Seneca Nation of Indians regarding possible impacts. If traditional cultural resources are found, they would most likely be in areas that are not presently developed.	None expected for Phase 1; decommissioning activities would occur in previously disturbed areas or areas lacking traditional cultural properties. If Phase 2 involves close-in-place activities, no impacts are expected. If Phase 2 involves removal activities, there could be greater potential for impact due to land disturbance with the possibility of unearthing archaeological resources. If traditional cultural resources are found, they would most likely be in areas that are not presently developed. Continued active management of the SDA would not affect currently undeveloped land. There is ongoing communication with the Seneca Nation of Indians regarding possible impacts.	None expected; no traditional cultural properties were identified on site in previous studies. There is ongoing consultation with the Seneca Nation of Indians regarding possible impacts.

SDA = State-Licensed Disposal Area.

4.1.7.1 Sitewide Removal Alternative

Prehistoric Resources

Under the Sitewide Removal Alternative, all facilities would be removed and the entire site would be available for release for unrestricted use (except for possible operation of the Container Management Facility). About 16.6 hectares (41 acres) of previously undisturbed land would be affected by remediating the Cesium Prong. If prehistoric resources are found, they would most likely be in areas that are not presently developed. No adverse impacts on prehistoric resources are expected because the activities under this alternative would primarily occur in previously disturbed areas (WSMS 2009a). There has only been one prehistoric lithic findspot on WNYNSC, which was considered a stray find (WVNS 1994b) (see Chapter 3, Section 3.9.1). No other cultural material or cultural features were observed during additional shovel test pits. If additional prehistoric resources were uncovered during demolition or construction, work would stop and appropriate assessment, regulatory compliance, and recovery measures would be undertaken.

Historic Resources

Under this alternative, impacts on potential historic resources associated with natural stream channels would be greatest during removal of trees and vegetation along Erdman Brook to allow access for heavy excavation equipment. About 16.6 hectares (41 acres) of previously undisturbed land would be affected by remediating the Cesium Prong. If historic resources are found, they would most likely be in areas that are not presently developed. The possibility of unearthing previously undetected sites is greater near the banks of streams and rivers, where previous inhabitants tended to establish settlements. Increased human presence and vehicular traffic would also contribute to the disturbance. Of the 10 historic sites and structures identified during cultural resource surveys (see Chapter 3, Section 3.9.2), none has been determined eligible for inclusion in the National Register of Historic Places (SHPO 1995, DOE 2006c). If potential historic resources are found during demolition or construction, additional investigations may be required. Consultation with the State Historic Preservation Officer would be undertaken, as necessary, to determine the eligibility of any potentially disturbed sites for listing on the National Register of Historic Places, and, if appropriate, data and artifact recovery would be conducted. Further mitigation measures would be developed and implemented should such a discovery occur.

Traditional Cultural Properties

Under the Sitewide Removal Alternative, most activities would occur within previously disturbed areas contained within or adjacent to developed areas. About 16.6 hectares (41 acres) of previously undisturbed land would be affected by remediating the Cesium Prong. If traditional cultural properties are found, they would most likely be in areas that are not presently developed. The likelihood that these areas contain cultural materials intact or in their original context is small, as indicated by the results of cultural resources studies (SHPO 1995, DOE 2005a).

Under this alternative, the reservoirs in WMA 12 would be drained slowly and in accordance with applicable Federal and state regulations and approval from NYSDEC, the New York State Department of Health, and EPA. The reservoirs drain into Buttermilk Creek, which flows into Cattaraugus Creek. Cattaraugus Creek, located downstream approximately 24 kilometers (15 miles) from WNYNSC, holds great cultural and economic significance to the Seneca Nation of Indians (Snyder 1993). Because decommissioning activities that could adversely impact Cattaraugus Creek and potential traditional cultural resources would be accomplished in a controlled manner, no impacts are expected (WSMS 2009a). As appropriate, DOE would coordinate with the Seneca Nation of Indians to address any impacts that could result from implementing this alternative.

4.1.7.2 Sitewide Close-In-Place Alternative

Prehistoric Resources

Under this alternative, key facilities would be closed in place. Other areas would be isolated and could remain under license or permit for the foreseeable future. About 10.1 hectares (25 acres) of previously undisturbed land would be affected by installation of erosion control features. If prehistoric resources are found, they would most likely be in areas that are not presently developed. As for the Sitewide Removal Alternative, due to the absence of prehistoric finds in the area, no impacts on prehistoric resources are expected. (The only artifact recovered from surveys of this area is considered to be a "stray find" because it was isolated and not found in association with other prehistoric cultural material or features.) If additional prehistoric resources were uncovered, work would stop and appropriate assessment, regulatory compliance, and recovery measures would be undertaken.

Historic Resources

As noted for the Sitewide Removal Alternative, no historic sites or structures that are eligible for the inclusion in the National Register of Historic Places have been identified during cultural resource surveys at WNYNSC. About 10.1 hectares (25 acres) of previously undisturbed land would be affected by erosion control features. If historic resources are found, they would most likely be in areas that are not presently disturbed. Although the majority of activities under the Sitewide Close-In-Place Alternative would occur within previously disturbed areas contained within or adjacent to developed areas, there is always the potential to unearth or expose cultural material during excavation. If historic resources were found, consultation with the State Historic Preservation Officer would be undertaken, as necessary, to determine the eligibility of any potentially disturbed sites for listing on the National Register of Historic Places, and, if appropriate, data and artifact recovery would be conducted. Further, mitigation measures would be developed and implemented should such a discovery occur.

Traditional Cultural Properties

Under this alternative, most activities would occur within previously disturbed areas contained within or adjacent to developed areas. Approximately 10.1 hectares (25 acres) of previously undisturbed land would be affected by installation of erosion control features. If traditional cultural properties were found, they would most likely be in areas that are not presently developed. Decommissioning activities that could adversely impact Cattaraugus Creek and potential traditional cultural properties would be accomplished in a controlled manner and impacts would be minimal (WSMS 2009b). As appropriate, DOE would coordinate with the Seneca Nation of Indians to address any impacts that could result from implementing this alternative.

4.1.7.3 Phased Decisionmaking Alternative

Prehistoric Resources

Under this alternative, decommissioning would be conducted in two phases. Phase 1 would initiate the decommissioning process for parts of WNYNSC, and Phase 2 would complete the decommissioning or long-term management process for the balance of WNYNSC. No impacts on prehistoric resources are expected. As stated for the previous alternatives, no significant prehistoric finds were discovered during previous surveys, although similar to that under the Sitewide Removal and Sitewide Close-In-Place Alternatives, there would be a greater potential for impact if Phase 2 activities involve disturbances of previously undeveloped land. There would be less disturbance of previously undeveloped land if the sitewide Phase 2 decision was to close the remaining waste and contamination in place than if the sitewide decision was to remove the remaining waste and contamination. Continued active management of the SDA would neither increase or decrease impacts because none of the SDA consists of previously undeveloped land.

If additional prehistoric resources were uncovered during construction, work would stop and appropriate assessment, regulatory compliance, and recovery measures would be undertaken.

Historic Resources

Under both phases of the Phased Decisionmaking Alternative, impacts on historic resources would be similar to those stated for the Sitewide Removal and Close-In-Place Alternatives. The existing historic sites and structures identified in previous surveys were not determined to have cultural significance, although if historic resources were found, they would be most likely be in areas that are not presently disturbed. There would be less disturbance of previously undeveloped land if the sitewide Phase 2 decision was to close the remaining waste and contamination in place than if the sitewide decision was to remove the remaining waste and contamination. Continued active management of the SDA would neither increase or decrease impacts because none of the SDA consists of previously undeveloped land.

If historic resources were found, consultation with the State Historic Preservation Officer would be undertaken, as necessary, to determine the eligibility of any potentially disturbed sites for listing on the National Register of Historic Places, and, if appropriate, data and artifact recovery would be conducted. Further, mitigation measures would be developed and implemented should such a discovery occur.

Traditional Cultural Properties

It is not expected that either phase of the Phased Decisionmaking Alternative would have any impacts on traditional cultural properties. As for the Sitewide Removal and Close-In-Place Alternatives, historic resources would be most likely found in areas that are not presently disturbed, and most decommissioning activities would occur within previously disturbed areas contained within or adjacent to developed areas. There would be less disturbance of previously undeveloped land if the sitewide Phase 2 decision was to close the remaining waste and contamination in place than if the sitewide decision was to remove the remaining waste and contamination. Continued active management of the SDA would neither increase or decrease impacts because none of the SDA consists of previously undeveloped land.

As appropriate, DOE would coordinate with the Seneca Nation of Indians to address any impacts that could result from implementing this alternative.

4.1.7.4 No Action Alternative

Prehistoric Resources

No actions toward decommissioning would be taken. No impacts on prehistoric resources are expected because no additional disturbances to previously undisturbed areas of the site are planned.

Historic Resources

No impacts on historic resources are expected because no additional disturbances to previously undisturbed areas of the site are planned.

Traditional Cultural Properties

No impacts on traditional cultural properties are expected under this alternative. Mitigation measures would be implemented as needed following the replacement or refurbishment of a structure, system, or component

(WSMS 2009d). As appropriate, DOE would coordinate with the Seneca Nation of Indians to address any impacts that could result from implementing this alternative.

4.1.8 Socioeconomics

Socioeconomic impacts are the result of changes to the demographic, economic, and social conditions of a region. The major measure in this analysis is the change in the number of jobs in the affected region. Jobs are characterized by two types: (1) construction-related jobs, which are transient in nature and short in duration, and thus, less likely to have a longer term socioeconomic impact; and (2) operations-related jobs in support of facility operations, which are required for a longer period of time, and thus, have a greater potential for permanent socioeconomic impacts in the region.

Potential economic impacts include the effects on employment, earnings, and output. Because earnings and output are a derivation of employment, this analysis focuses on employment impacts. **Table 4–11** lists the potential employment impacts estimated under each alternative. To provide a backdrop to realize the scale of the impacts, the average annual employment associated with the implementation of each alternative was compared to the projected regional labor force during the final year of decommissioning activities. Potential social and demographic impacts as a result of changes in employment and economic activity are discussed in this section.

Based on the expected changes in employment levels, the impact on economic conditions currently experienced within the ROI would be small. For the purposes of comparison, as of 2008, there were about 484,000 individuals employed in the two-county ROI (445,000 in Erie County and 39,000 in Cattaraugus County) (NYSDOL 2008b). The largest impact would be associated with implementing the Sitewide Removal Alternative, because this alternative would have a long-lasting, elevated worker requirement that would put the most money into the local economy. No change is expected in regional unemployment rates because the average requirements for additional workers at the site to support closure activities would be a very small percentage of workers in the region, and, more importantly, much of the work would be accomplished over relatively short periods of time by subcontractors hired to accomplish specific demolition or cleanup tasks. The businesses that accomplish these efforts typically work on jobs for set periods of time and then move on to other jobs, so it is not expected that the need for additional workers at the site would result in an influx of workers into the area during implementation of any of the alternatives. In some cases, personnel who may be losing permanent positions as activities are closed on site might transition to cleanup-related activities. There would eventually be a loss of employment at the site as a result of implementing the alternatives, but these losses would be known in advance and planning should allow the community to absorb the relatively small number of workers without unduly stressing existing support programs.

There would be no appreciable impact to the demographic characteristics of the ROI. The in-migration of workers, if any, to support the decommissioning or long-term management operations at WNYNSC under any of the alternatives would be small. Likewise, there would be no appreciable change in the current availability of housing and/or demand for community services within the ROI.

During implementation of the Sitewide Removal, Sitewide Close-In-Place, or Phased Decisionmaking (Phase 1) Alternatives, additional funds would flow into the local economy as a result of increased spending to support decommissioning activities. About $100 million (2008 dollars) of project funding is estimated to be spent annually implementing the decommissioning actions for each of these three alternatives (WSMS 2009e), although a large fraction of these funds would go toward shipping waste off site for alternatives that involve removal, and the full benefit of these funds would not necessarily flow into the local economy.

Table 4–11 Summary of Socioeconomic Impacts

Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Decommissioning Action Employment Levels	Greatest potential for socioeconomic impacts due to the longest duration of decommissioning actions (average 250 employees over 60 years). Employment levels would be a small fraction of regional employment, so there would be no discernible impact on socioeconomic infrastructure. Eventual reduction in employment is known and should be manageable.	Moderate potential for socioeconomic impacts over the duration of decommissioning actions (average 320 employees over 7 years). Employment levels would be a small fraction of regional employment, so there would be no discernible impact on socioeconomic infrastructure. Eventual reduction in employment is known and should be manageable.	Moderate potential for socioeconomic impacts over the duration of Phase 1 decommissioning actions (average 230 employees over 8 years). Additional employment could follow from the Phase 2 decision, depending on actions to be taken. If the Phase 2 decision is removal of all remaining waste and contamination, employment levels (in worker years) for this alternative would be similar to those for the Sitewide Removal Alternative; if the SDA Phase 2 decision is continued active management, the overall labor resources required to complete the alternative would decrease by about 25 percent. If the Phase 2 decision is close-in-place, the employment levels (in worker-years) would be equal to or slightly less than those for the Sitewide Close-In-Place Alternative; if the SDA Phase 2 decision is continued active management, the overall labor resources required to complete the alternative would decrease by about 15 percent. Employment levels would be a small fraction of regional employment, so there would be no discernible impact on socioeconomic infrastructure. Eventual reduction in employment is known and should be manageable.	No decommissioning action employment.
Monitoring and Maintenance Employment Levels	About 20 employees assuming onsite storage of orphan waste; none if onsite storage is not necessary.	About 31 employees until the Interim Storage Facility is removed in year 33; 18 employees thereafter.	About 50 employees until the Interim Storage Facility is removed in year 30. Longer-term employment depends on the Phase 2 decision.	About 75 employees, including the effective annual level for routine replacement activities.

SDA = State-Licensed Disposal Area.

4.1.8.1 Sitewide Removal Alternative

An average annual workforce of about 250 would be required throughout the 60-year implementation of this alternative, which would result in the highest number of worker-years of any of the decommissioning alternatives. Resulting indirect employment is expected to average about 270 workers. Peak staffing of approximately 300 is estimated to occur between years 26 and 31. The lowest staffing levels would be required during the last year of the decommissioning actions, when approximately 40 individuals would be needed during the final stages of excavation of the North Plateau Groundwater Plume (WSMS 2009a). Construction employment is estimated to peak at about 140 workers around year 3. The average total employment that could be attributed to implementing this alternative is estimated to be approximately 0.10 percent of the projected regional labor force during the final year of the implementation phase. Assuming no orphan waste has to be managed on site, no long-term monitoring staff would be required because the site would meet all the criteria for unrestricted release. If orphan waste must be managed on site, operations would cost approximately $3.7 million annually (WSMS 2009a) and require a staff of approximately 20 workers.

The level of employment associated with the Sitewide Removal Alternative is a very small percentage of the projected regional labor force and would not be considered a notable growth-inducing economic driver. Similarly, at the end of the project, the additional land available for release for unrestricted use is not expected to spur development or other growth-inducing factors.

4.1.8.2 Sitewide Close-In-Place Alternative

The average annual staffing requirements during the 7-year decommissioning period would be about 320 workers, which would result in fewer worker-years than that for the Sitewide Removal Alternative. The average indirect employment during decommissioning is estimated at about 340 workers. Peak employment of about 350 workers is estimated to occur around year 2. Construction employment is estimated to peak at about 131 workers around year 7. The average total employment for implementing this alternative would be approximately 0.13 percent of the projected ROI labor force during the final year of decommissioning actions. For purposes of analysis, operation of the Interim Storage Facility is projected to continue until about year 32, and be demolished the following year. After decommissioning of this facility, it is expected that the labor force of 31 employees would be reduced to 18 employees who would perform routine monitoring, maintenance, and systems replacement activities, including replacement of the North Plateau permeable treatment wall about every 20 years (WSMS 2009b).

The level of employment associated with the Sitewide Close-In-Place Alternative is a very small percentage of the projected regional labor force and would not be considered a notable growth-inducing economic driver. Similarly, at the end of the project, the additional land available for release for unrestricted use is not expected to spur development or other growth-inducing factors.

4.1.8.3 Phased Decisionmaking Alternative

During Phase 1, estimated annual staffing would average approximately 230 workers. The peak requirement of 330 workers would occur approximately in year 3 during construction of the Interim Storage Facility and removal of facilities such as the Main Plant Process Building and Low-Level Waste Treatment Facility area lagoons. The average indirect employment during Phase 1 decommissioning is estimated at about 250 workers. The average total employment due to activities at WNYNSC during Phase 1 is estimated to be 0.09 percent of the projected ROI labor force during the final year of Phase 1 decommissioning activities. Phase 1 decommissioning actions would be completed by year 8, but monitoring and maintenance activities would continue while onsite studies are conducted and the Interim Storage Facility is operational. Employment during this time would be about 50 workers. For purposes of analysis, the Interim Storage Facility was projected to operate until approximately year 30, when it would be demolished (WSMS 2009c). Activities associated with Phase 2 are expected to begin during the end of Phase 1 decommissioning actions or in the early years of the monitoring and maintenance period. If a Phase 2 decision is delayed past the completion of Phase 1 decommissioning activities, there could be a drop in employment until a Phase 2 decision is made.

If the Phase 2 decision is removal of all remaining waste and contamination, employment levels and related socioeconomic impacts for the entire Phased Decisionmaking Alternative would be similar to those described for the Sitewide Removal Alternative. If the decision for the SDA is continued active management, the employee resources necessary to implement removal would decrease due to the reduction in removal activity outweighing the addition of maintenance personnel. The decrease in removal activity would decrease labor requirements by approximately 3,800 worker-years (25 percent). It is estimated that approximately 10 employees would be required for continued active management of the SDA.

If the Phase 2 decision is in-place closure, employment levels for the entire Phased Decisionmaking Alternative would be equal to or slightly less than those described under the Sitewide Close-In-Place Alternative. If the Phase 2 decision for the SDA is continued active management, the employment resources necessary to implement sitewide closure would decrease due to the reduction in removal activity outweighing the addition of maintenance personnel. The decrease in removal activity would decrease the labor requirements by approximately 530 worker-years (15 percent). Again, approximately 10 employees would be required for continued active management of the SDA.

The level of employment associated with the Phased Decisionmaking Alternative is a very small percentage of the projected regional labor force and would not be considered a notable growth-inducing economic driver. Possible fluctuations in employment between completion of Phase 1 decommissioning activities and the implementation of Phase 2 would not cause a notable impact on unemployment rates in the ROI. At the end of Phase 2, the additional land that may be available for release for unrestricted use would not be expected to spur development or other growth-inducing factors.

4.1.8.4 No Action Alternative

Approximately 75 full-time-equivalent personnel would be required to monitor and maintain WNYNSC. These personnel would include operations personnel who would provide full-time staffing (i.e., 24 hours a day, 7 days a week). Also included would be engineering and maintenance personnel, as well as personnel within the various support organizations, including Quality Assurance, Industrial Hygiene and Safety, Purchasing, Financial, Environmental Affairs, Computer Support, Human Resources, Analytical Labs, and Security, as well as personnel expected to be required about every 20 to 25 years to replace roofs, the SDA and NDA geomembranes, and the permeable treatment wall (WSMS 2009d). The average indirect employment is estimated at about 80 workers. The average annual total employment attributed to the No Action Alternative is estimated to be 0.03 percent or less of the projected ROI labor force.

The level of employment associated with the No Action Alternative is a very small percentage of the projected regional labor force and would not be considered a notable growth-inducing economic driver. Similarly, the land available for release for unrestricted use is not expected to spur development or other growth-inducing factors.

4.1.9 Human Health and Safety During Decommissioning Activities

Actions to implement decommissioning would result in releases of radioactive materials to the atmosphere and to local surface waters. These releases would result in radiation doses and the risk of latent cancer fatalities (LCFs) to offsite individuals and populations, as well as occupational exposure to site workers. Accidents during decommissioning actions could result in doses to offsite individuals. Because fatal cancer is the most serious effect of environmental and occupational radiation exposures, estimates of cancer fatalities, rather than cancer incidence, are presented in this section. These effects are referred to as "latent" cancer fatalities because the cancer may take many years to develop. The numbers of fatal cancers can be used to compare the risks among the various alternatives.[8] A more-detailed discussion of LCFs is presented in Appendix I, Section I.3, of this EIS. (Note that cancer incidence [latent cancer morbidity] is analyzed in Section 4.1.10 to enable comparison of the projected long-term impacts under the EIS alternatives with the Comprehensive Emergency Response, Compensation, and Liability Act [CERCLA] risk range.)

Section 4.1.9.1 provides incident-free radiological impacts, while Section 4.1.9.2 presents accident-related radiological and chemical impacts. **Table 4–12** presents a comparison of the impacts under normal operations and accidents.

[8] The risk factor of 0.0006 fatal cancers per rem or person-rem (DOE 2002f) was used as the conversion factor for all radiological exposures due to accidents. For incident-free decommissioning operations resulting in radiological exposure, lifetime fatal cancer risk was calculated using radionuclide-specific risk factors.

Table 4–12 Summary of Health and Safety Impacts

Environmental Resource	Sitewide Removal Alternative	Sitewide Close-In-Place Alternative	Phased Decisionmaking Alternative	No Action Alternative
Total Public Population Dose	Total public population dose from decommissioning actions over 60 years would be approximately 120 person-rem and 0.0010 person-rem when the Interim Storage Facility is demolished. No public population dose would occur in the region following decommissioning actions, even if orphan waste was stored pending offsite disposal.	Total public population dose from decommissioning actions over 7 years would be approximately 40 person-rem. There would be a small additional dose of 0.00046 person-rem from each periodic North Plateau Groundwater Plume permeable treatment wall replacement, if necessary, and a one-time dose of 0.0010 person-rem when the Interim Storage Facility is demolished (total 0.0015 person-rem if both activities occur in the same year).	Total public population dose from the Phase 1 decommissioning actions over 8 years would be approximately 42 person-rem. There would be a small additional dose of 0.038 person-rem from one-time North Plateau Groundwater Plume permeable treatment wall replacement, if necessary, one-time Interim Storage Facility removal, and annual WMA 3 operations during Phase 1 after decommissioning actions. There would be an additional public population dose for the Phase 2 actions, which have not been defined at this time. Depending on the decision for Phase 2, the total decommissioning dose for both phases would be less than 82 person-rem if the Phase 2 decision is in-place closure and about 120 person-rem if the Phase 2 decision is removal. If the Phase 2 decision for the SDA is continued active management, the total population dose would be bounded by this range.	There would be no decommissioning actions. There would be a recurring annual dose of 0.083 person-rem per year as WNYNSC is monitored and maintained for the foreseeable future. This annual population dose would gradually decrease with time as the inventory decays.
Peak Annual MEI Dose	The peak annual dose to the MEI would be 1.3 millirem, due to releases to the atmosphere during decommissioning actions.	The peak annual dose to the MEI would be 0.16 millirem, due to air releases during decommissioning actions.	The peak annual dose to the MEI would be 2.2 millirem, due to releases to the atmosphere during decommissioning actions. Depending on the decision for Phase 2 (i.e., Sitewide Close-In-Place Alternative or Sitewide Removal Alternative), the peak annual Phase 2 dose would generally be no greater than that for the Sitewide Close-In-Place Alternative or Sitewide Removal Alternative. If the Phase 2 decision for the SDA is continued active management, the peak annual dose would be bounded for some receptors by the No Action Alternative.	The peak annual dose to the MEI would be 0.61 millirem, due to recurring liquid releases as the facilities are being monitored and maintained.
Total Worker Dose	Total worker population dose from decommissioning actions over 60 years is estimated to be approximately 990 person-rem. A recurring worker exposure of about 0.15 person-rem per year would occur following decommissioning actions if orphan waste is stored on site pending offsite disposal.	Total worker population dose from decommissioning actions over 7 years is estimated to be approximately 120 person-rem. A recurring worker exposure of about 0.80 person-rem per year would occur as part of monitoring and maintenance activities.	Total worker population dose from Phase 1 decommissioning actions over 8 years is estimated to be approximately 160 person-rem. There would be additional occupational exposure for Phase 1 actions following decommissioning of 1.7 person-rem per year. The total worker decommissioning dose for Phase 1 and Phase 2 would be 240 person-rem if in-place closure is chosen for Phase 2, and 990 person-rem if removal is chosen for Phase 2. Reduced total worker decommissioning doses would result if the Phase 2 decision for the SDA is continued active management.	There are no decommissioning actions. A recurring worker exposure of approximately 2.0 person-rem per year would occur as part of monitoring and maintenance activities, assuming no orphan waste is stored on site.
Potential Accidents – Relative Risk to the Population and MEI	Highest [a]	Low [a]	Low [a,b]	Lowest [a]

MEI = maximally exposed individual, SDA = State-Licensed Disposal Area.

[a] These terms are meant to show a relative comparison between alternatives of the very small radiological consequences and risks for all short-term accident scenarios for all alternatives.

[b] Depending on the decision for Phase 2 actions, the relative risk could remain low or be as high as that for the Sitewide Removal Alternative. This would be the case whether or not the Phase 2 decision for the SDA is continued active management.

4.1.9.1 Incident-free Radiological Impacts

Population

The Sitewide Removal Alternative, Sitewide Close-In-Place Alternative, and Phase 1 of the Phased Decisionmaking Alternative would each result in controlled releases of radionuclides to the atmosphere and surface streams during decommissioning. While there would be no decommissioning actions under the No Action Alternative, ongoing releases to the atmosphere and surface water would occur.

Controlled releases to air and water during decommissioning actions would result in doses to the surrounding general population. The releases are presented in terms of a peak annual population dose and a total population dose. Peak annual population dose is the largest dose expected for any of the years during decommissioning operations under each alternative; the total population dose is the sum of the annual doses over the periods of decommissioning under each alternative. The population dose for air releases is based on the dose to 1.7 million people in the U.S. and Canada who live within 80 kilometers (50 miles) of WNYNSC. The population dose for liquid releases is based on the dose to the population served by two water treatment systems that are within 80 kilometers (50 miles) of WNYNSC. Liquid releases flow off site via permitted outfalls into Cattaraugus Creek and ultimately into Lake Erie and the Niagara River, where they could enter water treatment plants. These water treatment plants serve 951,000 individuals. The drinking-water dose analysis conservatively assumes no radionuclide removal in the water treatment system. In addition, the potential exists for a population dose from the consumption of fish raised in Lake Erie. Fish yields from northern Lake Erie were used to establish an estimate of the amount of contaminated fish that might be consumed. This dose was added to the population dose for the Lake Erie and Niagara River water users. The GENII [Hanford Environmental Radiation Dosimetry Software System, Generation 11] Version 2 computer model (PNNL 2007) was used to estimate the radiological impacts of incident-free decommissioning operations. Discussion of the model and its application, along with results, is presented in Appendix I, Section I.4, of this EIS.

In addition, there could be long-term groundwater releases and potential unmitigated erosion releases under all of the alternatives, except that those for the Sitewide Removal Alternative would be very small because the potential sources of releases would be removed to levels consistent with applicable regulatory standards. The potential for long-term releases under the Phased Decisionmaking Alternative is not currently quantitatively evaluated, because Phase 2 activities have not been defined. Phase 2 releases would not be expected to be greater than those for the Sitewide Close-In-Place and No Action Alternatives, and in fact would be expected to be less because of the waste and contamination removed during Phase 1. Impacts from long-term releases are addressed in Section 4.1.10.

Table 4–13 summarizes the projected total population dose to the general population and the risk associated with this dose in terms of additional LCFs for each of the alternatives as a result of decommissioning actions. The projected dose to the general population for the decommissioning alternatives ranges from approximately 40 to 120 person-rem. These doses are expected to result in less than 1 (0.012 to 0.027) additional LCF within the affected population. In other words, no additional LCFs are expected in the population as a result of decommissioning actions.

The total decommissioning population dose for Phases 1 and 2 of the Phased Decisionmaking Alternative would depend the Phase 2 decision. Because some removal activities would occur during Phase 1, the total decommissioning population dose would be greater than that for the Sitewide Close-In-Place Alternative if the Phase 2 decision is in place closure of all remaining waste and contamination. The total dose for both phases would be less than 82 person-rem, which is the sum of the population dose for Phase 1 and the Sitewide Close-In-Place Alternative. The dose would be approximately the same as that for the Sitewide Removal

Alternative (120 person-rem) if the Phase 2 decision is to remove all remaining waste and contamination. The total decommissioning dose would be bounded by this range if the Phase 2 decision for SDA is continued active management because no decommissioning of the SDA would take place.

Table 4–13 Total Population Doses and Risk from Decommissioning Actions

Medium	Sitewide Removal Alternative (over 60 years)		Sitewide Close-In-Place Alternative (over 7 years)		Phased Decisionmaking Alternative – Phase 1 (over 8 years) [a]		No Action Alternative [b]	
	Dose (person-rem)	Risk (LCFs)	Dose (person-rem)	Risk (LCFs)	Dose (person-rem)	Risk (LCFs)	Dose [c] (person-rem)	Risk [c] (LCFs)
Air Releases [c]	72	0.011	2.3	0.00050	42	0.0056	NA	NA
Liquid Releases [c]	50	0.016	37	0.012	0.051	0.000016	NA	NA
Total	120	0.027	40	0.012	42	0.0056	NA	NA

LCF = latent cancer fatality, NA = not applicable.
[a] Phase 2 doses would be no greater than those for the Sitewide Removal or Sitewide Close-In-Place Alternatives if one of these actions is selected, or if the Phase 2 decision for the State-Licensed Disposal Area is continued active management.
[b] No decommissioning actions occur for the No Action Alternative.
[c] See text for descriptions of the populations addressed in the analyses.
Note: Totals may not add due to rounding.

In addition to total population dose, an estimate of the peak annual dose to the general population from the decommissioning actions for each of the decommissioning alternatives is presented in **Table 4–14**. The peak annual dose represents the highest projected annual dose to members of the general population for a given alternative. It is a function of the rate at which specific decommissioning activities occur. The peak annual dose to the general population would range from 10 to 27 person-rem, depending on the alternative.

Table 4–14 Peak Annual Population Dose from Decommissioning Actions (person-rem per year)

Medium	Sitewide Removal Alternative	Sitewide Close-In-Place Alternative	Phased Decisionmaking Alternative – Phase 1 [a]	No Action Alternative [c]
Air Releases [b]	7.9	0.64	14	NA
Liquid Releases [b]	2.5	26	0.009	NA
Total [d]	10	27	14	NA

NA = not applicable.
[a] Phase 2 doses would be no greater than those for the Sitewide Removal or Sitewide Close-In-Place Alternatives if one of these actions is selected.
[b] See text for descriptions of the populations addressed in the analyses.
[c] No decommissioning actions occur for the No Action Alternative.
[d] The listed totals are conservative because the peak year for both air and water releases would need to coincide to obtain the listed total collective doses.
Note: Totals may not add due to rounding.

For Phase 2 of the Phased Decisionmaking Alternative, the peak annual population doses from decommissioning would be bounded by the ranges shown for the Sitewide Removal and Sitewide Close-In-Place Alternatives. The peak annual doses and risks for Phase 2 could be smaller because of the decommissioning actions during Phase 1 that would remove some waste and contamination from the site. If the Phase 2 decision for the SDA is continued active management, peak annual Phase 2 decommissioning doses could be reduced because no decommissioning of the SDA would take place.

After completion of the decommissioning actions under the decommissioning alternatives, there are expected to be minimal atmospheric or water releases and thus, negligible population doses. The exception would be the maintenance actions for as-needed replacement of the permeable treatment wall and the removal of the Interim

Storage Facility for the Sitewide Close-In-Place Alternative and Phase 1 of the Phased Decisionmaking Alternative. The annual population doses due to releases after completion of the decommissioning actions are presented in **Table 4–15**. The doses shown for the Sitewide Close-In-Place and Phased Decisionmaking (Phase 1) Alternatives are peaks that are projected to occur during years when the permeable treatment wall maintenance actions would take place; the doses for the No Action Alternative apply to every year.

Table 4–15 Population Dose Following Completion of Decommissioning Actions (person-rem per year)

Medium	*Sitewide Removal Alternative* [a]	*Sitewide Close-In-Place Alternative* [b]	*Phased Decisionmaking Alternative – Phase 1* [c]	*No Action Alternative* [d]
Air Releases [e]	Negligible	0.0015	0.0015	0.0040
Liquid Releases [e]	Negligible	0.0	0.038	0.079
Total	Negligible	0.0015	0.038	0.083

[a] No releases are expected, even if orphan waste is stored.
[b] Doses are peak doses (about 0.00046 person-rem) coincident with periodic replacement of the permeable treatment wall (about every 20 years, if necessary), plus a one-time dose associated with demolition of the Interim Storage Facility (about 0.0010 person-rem). It is conservatively assumed that both doses occur in the same year.
[c] Air release doses are peak doses coincident with one-time replacement of the permeable treatment wall, and with one-time demolition of the Interim Storage Facility. Liquid release doses are from annual releases from WMA 3 from ongoing operations after completion of Phase 1 decommissioning actions. Annual population doses from the Phased Decisionmaking Alternative during Phase 2 decommissioning actions cannot be analyzed until a decision is made on Phase 2 actions. Phase 2 doses would be no greater than those for the Sitewide Removal or Sitewide Close-In-Place Alternatives if one of these actions is selected. Phase 2 doses could be larger if the Phase 2 decision for the State-Licensed Disposal Area is continued active management, but no greater than those for the No Action Alternative.
[d] Based on releases associated with continued operation of the existing ventilation and wastewater treatment systems. No decommissioning occurs for the No Action Alternative.
[e] See text for descriptions of the populations addressed in the analyses.
Note: Totals may not add due to rounding.

Peak annual population doses following decommissioning for Phase 1 of the Phased Decisionmaking Alternative are projected to be larger than those for the Sitewide Close-In-Place Alternative. The peak dose is projected to occur only once (if at all) during Phase 1 activities, but would occur periodically under the Sitewide Close-In-Place Alternative. Peak annual population doses are larger for Phase 1 because, in addition to those associated with as-needed permeable treatment wall replacement, releases to air and water (and therefore population doses) are conservatively projected from the waste and contamination not removed or closed in place during Phase 1 actions.

For the combined (Phase 1 and 2) Phased Decisionmaking Alternative, a range of annual population doses could result following completion of decommissioning actions depending on the Phase 2 decision. If the Phase 2 decision is removal of all remaining waste and contamination, the annual population dose would be negligible as summarized in Table 4–15. If the Phase 2 decision is in-place closure of all remaining waste and contamination, the annual population dose would be bounded by that for the Sitewide Close-In-Place Alternative. If the Phase 2 decision is continued active management of the SDA, the annual population dose would be bounded by that for the No Action Alternative.

Maximally Exposed Individual

This section analyzes the dose to the maximally exposed individual (MEI) from decommissioning actions. The MEI dose is the largest dose expected for any individual member of the public whether from air emissions or liquid emissions. The releases to the atmosphere and to surface water result in impacts in different locations. For this reason, the following discussion addresses three receptors, any one of whom could be the MEI. One MEI is assumed to be at the site boundary for maximum exposure to air emissions, while other MEIs are located downstream for maximum liquid exposure.

For air releases, because of distance and meteorological conditions, the receptor who would receive the highest dose is located about 1.3 kilometers (0.8 miles) north-northwest of the Main Plant Process Building. It is conservatively assumed that all the food (fruit, vegetables, and meat) consumed by this receptor is raised on or near the receptor's residence. This receptor is also assumed to spend time outside, to be directly exposed to the atmospheric releases. For liquid releases, two receptors are analyzed, either of which could be the MEI, depending on the radionuclides released. The first is a receptor assumed to be along Cattaraugus Creek downstream of the confluence with Buttermilk Creek, which is located about 5.6 kilometers (3.5 miles) downstream of the Main Plant Process Building. It is assumed that this receptor drinks untreated Cattaraugus Creek water and annually consumes approximately 9 kilograms (20 pounds) of fish that is raised in Cattaraugus Creek near its confluence with Buttermilk Creek. The second receptor who could be the MEI for liquid releases would be a receptor on the lower reaches of Cattaraugus Creek, located about 28.2 kilometers (17.5 miles) downstream from the site, who annually consumes 62 kilograms (137 pounds) of locally raised fish, and drinks untreated Cattaraugus Creek water. An individual living on Seneca Nation of Indians land could be such a receptor. A receptor at the site boundary would not be impacted by liquid releases because the closest liquid pathway is Buttermilk Creek, which is not located at the closest site boundary.

The projected doses to the three potential MEI receptors under each of the decommissioning alternatives are presented in **Table 4–16**. These dose calculations are based on the assumption that the MEI remains at the exposure point for the duration of the decommissioning actions. In the case of the Sitewide Removal Alternative, this would be 60 years; for the Sitewide Close-In-Place Alternative, 7 years; and for Phase 1 of the Phased Decisionmaking Alternative, 8 years. Under the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives, the receptor at the nearest site boundary has the largest total dose. The dose would be highest under the Sitewide Removal Alternative: a total dose of 14 millirem to the MEI at the site boundary over the decommissioning time period, which would equate to an increased risk of developing a fatal cancer of 2.9×10^{-6}, or approximately 1 chance in 350,000. The highest dose to the MEI under the Sitewide Close-In-Place Alternative would be 0.58 millirem, with an increased fatal cancer risk of 1.6×10^{-7}, or approximately 1 chance in 6 million. The dose to the MEI for Phase 1 of the Phased Decisionmaking Alternative would be 6.8 millirem, with an increased fatal cancer risk of 1.1×10^{-6}, or approximately 1 chance in 900,000. There is no dose or risk under the No Action Alternative in Table 4–16 because there would be no decommissioning actions under this alternative.

For Phase 2 of the Phased Decisionmaking Alternative, the total doses and risks to the MEI would be between the values shown for the Sitewide Removal and Sitewide Close-In-Place Alternatives. The doses and risks for Phase 2 would be somewhat smaller because of the decommissioning actions during Phase 1 that would remove some of the site waste and contamination. If the Phase 2 decision for the SDA is continued active management, the total dose and risk to the MEI during Phase 2 would be expected to be reduced because no decommissioning would take place for the SDA.

Table 4–17 shows the peak annual dose to the MEI from both air and liquid releases for the alternatives. All of these radiological doses would be in compliance with 40 CFR Part 61, Subpart H, and 40 CFR Part 141. The peak annual dose to the MEI from air emissions is 1.3 millirem under the Sitewide Removal Alternative, 0.16 millirem under the Sitewide Close-In-Place Alternative, 2.2 millirem for Phase 1 of the Phased Decisionmaking Alternative, and 0.29 millirem under the No Action Alternative. This considers releases while decommissioning actions are occurring as well as releases for monitoring and maintenance activities; it also considers releases for the No Action Alternative, which does not involve decommissioning actions.

[9] Depending on the decision for Phase 2 actions (i.e., removal or in-place closure), the MEI dose and risk for the entire Phased Decisionmaking Alternative would be no greater than those presented for the Sitewide Removal or Sitewide Close-In-Place Alternatives.

Table 4–16 Total Dose and Risk to the Maximally Exposed Individual from Decommissioning Actions

Receptor	*Sitewide Removal Alternative (Over 60 years)*		*Sitewide Close-In-Place Alternative (Over 7 years)*		*Phased Decisionmaking Alternative – Phase 1 (Over 8 years)* [a]		*No Action Alternative* [b]	
	Dose (millirem)	*Risk (LCF)*	*Dose (millirem)*	*Risk (LCF)*	*Dose (millirem)*	*Risk (LCF)*	*Dose* [b] *(millirem)*	*Risk* [b] *(LCF)*
Receptor at nearest site boundary (airborne releases)	14	2.9×10^{-6}	0.58	1.6×10^{-7}	6.8	1.1×10^{-6}	NA	NA
Receptor on Cattaraugus Creek near site (liquid and airborne releases)	3.1	5.7×10^{-7}	0.29	8.7×10^{-8}	1.7	2.2×10^{-7}	NA	NA
Receptor on lower reaches of Cattaraugus Creek (liquid and airborne releases)	0.65	2.3×10^{-7}	0.32	1.1×10^{-7}	0.029	3.9×10^{-9}	NA	NA

LCF = latent cancer fatality, NA = not applicable.

[a] Phase 2 doses would be no greater than those under the Sitewide Removal or Sitewide Close-In-Place Alternatives if one of these actions is selected. This would still be the case if the Phase 2 decision for the State-Licensed Disposal Area is continued active management.

[b] No decommissioning actions occur for the No Action Alternative.

Table 4–17 Peak Annual Dose and Risk to Potential Maximally Exposed Individual

Receptor	*Sitewide Removal Alternative*		*Sitewide Close-In-Place Alternative*		*Phased Decisionmaking Alternative – Phase 1* [a]		*No Action Alternative*	
	Dose (millirem)	*Risk (LCF)*	*Dose (millirem)*	*Risk (LCF)*	*Dose (millirem)*	*Risk (LCF)*	*Dose (millirem)*	*Risk (LCF)*
Receptor at nearest site boundary [b]	1.3	2.0×10^{-7}	0.16	4.2×10^{-8}	2.2	3.5×10^{-7}	0.29	9.3×10^{-9}
Receptor on Cattaraugus Creek near site [c]	0.32	4.7×10^{-8}	0.13	3.9×10^{-8}	0.54	7.2×10^{-8}	0.21	5.8×10^{-8}
Receptor on lower reaches of Cattaraugus Creek [c]	0.031	9.7×10^{-9}	0.12	4.0×10^{-8}	9.6×10^{-3}	1.2×10^{-9}	0.61	2.1×10^{-7}

LCF = latent cancer fatality.

[a] Peak Phase 2 doses would be no greater than those under the Sitewide Removal or Sitewide Close-In-Place Alternatives if removal or in-place closure is selected for Phase 2. Peak Phase 2 doses could be bounded for some receptors by the No Action Alternative if the Phase 2 decision for the State-Licensed Disposal Area is continued active management.

[b] Impacts due to airborne releases.

[c] Impacts due to air and liquid releases.

To provide perspective, the maximum peak annual dose to the MEI (2.2 millirem for Phase 1 of the Phased Decisionmaking Alternative) can be compared to the average dose from ubiquitous background and other sources of radiation. The average annual American radiation exposure is currently estimated to be about 620 millirem per year (NCRP 2009) (see Chapter 3, Table 3-16).

For Phase 2 of the Phased Decisionmaking Alternative, the peak annual MEI doses would depend on the decision. If the Phase 2 decision is removal of all remaining waste and contamination, the peak annual MEI doses would be bounded by those listed in Table 4-17 for the Sitewide Removal Alternative. If the Phase 2 decision is in-place closure of all remaining waste and contamination, peak annual MEI doses would be bounded by those listed in this table for the Sitewide Close-In-Place Alternative. If the Phase 2 decision is continued active management of the SDA, peak annual doses could be bounded for some receptors by the No Action Alternative.

Worker

This section presents estimates of the dose to the workers at WNYNSC during decommissioning actions and during the period following completion of decommissioning actions. The occupational doses were estimated as part of the preliminary engineering work under each alternative. The method for estimating occupational exposure is presented in the methodology technical report (WSMS 2009e), and the specific estimates are presented in the technical reports for the various alternatives (WSMS 2009a, 2009b, 2009c, 2009d).

The first row in **Table 4–18** shows the total dose to the worker population from decommissioning actions, while the second row shows the average annual individual worker dose from decommissioning actions. The third row on the table presents the annual worker population dose for activities following completion of the decommissioning actions as well as those from storage of waste, monitoring, maintenance, and as-needed replacement of the SDA geomembrane and North Plateau Groundwater Plume permeable treatment wall. The values in the third row are based on the assumption that no orphan waste remains on site. The fourth row presents the annual worker population dose for all the post-decommissioning actions in the third row, plus the dose from monitoring any orphan waste generated by decommissioning actions.

As shown in Table 4–18, total worker dose for the decommissioning alternatives ranges from approximately 120 person-rem under the Sitewide Close-In-Place Alternative to 990 person-rem under the Sitewide Removal Alternative. These doses would result in less than 1 (about 0.1 to 0.6) additional fatal cancer among the involved worker population. The average annual worker dose would range from 54 millirem under the Sitewide Close-In-Place Alternative to 83 millirem under Phase 1 of the Phased Decisionmaking Alternative. Note that DOE limits dose to a worker to 5 rem per year, but an administrative control level of 500 millirem per year has been established for activities on the Project Premises (10 CFR 835.202, WVNSCO 2006). All workers working in radiation areas would be monitored to ensure their doses are within annual limits.

The Sitewide Removal Alternative has no long-term activities other than potential storage of orphan waste. The Sitewide Close-In-Place Alternative would involve long-term monitoring and maintenance activities, and the incremental exposure from the storage of orphan waste would be very small. The annual worker population monitoring and maintenance dose following completion of the Phase 1 removal actions is greater than that for site maintenance under the Sitewide Close-In-Place Alternative because the facilities would be in a condition similar to the No Action condition and not placed in a low-maintenance configuration.

Total worker doses for the entire Phased Decisionmaking Alternative (Phase 1 and Phase 2) would be about 240 person-rem if the Phase 2 decision is in-place closure, and about 990 person-rem if the Phase 2 decision is removal of remaining waste and contamination. Reduced total worker decommissioning doses would result if the Phase 2 decision for the SDA is continued active management. For Phase 2 actions following decommissioning, the total annual worker population dose would be very low as shown in Table 4–18 if the Phase 2 sitewide decision is removal or in-place closure. The total annual worker population dose could be larger if the Phase 2 decision for the SDA is continued active management, but would be bounded by that for the No Action Alternative.

The range of annual doses to the post-decommissioning monitoring and maintenance worker can be also estimated based on a review of historical data. Site workers performing work similar to the type envisioned for post-decommissioning monitoring and maintenance, plus some higher-exposure work, receive annual doses of 10 millirem per year to 60 millirem per year. When allowances are made for the fact that higher-exposure work would not be included in post-decommissioning monitoring and maintenance, it is estimated that the annual dose to post-decommissioning monitoring and maintenance workers would generally be in the range of 10 to 20 millirem per year.

Table 4–18 Projected Worker Dose and Risk During and After Decommissioning

	Sitewide Removal Alternative		***Sitewide Close-In-Place Alternative***		***Phased Decisionmaking Alternative – Phase 1*** [b]		***No Action Alternative*** [d]	
	Dose	***Risk (LCF)***	***Dose***	***Risk (LCF)***	***Dose***	***Risk (LCF)***	***Dose***	***Risk (LCF)***
Total worker population dose from decommissioning actions (person-rem) [a]	990	0.60	120	0.070	160	0.090	NA	NA
Average individual worker dose from decommissioning actions [a] (millirem per year)	66	0.00004	54	0.000030	83	0.000050	NA	NA
Total annual worker population dose for actions following decommissioning actions—no generated orphan waste monitoring and maintenance (person-rem per year)	0.0	0.0	0.80	0.0005	1.7	0.001	2.0	0.0010
Total annual worker population dose for actions following decommissioning actions—with generated orphan waste monitoring and maintenance (person-rem per year)	0.15	0.000090	0.80 [c]	0.00050	1.7 [c]	0.001	2.1	0.0010

LCF = latent cancer fatality, NA = not applicable.

[a] Based on a total workforce of 250, 320, and 230 persons for the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives, respectively.

[b] Depending on the decision for Phase 2 actions (e.g., removal or close-in-place), the Phase 2 projected worker dose and risk during decommissioning would be no greater than that projected for the Sitewide Removal or Sitewide Close-In-Place Alternatives. If the Phase 2 decision is removal, the total worker population dose for Phase 2 would be about 830 person-rem. If the Phase 2 decision is in-place closure, the total worker population dose for Phase 2 would be about 76 person-rem. Phase 2 doses would be reduced in either case if the Phase 2 decision for the State-Licensed Disposal Area is continued active management.

[c] The contribution to this dose from orphan waste is small relative to that from the other wastes.

[d] The No Action Alternative has no decommissioning actions.

Sources: WSMS 2009a, 2009b, 2009c, 2009d, 2009e.

Table 4–19 presents the estimated worker nonradiological accidents and fatalities that could occur from actions planned for each of the proposed alternatives. These estimates were projected using data from DOE's historical database for worker injuries and fatalities at its facilities (WSMS 2009a, 2009b, 2009c, 2009d, 2009e). These estimates are conservative in that the average WNYNSC injury rates for the period 1999 through 2005 were about half of those obtained from the overall DOE historical database, as discussed in Chapter 3, Section 3.11.4 of this EIS, and smaller than the average injury rates associated with related industries. Using the projected number of hours involved in implementing the alternatives and the historical accident rates, it is estimated that over 60 years, the number of reportable cases would be 556 for the Sitewide Removal Alternative with 267 lost workdays; for the Sitewide Close-In-Place Alternative, over 60 years, there would be 131 reportable cases and 63 lost workdays. Phase 1 of the Phased Decisionmaking Alternative would result in 122 reportable cases and 59 lost workdays, over 30 years. If removal of all remaining waste and contamination was selected for Phase 2, the total number of reportable cases, lost workdays, and worker fatalities for Phase 2 could be as many as that for the Sitewide Removal Alternative; if close-in-place is selected for all remaining waste and contamination, the total numbers for Phase 2 could be as many as that for the Sitewide Close-In-Place Alternative. If the Phase 2 decision for the SDA is continued active management, the total numbers for Phase 2 would be expected to be less than or equal to those for the Sitewide Removal or Sitewide Close-In-Place Alternatives.

Over 60 years, there would be 148 reportable cases and 71 lost workdays for the No Action Alternative. No fatalities from worker accidents are expected under any of the alternatives. These estimates are for work accomplished on site and do not include transportation accidents. Transportation accidents are addressed in Section 4.1.12, Transportation, of this EIS.

Table 4–19 Conventional Worker Injuries and Fatalities for Implementing Each Alternative

				No Action Alternative (over 60 years)
Total Reportable Cases	556	131	122	148
Lost Workday Cases	267	63	59	71
Estimated Fatalities	0.22	0.06	0.05	0.045

[a] To provide a basis of comparison among the alternatives, impacts are presented over a 60-year period for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternative; and, for purposes of analysis, 30 years for Phase 1 of the Phased Decisionmaking Alternative.

4.1.9.2 Accident Impacts

Radiological Accident Impacts

This section estimates the consequences of significant radiological accidents and radiological accident risk during decommissioning activities under the decommissioning alternatives. The consequences of short-term significant radiological accidents that could occur over minutes to days are presented both in terms of radiation dose and LCFs. LCFs from radiation doses are based on a 50-year latent time period after exposure to a radiation dose. The LCF risks are based on accident-specific probability estimates.

For each alternative, a range of postulated accidents that encompasses a range of annual frequencies and radiological consequences was examined to provide a basis for estimating risk and for understanding the differences in accident risks for the various alternatives.

Radiological accidents were identified by reviewing the description of facilities and operations presented in the engineering reports for each of the alternatives (WSMS 2009a, 2009b, 2009c, 2009d, 2009e), the West Valley Safety Analysis Report (WVNS 2004a), and relevant EISs including the *Final West Valley Demonstration Project Waste Management Environmental Impact Statement (Waste Management EIS)* (DOE/EIS-0337F) (DOE 2003e), and the *Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Center (Plutonium Residues EIS)* (DOE/EIS-0277F) (DOE 1998). The *Plutonium Residues EIS* is relevant to this analysis because it analyzes a number of accidents involving buildings or structures with similar contamination and seismic collapse scenarios as the Main Plant Process Building accident scenario analyzed in this EIS.

Accident scenario identification focuses on accidents that would have greater consequences or higher frequencies (i.e., greater than 10^{-6} per year); therefore, attention was focused on buildings or structures that have high radionuclide inventories (the Main Plant Process Building and the Waste Tank Farm), as well as operations that are conducted multiple times (the filling and handling of waste packages) or that would have limited or no features that would mitigate the effects of an accident (outdoor waste package handling operations). Radionuclide inventories in other facilities and in soil being removed are at a much lower concentration or activity level, and accidents involving them would be bounded by potential accidents involving the aforementioned structures and components.

After the spectrum of accidents was identified, release fractions and accident frequency were estimated. The previously noted safety analysis reports and EISs provided a basis for estimating accident frequency. The radiological impacts of accident releases were calculated using the MACCS2 computer code (Sandia 1997), which estimates radiological doses and health effects from accidental releases to the atmosphere. A further description of the accident identification and analysis methodology is presented in Appendix I, Section I.5.

A total of 15 individual accident scenarios were analyzed, including a scenario involving the Main Plant Process Building, a scenario involving the Waste Tank Farm, 11 scenarios involving radioactive waste packages, a scenario involving the NDA, and a scenario involving the SDA. The accident scenarios for the Main Plant Process Building and the Waste Tank Farm are assumed to be initiated by a seismically induced structural failure. The radioactive waste package accident scenarios encompassed all the different types of waste packages and initiators such as a drop, puncture, or fire. The NDA and SDA accident scenarios involve exhumation and plume release initiated by a fire. A detailed discussion of the different accident scenarios is presented in Appendix I, Section I.5.

This EIS does not present a quantitative analysis of accident consequences and risks to workers because there is no adequate method for calculating meaningful consequences at or near the location where the accident occurs. The results are dependent on details of worker location and actions immediately following the accident and parameters that have a very large uncertainty and vary significantly over time. The risk to these workers would be due to both radiological and nonradiological effects. For example, in a fire, the involved workers could be exposed to both airborne radioactive material and the smoke and heat of the fire. Similarly, in an earthquake, involved workers could be exposed to both airborne radioactive material and could be injured or killed by the collapse of a structure before they could be evacuated.

The consequences and annual risks for the dominant accident scenarios associated with each alternative are presented in **Table 4–20**. For each alternative, the largest consequence estimate to the general population and the MEI, as well as the dominant annual risk contributor, are in **bold**. It should be noted that for the Phased Decisionmaking Alternative, only Phase 1 accident consequences and risks have been analyzed. Accident consequences and risks for Phase 2 of this alternative could be larger, depending on the decision about further actions, but they would be no greater than those for the Sitewide Removal Alternative. This would be the case whether or not the Phase 2 decision for the SDA is continued active management.

To put the doses from these accidents in perspective, the largest dose to the MEI of 0.68 rem from the Greater-Than-Class C drum puncture scenario is below any dose for which any health effects could occur in an individual, and much lower than the allowable annual worker dose. The maximum MEI latent cancer risk of 0.000037 from the Greater-Than-Class C drum puncture accident scenario means there would be about 1 chance in 27,000 of an LCF to the MEI for the most severe accident. For comparison and assuming one such accident over the lifetime of a worker, the latest National Cancer Institute statistics (NCI 2008) indicate that the chance of a fatal latent cancer in all Americans over their lifetime is about 0.22, or slightly greater than one chance in five.

For perspective the maximum accident population dose of 3.4 person-rem may be compared to the annual average population dose from ubiquitous background and other sources of radiation (NCRP 2009) of 1.1 million person-rem that would be received by the 1.7 million residents within an 80-kilometer (50-mile) radius of WNYNSC. Another perspective on the population dose from this postulated bounding accident is that the risk to the average individual in the general population in terms of developing an LCF from a 3.4-person-rem population dose is 1.3×10^{-9}, or 1 chance in 770 million.

Table 4–20 Dominant (Bounding) Accident Annual Risk and Consequences During Decommissioning

Bounding Accident	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative – Phase 1* [e]	*No Action Alternative*
Main Plant Process Building Collapse (frequency = 0.0001 per year)				
Population dose	0.68 person-rem	0.68 person-rem	0.68 person-rem	**0.68 person-rem**
MEI dose [a]	0.046 rem	0.046 rem	0.046 rem	**0.046 rem**
Population annual risk	4.1×10^{-8}	4.1×10^{-8}	4.1×10^{-8}	**4.1×10^{-8}**
MEI annual risk [a]	2.7×10^{-9}	2.7×10^{-9}	2.7×10^{-9}	**2.7×10^{-9}**
Radioactive Waste Package Handling Accidents				
Greater-Than-Class C Drum Puncture [d] *(frequency = 0.09 per year)*				
Population dose	1.9 person-rem	Not applicable	Not applicable	Not applicable
MEI dose [b]	**0.68 rem**			
Population annual risk	**0.00010**			
MEI annual risk [b]	**0.000037**			
Transuranic (remote-handled) Drum Puncture [d] *(frequency = 0.09 per year; 0.01 per year; 0.1 per year)* [f]				
Population dose	0.27 person-rem	0.27 person-rem	0.27 person-rem	Not applicable
MEI dose [b]	0.029 rem	0.029 rem	0.029 rem	
Population annual risk	1.5×10^{-5}	**1.6×10^{-6}**	**1.6×10^{-5}**	
MEI annual risk [b]	1.6×10^{-6}	1.8×10^{-7}	1.7×10^{-6}	
High-Integrity Container Fire (frequency = 0.0001 per year)				
Population dose	**3.4 person-rem**	**3.4 person-rem**	**3.4 person-rem**	Not applicable
MEI dose [b]	0.053 rem	**0.053 rem**	**0.053 rem**	
Population annual risk	2.0×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	
MEI annual risk [b]	3.2×10^{-9}	3.2×10^{-9}	3.2×10^{-9}	
High-Integrity Container Puncture [d] *(frequency = 0.09 per year; 0.01 per year; 0.1 per year)* [f]				
Population dose	0.12 person-rem	0.12 person-rem	0.12 person-rem	Not applicable
MEI dose [b]	0.033 rem	0.033 rem	0.033 rem	
Population annual risk	6.5×10^{-6}	7.3×10^{-7}	7.2×10^{-6}	
MEI annual risk [b]	1.8×10^{-6}	**2.0×10^{-7}**	**2.0×10^{-6}**	
Class B/C Box Puncture [d] *(frequency = 0.09 per year; 0.01 per year; 0.1 per year)* [f]				
Population dose	0.12 person-rem	0.12 person-rem	0.12 person-rem	Not applicable
MEI dose [b]	0.028 rem	0.028 rem	0.028 rem	
Population annual risk	6.5×10^{-6}	7.3×10^{-7}	7.2×10^{-6}	
MEI annual risk [b]	1.5×10^{-6}	1.6×10^{-7}	1.7×10^{-6}	
Class A Box Puncture [d] *(frequency = 0.09 per year; 0.01 per year; 0.1 per year; 0.005 per year)* [f]				
Population dose	0.00038 person-rem	0.00038 person-rem	0.00038 person-rem	0.00038 person-rem
MEI dose [b]				
Population annual risk	0.000091 rem	0.000091 rem	0.000091 rem	0.000091 rem
MEI annual risk [b]	2.0×10^{-8}	2.3×10^{-9}	2.3×10^{-8}	1.1×10^{-9}
	5.0×10^{-9}	5.5×10^{-10}	5.5×10^{-9}	2.7×10^{-10}
Radioactive Waste Exhumation Accident				
SDA Exhumation Fire (frequency = 0.0001 per year)				
Population dose	0.078 person-rem	Not applicable	Not applicable	Not applicable
MEI dose [c]	0.0034 rem			
Population annual risk	4.7×10^{-9}			
MEI annual risk [c]	2.0×10^{-10}			

MEI = maximally exposed individual, SDA = State-Licensed Disposal Area.

[a] Located 244 meters (800 feet) from the accident.

[b] Located 183 meters (600 feet) from the accident.

[c] Located 2,500 meters (8,200 feet) from the accident.

[d] This accident scenario assumes human error while handling the package, which results in an object penetrating the confinement wall of the package and a release of radioisotopes to the environment.

[e] Phase 2 doses would be no greater than those for the Sitewide Removal or Sitewide Close-In-Place Alternatives if one of these actions is selected. This would still be the case if the Phase 2 decision for the State-Licensed Disposal Area is continued active management.

[f] The listed three frequencies are for accidents associated with the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives, respectively.

Note: Not applicable indicates that the specific type of radioactive waste package is not used for the alternative.

In considering the overall risk from accidents for an alternative, it is necessary to consider the duration of the various operations in the decommissioning process. In addition, in the case of radioactive waste package handling accidents, the total number of packages and annual handling rate must be considered. **Table 4–21** is a summary of the estimated number of years that each type of operation would occur under each alternative and the respective number of radioactive waste packages handled. This table only presents values for Phase 1 of the Phased Decisionmaking Alternative. Phase 2 could result in additional radioactive waste package handling up to that analyzed for the Sitewide Removal Alternative, depending on the Phase 2 decision.

Table 4–21 Duration for Major Accident Scenarios

	Sitewide Removal Alternative	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)*	*No Action Alternative*
Years before initiating Main Plant Process Building removal or stabilization	5	1	1	No removal or stabilization
Years before Waste Tank Farm removal or stabilization	20	2	No removal or [b] stabilization	No removal or stabilization
Years of radioactive waste package handling during decommissioning actions	60	7	8	0 [a]
Number of radioactive waste packages handled	256,564	3,904	35,069 [b]	4,294 every 20 years [a]
Annual radioactive waste package handling rate	4,276	558	4,384 [b]	215 [a]

[a] Average over 20-year time intervals to account for periodic waste disposal, along with annual expected waste disposal volumes, and assumes drums for Class A waste and the low-specific-activity container for low-specific-activity waste. This alternative does not involve preparation for decommissioning.

[b] The status of the Waste Tank Farm and numbers/ratio of radioactive waste packages may change for Phase 2, depending on Phase 2 decision.

Sources: WSMS 2009a, 2009b, 2009c, 2009d.

The combination of the annual risk estimate for various accident types and the activity duration estimates supports the development of an overall relative risk estimate for the EIS alternatives for accidents that would involve short-term releases of radionuclides to the atmosphere. This overall relative risk is presented in **Table 4–22**. The terms used in this table (highest, low, and lowest) are intended to convey a relative qualitative assessment of the accident risk among the alternatives. The absolute magnitude of accident consequences and risks for all alternatives is estimated to be very small and is not expected to present a significant health risk to the general population.

Table 4–22 Relative Accident Population and Maximally Exposed Individual Annual Risk Comparison Rating Between Alternatives

Sitewide Removal Alternative	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)*	*No Action Alternative*
Highest [a]	Low [a]	Low [a, b]	Lowest [a]

[a] These terms are meant to show a relative comparison between alternatives of the very small radiological consequences and risks for all short-term accident scenarios for all alternatives.

[b] Depending on the Phase 2 decision, the relative risk could remain low or be as high as that for the Sitewide Removal Alternative. This would be the case whether or not the Phase 2 decision for the State-Licensed Disposal Area is continued active management.

The Sitewide Removal Alternative has the greatest potential for a short-term accident with the highest consequences and is expected to have the highest overall short-term accident risk because it has the greatest number and duration of higher radioactivity content waste removal, packaging, and handling operations, and because the actions would take place over a longer period of time.[10]

The most significant short-term accident scenarios for the Sitewide Close-In-Place, Phased Decisionmaking (Phase 1),[10] and No Action Alternatives have lower projected consequences than the Sitewide Removal Alternative accident scenarios. The overall accident risk for these alternatives is estimated to be less than the overall accident risk for the Sitewide Removal Alternative. The overall accident risk for Phase 1 of the Phased Decisionmaking Alternative is slightly higher than the risk for the Sitewide Close-In-Place and No Action Alternatives as a result of the additional activity related to the Main Plant Process Building removal and the greater number of annual radioactive waste handling operations.

The most serious accident for the No Action Alternative, in terms of population dose, is the same as that for the Sitewide Close-In-Place and Phased Decisionmaking (Phase 1) Alternatives,[10] but the overall risk from accidents involving short-term releases to the atmosphere for this alternative is estimated to be lower than the risk for the other two alternatives. The No Action Alternative does, however, have a higher risk of groundwater contamination over the long term as a result of degradation of the Main Plant Process Building and Waste Tank Farm because these facilities are not remediated under this alternative. It should also be noted that there are no plans for removal of the high-level radioactive waste tanks in Phase 1 of the Phased Decisionmaking Alternative.

Toxic Chemical Accident Impacts

The basic method for toxic chemical accident analysis is comparable to that used for radioactive material accident analysis. The methodology and more-detailed results are presented in Appendix I, Section I.5.8, of this EIS.

The operations that would be conducted under the various alternatives do not involve the use of toxic chemicals as process chemicals; therefore, no processing accidents involving hazardous chemicals were analyzed.

Inventories of Resource Conservation and Recovery Act (RCRA) hazardous materials have been estimated within the Waste Tank Farm, the Main Plant Process Building, the NDA, and the SDA (WSMS 2005a, 2005b, 2005c; SAIC 2005a, 2005b). These inventories exist within equipment and individual components such as switches, lamps, and shielded windows, and are not concentrated in one tank or physical location. Their physical and chemical forms are not consistent with serious accident consequences because the inventory is limited, generally solid, and dispersed. In the event of an accident involving a high-level radioactive waste tank, Main Plant Process Building, or the NDA or SDA, the largest risks would be associated with the radioactive materials, as discussed earlier in this section. Any risk from toxic chemicals present in these areas would be a fraction of the radiological risk. Based on the type, form, and distribution of toxic chemicals at WNYNSC, no credible toxic chemical accidents affecting worker or public health are expected to occur.

4.1.10 Long-term Human Health

This section summarizes the long-term human health consequences under the four EIS alternatives. The estimate of consequences under the Sitewide Removal Alternative is based on knowledge of the residual contamination standard that would be applied to the removal actions. The estimates of consequences under the Sitewide Close-In-Place and No Action Alternatives are based on models designed to reflect what are

[10] *The Phase 2 decision for the Phased Decisionmaking Alternative may change the relative risk of this alternative.*

considered to be the major physical processes controlling the movement of contaminants through the environment. Radiological dose and cancer risk are the measures of consequence used in this analysis for radionuclides, cancer risk for carcinogenic hazardous materials, and Hazard Quotients for non-carcinogenic hazardous materials. The risk results are also compared with the CERCLA risk range: according to EPA the appropriate measure of impact for this comparison is risk of cancer (EPA 1989).

The dose and risk depend upon contaminant release rate, contaminant movement through the environment, and the location and timing of human actions that would result in human exposure to radionuclides and hazardous chemicals. Predictions of human behavior are not considered to be reliable and so a spectrum of scenarios that cover a range of hypothetical human actions was defined and evaluated. The scenarios evaluated include an optimistic bound, for which it was assumed that institutional controls were effective in keeping surface engineered features (e.g., roofs, engineered covers) maintained and in preventing human intrusion onto the site. The scenarios also include a more-pessimistic case where it was assumed that institutional controls are lost after 100 years and remain that way, allowing hypothetical individuals to access the site and undertake a variety of activities at a variety of locations. The scenarios also include an unmitigated erosion case that would result in consequences only after an extended period of time following loss of institutional controls.

No specific analysis was conducted for the long-term human health consequences for the Phased Decisionmaking Alternative. The long-term impacts of this alternative depend on the Phase 2 decision for the Waste Tank Farm, the NDA, and the SDA. If a removal decision is made for all these facilities, the consequences would be comparable to those estimated for the Sitewide Removal Alternative. If an in-place closure decision is made for all these facilities, the consequences would be comparable to those estimated for the Sitewide Close-In-Place Alternative. If the Phase 2 decision for the SDA is continued active management, the consequences for some exposure scenarios and receptors would be bounded by those for the No Action Alternative.

4.1.10.1 Summary of Long-term Performance Assessment

Changes to the Long-Term Performance Assessment for this Final EIS

The near-field hydrologic flow model and the erosion model were revised for the Final EIS. The lateral extent of the North Plateau near-field hydrologic flow model was extended to include the entirety of the thick-bedded unit and slack-water sequence and the specification of stratigraphy was revised to reflect the current understanding of the structure of the slack-water sequence. Additional details on the revised structural interpretation and its implications on near-field flow are discussed in Appendix E, Section E.4. The increased North Plateau flow rate resulted in higher short-term and lower long-term doses for postulated users of North Plateau groundwater. Other changes for the Final EIS that influenced the predicted doses for exposure scenarios were changes in the Waste Tank Farm inventory to reflect planned DOE decontamination actions, changes in estimated flow tube width, and a correction in radionuclide decay chain data for the direct intrusion analysis. For groundwater release scenarios, most peak annual dose estimates for specific source areas changed by less than a factor of two. The peak annual dose to an intruder who uses North Plateau groundwater decreased compared to the Revised Draft EIS because more of the plume inventory is projected to move off site before the intrusion is postulated. The revised dose estimates resulting from the revised near-field flow model are presented in Sections 4.1.10.3.1 and 4.1.10.3.2.

The basic approach of using a site-calibrated landscape evolution model was retained for the Final EIS. The CHILD model was recalibrated using probabilistic (Monte-Carlo) techniques to identify five sets of parameters that allow the model to predict a topography comparable to current conditions at a rate consistent with known Buttermilk Creek downcutting rates. These five sets of calibration parameters were used to project future topography for an unmitigated erosion scenario. The calibrated model predicted gully advance rates that decreased with time. Projected gully advance rate was greater when the analysis assumed a climate that is wetter than current conditions. The faster gully advance rate was used for the revised erosion dose analysis. Overall, the estimated doses for individuals who ingested contamination released by erosion decreased for the Final EIS as a result of the using a gully with a decreasing advance rate. The dose estimates resulting from the revised erosion analysis are presented in Section 4.1.10.3.3.

Table 4–23 presents a summary of the long-term human health consequences under the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives expressed in terms of radiological dose. The table is limited to the presentation of dose information because the analysis showed that the peak risk to all hypothetical receptors is from radiological constituents rather than chemically hazardous constituents. The term "hypothetical receptors" is used because none of the doses and risks calculated in Section 4.1.10 represent impacts to real individuals; the receptors are assumed to be in locations and pursue activities that would result in upper-bound assessments of dose and risk. Results are presented for three cases—institutional controls remain in effect, loss of institutional controls after 100 years without erosion, and loss of institutional control after 100 years with unmitigated erosion.

The top section of Table 4–23 compares doses to populations and individual receptors assumed to use untreated water obtained from Lake Erie or the Niagara River; the second section compares doses to postulated receptors assumed to farm alongside and use untreated water from Cattaraugus Creek downstream of WNYNSC; and the third section compares doses to a spectrum of postulated receptors assumed to access WNYNSC after institutional controls are lost. The Lake Erie and Niagara River water user populations and individual receptors were assumed to consume and garden with untreated river or lake water, and to consume fish from the lake. The Cattaraugus Creek receptors were assumed to consume water and fish and irrigate farms with untreated water obtained either directly downstream of WNYNSC or on the lower reaches of the creek. The receptor at the latter location was assumed to consume larger quantities of fish than other receptors, and could be a member of the Seneca Nation of Indians. The onsite receptors were assumed to undertake activities such as hiking and recreation, housing or well construction, onsite farming, or well-water use in contaminated areas, or to use untreated water from Buttermilk Creek for consumption or farming.

The results show the importance of institutional controls in keeping potential receptors away from direct contact with contaminated media (soil and water). The results also show that either institutional controls or engineered barriers can protect receptors along Buttermilk Creek and offsite.

Details of the long-term human health consequences are presented in the balance of this section. More-detailed information is presented in various appendices.

- Appendix H contains information on the details of the analysis and analytical results. The appendix contains sensitivity analyses and a discussion on why the deterministic analysis is considered to be conservative.

- It also contains a more-detailed identification of receptors and has figures that show the locations of receptors:

  - Figure H–2 shows the locations of the offsite receptors.

  - Figure H–3 shows the locations of the receptors chosen for erosion modeling of the Low-Level Waste Treatment Facility, NDA, and SDA, and of the wells used in contaminated groundwater scenarios.

- Appendix E contains a description of the groundwater models (three-dimensional and one-dimensional) used in the Long-term Performance Assessment.

- Appendices F and G present a description of the unmitigated erosion models used in the Long-term Performance Assessment.

Appendix G presents a description of how the various onsite and offsite scenarios were modeled, and specifically how human health impacts were calculated.

Table 4–23 Summary of Long-Term Human Health Consequences

Cases	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Postulated Offsite Receptors – Lake Erie/Niagara River Water Users			
Institutional controls remain in effect	There would be a negligible dose	There would be a peak annual dose of about 0.2 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie (Table 4–29, footnote d). The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be approximately 34,000 person-rem (Table 4–30). [a]	There would be a peak annual dose of about 0.2 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie (Table 4–29, footnote d). The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be approximately 35,000 person-rem (Table 4–30). [a]
Loss of institutional controls after 100 years, without erosion	Same; no discernable effect due to loss of institutional controls	There would be a peak annual dose of about 0.2 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie (Table 4–38, footnote d). The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be approximately 34,000 person-rem (Table 4–39). [a]	There would be a peak annual dose of about 0.6 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie (Table 4–38, footnote e). The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be about 120,000 person-rem (Table 4–39). [a]
Loss of institutional controls after 100 years, with unmitigated erosion	Same; no discernable effect due to loss of institutional controls	There would be a peak annual dose of about 0.4 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie Table 4–44. [a] The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be about 1 million person-rem (Table 4–45). [a]	There would be a peak annual dose of about 2.7 millirem per year to a resident farmer using untreated water for drinking and irrigation and consuming fish raised in Lake Erie (Table 4–44, footnote a). The total population dose accumulated over 10,000 years by Lake Erie/Niagara River water users would be about 1.4 million person-rem (Table 4–45). [a]
Postulated Cattaraugus Creek and Seneca Nation of Indians Receptors			
Institutional controls remain in effect	There would be a negligible dose	There would be peak annual doses of less than 0.7 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation (Tables 4–24 and H–56).	There would be peak annual doses of less than 0.7 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation (Tables 4–24 and H–56).
Loss of institutional controls after 100 years, without erosion	Same; no discernable effect due to loss of institutional controls	There would be peak annual doses of less than 0.7 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation (Tables 4–35 and H–56).	There would be peak annual doses of 2-3 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation(Tables 4–35 and H–56).

Cases	Sitewide Removal Alternative	Sitewide Close-In-Place Alternative	No Action Alternative
Loss of institutional controls after 100 years, with unmitigated erosion	Same; no discernable effect due to loss of institutional controls	There would be peak annual doses of less than about 4 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation (Tables 4–42 and 4–43).	There would be peak annual doses of 15 to 34 millirem per year to a resident farmer using untreated Cattaraugus Creek water for drinking and irrigation and consuming fish raised in Cattaraugus Creek either just outside the site boundary or at the Seneca Nation of Indians reservation (Tables 4–42 and 4–43).
Postulated Onsite Receptors (Intruders)			
Institutional controls remain in effect	Situation not assumed for Sitewide Removal Alternative	No consequences because receptors are not allowed on site.	No consequences because receptors are not allowed on site.
Loss of institutional controls after 100 years, without erosion	Peak annual dose less than 25 millirem	There could be peak annual doses of less than 2 millirem per year to workers who drill a well downgradient from facilities without a protective cap, or build a home over waste without a protective cap. Protective caps over the Main Plant Process Building, Waste Tank Farm, and burial areas are assumed to prevent well drillers from drilling into those facilities (Table 4–32). There could be peak annual doses of less than about 7 millirem per year to a resident farmer with a garden containing contaminated soil. Protective caps over the Main Plant Process Building, Waste Tank Farm, and burial areas are assumed to prevent construction of a garden (Table 4–33).	There could be peak annual doses of a few to tens of rem per year to workers who drill a well downgradient from facilities, none of which have protective caps, or build a home over waste without a protective cap (Table 4–32). There could be peak annual doses of less than 1 millirem per year to approximately 200 rem per year to a resident farmer with a garden containing contaminated soil over a facility, none of which have protective caps (Table 4–33).
		There could be a peak annual dose of less than 1 millirem per year to about 160 millirem per year to a resident farmer using untreated contaminated groundwater for drinking and irrigation obtained downgradient from a protective cap. The low-hydraulic conductivity of the South Plateau is assumed to preclude this scenario from occurring there (Table 4–34).	There could be peak annual doses of less than a few millirem per year to about 400 rem per year to a resident farmer using untreated contaminated groundwater for drinking and irrigation. There are no protective caps. The low-hydraulic conductivity of the South Plateau precludes this scenario from occurring there (Table 4–34).
		There could be a peak annual dose of about 4 millirem per year to a resident farmer on Buttermilk Creek (Table 4–31).	There could be a peak annual dose of about 14 millirem per year to a resident farmer on Buttermilk Creek (Table 4–31).
Loss of institutional controls after 100 years, with unmitigated erosion	Peak annual dose less than 25 millirem	There could be a peak annual dose of about 70 millirem per year to an onsite resident/recreational hiker (Table 4–40). There could be a peak annual dose of about 16 millirem per year to a resident farmer on Buttermilk Creek (Table 4–41).	There could be a peak annual dose of about 130 millirem per year to an onsite resident/recreational hiker (Table 4–40). There could be a peak annual dose of about 115 millirem per year to a resident farmer on Buttermilk Creek (Table 4–41).

[a] For perspective, the 565,000 Lake Erie water users would receive an average population dose of 350,000 person-rem each year from ubiquitous background and other sources of radiation (see Chapter 3, Table 3-16) not associated with the Western New York Nuclear Service Center.

4.1.10.2 Sitewide Removal Alternative

The Sitewide Removal Alternative is addressed separately because it would entail decontamination of the entire WNYNSC, so that it would be available for release for unrestricted use. This means that the radiation dose to any reasonably foreseeable onsite receptor would be less than 25 millirem per year.[11] The residual contamination is not known with enough precision to warrant an offsite dose analysis, but it is recognized that offsite dose consequences would be substantially below those for the Sitewide Close-In-Place or No Action Alternatives.

Radioactive Contamination

Under this alternative, any remaining residual radiological contamination would be below the unrestricted use dose criteria of 10 CFR 20.1402. To demonstrate that decommissioning is adequate would require analysis of a number of representative, reasonably conservative scenarios to ensure that none of the range of potential human activities on WNYNSC would lead to the accumulation of individual radiation doses exceeding the unrestricted use dose criteria. One possible way of achieving this would be to use the analysis of the scenarios to estimate derived concentration guideline limits (DCGLs) that could be used as decommissioning targets in various parts of the site. Examples of screening DCGLs for soil screening contamination levels, published by the NRC, are provided in Appendix H, Table H–18. In practice, official DCGLs would be developed through the Decommissioning Plan process.

Hazardous Chemical Contamination

Under this alternative, facilities and areas having hazardous chemical contamination would be removed in compliance with the criteria for clean closure. The criteria could include NYSDEC TAGM-4046, *Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC 1994); NYSDEC Division of Water, Technical and Operational Guidance Series 1.1.1, *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent, Limitations* (NYSDEC 1998b); or other agency-approved cleanup objectives that are protective of human health and the environment (e.g., risk-based action levels).

4.1.10.3 Alternatives with Waste On Site

The remainder of this analysis addresses the impacts that are expected to result from implementing the Sitewide Close-In-Place and No Action Alternatives.[12] These two alternatives would leave some amount of hazardous and radioactive material on site. The analysis addresses the impacts caused by releases to the local groundwater that then discharges to onsite streams (Franks Creek and Buttermilk Creek) to a spectrum of individual and population receptors located outside the current WNYNSC boundary. It also addresses the effects of radionuclide releases on individual receptors and the local population, and the effect of both radionuclide and hazardous chemical releases on the two closest individual receptors.

The information is presented in two sections. The first section (Section 4.1.10.3.1) addresses impacts given continuation of institutional controls. These impacts incorporate the effects of institutional controls that

---

[11] *The dose to an individual coming into direct contact with the residual contamination would be less than 25 millirem per year. Any receptor coming into contact with residual contamination that has migrated from its original location (the more likely scenario) would receive a much lower dose.*

[12] *There is no long-term performance assessment for the Phased Decisionmaking Alternative, because the long-term impact depends on the final condition, which is yet to be defined. There is a qualitative discussion of the impacts of the Phased Decisionmaking Alternative in Appendix H, Section H.2.3, of this EIS, and in Section 4.1.10.4 of this chapter. For most exposure scenarios and receptors, long-term impacts would be bounded by those for the Sitewide Removal and Sitewide Close-In-Place Alternatives. Long-term impacts for some exposure scenarios and receptors would be bounded by those for the No Action Alternative*

prevent access to the WMAs and maintain engineered features such as erosion control structures and engineered caps. The information is also used to estimate total risk to offsite receptors from both radionuclides and hazardous chemicals; in the latter case, for comparison to CERCLA risk criteria.

The second section (Section 4.1.10.3.2) addresses impacts assuming loss of institutional controls.[13] This section analyzes potential impacts for two general situations. The first is loss of institutional controls after 100 years so that intruders are allowed to enter WNYNSC and various WMAs. Doses are assessed for intruders assumed to occupy the Buttermilk Creek area (Section 4.1.10.3.2.1) or the North and South Plateaus (Section 4.1.10.3.2.2) and for offsite receptors (Section 4.1.10.3.2.3). Second, Section 4.1.10.3.3 addresses impacts on offsite receptors assuming that unmitigated erosion occurs. The analytical results presented here are from deterministic analyses that are considered to be generally conservative.[14] More details on both the deterministic and sensitivity/uncertainty analyses are presented in Appendix H of this EIS.

4.1.10.3.1 Indefinite Continuation of Institutional Controls

This section presents long-term radiological dose and radiological and hazardous chemical risks to offsite receptors for the Sitewide Close-In-Place and No Action Alternatives. All of the impacts discussed in this section are the result of groundwater flow through WMAs and the discharge of contaminated groundwater to either Franks Creek or Buttermilk Creek, and hence to Cattaraugus Creek. The section is organized by receptor, beginning with the nearest offsite receptor and progressing to the farthest.[15] The receptors are:

- Cattaraugus Creek – downstream of the confluence with Franks Creek (Cattaraugus Creek receptor);
- Cattaraugus Creek – Seneca Nation of Indians, Cattaraugus Reservation (Seneca Nation of Indians receptor); and
- Lake Erie/Niagara River water users – water intake systems at Sturgeon Point on Lake Erie and in the Niagara River downstream of Cattaraugus Creek.

The NYSERDA View Indicates….

The Final EIS Analysis of Contaminant Transport by Groundwater Needs Improvement. In particular, the View states that there is no compelling argument for using the simplified one-dimensional flow and transport model for purposes of calculating long-term dose rather than the three-dimensional model presented in Appendix E.

DOE's Response….

The one-dimensional model was used for contaminant transport analysis in this EIS because testing showed that the one-dimension model predictions of strontium-90 concentrations at various locations in the North Plateau Groundwater Plume centerline are comparable to the three-dimensional model (STOMP) prediction, and those predictions are similar to field observations. In addition, the one-dimensional model has a much shorter run time than the STOMP model when analyzing site-specific contaminant transport and is easier to integrate with both the release models and the dose consequence models. The use of the one-dimensional model also introduces an element of conservatism because it does not take credit for lateral dispersion of contaminants which would lower the plume centerline concentrations.

The basic approach to hydrologic modeling used for the Revised Draft EIS was retained for the Final EIS. The discussion of the regional hydrologic model was expanded for the Final EIS to clarify particular issues raised in comments on Appendix E of the Revised Draft EIS. The hydrologic parameters used in the one-dimensional transport analysis are drawn from three-dimensional hydrologic analysis discussed in Section E.4; the rationale for the use of the one-dimensional model is discussed in Appendix E, Section E.4.1.1 of the Final EIS.

It is DOE's opinion that using the three-dimensional hydrologic model for flow and transport to calculate long-term dose would significantly increase the time required to perform the analysis without providing a significantly more accurate answer. As discussed in Chapter 4, Section 4.3.5, there are many parameters that contribute to uncertainty in the long-term dose estimate and the groundwater transport model is not considered to be a major source of uncertainty.

---

[13] *In the long-term performance assessment, the institutional controls are assumed to be lost after 100 years.*
[14] *The major reasons that contribute to the assessment that estimates of dose are conservative are listed in Section 4.3.5 of this chapter and are further discussed in Appendix H, Section H.2.2.1.*
[15] *Receptors are described in detail in Appendix D, Section D.3.1.3, of this EIS.*

Cattaraugus Creek Receptor

The Cattaraugus Creek receptor is a postulated offsite receptor who is close to the site boundary and experiences the impact of liquid release from all portions of the site. This receptor is conservatively assumed to drink untreated water from Cattaraugus Creek, eat fish from the creek, and irrigate a garden with untreated water from the creek.

A resident farmer is an example of a Cattaraugus Creek receptor. There are several such receptors in this analysis. In general, the resident farmer scenario is based on contact with contamination in surface soil and involves a set of activities including living in a home, maintaining a garden, and harvesting fish. The scenario may be initiated by irrigation with contaminated surface water. For both radionuclides and hazardous chemicals, maintenance of a home and garden involves inhalation of fugitive dust, and consumption of crops and animal products. For radionuclides, an additional pathway, exposure to external radiation, is also evaluated.

Radiological Risk

Table 4–24 presents the peak annual total effective dose equivalent (TEDE) from each of the major WMAs within WNYNSC, and the timing of that peak. The years to peak exposure were measured from a starting date of 2020, the anticipated date for completion of decommissioning activities under the Sitewide Close-In-Place Alternative.[16] The last row of Table 4–24 shows the magnitude and timing of the peak dose when release for all facilities are considered. This was developed from an analysis of the dose to the Cattaraugus Creek receptor for each year following completion of decommissioning actions.

Table 4–24 Peak Annual Total Effective Dose Equivalent in Millirem Per Year for the Cattaraugus Creek Receptor (year of peak exposure in parentheses) – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	0.019 (200)	0 [b]
Vitrification Facility – WMA 1	0.000037 (1,000)	0 [b]
Low-Level Waste Treatment Facility – WMA 2	0.00026 (100)	0.015 (100)
Waste Tank Farm – WMA 3	0.0019 (300)	0 [b]
NDA – WMA 7 [c]	0.010 (8,700)	0.010 (8,700)
SDA – WMA 8 [c]	0.23 (37,300)	0.23 (37,300)
North Plateau Groundwater Plume [c]	0.51 (34)	0.51 (34)
Total	0.51 (34)	0.51 (34)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed to prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

[16] *In Table 4–24 and other tables and figures, the years until total peak dose or risk do not coincide with the years until peak individual WMA doses because the total peak is not a simple sum of individual peaks.*

The North Plateau Groundwater Plume contributes the largest peak annual TEDE, 0.51 millirem per year at 34 years. There is also a long-term peak of 0.23 millirem per year at approximately year 37,000 caused by the SDA. The dominant radionuclide and pathway at 34 years are strontium-90 in drinking water and at 37,000 years are uranium-234 in fish.

Figure 4–3 presents the annual dose as a function of time to a Cattaraugus Creek receptor for the Sitewide Close-In-Place Alternative. The North Plateau Groundwater Plume peak at 34 years does not appear on this plot because, on the time scale presented on the x-axis, it essentially coincides with the y-axis. Figure 4–3 shows the SDA peak at approximately 37,000 years and a subsidiary SDA peak at about 1,000 years. **Figure 4–4** provides a similar plot for the No Action Alternative.

The peak annual dose under both the No Action Alternative and the Sitewide Close-In-Place Alternative is 0.51 millirem per year. For perspective, the average individual radiation dose in the United States from ubiquitous background and other sources of radiation is about 620 millirem per year, of which about 230 millirem is due to radon (NCRP 2009).

A complementary measure is the peak lifetime risk (excess risk of morbidity, or risk of contracting cancer, both fatal and nonfatal) to the Cattaraugus Creek receptor arising from radiological discharges. This risk was calculated assuming a lifetime exposure at the peak dose rate.[17] **Table 4–25** shows how this risk varies from different WMAs and what it is for the entire WNYNSC under each alternative. Because the doses from which the latent cancer morbidity risk was calculated differ little between the alternatives, neither do the risks.

Table 4–25 presents results consistent with those presented in Table 4–24. It shows that the radiological risk would be dominated by the release from the North Plateau Groundwater Plume for both the Sitewide Close-In-Place Alternative and for the No Action Alternative. It also shows that the lifetime cancer risk would be within the CERCLA risk range of 1×10^{-6} to 1×10^{-4}.

Hazardous Chemical Risk

Estimates of the risk to the Cattaraugus Creek receptor from hazardous chemicals in the NDA, SDA, the Main Plant Process Building, and the Waste Tank Farm have also been prepared. Three measures were used: lifetime cancer risk, Hazard Index, and comparison to maximum contaminant levels (MCLs) for drinking water. Tables 4–26 through 4–28 summarize this information for the WMAs having the dominant lifetime hazardous chemical risk. These estimates of lifetime cancer risk, Hazard Index, and comparison to MCLs are based on current inventory estimates. A list of the hazardous chemicals used to develop these estimates is provided in Appendix I, Table I–28, of this EIS. An explanation of how the estimates were calculated is provided in Appendix H of this EIS.

Table 4–26 shows that the lifetime cancer risk from hazardous chemicals would be very small for both alternatives, and would be dominated by the SDA. For WMA 7 and 8, the peak hazardous chemical risks are essentially the same for both alternatives.

Comparing the radiological risk information in Table 4–25 with the chemical risk information in Table 4–26, it can be seen that the lifetime cancer risk to the Cattaraugus Creek receptor would be dominated by radionuclides rather than hazardous chemicals. The peak radiological risk is on the order of 500 times greater than the peak chemical risk. The chemical risk is below the CERCLA risk range of 1×10^{-6} to 1×10^{-4}.

[17] Note also that the risk was not calculated by the simple method of taking the peak lifetime TEDE and multiplying by 6×10^{-4} LCF per person-rem. The risks were calculated by summing the risks for individual radionuclides using data from Federal Guidance Report 13 (EPA 1999b).

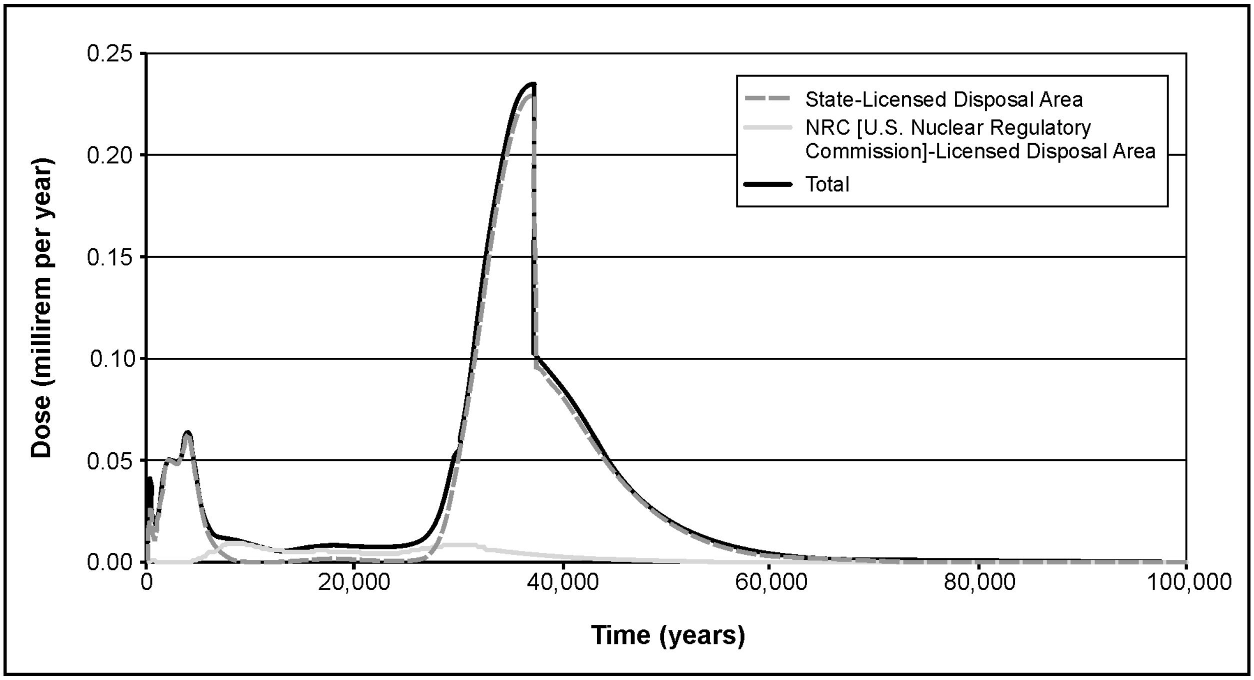

Figure 4–3 Annual Total Effective Dose Equivalent for the Cattaraugus Creek Receptor with the Sitewide Close-In-Place Alternative and Indefinite Continuation of Institutional Controls

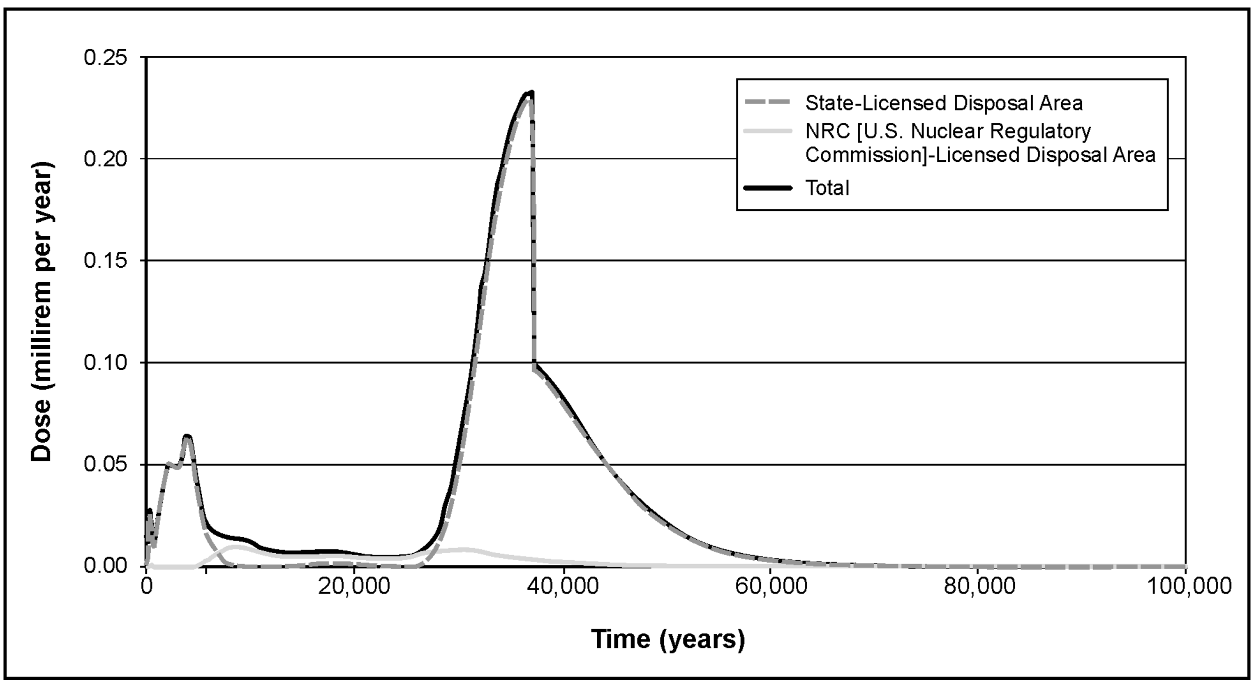

Figure 4–4 Annual Total Effective Dose Equivalent for the Cattaraugus Creek Receptor with the No Action Alternative and Indefinite Continuation of Institutional Controls

Table 4–25 Peak Lifetime Radiological Risk (risk of latent cancer morbidity) for the Cattaraugus Creek Receptor (year of peak risk in parentheses) – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	4.2×10^{-7} (200)	0 [b]
Vitrification Facility – WMA 1	3.12×10^{-10} (300)	0 [b]
Low-Level Waste Treatment Facility – WMA 2	6.45×10^{-9} (100)	3.3×10^{-7} (100)
Waste Tank Farm – WMA 3	7.84×10^{-8} (300)	0 [b]
NDA – WMA 7 [c]	2.61×10^{-7} (8,600)	2.61×10^{-7} (8,600)
SDA – WMA 8 [c]	2.89×10^{-6} (37,300)	2.89×10^{-6} (37,300)
North Plateau Groundwater Plume [c]	1.10×10^{-5} (34)	1.10×10^{-5} (34)
Total	1.10×10^{-5} (34)	1.10×10^{-5} (34)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed to prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Table 4–26 Peak Lifetime Risk from Hazardous Chemicals (risk of latent cancer morbidity) for the Cattaraugus Creek Receptor (year of peak risk in parentheses) – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	1.4×10^{-9} (5,000)	0 [b]
Vitrification Facility – WMA 1	1.3×10^{-10} (11,700)	0 [b]
Waste Tank Farm – WMA 3	1.1×10^{-10} (8,900)	0 [b]
NDA – WMA 7 [c]	1.4×10^{-9} (85,900)	1.4×10^{-9} (85,900)
SDA – WMA 8 [c]	2.1×10^{-8} (100)	2.1×10^{-8} (100)
Total	2.1×10^{-8} (100)	2.1×10^{-8} (100)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] The limited information available on hazardous chemical inventories in the Low-Level Waste Treatment Facility suggests it would not make a noticeable contribution to the overall long-term risk from hazardous chemicals. There is no hazardous chemical inventory available for the Construction and Demolition Debris Landfill in WMA 4.

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed to prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

The comparison of lifetime cancer risk from radionuclides and chemicals for the Cattaraugus Creek receptor under the Sitewide Close-In-Place Alternative is shown on **Figure 4–5**. This figure again demonstrates that the greatest risk would be from radionuclides. The radionuclide risk peaks at about 40,000 years and then declines until it becomes approximately equal to the hazardous chemical risk after 80,000 years. The chemical risk increases from about 40,000 years onward as a result of the release of arsenic, which travels very slowly through the groundwater beneath the site. This general pattern is similar for the No Action Alternative and for the other receptors discussed later in this section.

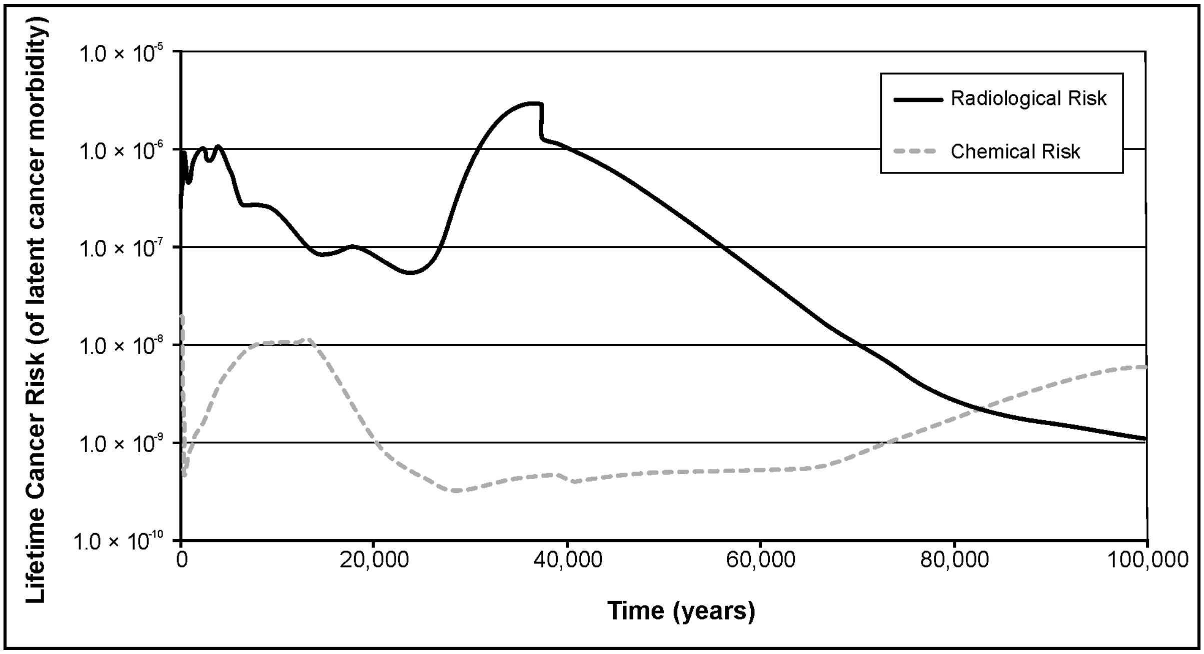

Figure 4–5 Lifetime Latent Cancer Morbidity Risk from Radionuclides and Hazardous Chemicals for the Cattaraugus Creek Receptor with the Sitewide Close-In-Place Alternative and Indefinite Continuation of Institutional Controls

Another measure of chemical risk that is appropriate for noncarcinogenic chemicals is the Hazard Index for an individual receptor.[18] If the Hazard Index is greater than 1, the situation is considered to be hazardous for the receptor. **Table 4–27** presents the Hazard Index peaks for the Cattaraugus Creek receptor. As can be seen, the Hazard Index peaks are much less than 1 for both alternatives.

There are some hazardous chemicals for which there is no carcinogenic slope factor or reference dose, but they are recognized as hazardous materials, and MCLs have been issued under the Clean Water Act. A primary example that is relevant to WNYNSC is lead. When the inventory for a known hazardous material could be estimated, but there was no slope factor or reference dose for the material, an analysis was conducted to determine the maximum concentration of the hazardous material in the year of peak risk and the year of peak Hazard Index. **Table 4–28** shows the results of this analysis. This ratio of peak concentration to MCL would always be less than 1, and for most elements, it would be far less than 1 (less than 0.001).

[18] The Hazard Index is defined as the sum of the Hazard Quotients for substances that affect the same target organ or organ system. The Hazard Quotient for a specific chemical is the ratio of the exposure to the hazardous chemical (e.g., amount ingested over a given period) to a reference value regarded as corresponding to a threshold of toxicity, or a threshold at which some recognizable health impact would appear. If the Hazard Quotient for an individual chemical or the Hazard Index for a group of chemicals exceeds unity, the chemical(s) may produce an adverse effect, but normally this will require a Hazard Index or Quotient of several times unity. A Hazard Index or Quotient of less than unity indicates that no adverse effects are expected over the period of exposure.

Table 4–27 Peak Chemical Hazard Index for the Cattaraugus Creek Receptor (year of peak Hazard Index in parentheses) – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	5.8×10^{-5} (3,400)	0 [b]
Vitrification Facility – WMA 1	5.3×10^{-6} (15,100)	0 [b]
Waste Tank Farm – WMA 3	7.1×10^{-5} (9,900)	0 [b]
NDA – WMA 7 [c]	1.5×10^{-5} (30,100)	1.5×10^{-5} (30,100)
SDA – WMA 8 [c]	3.4×10^{-3} (3,900)	3.4×10^{-3} (3,900)
Total	3.5×10^{-3} (3,900)	3.4×10^{-3} (3,900)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] The limited information available on hazardous chemical inventories in the Low-Level Waste Treatment Facility suggests it would not make a noticeable contribution to the overall long-term risk from hazardous chemicals. There is no hazardous chemical inventory available for the Construction and Demolition Debris Landfill in WMA 4.

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed to prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Table 4–28 Chemicals with Largest Fraction of Maximum Concentration Levels in Cattaraugus Creek at Year of Peak Risk and Year of Peak Hazard Index – Indefinite Continuation of Institutional Controls [a]

Waste Management Areas [b]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
	Year of Peak Risk in Parentheses	
Main Plant Process Building – WMA 1	1.07×10^{-4} (8,500) Pb [d]	0 [c]
Vitrification Facility – WMA 1	1.89×10^{-7} (40,500) Pb [d]	0 [c]
Waste Tank Farm – WMA 3	7.25×10^{-7} (9,000) Tl [e]	0 [c]
NDA – WMA 7 [j]	1.3×10^{-6} (86,700) As [f]	1.3×10^{-6} (89,200) As
SDA – WMA 8 [j]	1.07×10^{-4} (100) Benzene [g]	1.07×10^{-4} (100) Benzene
	Year of Peak Hazard Index in Parentheses	
Main Plant Process Building – WMA 1	9.47×10^{-5} (3,400) Pb [d]	0 [c]
Vitrification Facility – WMA 1	1.50×10^{-7} (26,000) Sb [h]	0 [c]
Waste Tank Farm – WMA 3	8.78×10^{-7} (12,400) Sb [h]	0 [c]
NDA – WMA 7 [j]	3.4×10^{-5} (30,200) Usol [i]	3.4×10^{-5} (30,200) Usol
SDA – WMA 8 [j]	9.03×10^{-3} (4,700) Usol [i]	9.03×10^{-3} (4,700) Usol

MCL = maximum contaminant level, NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] Presented as fraction of the applicable MCL per years until peak exposure per chemical.

[b] The limited information available on hazardous chemical inventories in the Low-Level Waste Treatment Facility suggests it would not make a noticeable contribution to the overall long-term risk from hazardous chemicals. There is no hazardous chemical inventory available for the Construction and Demolition Debris Landfill in WMA 4.

[c] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The health impacts of hazardous chemicals released from these units would be minimal as long as these engineered systems function as originally designed and institutional controls prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[d] Pb = lead, MCL (Action Level) = 0.015 milligrams per liter. There is no published MCL for lead, so the Action Level is used instead.

[e] Tl = thallium, MCL = 0.002 milligrams per liter.

[f] As = arsenic, MCL = 0.01 milligrams per liter.

[g] Benzene, MCL = 0.005 milligrams per liter.

[h] Sb = antimony, MCL = 0.006 milligrams per liter.

[i] Usol = soluble uranium, MCL = 0.03 milligrams per liter.

[j] NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Seneca Nation of Indians Receptor

The postulated Seneca Nation of Indians receptor activities are similar to those of the Cattaraugus Creek receptor, but involve the consumption of a larger amount of fish (62 kilograms as opposed to 9 kilograms per year – see Appendix H, Table H–17) raised in the lower reaches of Cattaraugus Creek or in Lake Erie near the point where Cattaraugus Creek discharges into the lake. Because of bioaccumulation of radionuclides in fish at this location, the dose to this receptor is greater than that for the Cattaraugus Creek receptor. Detailed results are presented in Appendix H, Section H.2.2.2.2. The following is a summary of results for the Seneca Nation of Indians receptor under both the Sitewide Close-In-Place Alternative and the No Action Alternative:

- The North Plateau Groundwater Plume causes a short-term peak annual TEDE at 34 years. The peak lifetime radiological risk is about a factor of 1.3 higher for the Seneca Nation of Indians receptor than it is for the Cattaraugus Creek receptor. The dominant radionuclide is strontium-90 via drinking water. The risks associated with this peak would be within the CERCLA lifetime cancer risk range of 1×10^{-6} to 1×10^{-4} for both alternatives.

- The long-term peak annual TEDE due to groundwater releases:
  - Would be less than 1 millirem per year under both alternatives;
  - Would be higher than that for the Cattaraugus Creek receptor under both alternatives, due to the aforementioned consumption of fish; the peak annual TEDE for the Seneca Nation of Indians receptor is approximately 2.4 times higher than that for the Cattaraugus Creek receptor under both the Sitewide Close-In-Place and No Action Alternatives;
  - Would occur at approximately the same time as that for the Cattaraugus Creek receptor; and
  - Would be dominated by releases from the SDA under both the Sitewide Close-In-Place and No Action Alternatives.

- The long-term peak lifetime radiological risk due to groundwater releases:
  - Would be dominated by releases from the NDA and SDA under both the Sitewide Close-In-Place and No Action Alternatives;
  - Would be within the CERCLA risk range of 1×10^{-6} to 1×10^{-4} under the Sitewide Close-In-Place Alternative and for the No Action Alternative; and
  - Would bear much the same relationship to the Cattaraugus Creek peak lifetime radiological risk as does the peak TEDE to the Cattaraugus Creek peak TEDE (in this case, a factor of 2.8 higher).

- The dominant radionuclide would be uranium-234 via the fish consumption pathway.

The hazardous chemical risk and Hazard Index were calculated for the Seneca Nation of Indians receptor in the same manner as they were for the Cattaraugus Creek receptor. Similar to that of the Cattaraugus Creek receptor, the hazardous chemical lifetime cancer risk would be a small fraction of the risk resulting from the estimated release of radionuclides under the same alternative, and the Hazard Index is small. Likewise, the calculated MCL fractions for each chemical are all less than unity.

Lake Erie/Niagara River Water Users

In addition to the Cattaraugus Creek and Seneca Nation of Indians receptors, peak annual and time-integrated population dose estimates have been prepared. These are summarized in **Tables 4–29** and **4–30**, respectively. Lake Erie water users consume untreated water taken from Sturgeon Point while Niagara River water users consume untreated water from several structures in the eastern channel of the Niagara River.[19] They are also assumed to eat fish from Lake Erie, and (conservatively) to all be residential farmers.

Under the Sitewide Close-In-Place and the No Action Alternatives, the predicted peak population dose is about 95 person-rem. Most of the population dose shown in Table 4–29 would be received by receptors using water from the Sturgeon Point intake, which would see higher radionuclide concentrations than the intake structures on the Niagara River. No credit is taken for dilution in the flow between the mouth of Cattaraugus Creek and the Sturgeon Point intake structure. Complete mixing in the flow of the Niagara River is assumed for water intake points in the Niagara River. The estimated annual radiation dose from ubiquitous background and other sources of radiation (NCRP 2009) accumulated by the Sturgeon Point (Lake Erie) water users alone (565,000 people) would be approximately 350,000 person-rem.[20]

Table 4–30 presents the time-integrated population dose over periods of 1,000 and 10,000 years. For perspective, under both alternatives, the total population dose accumulated over 10,000 years (approximately 34,000 to 35,000 person-rem) would be less than the background dose that would be accumulated in 1 year by Lake Erie (Sturgeon Point) water users alone (350,000 person-rem).

Table 4–29 Peak Annual Total Effective Population Dose Equivalent (person-rem per year) for the Lake Erie/Niagara River Water Users (year of peak dose in parentheses) – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	1.0 (200)	0 [b]
Vitrification Facility – WMA 1	0.0030 (1,000)	0 [b]
Low-Level Waste Treatment Facility – WMA 2	0.038 (100)	2.7 (100)
Waste Tank Farm – WMA 3	0.41 (300)	0 [b]
NDA – WMA 7 [c]	1.2 (30,100)	1.2 (30,100)
SDA – WMA 8 [c]	18 (37,300)	18 (37,300)
North Plateau Groundwater Plume [c]	95 (34)	95 (34)
Total	95 [d] (34)	95 [d] (34)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed to prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

[d] Almost all of these 95 person-rem per year would be accumulated by the 565,000 Lake Erie (Sturgeon Point) water users. This corresponds to a peak annual individual dose of approximately 0.2 millirem per year.

---

[19] *There are an estimated 565,000 Lake Erie (Sturgeon Point) water users and 390,000 Niagara River water users.*

[20] *The background radiation dose accumulated by the Sturgeon Point group of postulated water users is appropriate for comparison with the 95 person-rem listed in Table 4–29 because virtually all of this dose is accumulated by that group.*

Table 4–30 Time-integrated Total Effective Population Dose Equivalent for Lake Erie/Niagara River Water Users in Person-rem Over 1,000 and 10,000 years – Indefinite Continuation of Institutional Controls

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Integration Over 1,000 Years		
Main Plant Process Building – WMA 1	590	0 [b]
Vitrification Facility – WMA 1	2	0 [b]
Low-Level Waste Treatment Facility – WMA 2	13	340
Waste Tank Farm – WMA 3	130	0 [b]
NDA – WMA 7 [c]	150	150
SDA – WMA 8 [c]	710	710
North Plateau Groundwater Plume [c]	2,400	2,400
Total	4,000	3,600
Integration Over 10,000 Years		
Main Plant Process Building – WMA 1	940	0 [b]
Vitrification Facility – WMA 1	5	0 [b]
Low-Level Waste Treatment Facility – WMA 2	50	1,500
Waste Tank Farm – WMA 3	260	0 [b]
NDA – WMA 7 [c]	2,200	2,200
SDA – WMA 8 [c]	28,000	28,000
North Plateau Groundwater Plume [c]	2,500	2,500
Total	34,000	35,000

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials

[b] It is assumed that proactive maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs, etc.) operational indefinitely. The doses from these units would be minimal as long as institutional controls ensure that these engineered systems function as originally designed prevent releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Note: Totals may not add due to rounding.

Conclusions Given Continuation of Institutional Controls

For alternatives where waste would remain on site, the overall assessment is that the dose and risk are small for both alternatives. The risk is dominated by the radiological hazards. The peak annual dose to offsite receptors is less than 25 millirem per year when considering all WMAs, regardless of the alternative.[21] For both the Sitewide Close-In-Place Alternative and the No Action Alternative, the radiological hazard in the short term is dominated by the North Plateau Groundwater Plume. In the longer term it is dominated by the SDA.

4.1.10.3.2 Conditions Assuming Loss of Institutional Control – Groundwater-Driven Releases

A loss of institutional controls is assumed to take place after 100 years. In the case of the No Action Alternative, loss of institutional controls means that all maintenance activities cease and, in particular, no effort is made to keep radionuclides confined within the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm. Conservatively, failure of containment of these facilities is assumed to take place immediately upon loss of institutional controls. For the Sitewide Close-In-Place Alternative, however, it is

[21] *Compliance with decommissioning dose criteria is discussed in Appendix L of this EIS.*

expected that cessation of maintenance and other activities has little effect on the rate of release of radionuclides from areas that dominate dose in this case, such as the SDA, NDA, and North Plateau Groundwater Plume. Finally, for both alternatives, loss of institutional controls means that intruders could enter the site.

The scenarios considered in this section are: (1) loss of institutional controls leading to intruders along Buttermilk Creek; (2) loss of institutional controls leading to intruders on or adjacent to the North and South Plateaus; (3) loss of institutional controls on offsite receptors. All of these analyses focus on the impacts of radionuclides being released and coming in contact with human receptors. For radiological health impacts, the discussion is confined to dose impacts only (except for offsite receptors), because there are dose standards for situations following loss of institutional controls, but not risk standards.

4.1.10.3.2.1 Loss of Institutional Controls Leading to Intruders on Buttermilk Creek

Table 4–31 presents the predicted peak annual TEDE for the Buttermilk Creek resident farmer for each alternative, assuming failure of the active controls that would detect and mitigate releases from the Main Plant Process Building, the Waste Tank Farm, and the North Plateau Groundwater Plume after 100 years. See Appendix H, Figure H–2, of this EIS for the location of this receptor.

All of the projected doses for the Sitewide Close-In-Place Alternative would be less than 5 millirem per year. The No Action Alternative would result in the highest peak annual dose to this receptor (14 millirem per year), dominated by the Waste Tank Farm (11 millirem per year). If the loss of institutional controls were to occur earlier (i.e., prior to year 100), the dose would be higher because radionuclides from facilities such as the Waste Tank Farm could then migrate toward receptors and reach them sooner with less radioactive decay having taken place. For the Sitewide Close-In-Place Alternative, the North Plateau Groundwater Plume, followed by the SDA are the largest contributors to the long-term dose, while for the No Action Alternative, the Waste Tank Farm would dominate.

The NYSERDA View Indicates….

The Final EIS assumptions for the performance of engineered barriers such as caps, slurry walls, reducing grout, and other engineered materials intended to keep contamination physically and chemically bound in place have not been substantiated and may be overly optimistic. Additional analysis and verification are required for the performance of the engineered barriers that are used in the Final EIS site closure alternatives.

DOE's Response….

The National Academies' Committee to Assess the Performance of Engineered Barriers has reviewed the available data to support the estimate of long-term barrier performance and has noted the generally acceptable performance to date. This Committee also noted that extrapolations of long-term performance from existing data will have high uncertainties until field data are accumulated for longer periods of time. NYSERDA's call for additional references to support assumptions about barrier performance does not recognize that there are serious limitations on the availability of data as noted by the Committee. Appendix H, Section H.2.2.1, includes references for the assumptions about engineered barrier properties wherever possible. In many cases, the properties of the degraded materials are similar to those of the surrounding natural material.

NYSERDA's statement that the EIS does not analyze the consequences of erosion on North Plateau barriers is incorrect. The analysis presented in Appendix H, Section H.3.4, shows peak annual doses following erosion damage of the slurry wall around the Waste Tank Farm and Main Plant Process Building.

NYSERDA's statement that the Final EIS assumes that engineered barrier properties would remain unchanged for 100,000 years is misleading. As stated in Section H.2.2.1, the analysis assumes immediate barrier degradation which continues for the entire assessment period. The long-term performance assessment assumes degraded barrier properties until the year of peak dose or peak risk is identified. Most of the peak doses occur before 10,000 years. Some of the dose peaks for the burial areas are in the range of 30,000 to 40,000 years. The only peaks that approach 100,000 years are for chemical risks from the burial areas. The analytical period used when determining compliance with NRC's License Termination Rule is 1,000 years as noted in Appendix D, Section D.3.1.

Table 4–31 Peak Annual Total Effective Dose Equivalent in Millirem Per Year for the Buttermilk Creek Resident Farmer (year of peak dose in parentheses) – Loss of Institutional Controls after 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	0.14 (200)	2 (200)
Vitrification Facility – WMA 1	0.00028 (1,000)	0.79 (200)
Low-Level Waste Treatment Facility – WMA 2	0.0020 (100)	0.12 (100)
Waste Tank Farm – WMA 3	0.014 (300)	11 (200)
NDA – WMA 7 [b]	0.076 (8,700)	0.076 (8,700)
SDA – WMA 8 [b]	1.7 (37,300)	1.7 (37,300)
North Plateau Groundwater Plume [b, c]	3.9 (34)	3.9 (34)
Total	3.9 (34)	14 (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

[c] The peak arising from the North Plateau Groundwater Plume at 34 years will have already passed by the time institutional controls fail. In practice, no one would be allowed to farm on Buttermilk Creek at that time, so the 34-year dose is conservative.

4.1.10.3.2.2 Loss of Institutional Controls Leading to Intruders in the North and South Plateaus

This section presents the estimated doses to a spectrum of intruders who enter WNYNSC in the event of loss of institutional controls designed to limit site access. These scenarios are considered to be conservative and useful for understanding the potential magnitude of impacts if intruders come onto the North or South Plateaus. The specific intruders evaluated were: (1) a direct intruder worker, (2) a resident farmer who has waste material directly deposited in his garden as a result of well drilling or home construction, and (3) a resident farmer who uses contaminated groundwater. Direct intruders are assumed to be located immediately above the waste in each WMA, while contaminated groundwater is assumed to come from wells that are located approximately 150 meters (490 feet) downgradient from the edge of the waste (see Appendix H, Figure H–3, of this EIS). Additional information on these exposure scenarios is provided in Appendix D of this EIS. For the purposes of analysis of the No Action Alternative, the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm are assumed to have lost their structural integrity and collapsed at the time of loss of institutional controls after exactly 100 years.

Intruder Worker

Two worker scenarios were considered: a well driller and a home construction worker. For the well driller, exposure pathways include inadvertent ingestion of contaminated soil, inhalation of contaminated dust, and direct exposure to contaminated water in a cuttings pond. For home construction, exposure pathways include inadvertent ingestion of contaminated soil, inhalation of contaminated dust, and exposure to external radiation from the walls of an excavation for the foundation of a home. However, the home construction scenario is not considered credible when there is a thick-engineered cap (e.g., the South Plateau burial grounds under the Sitewide Close-In-Place Alternative).

The results of this analysis are summarized in **Table 4–32**, with the results presented for the scenario with the highest TEDE.

Table 4–32 Estimated Peak Total Effective Dose Equivalent in Millirem Per Year to Intruder Worker (well driller or home construction worker) – Intrusion After 100 Years

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	Not applicable	3,910 [a, b]
Vitrification Facility – WMA 1	Not applicable	28,000 [a, b]
Low-Level Waste Treatment Facility – WMA 2	1.0 [c]	45,000 [a, b]
Waste Tank Farm – WMA 3	Not applicable	133 [c]
NDA – WMA 7	Not applicable	19,000 [a]
SDA – WMA 8	Not applicable	3,110 [a, b]
North Plateau Groundwater Plume	0.0000011 [b]	0.0000011 [b]
Cesium Prong – On site	1.9 [b]	1.9 [b]

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] The doses for the No Action Alternative are very high because, in this scenario, the well driller or home construction worker intrudes directly into volumes that contain high inventories of radionuclides. In the corresponding Sitewide Close-In-Place scenarios, the concentrated inventories have been covered by a cap that is thick enough to preclude a home construction worker from reaching the remaining inventories.

[b] Peak impact due to home construction scenarios.

[c] Peak impact due to well-drilling scenarios.

Under the Sitewide Close-In-Place Alternative, none of the predicted doses would exceed 2 millirem per year. However, the No Action Alternative peak annual doses could be substantial—up to 45,000 millirem per year—with the highest potential dose being from the Low-Level Waste Treatment Facility in the home construction scenario.

This analysis shows the importance of the thick, multi-layered engineered barrier in limiting the extent of direct intrusion into the waste, thereby limiting the dose from the disposal areas under the Sitewide Close-In-Place Alternative.

Resident Farmer with Waste Material in His Garden

Table 4–33 presents the doses to the resident farmer as a result of direct contact with contamination that would be brought to the surface and placed in a garden following a well drilling or home construction scenario.

Resident Farmer Using Contaminated Groundwater

Table 4–34 presents the doses to the resident farmer whose contact with the waste would be through an indirect pathway—the use of contaminated water. The receptors for the North Plateau facilities (Main Plant Process Building, Low-Level Waste Treatment Facility, Waste Tank Farm, and North Plateau Groundwater Plume) have wells in the sand and gravel layer on the North Plateau. The scenario is inapplicable for the NDA and SDA receptor because of the low hydraulic conductivity of the unweathered Lavery till and the unsaturated conditions in the Kent recessional sequence.

The results for the No Action Alternative in both Tables 4–33 and 4–34 clearly show that serious consequences are possible should institutional control over facilities like the Main Plant Process Building or the Waste Tank Farm be lost.

Table 4–33 Estimated Peak Annual Total Effective Dose Equivalent in Millirem Per Year to a Resident Farmer with a Garden Containing Contaminated Soil from Well Drilling or House Construction – Intrusion After 100 Years

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	Not applicable	19,900 [a, c]
Vitrification Facility – WMA 1	Not applicable	235,000 [a, c]
Low-Level Waste Treatment Facility – WMA 2	7.0 [b, d]	65,400 [a, c,]
Waste Tank Farm – WMA 3	Not applicable	2,080 [a, c]
NDA – WMA 7	Not applicable	61,500 [a, d]
SDA – WMA 8	Not applicable	2,150 [a, c]
North Plateau Groundwater Plume	0 [d]	0 [d]
Cesium Prong – On site	4.4 [c]	4.4 [c]

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] The doses for the No Action Alternative are very high because, in this scenario, the well driller or home construction worker intrudes directly into volumes that contain high inventories of radionuclides. In the corresponding Sitewide Close-In-Place scenarios, the concentrated inventories have been covered by a cap that is thick enough to preclude a home construction worker from reaching the remaining inventories.

[b] In the case of the Low-Level Waste Treatment Facility, it is possible for the well driller to penetrate soil contaminated with radioactive waste and spread radioactive material over a farmer's garden. However, the amount of material brought to the surface by a well driller is much less than that spread around during home construction.

[c] Peak impact due to home construction scenarios.

[d] Peak impact due to well-drilling scenarios. The predicted dose to the well drillers from the North Plateau Groundwater Plume is close to zero due to the cap.

Table 4–34 Estimated Peak Annual Total Effective Dose Equivalent in Millirem Per Year to a Resident Farmer Using Contaminated Groundwater – Intrusion After 100 Years

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	162	28,387 [a]
Vitrification Facility – WMA 1	1.9	101,000 [a]
Low-Level Waste Treatment Facility – WMA 2	31.6	1,448 [a]
Waste Tank Farm – WMA 3	157	397,988 [a]
NDA – WMA 7	Not applicable	Not applicable
SDA – WMA 8	Not applicable	Not applicable
North Plateau Groundwater Plume [b]	72	72
Cesium Prong – On site	4.4	4.4

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] The doses for the No Action Alternative are very high because, in this scenario, the well intrudes directly into volumes that contain high inventories of radionuclides. In the Sitewide Close-In-Place scenario the caps over the SDA, NDA, process building and vitrification facility prevent direct intrusion into the waste and the slurry wall and cap limit flow of water through the waste.

[b] North Plateau Groundwater Plume interstitial velocity calculated from STOMP model outputs was the same under Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

The time series of dose for the North Plateau Groundwater Plume under the Sitewide Close-In-Place Alternative is presented on **Figure 4–6** for receptors at 150 and 300 meters from the source of the plume. The figure illustrates the sensitivity of the dose to the time at which the intrusion occurs, and to where the intruder places his farm. The peak dose from the North Plateau Groundwater Plume for the Sitewide Close-In-Place Alternative is received by the receptor at 300 meters at about 30 years. The distance of 150 meters (490 feet) is in the vicinity of the peak concentration of the North Plateau Groundwater Plume at the first year of the period of analysis for both the No Action and Sitewide Close-In-Place Alternatives, and just outside of the downgradient slurry wall for the Sitewide Close-In-Place Alternative. The distance of 300 meters (980 feet) is located just upgradient of the North Plateau drainage ditch, the first location of discharge of the plume to the surface. Under each alternative, the predicted peak onsite concentration would occur during the period of institutional controls when a receptor could not access the contaminated groundwater. As time proceeds, the radionuclide concentration in the plume decreases at locations near the source and increases and then decreases at locations further removed from the source. This behavior explains the occurrence of peak dose at a location removed from the original source for an analysis time of 100 years.

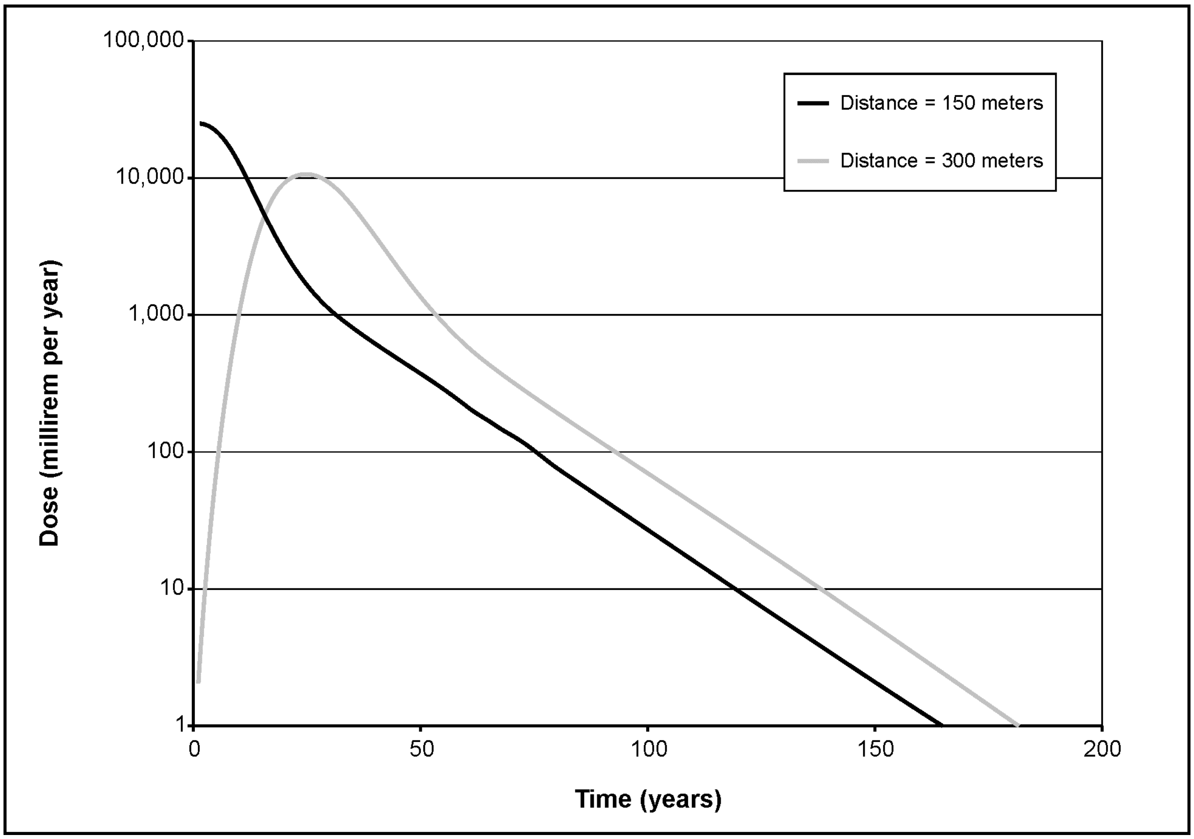

Figure 4–6 Time Series of Dose for Onsite Receptors for North Plateau Groundwater Plume Under the Sitewide Close-In-Place Alternative – Time Measured from Completion of Decommissioning

Dose from Multiple Sources

The previous discussion presented information on the dose to various receptors from individual WMAs. There is the potential for receptors to come in contact with contamination from multiple areas and therefore receive higher doses than would be received from a single WMA. The highest doses are to home construction intruders under the No Action Alternative (Table 4–32), a resident farmer with contamination from home construction under the No Action Alternative (Table 4–33), and a resident farmer using contaminated groundwater for either the Sitewide Close-In-Place Alternative or the No Action Alternative (Table 4–34).

The greatest potential for a dose from multiple sources under the No Action Alternative would be the combination of a garden contaminated with material from home construction and irrigated with contaminated groundwater. These combinations could result in peak doses approaching 200,000 to 500,000 millirem per year, with the higher value occurring if the well is located near the Waste Tank Farm.

4.1.10.3.2.3 Effect of Loss of Institutional Controls on Offsite Receptors

This section is parallel to Section 4.1.10.3.1, which presented the results of the long-term performance assessment for offsite receptors assuming indefinite continuation of institutional controls. However, this section reexamines the analysis for the offsite receptors assuming that institutional controls would be lost after 100 years (i.e., site maintenance activities would cease). In particular, it is assumed that there would be no more efforts to contain radionuclides and hazardous chemicals within WMAs on the North and South Plateaus. Conservatively, these are assumed to fail as soon as institutional controls fail. This section reexamines the analysis for the offsite receptors. Section 4.1.10.3.2.4 considers a scenario where institutional controls are assumed to be lost and unmitigated erosion occurs.

The principal effect of allowing releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm is to considerably increase predicted doses and risks under the No Action Alternative. However, the predicted doses and risks under the Sitewide Close-In-Place Alternative are barely changed because the engineered features that would be put in place around and above (for example) the NDA and SDA would be little affected by the cessation of maintenance. Therefore, the discussion in Section 4.1.10.3.2.3 focuses on the No Action Alternative. Tabular results for the Sitewide Close-In-Place Alternative are included for comparison.

Cattaraugus Creek Receptor

As described previously, the Cattaraugus Creek receptor is a postulated offsite receptor who is closest to the site boundary and receives the impact of liquid release from all portions of the site. This receptor is conservatively assumed to drink untreated water from Cattaraugus Creek, eat fish from the creek, and irrigate a garden with untreated water from the creek.

Figure 4–7 presents the annual TEDE as a function of time to the Cattaraugus Creek receptor for the No Action Alternative. See Figure 4–4 for the comparable plot for the No Action Alternative with indefinite continuation of institutional controls. The North Plateau Groundwater Plume peak at 34 years does not appear on this figure because, on the time-scale presented in the x-axis, it essentially coincides with the y-axis.

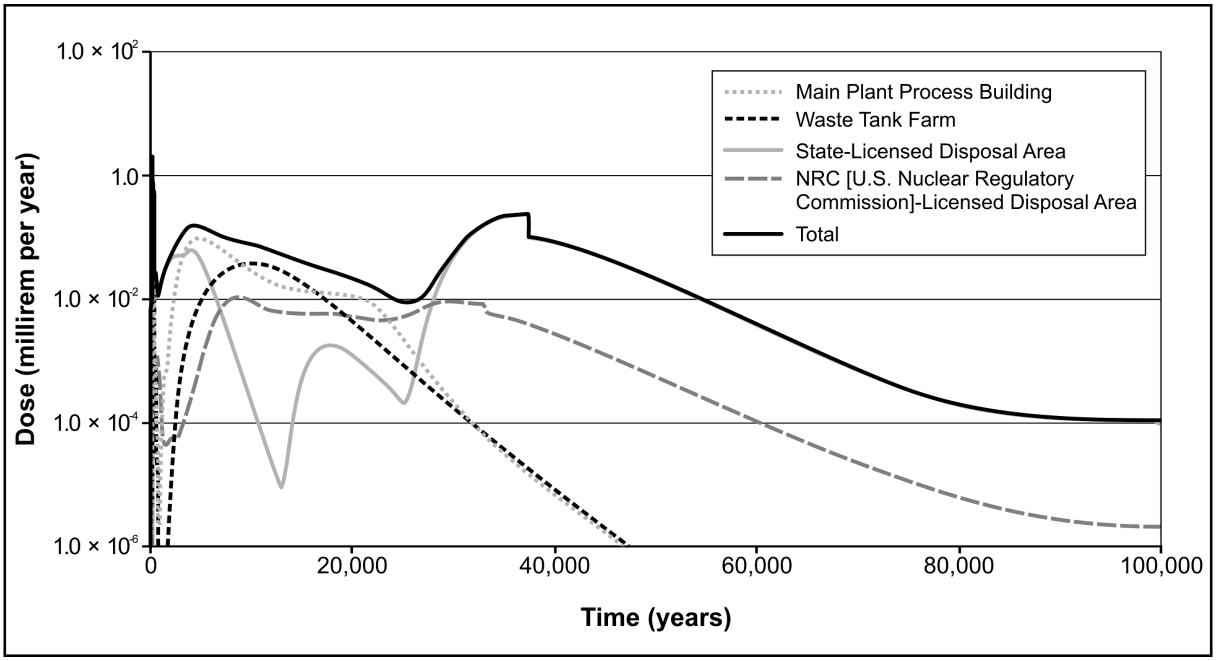

Figure 4–7 Annual Total Effective Dose Equivalent for the Cattaraugus Creek Receptor Under the No Action Alternative with Loss of Institutional Controls After 100 Years

The figure shows a number of peaks that correspond to the arrival of "pulses" of radionuclides from different areas on the site. This is further clarified by **Table 4–35**, which, for each alternative, displays the WMA, the predicted peak annual TEDE arising from radionuclides leaching from the WMA, and the predicted years until peak annual TEDE.

Table 4–35 Peak Annual Total Effective Dose Equivalent in Millirem Per Year for the Cattaraugus Creek Receptor (year of peak exposure in parentheses) – Loss of Institutional Controls After 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	0.019 (200)	0.26 (200)
Vitrification Facility – WMA 1	0.000037 (1,000)	0.10 (200) [b]
Low-Level Waste Treatment Facility – WMA 2	0.00026 (100)	0.015 (100)
Waste Tank Farm – WMA 3	0.0019 (300)	1.5 (200)
NDA – WMA 7 [c]	0.010 (8,700)	0.010 (8,700)
SDA – WMA 8 [c]	0.23 (37,300)	0.23 (37,300)
North Plateau Groundwater Plume [c]	0.51 (34)	0.51 (34)
Total	0.51 (34)	1.9 (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational for 100 years, after which they would fail completely.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

The results presented in Table 4–35 show that the total peak annual dose to the Cattaraugus Creek receptor due to groundwater releases would be less than 2 millirem per year under both alternatives. However, whereas in Table 4–24 the predicted total doses for the two alternatives were about the same, the long-term peak for the No Action Alternative is now about 4 times larger. For the No Action Alternative, the peak annual dose would be dominated by the Waste Tank Farm and occur at approximately 200 years. The dominant radionuclide from the Waste Tank Farm with the No Action Alternative is strontium-90 in drinking water. The doses for the Sitewide Close-In-Place Alternative with loss of institutional controls are much the same as they were for indefinite continuation of institutional controls, reflecting the conservative nature of the assumptions made with respect to the degradation of barriers in the latter case. This is because the movement of contaminants under the Sitewide Close-In-Place Alternative is not controlled by features that are sensitive to the presence or absence of institutional controls.

Table 4–36 shows the peak risk of latent cancer morbidity for the Cattaraugus Creek receptor arising from radiological discharges. It also shows how this risk varies from different WMAs and what it is for contributions from the entire site for each alternative. As expected, this table closely parallels the dose table, Table 4–35. Releases from the Main Plant Process Building, the Vitrification Facility, and the Waste Tank Farm under the No Action Alternative result in a projected lifetime risk of cancer fatality of 4.1×10^{-5} per year, which is about a factor of 4 greater than the risk for the Sitewide Close-In-Place Alternative. Both of these values lies within the CERCLA risk range of 1×10^{-6} to 1×10^{-4}.

Table 4–36 Peak Lifetime Radiological Risk (risk of latent cancer morbidity) for the Cattaraugus Creek Receptor (year of peak risk in parentheses) – Loss of Institutional Controls After 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	4.2×10^{-7} (200)	5.62×10^{-6} (200)
Vitrification Facility – WMA 1	3.12×10^{-10} (300)	2.28×10^{-6} (200) [b]
Low-Level Waste Treatment Facility – WMA 2	6.45×10^{-9} (100)	3.38×10^{-7} (100)
Waste Tank Farm – WMA 3	7.84×10^{-8} (300)	3.24×10^{-5} (200)
NDA – WMA 7 [c]	2.61×10^{-7} (8,600)	2.61×10^{-7} (8,600)
SDA – WMA 8 [c]	2.89×10^{-6} (37,300)	2.89×10^{-6} (37,300)
North Plateau Groundwater Plume [c]	1.10×10^{-5} (34)	1.10×10^{-5} (34)
Total	1.10×10^{-5} (34)	4.06×10^{-5} (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational for 100 years, after which they would fail completely.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Table 4–37 shows the peak lifetime cancer risk from chemical exposure broken down by WMA. In contrast to radiological doses, the additional releases from the Main Plant Process Building and Waste Tank Farm that occur in the case of the No Action Alternative do not cause a large increase in risk. This is because, when analyzing only chemicals, inventories of hazardous chemicals are much larger and more mobile in the NDA and SDA than in the buildings and tanks.[22] As was the case for indefinite continuation of institutional controls, the chemical risks are a small fraction of the radiological risks, except for times approaching 100,000 years.

Detailed calculations also confirm that, for loss of institutional controls after 100 years, the Hazard Index and the fraction of MCL both remain much less than unity.

Table 4–37 Peak Lifetime Risk from Hazardous Chemicals (risk of latent cancer morbidity) for the Cattaraugus Creek Receptor (year of peak risk in parentheses) – Loss of Institutional Controls After 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	1.4×10^{-9} (5,000)	3.0×10^{-9} (4,000) [b]
Vitrification Facility – WMA 1	1.3×10^{-10} (11,700)	3.6×10^{-9} (1,100) [b]
Waste Tank Farm – WMA 3	1.1×10^{-10} (8,900)	1.3×10^{-9} (2,300) [b]
NDA – WMA 7 [c]	1.4×10^{-9} (85,900)	1.4×10^{-9} (85,900)
SDA – WMA 8 [c]	2.1×10^{-8} (100)	2.1×10^{-8} (100)
Total	2.1×10^{-8} (100)	2.1×10^{-8} (100)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.
[a] The limited information available on hazardous chemical inventories in the Low-Level Waste Treatment Facility suggest it would not make a noticeable contribution to the overall long-term risk from hazardous chemicals.
[b] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational for 100 years, after which they would fail completely.
[c] NDA and SDA interstitial velocity calculated from STOMP model outputs were the same for the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Seneca Nation of Indians Receptor

As described above for the case where institutional controls remain in place, the timing of the peak annual dose to the Seneca Nation of Indians receptor for the case when institutional controls fail after 100 years is similar to that for the Cattaraugus Creek receptor, but the Seneca Nation of Indians receptor dose is larger because the Seneca Nation of Indians receptor is postulated to consume a larger amount of fish (62 kilograms per year) raised in the lower reaches of Cattaraugus Creek or in Lake Erie near the point where Cattaraugus Creek discharges into the lake. Detailed results are presented in Appendix H, Section H.2.2.3.3 (Tables H–56 through H–59). The following is a summary of those results for the Seneca Nation of Indians receptor in the case of the No Action Alternative.

- The long-term peak annual total effective dose due to groundwater releases:
  - Would be less than 3 millirem per year;
  - Would be slightly higher than that of the Cattaraugus Creek receptor (about a factor of 1.3);
  - Would occur at approximately the same time as for the Cattaraugus Creek receptor; and
  - Would be dominated by the Waste Tank Farm.

[22] *Note that, in general, organic chemicals experience less retardation than radionuclides. The controlling constituent of the SDA impact is more strongly retarded than that of the NDA impact, which is why the NDA peak occurs much earlier than the SDA peak. Note also that degradation of organic compounds is not addressed.*

- The peak lifetime radiological risk of latent cancer morbidity due to groundwater releases:
  - Would be dominated by the Waste Tank Farm;
  - Would lie within the CERCLA risk range of 1×10^{-6} to 1×10^{-4}; and
  - Would bear much the same relationship to the Cattaraugus Creek peak lifetime radiological risk as does the peak TEDE to the Cattaraugus Creek peak TEDE (i.e., somewhat higher).
- The dominant radionuclide would be strontium-90 via fish (as opposed to strontium-90 via drinking water for the Cattaraugus Creek receptor).
- The latent cancer morbidity risk from hazardous chemicals would be very much smaller than that from radioactive materials except approaching 100,000 years. The Hazard Indices and fractions of MCL remain much less than unity.
- As with the Cattaraugus Creek receptor, the dose to the Seneca Nation of Indians receptor under the Sitewide Close-In-Place Alternative with loss of institutional controls after 100 years is similar to that for indefinite continuation of institutional controls because the movement of contamination under the Sitewide Close-In-Place Alternative is not controlled by features that are sensitive to the presence or loss of institutional controls.

Lake Erie/Niagara River Water Users

Table 4–38 presents the peak annual population TEDE for Lake Erie/Niagara River water users. **Table 4–39** presents the population TEDE integrated over 1,000 and 10,000 years.

Table 4–38 Peak Annual Total Effective Population Dose Equivalent in Person-Rem per Year for Lake Erie/Niagara River Water Users (year of peak dose in parentheses) – Loss of Institutional Controls After 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Main Plant Process Building – WMA 1	1.0 (200)	36 (200) [b]
Vitrification Facility – WMA 1	0.0030 (1,000)	20 (200) [b]
Low-Level Waste Treatment Facility – WMA 2	0.038 (100)	2.7 (100)
Waste Tank Farm – WMA 3	0.41 (300)	287 (200) [b]
NDA – WMA 7 [c]	1.2 (30,100)	1.2 (30,100)
SDA – WMA 8 [c]	18 (37,300)	18 (37,300)
North Plateau Groundwater Plume [c]	95 (34)	95 (34)
Total	95 (34) [d]	344 (200) [e]

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational for 100 years, after which they would fail completely. The doses from these units would be minimal as long as these engineered systems function as originally designed.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

[d] This total dose of 95 person-rem per year would be primarily accumulated by the 565,000 Lake Erie (Sturgeon Point) water users, giving a peak annual individual TEDE of approximately 0.2 millirem per year.

[e] This total dose of 344 person-rem per year would be primarily accumulated by the 565,000 Lake Erie (Sturgeon Point) water users, giving a peak annual individual TEDE of approximately 0.6 millirem per year.

Table 4–39 Time-integrated Total Effective Population Dose Equivalent for Lake Erie/Niagara River Water Users in Person-Rem Over 1,000 and 10,000 Years – Loss of Institutional Controls After 100 Years

Waste Management Areas [a]	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
Integration over 1,000 years		
Main Plant Process Building – WMA 1	590	3,800 [b]
Vitrification Facility – WMA 1	2	2,000 [b]
Low-Level Waste Treatment Facility – WMA 2	13	340
Waste Tank Farm – WMA 3	130	31,000 [b]
NDA – WMA 7 [c]	150	150
SDA – WMA 8 [c]	710	710
North Plateau Groundwater Plume [c]	2,400	2,400
Total	4,000	40,000
Integration over 10,000 years		
Main Plant Process Building – WMA 1	940	41,000
Vitrification Facility – WMA 1	5	2,500 [b]
Low-Level Waste Treatment Facility – WMA 2	50	1,500
Waste Tank Farm – WMA 3	260	42,000
NDA – WMA 7 [c]	2,200	2,200
SDA – WMA 8 [c]	28,000	28,000
North Plateau Groundwater Plume [c]	2,500	2,500
Total	34,000	120,000

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

[a] For WMAs 1 through 3, the contributions to dose are presented for the key facilities that contain almost all of the radioactive materials in the WMA, while the NDA (WMA 7) and SDA (WMA 8) are presented as entities in their own right. Other WMAs are not sources of radioactive materials.

[b] It is assumed that maintenance actions would keep engineered systems (geomembrane covers, drying systems, roofs) operational for 100 years, after which they would fail completely.

[c] North Plateau Groundwater Plume, NDA, and SDA interstitial velocities calculated from STOMP model outputs were the same under the Sitewide Close-In-Place and No Action Alternatives; therefore, peaks are the same for both alternatives.

Note: Totals may not add due to rounding.

As described previously, most of the population dose shown in Table 4–38 would be received by receptors using water from the Sturgeon Point intake, which would see higher radionuclide concentrations than the intake structures on the Niagara River. The peak annual dose is about 95 person-rem under the Sitewide Close-In-Place Alternative and approximately 344 person-rem under the No Action Alternative. For perspective, the estimated annual background radiation dose for Lake Erie water users (565,000 receptors) would be approximately 350,000 person-rem.

Table 4–39 presents the time-integrated population dose over periods of 1,000 and 10,000 years. For the Sitewide Close-In-Place Alternative and the No Action Alternative, the total population dose accumulated over 10,000 years (34,000 person-rem and 120,000 person-rem, respectively) would be smaller than the background dose that would be accumulated in 1 year by Sturgeon Point (Lake Erie) water users alone (350,000 person-rem).

4.1.10.3.3 Conditions Assuming Loss of Institutional Control – Erosion-Driven Releases

The NYSERDA View Indicates….

The Final EIS Analysis of Soil Erosion is Not Scientifically Defensible and Should Not be Used for Long-term Decisionmaking. The erosion analysis in the Final EIS is not scientifically defensible because in NYSERDA's opinion, many of the modeling results are inconsistent with what is observed at WNYNSC today and do not explicitly predict the location and magnitude of stream meandering, gully erosion, and other physical changes in the landscape.

DOE's Response….

The erosion analysis is scientifically defensible. This analysis has been conducted by acknowledged experts in this technical specialty using landscape evolution models, a theoretical approach consistent with methods currently available to the scientific community, and all available site-specific data. Although DOE was of the opinion that the erosion modeling performed for the Revised Draft EIS met NEPA and SEQR requirements and could be used to make long-term decisions for WNYNSC, between the Revised Draft and Final EIS, DOE made changes to its modeling effort and analysis in response to NYSERDA's comments. The original analytical approach together with the acknowledgement and discussion of the uncertainty in the analysis meets the requirements of NEPA and SEQR.

- *NYSERDA's statement that the soil erosion analysis in this EIS is "not scientifically defensible and should not be used for long-term decisionmaking" appears to be a comment on the state of landscape evolution science in general. NYSERDA's statements about the state of the science of landscape evolution modeling, including the statement that such models necessarily represent nature in a very abstract, simplistic way, recognize the current state of the science for erosion analysis. In addition, neither NYSERDA nor its expert panel identified any specific analytical improvements that could be implemented for the analysis in this EIS.*

  For the Final EIS, and in response to concerns raised in the NYSERDA View for the Revised Draft EIS, the CHILD erosion model was recalibrated using Monte-Carlo (probabilistic) methods and more detailed calibration criteria. Five sets of calibration parameters produced topography predictions close to observed conditions. These five sets of calibration parameters were then used to develop topography predictions over 10,000 years for the unmitigated erosion scenario.

- *NYSERDA's statements that the results from short-term erosion predictions reported in Appendix F provide little useful information with regard to erosion rates at WVDP misses the purpose of presenting this information in Appendix F. As stated in Section F.3.2, this information from previous studies is presented to provide perspective on the reasonableness of the CHILD results. Predictions from the calibrated CHILD model are relied upon to obtain insight into long-term erosion at the West Valley site.*

- *NYSERDA's statement that "With the exception of one modeling scenario, the simulation results show no gully erosion of the South Plateau over the next 10,000 years" is incorrect. While some South Plateau erosion predictions show limited erosion, other cases show erosion that includes gully advance. These results are briefly discussed in Sections F.3.1.6.7 and F.3.1.6.9, which discuss the CHILD erosion predictions for the No Action and Close-In-Place Alternatives, respectively. These sections discuss the erosion predictions including gully advance that were developed by CHILD using various calibration cases.*

  The unmitigated erosion analysis predicts gully advancement on both the North and South Plateaus. The dose estimates for the unmitigated erosion scenario were developed using the more rapid gully advance rate predicted by the calibrated CHILD model (NPTwet Case for the Sitewide Close-In-Place Alternative), and assumes the gully advances into areas determined to be vulnerable to gully formation. These conservative assumptions were used in recognition of the uncertainty about the precise location and advance rate of gullies. The CHILD predictions do not support gully penetration into the area of the Main Plant Process Building or Waste Tank Farm within 10,000 years. Appendix F and Chapter 4, Section 4.1.10.3.3 have been revised to present the updated results and discuss the updated methodology. In addition, Section 2.3 of the Comment Response Document includes a summary level discussion of the erosion analysis.

- *NYSERDA's statement that the predictions are "wholly inconsistent with what is being observed at these locations today" is inconsistent with DOE's interpretation of the projections. Section F.3.1.6.10 discusses both consistencies and inconsistencies between the CHILD predictions and present day patterns.*

- *DOE recognizes that the NYSERDA staff considers the 10,000-year predictions to be unrealistic and overly optimistic, but there does not appear to be any technical basis for this opinion because NYSERDA has not performed an independent long-term erosion analysis.*

Erosion is recognized as a site phenomenon, and so a conservative scenario of unmitigated erosion is analyzed to estimate the dose to various receptors. For the purposes of this analysis, unmitigated erosion is defined to mean that credit is not taken for the presence of erosion control structures or performance monitoring and maintenance of any kind. Predictions of unmitigated erosion for thousands of years into the future were developed with the help of a landscape evolution model that was calibrated to reproduce both historical erosion rates and current topography, starting from the topography estimated to exist after the last glacial recession. The development of the unmitigated erosion estimate is discussed in Appendix F of this EIS. The chosen erosion scenario for the landscape evolution model corresponds to a case in which the site becomes partly forested and partly grassland.

The modeling described in this section considers unmitigated erosion for the Low-Level Waste Treatment Facility on the North Plateau and the SDA and NDA on the South Plateau only. The landscape evolution model predicts very little erosion in the region of the Main Plant Process Building, Vitrification Facility, and Waste Tank Farm, and also predicts that the only places where any serious erosion is expected in the foreseeable future would be in the vicinities of the Low-Level Waste Treatment Facility, SDA, or NDA. The analysis was based on the size and configuration of a large gully predicted to develop at the north end of the North Plateau under conditions of elevated precipitation and reduced infiltration (see Appendix F, Section F.3.1.6.4). A more-complete description of this gully is presented in Appendix H, Section H.2.2.

A spectrum of erosion-related receptors was examined: (a) three residents,[23] one on the west bank of Erdman Brook south of the Low-Level Waste Treatment Facility, one on the east bank of Franks Creek opposite the SDA, and one on the west bank of Erdman Brook opposite the NDA, each of whom would be exposed to direct radiation from the eroded opposite bank and would spend some time hiking about the site; (b) a resident farmer along Buttermilk Creek; and (c) the same offsite receptors as those evaluated for the case of continuation of institutional controls—Cattaraugus Creek, Seneca Nation of Indians, and Lake Erie/Niagara River water users.

Low-Level Waste Treatment Facility/NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area/State-Licensed Disposal Area Resident/Recreational Hiker

Table 4–40 presents the peak annual TEDE for the resident/recreational hiker for the Low-Level Waste Treatment Facility, NDA, and SDA if unmitigated erosion was allowed to take place. The table also shows the year of peak annual dose. The assumptions governing the behavior and exposure of the recreational hiker are given in Appendix H, Table H–5, of this EIS. Exposure modes for a hiker include inadvertent ingestion of soil, inhalation of fugitive dust, and exposure to direct radiation. However, this receptor does not ingest radionuclides through food and water pathways.

The projected results are quite similar for the Sitewide Close-In-Place and the No Action Alternatives. Because of conservative assumptions in the unmitigated erosion model, the engineered cap only slightly reduces the rate of erosion for the Sitewide Close-In-Place Alternative. No credit is taken for stream erosion controls for the erosion resistance of the rock along the side of the engineered cap. Additional detail on the unmitigated erosion release model is provided in Appendix G of this EIS.

[23] The onsite resident differs from the onsite resident farmer in that the former has no garden and does not drink contaminated water. See Appendix H, Figure H–3, of this EIS, for the locations of these three receptors.

Table 4–40 Peak Annual Total Effective Dose Equivalent in Millirem Per Year to a Resident/Recreational Hiker on the Low-Level Waste Treatment Facility, NDA, and SDA (year of peak exposure in parentheses) – Unmitigated Erosion

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
NDA – WMA 7	34 (200)	70 (160)
SDA – WMA 8	29 (190)	40 (160)
Low-Level Waste Treatment Facility – WMA 2	11 (180)	28 (140)
Total	68 (200)	129 (160)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

Buttermilk Creek Resident Farmer

Table 4–41 presents the peak annual TEDE from the eroded Low-Level Waste Treatment Facility, NDA, and SDA for the Buttermilk Creek resident farmer for the unmitigated erosion scenario. See Appendix H, Section H.1.3.1, for a discussion of the location of the Buttermilk Creek resident farmer. The table also shows the year of peak annual dose. For comparison, the predicted annual TEDEs for the case of loss of institutional controls without unmitigated erosion are 3.9 millirem per year under the Sitewide Close-In-Place Alternative and 14 millirem per year under the No Action Alternative (see Table 4–31).

Table 4–41 Peak Annual Total Effective Dose Equivalent in Millirem Per Year for the Buttermilk Creek Resident Farmer (year of peak exposure in parentheses) – Unmitigated Erosion

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
NDA – WMA 7	12 (490)	84 (200)
SDA – WMA 8	5 (420)	26 (160)
Low-Level Waste Treatment Facility – WMA 2	6 (200)	12 (170)
Total	16 (860)	115 (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

Cattaraugus Creek Receptor

Table 4-42 presents the peak annual TEDE from the Low-Level Waste Treatment Facility, NDA, and SDA for the Cattaraugus Creek resident farmer for the unmitigated erosion scenario.

The doses to the Cattaraugus Creek receptor, if unmitigated erosion were allowed to progress at WNYNSC, show a similar pattern to that seen for the Buttermilk Creek intruder, but the doses would be generally lower by a factor of about eight.

For comparison, the peak annual TEDE to the Cattaraugus Creek receptor for the case of loss of institutional controls without unmitigated erosion is 0.51 millirem per year under the Sitewide Close-In-Place Alternative and 1.9 millirem per year under the No Action Alternative (see Table 4–35).

Table 4–42 Peak Annual Total Effective Dose Equivalent in Millirem Per Year for the Cattaraugus Creek Receptor (year of peak exposure in parentheses) – Unmitigated Erosion

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
NDA – WMA 7	1.5 (490)	11 (200)
SDA – WMA 8	0.68 (420)	3.4 (160)
Low-Level Waste Treatment Facility – WMA 2	0.74 (200)	1.6 (170)
Total	2.1 (860)	15 (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

An illustration of how the peak annual dose to the Cattaraugus Creek receptor would vary as a function of time for the Sitewide Close-In-Place Alternative is presented on **Figure 4–8**. The variations for the No Action Alternative are almost identical. The variations for the Buttermilk Creek farmer (provided earlier) and the Seneca Nation of Indians receptor (in this section) have the same shape, although the peaks are not of the same magnitude. The plot cuts off at about 3,000 years because the peak annual dose occurs prior to 100 years and rates of erosion decrease with time.

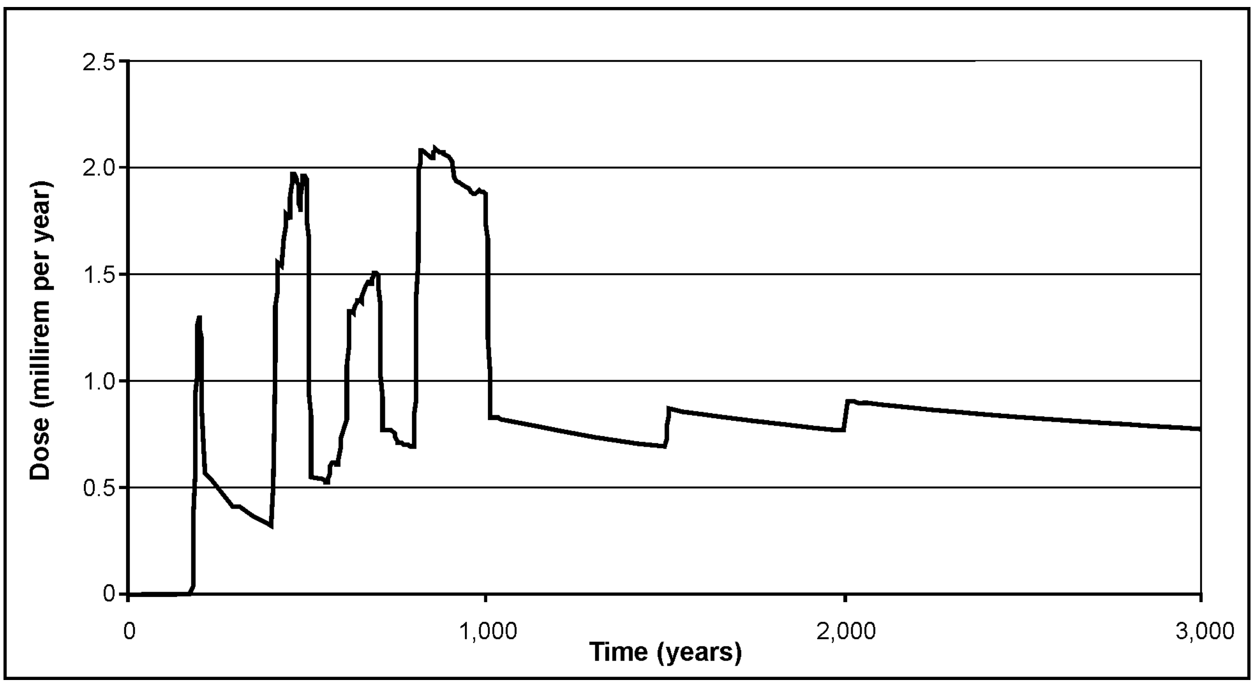

Figure 4–8 Annual Total Effective Dose Equivalent for the Cattaraugus Creek Receptor as a Function of Time with the Sitewide Close-In-Place Alternative and Unmitigated Erosion

Seneca Nation of Indians Receptor

As described previously, a Seneca Nation of Indian receptor is postulated to use Cattaraugus Creek near Gowanda for drinking water and to consume large quantities of fish raised in these waters. The peak annual dose for this receptor is presented in **Table 4–43**.

The timing of the dose peaks for the Seneca Nation of Indians receptor, in the event of unmitigated erosion at WNYNSC, show a similar pattern to that seen for the Cattaraugus Creek receptor, but the numerical values of the dose peaks would be higher by a factor of about two as a result of the higher assumed level of fish consumption.

Table 4–43 Peak Annual Total Effective Dose Equivalent in Millirem Per Year to the Seneca Nation of Indians Receptor (year of peak exposure in parentheses) – Unmitigated Erosion

Waste Management Areas	*Sitewide Close-In-Place Alternative*	*No Action Alternative*
NDA – WMA 7	4 (490)	26 (200)
SDA – WMA 8	1 (420)	7 (160)
Low-Level Waste Treatment Facility – WMA 2	2 (200)	3 (170)
Total	4 (490)	34 (200)

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, WMA = Waste Management Area.

For comparison, the peak annual TEDE to the Seneca Nation of Indians receptor for the case of loss of institutional controls without unmitigated erosion is 0.68 millirem per year for the Sitewide Close-In-Place Alternative and 2.5 millirem per year for the No Action Alternative, see Appendix H, Table H–56.

Lake Erie/Niagara River Water Users

Peak annual and time-integrated population dose estimates have been prepared for the unmitigated erosion release scenario. These are summarized in **Tables 4–44** and **4–45**, respectively.

As described previously, most of this population dose would be received by the estimated 565,000 receptors postulated to use water from the Sturgeon Point intake on Lake Erie. Using an average annual dose rate from ubiquitous background and other sources of radiation of 620 millirem per year (NCRP 2009), the annual background population dose for these receptors would be approximately 350,000 person-rem. This estimated dose provides perspective to peak annual population doses that were estimated for the Sitewide Close-In-Place Alternative (240 person-rem per year) and the No Action Alternative (1,500 person-rem per year).

Table 4–44 Peak Annual Total Effective Dose Equivalent Population Dose in Person-rem Per Year to the Lake Erie/Niagara River Water Users (year of peak exposure in parentheses) – Unmitigated Erosion

	Sitewide Close-In-Place Alternative	*No Action Alternative*
Unmitigated Erosion	240 (860) [a, b]	1,500 (200) [a, b]

[a] These population doses would be mostly accumulated by the 565,000 Lake Erie (Sturgeon Point) water users, corresponding to peak annual individual TEDEs of about 0.4 millirem (Sitewide Close-In-Place Alternative) and 2.7 millirem per year (No Action Alternative).
[b] For comparison, the peak population dose without unmitigated erosion would be 95 and 344 person-rem per year for the Sitewide Close-In-Place and No Action Alternatives, respectively (see Table 4–38).

Table 4–45 Time-integrated Total Effective Population Effective Dose Equivalent in Person-rem to the Lake Erie/Niagara River Water Users – Unmitigated Erosion

	Sitewide Close-In-Place Alternative	*No Action Alternative*
Integration over 1,000 years	170,000 [a]	450,000 [b]
Integration over 10,000 years	1,000,000 [a]	1,400,000 [b]

[a] For comparison, the time-integrated doses without unmitigated erosion would be approximately 4,000 and approximately 34,000 person-rem, respectively (see Table 4–39).
[b] For comparison, the time-integrated doses without unmitigated erosion would be approximately 40,000 and approximately 120,000 person-rem (see Table 4–39).

Additional perspective is provided by the cumulative population dose at 1,000 and 10,000 years. The background population dose accumulated by Sturgeon Point (Lake Erie) water users alone under the No Action Alternative would be approximately 200 million person-rem over 1,000 years, and 2 billion person-rem over

10,000 years. As shown in Table 4–45, the additional population doses accumulated from WNYNSC would be relatively small.

Conclusions for Loss of Institutional Controls Leading to Unmitigated Erosion

The results for uncontrolled erosion of the SDA, NDA and Low-Level Waste Treatment Facility for the Sitewide Close-In-Place Alternative show TEDEs of up to about 68 millirem per year for the resident hiker, 16 millirem per year for the Buttermilk Creek resident farmer, 2 millirem per year for the Cattaraugus Creek receptor, and 4 millirem per year for the Seneca Nation of Indians receptor. For the two offsite receptors, these represent an increase by a factor of about four over the case without unmitigated erosion. The corresponding results for the No Action Alternative are 129, 115, 15, and 34 millirem per year, respectively – higher than those for the Sitewide Close-In-Place Alternative, as expected. Those for the two offsite receptors are higher than those for the case of no erosion by a factor of about eight.

Integrated Groundwater/Erosion Model

In the foregoing analysis, groundwater releases and erosion releases (i.e., particulate matter washed into rivers and streams) are modeled separately. At the present time, integrated models of groundwater and erosional releases are beyond the state-of-the art. This question is addressed in sensitivity studies in Appendix H, Section H.3. However, dose impacts on offsite receptors are about 4-6 times greater in the unmitigated erosion scenarios than they are in the groundwater release scenarios for the Sitewide Close-In-Place Alternative, but the erosion peaks occur much later. In this case, one would not expect much difference in the results of an integrated model. For the No Action Alternative, the dose to offsite receptors ranges from about 8 to 14 times that for the groundwater release scenarios and the peaks occur in comparable time frames, but from different waste management areas. In this particular case, one might expect an integrated model to predict doses that are additive of the two individual results.

4.1.10.4 Some Observations on the Phased Decisionmaking Alternative

As previously discussed, it is not possible to do a long-term performance assessment for the Phased Decisionmaking Alternative, because the ultimate disposition of various areas of the site is not known. For most exposure scenarios and receptors, however, long-term impacts would be bounded by those for the Sitewide Removal and Sitewide Close-In-Place Alternatives. Long-term impacts for some exposure scenarios and receptors would be bounded by those for the No Action Alternative if the Phase 2 decision for the SDA is continued active management.

Some general observations are possible.

Main Plant Process Building and Vitrification Facility – Waste Management Area 1

The plume source volume for the Main Plant Process Building and the Vitrification Facility would be completely removed. These actions most closely resemble those expected for these facilities under the Sitewide Removal Alternative. Therefore, residual contamination from these two structures would contribute negligibly to potential health impacts under any final disposition of the site.

Low-Level Waste Treatment Facility and Lagoons – Waste Management Area 2

All facilities in WMA 2 would be removed during Phase 1 except the permeable treatment wall, which may be replaced. The removal actions would reduce the inventory of radioactive materials and hazardous chemicals and residual contamination in this area, with the exception of that in the North Plateau Groundwater Plume (discussed below), would contribute negligibly to potential health impacts under any final disposition of the site.

Waste Tank Farm – Waste Management Area 3

The underground tanks of the Waste Tank Farm would be isolated with residual contamination in a dry form at the start of Phase 2 decommissioning and this configuration is expected to be maintained during the Phase 2 actions. Releases are not reasonably foreseeable in the near term and longer term consequences from the Waste Tank Farm would depend on the Phase 2 decision for the WMA. If the Waste Tank Farm is closed in place the long-term impacts would be the same as those for the Waste Tank Farm for the Sitewide Close-In-Place Alternative. If the Waste Tank Farm is removed, the long-term impacts would be small and consistent with those for the Sitewide Removal Alternative.

NDA – Waste Management Area 7

During Phase 1, the NDA would continue as at present, under monitoring and/or active management. For the immediate future, contamination would slowly migrate from this area consistent with the No Action Alternative, but there would be no offsite consequences in the near term. Over the longer term, consequences would depend on the Phase 2 decision. If the NDA is closed in place, the long-term impacts for the NDA would be the same as those for the Sitewide Close-In-Place Alternative. If the NDA is removed, the long-term impacts would be small and consistent with those for the Sitewide Removal Alternative.

SDA – Waste Management Area 8

During Phase 1, the SDA would continue as at present, under monitoring and/or active management. For the immediate future, contamination would slowly migrate from this area consistent with the No Action Alternative, but there would be no offsite impacts in the short term. Over the longer term, impacts would depend on the Phase 2 decision. If the decision for the SDA is in-place closure, long-term impacts for the SDA would be consistent with those for the Sitewide Close-In-Place Alternative. If the decision for the SDA is removal, long-term impacts for the SDA would be small and consistent with those for the Sitewide Removal Alternative. If the decision for SDA is continued active management, long-term impacts for the SDA would be bounded for some exposure scenarios and receptors by those for the No Action Alternative.

North Plateau Groundwater Plume

The source area of the North Plateau Groundwater Plume would be removed as in the Sitewide Removal Alternative. Migration of the non-source area of the North Plateau Groundwater Plume would result in a peak in the annual dose to offsite receptors around the year 2045. The dose would be on the order of 0.5 millirem per year for Cattaraugus Creek receptors and less than 0.2 millirem per year to Lake Erie/Niagara River water users (see the results for the Sitewide Close-In-Place and No Action Alternatives). These peak annual doses would not be increased by Phase 2 actions.

Conclusion – Phased Decisionmaking Alternative

Phase 1 removal actions for the Main Plant Process Building, Vitrification Facility, and Low-Level Waste Treatment Facility Area lagoons would result in minimal long-term impacts from residual waste and contamination in these areas. Impacts of the North Plateau Groundwater Plume would peak around the year 2045 and are not sensitive to the Phase 2 decision. Long-term impacts for the Waste Tank Farm, the NDA, and the SDA would depend on the Phase 2 decision. Long-term impacts for the Waste Tank Farm and the NDA are expected to be bounded by the results already calculated for the Sitewide Removal and Sitewide Close-In-Place Alternatives. Long term impacts for the SDA are expected to be bounded by results already calculated for the Sitewide Removal, Sitewide Close-In-Place, and No Action Alternatives.

4.1.11 Waste Management

Depending on the alternative, construction, operations, and decommissioning of facilities would generate several types of waste including nonhazardous, hazardous, low-level radioactive, mixed low-level radioactive, and transuranic waste. Definitions for the various waste types are provided in the text box in Chapter 2, Section 2.1, of this EIS.

Waste management impacts were assessed by comparing the projected waste volumes generated under each alternative to current waste management practices and to the volumes of waste being managed from ongoing activities at WNYNSC. Ongoing activities include waste treatment, storage, and disposal as evaluated in the *Final West Valley Demonstration Project Waste Management Environmental Impact Statement (Waste Management EIS)* (DOE/EIS-0337F) (DOE 2003e) and Supplement Analysis (DOE/EIS-0337-SA-01) (DOE 2006b); disposal of 36 surplus facilities as evaluated in the *Environmental Assessment for the Decontamination, Demolition, and Removal of Certain Facilities at the West Valley Demonstration Project*, (DOE/EA-1552) (DOE 2006c); and completion of certain actions described in Chapter 2, Section 2.3.1, of this EIS, representing the starting point for this EIS. **Table 4–46** presents a summary of the waste management impacts for the EIS alternatives.

As described in Chapter 2 of this EIS, under the Sitewide Removal, Sitewide Close-In-Place, and Phased Decisionmaking (Phase 1) Alternatives, new facilities would be constructed to manage some of the waste. The environmental impacts of construction, operations, and deactivation of these new waste management facilities are evaluated in the applicable sections of this chapter.

4.1.11.1 Waste Volumes

Large volumes of waste, much of it radioactive, are expected to be generated and processed for disposal during decommissioning of WNYNSC.

Table 4–47 compares the packaged waste volumes generated by the four EIS alternatives. The table is divided into two sections. The upper section of the table shows the volumes of wastes that would need to be processed and disposed of under the DOE/Commercial Disposal Option (DOE low-level radioactive waste is disposed of at DOE disposal facilities while commercial low-level radioactive waste is disposed of at commercial disposal facilities). The lower section of the table shows the volumes of wastes that would need to be processed and disposed of under the Commercial Disposal Option (all low-level radioactive waste is disposed of at commercial facilities). Note that the packaged volumes vary because of the different packaging required to meet the waste acceptance criteria of the waste disposal facilities. For example, DOE wastes that would be equivalent to Class B and C wastes under NRC regulations that would be disposed of at DOE disposal facilities are assumed to be packaged in B-25 boxes or 208-liter (55-gallon) drums, whereas commercial facilities are assumed to require packaging in high integrity containers (HICs).

Table 4–48 compares the packaged waste volumes generated by the activities performed under the three decommissioning alternatives for site monitoring and maintenance or long-term stewardship. These wastes are presented on an annual basis to allow comparison with each other and the No Action Alternative.

4.1.11.2 Management Options

There are a variety of disposal options available for the different types of wastes to be processed under the alternatives. Different disposal options may be available (i.e., whether the waste in question comes from an area that is a DOE responsibility or one that is a NYSERDA responsibility). **Table 4–49** presents these options by waste type.

Table 4–46 Summary of Waste Management Impacts

Activity	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)*	*No Action Alternative* [f]
Packaged Decommissioning Waste (cubic meters)				
Nonhazardous	140,000	15,000	33,000	NA
Hazardous	15	3	2	NA
LLW [a]	1,500,000	9,900	180,000	NA
GTCC [a]	4,200	0	0	NA
TRU [a]	1,000	35	710	NA
MLLW	570	410	41	NA
Total	1,600,000	26,000	210,000	NA
Impacts	Nonhazardous waste, Class A low-level radioactive waste (including low-specific-activity waste), and Greater-Than-Class C waste exceed the volumes being managed from ongoing activities.[b] Nonhazardous waste is common demolition debris that would have no adverse impact on commercial disposal facility capacity. Much of the low-level radioactive waste is low-specific-activity waste that would have no adverse impact on DOE or commercial disposal facility capacity.	All waste volumes would be less than the volumes being managed from ongoing activities.[c]	Nonhazardous waste and Class A low-level radioactive waste generated during Phase 1 (including low specific activity waste) would exceed the volumes being managed from ongoing activities.[b] Nonhazardous waste is common demolition debris that would have no adverse impact on commercial disposal facility capacity. Much of the low-level radioactive waste is low-specific-activity waste that would have no adverse impact on DOE or commercial disposal facility capacity. If the Phase 2 decision is removal of all remaining waste and contamination, the total waste volume generated under the entire Phased Decisionmaking Alternative would be similar to that generated under the Sitewide Removal Alternative. Approximately 30 percent of the Class A/LSA low-level radioactive waste and most of the mixed low-level radioactive, Class B and C low-level radioactive, and Greater-Than-Class C waste would not be generated if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, the waste volume generated under the entire Phased Decisionmaking Alternative would be the sum of the Phase 1 waste volume plus about 30 percent of the waste volume generated under the Sitewide Close-In-Place Alternative. The waste volume would be slightly less if the Phase 2 decision for the SDA is continued active management.	Not applicable.
Packaged Waste from Site Monitoring and Maintenance or Long-term Stewardship (cubic meters per year) [e]				
Nonhazardous	0	0	6	32
Hazardous	0	0	< 1	1
GTCC	0	0	0	0
TRU	0	0	0	0
LLW	0	110	140	450
MLLW	0	0	0	< 1
Total	0	110	150	480

Activity	Sitewide Removal Alternative	Sitewide Close-In-Place Alternative	Phased Decisionmaking Alternative (Phase 1)	No Action Alternative [f]
Impacts	Not applicable	Annual waste volumes would be less than those under the No Action Alternative (continuing current activities) and therefore would have little impact on the waste management infrastructure.	Annual long-term waste generation rates for Phase 2 would be almost double the Phase 1 monitoring and maintenance rates if the remaining facilities are closed in place, and would be zero if Phase 2 results in the removal of the remaining waste and contamination. If the Phase 2 decision for the SDA is continued active management and the Phase 2 decision for the remainder of the site is in-place closure, there would be small quantities of wastes generated annually from ongoing monitoring and maintenance of the SDA and long-term stewardship of the remaining affected portions of the site. If the Phase 2 decision for the SDA is continued active management and the Phase 2 decision for the remainder of the site is removal, there would be small quantities of wastes annually generated from ongoing monitoring and maintenance of the SDA but no waste from long-term stewardship for the remainder of the site. Annual waste volumes would be less than those under the No Action Alternative (continuing current activities) and therefore would have little impact on the waste management infrastructure.	Annual waste volumes would be similar to those currently generated by these activities and therefore would have little impact on the waste management infrastructure.
Orphan Waste Management (cubic meters per year)				
LLW	3.2 [c]	< 3.2 [c]	≤ 3.2 [c, d]	0
Impacts	Until the issues related to disposal of commercial Class B and C low-level radioactive waste, Greater-Than-Class C waste, and non-defense transuranic waste are resolved, these wastes would be stored in the Container Management Facility. High-level radioactive waste would be stored in the Interim Storage Facility until disposition decisions are made and implemented.	Until the issues related to disposal of commercial Class B and C low-level radioactive waste and non-defense transuranic waste are resolved, these wastes would be stored in Lag Storage Area 4. High-level radioactive waste would be stored in the Interim Storage Facility until disposition decisions are made and implemented.	Until the issues related to disposal of non-defense transuranic waste are resolved, this waste would be stored in Lag Storage Area 4. High-level radioactive waste would be stored in the Interim Storage Facility until disposition decisions are made and implemented.	High-level radioactive waste would continue to be stored in the Main Plant Process Building until disposition decisions are made and implemented.

Activity	Sitewide Removal Alternative	Sitewide Close-In-Place Alternative	Phased Decisionmaking Alternative (Phase 1)	No Action Alternative [f]

GTCC = Greater-Than-Class C waste, LLW = low-level radioactive waste, LSA = low-specific-activity, MLLW = mixed low-level radioactive waste, NA = not applicable, SDA = State-Licensed Disposal Area, TRU = transuranic waste, WVDP = West Valley Demonstration Project.

[a] Pre-WVDP Class B and C low-level radioactive waste, Greater-Than-Class C low-level radioactive waste, and non-defense transuranic waste do not have a clear disposal path and may need to be stored on site until a disposal location is available.

[b] Quantities indicated are the maximum quantities of packaged waste projected in the technical reports (WSMS 2009a, 2009b, 2009c, 2009d). Values are rounded to two significant figures.

[c] This annual volume is generated only if orphan waste is stored on site.

[d] Annual volumes are dependent on the Phase 2 decision, but would be less than or equal to those listed for the Sitewide Removal Alternative.

[e] Wastes from long-term stewardship would not be generated under Sitewide Removal Alternative, although some waste could be annually generated as part of temporary operation of an orphan waste storage facility. Long-term stewardship wastes would be generated under the Sitewide Close-In-Place Alternative. Monitoring and maintenance waste would be generated as part of Phase 1 of the Phased Decisionmaking Alternative and the No Action Alternative. Wastes from long-term stewardship may be generated following completion of Phase 2 of the Phased Decisionmaking Alternative if the decision for Phase 2 is in-place closure. Wastes from monitoring and maintenance may be generated following completion of Phase 2 if the Phase 2 decision for the SDA is continued active management.

[f] Decommissioning does not occur for the No Action Alternative.

Note: Quantities indicated are the maximum quantities of packaged waste projected in the technical reports. Values are rounded to two significant figures. Totals may not add due to rounding. To convert cubic meters to cubic feet, multiply by 35.314.

Source: Summarized from Tables 4–47 and 4–48 of this chapter.

Table 4–47 Comparison of Estimated Packaged Waste Volumes for Decommissioning Activities (cubic meters)

Waste Type (Disposal Location)	*Sitewide Removal Alternative* [a]	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)* [a, b]	*No Action Alternative* [c]
Assuming the DOE/Commercial Disposal Option				
Nonhazardous construction/demolition debris (commercial)	140,000	15,000	33,000	NA
Hazardous (commercial)	15	3	2	NA
Low-level radioactive				
DOE Low-specific-activity (DOE)	300,000	5,300	160,000	NA
DOE Class A – equivalent (DOE)	34,000	3,000	19,000	NA
DOE Class B – equivalent (DOE)	140	3	99	NA
DOE Class C – equivalent (DOE)	1,300	42	1,100	NA
Low-specific-activity/Class A [d] (commercial)	1,100,000	1,500	25	NA
Class B/C [e, f] (commercial)	4,900	23	0	NA
Greater-Than-Class C [f] (uncertain)	4,200	0	0	NA
Transuranic [f] (uncertain)	1,000	35	710	NA
Mixed low-level radioactive (commercial)	570	410	41	NA
Total	1,600,000	26,000	210,000	NA
Assuming the Commercial Disposal Option				
Nonhazardous construction/demolition debris (commercial)	140,000	15,000	33,000	NA
Hazardous (commercial)	15	3	2	NA
Low-level radioactive				
Low-specific-activity (commercial)	1,300,000	5,900	160,000	NA
Class A (commercial)	120,000	3,900	20,000	NA
Class B (commercial)	2,600	3	110	NA
Class C (commercial)	3,900	65	1,200	NA
Greater-Than-Class C [f] (uncertain)	4,200	0	0	NA
Transuranic [f] (uncertain)	1,000	35	710	NA
Mixed low-level radioactive (commercial)	570	410	41	NA
Total	1,600,000	26,000	210,000	NA

NA = not applicable.

[a] If the waste incidental to reprocessing process is not applied to the high-level radioactive waste storage tanks and waste residuals in the tanks, under the Sitewide Removal Alternative approximately 500 cubic meters (18,000 cubic feet) of waste would be added to the inventory of high-level radioactive waste already stored on site, and the amount of low-level radioactive waste and transuranic waste shown in this table would be reduced by about 210 cubic meters (7,500 cubic feet) and 280 cubic meters (10,000 cubic feet), respectively. For Phase 1 of the Phased Decisionmaking Alternative, approximately 51 cubic meters (1,800 cubic feet) of waste would be added to the inventory of high-level radioactive waste, and the amount of low-level radioactive waste and transuranic waste would be reduced by about 32 cubic meters (1,100 cubic feet) and 19 cubic meters (670 cubic feet), respectively.

[b] If Phase 2 of the Phased Decisionmaking Alternative results in removal of all remaining waste and contamination, the total decommissioning waste volumes generated under the entire Phased Decisionmaking Alternative (Phases 1 and 2) are expected to be very similar to those generated under the Sitewide Removal Alternative. Much less waste would be generated if

the Phase 2 decision for the State-Licensed Disposal Area (SDA) is continued active management. If Phase 2 of the Phased Decisionmaking Alternative results in in-place closure of all remaining waste and contamination, the decommissioning waste volumes generated under the entire Phased Decisionmaking Alternative (Phases 1 and 2) are expected to be similar to the sum generated by adding the Phase 1 waste volumes to approximately 30 percent of the waste volumes generated under the Sitewide Close-In-Place Alternative (WVES 2008). Comparable waste volumes would be generated if the Phase 2 decision for the SDA is continued active management.

[c] Decommissioning does not occur for the No Action Alternative.

[d] Represents pre-West Valley Demonstration Project low-specific-activity and Class A waste planned for disposal at a commercial disposal facility.

[e] Represents pre-West Valley Demonstration Project Class B and C waste planned for disposal at a commercial disposal facility.

[f] Pre-West Valley Demonstration Project Class B and C low-level radioactive waste, Greater-Than-Class C waste, and non-defense transuranic waste do not have a clear disposal path and may need to be stored on site until a disposal location is identified.

Note: Quantities indicated are the maximum quantities of packaged waste projected in the technical reports (WSMS 2009a, 2009b, 2009c, 2009d). Values are rounded to two significant figures. Totals may not add due to rounding. To convert cubic meters to cubic feet, multiply by 35.314.

Sources: WSMS 2009a, 2009b, 20098c, 2009d, 2009e.

Table 4–48 Comparison of Estimated Annual Packaged Waste Volumes for Site Monitoring and Maintenance or Long-term Stewardship Activities (cubic meters per year) [a]

Waste Type	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)* [b]	*No Action Alternative*
Disposal Using Commercial and DOE Facilities				
Nonhazardous construction/demolition debris	0	0	6	32
Hazardous	0	0	< 1	1
Low-level radioactive				
Low-specific-activity	0	100	74	110
Class A	0 [d]	6 [d]	71 [d]	340
Mixed low-level radioactive [c]	0	0	0	< 1
Total	0 [d]	110	150	480

[a] Wastes from long-term stewardship would not be generated for the Sitewide Removal Alternative, although wastes could be generated during operation of an orphan waste storage facility. Long-term stewardship wastes would be generated for the Sitewide Close-In-Place Alternative. Site monitoring and maintenance wastes would be generated as part of Phase 1 of the Phased Decisionmaking Alternative and the No Action Alternative. Wastes from long-term stewardship may be generated following completion of Phase 2 of the Phased Decisionmaking Alternative if the decision for Phase 2 is in-place closure. Wastes from monitoring and maintenance may be generated following completion of Phase 2 if the Phase 2 decision for the State-Licensed Disposal Area (SDA) is continued active management.

[b] Annual volumes are dependent on the Phase 2 decision. Annual long-term stewardship waste generation rates for Phase 2 would be almost double the Phase 1 monitoring and maintenance rates if remaining facilities are closed in place, and would be zero if Phase 2 results in removal of the remaining waste and contamination (WVES 2008). Continued active management of the SDA would result in annual monitoring and maintenance wastes.

[c] Represents mixed low-level radioactive waste planned for treatment and disposal at a commercial disposal facility.

[d] Storage of orphan waste is projected to annually generate up to 3.2 cubic meters of Class A low-level radioactive waste.

Note: Values are rounded to two significant figures. Totals may not add due to rounding. To convert cubic meters to cubic feet, multiply by 35.314.

Sources: WSMS 2009a, 2009b, 2009c, 2009d, 2009e.

Table 4–49 Waste Disposal Options

Waste Type	*Disposal Option(s)*
Nonhazardous construction/demolition debris	Permitted commercial construction/demolition debris landfill.
Hazardous	Permitted commercial hazardous waste treatment and/or disposal facility.
Low-level radioactive (low-specific-activity/ Class A/B/C)	Under the DOE/Commercial Disposal Option, DOE low-level radioactive waste would be disposed of at DOE facilities, while commercial low-level radioactive waste would be disposed of at commercial facilities. Under the Commercial Disposal Option, all low-level radioactive waste would be disposed of at commercial facilities.
Greater-Than-Class C	No disposal facility currently available.[a]
Transuranic	No disposal facility currently identified for non-defense transuranic waste.[b]
Mixed low-level radioactive	Permitted commercial mixed low-level radioactive waste disposal facility, such as EnergySolutions in Clive, Utah.
High-level radioactive	No disposal facility currently available. [c]

[a] All Greater-Than-Class C waste generated as part of any EIS alternative would be safely stored until an appropriate offsite disposal facility is available. DOE proposes to identify a disposal facility for Greater-Than-Class C and potential non-defense transuranic waste based on the *Disposal of Greater-Than-Class C Low-Level Radioactive Waste Environmental Impact Statement (GTCC EIS)* (DOE/EIS-0375). As announced in the July 23, 2007, Notice of Intent, the *GTCC EIS* will evaluate several DOE sites and generic locations for the disposal of Greater-Than-Class C waste and similar DOE waste (72 FR 40135).

[b] All non-defense transuranic waste generated as part of any EIS alternative would be safely stored until DOE has determined that all statutory and regulatory requirements regarding offsite disposal have been met, subject to further NEPA review as appropriate.

[c] Vitrified high-level radioactive waste would be stored on site until disposition decisions are made and implemented.

Sources: Modified from WSMS 2009e.

Any nonhazardous solid waste generated during decommissioning and/or site monitoring and maintenance or long-term stewardship activities would be packaged and transported in conformance with standard industrial practices. Solid waste, such as uncontaminated metal items that can be recycled, would be sent off site for that purpose. The remaining debris derived from demolition of uncontaminated structures would be packaged in roll-off containers for transport to an offsite permitted commercial or municipal disposal facility in accordance with applicable regulations (WSMS 2009e). Trash, such as waste paper generated by routine office work, is not included in the nonhazardous waste estimates (WSMS 2009a).

Hazardous waste would be packaged in U.S. Department of Transportation (DOT)-approved containers in a manner appropriate to the specific waste type, and shipped off site to permitted commercial recycling, treatment, and disposal facilities. (Treatment would be performed before disposal to meet RCRA land-disposal restriction standards.) The hazardous waste would be accumulated for less than 90 days. Therefore, long-term hazardous waste storage facilities would not be required.

Low-level radioactive waste (e.g., contaminated personal protective equipment, tools, filters, rubble, debris, soil, and sediment) would be generated during decommissioning and/or site monitoring and maintenance or long-term stewardship activities. Low-level radioactive waste would be packaged in Sealand containers, lift liners, 208-liter (55-gallons) drums, B-25 boxes, HICs, or similar containers, depending on the waste classification (WSMS 2009a, 2009e). Low-level radioactive waste is typically not treated, or only minimally treated (e.g., drying and compaction), before being sent directly to disposal. Therefore, long-term storage facilities would not be required for most low-level radioactive waste. Class B and C low-level radioactive waste may pose an exception as described later in this section.

In May 2000, the State of South Carolina passed an act forming the Atlantic Interstate Low-Level Radioactive Waste Compact (Atlantic Compact), which includes the States of South Carolina, New Jersey, and Connecticut, under the Low-Level Radioactive Waste Policy Act. As of June 2008, the Atlantic Compact does not accept waste for disposal at the Barnwell, South Carolina, disposal facility from locations outside the Atlantic Compact. The Barnwell facility was the only disposal facility recently available to WNYNSC for the disposal of Class B or C commercial wastes. Therefore, under alternatives that generate commercial Class B or C wastes, onsite storage would be needed until an offsite disposal location is available.

Low-level radioactive wastes buried in the NDA and SDA that exceed the Class C criteria of 10 CFR Part 61 are assumed to be Greater-Than-Class C wastes, which are generally not acceptable for near-surface disposal.[24] Only the Sitewide Removal Alternative (or the Phased Decisionmaking Alternative if the Phase 2 decision results in removal of remaining contaminants) has the potential to generate Greater-Than-Class C waste. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240), the Federal Government is responsible for disposal of Greater-Than-Class C waste in a facility licensed by the NRC. However, no such Greater-Than-Class C disposal facility exists at this time. An *Environmental Impact Statement for the Disposal of Greater-Than-Class C Low-Level Radioactive Waste (GTCC EIS)* (DOE/EIS-0375) that evaluates alternatives for developing a Greater-Than-Class C waste disposal facility is being prepared (72 FR 40135). Therefore, under the Sitewide Removal Alternative, onsite storage would be needed until an offsite disposal location is available.

The *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS)* (DOE/EIS-0026-S-2) analyzed the receipt and disposal of 1,890 cubic meters (66,744 cubic feet) of transuranic waste from the West Valley Demonstration Project (WVDP) (DOE 1997b). The 1,000 cubic meters (35,000 cubic feet) of packaged transuranic waste under the maximum alternative (Sitewide Removal Alternative), when added to the 2,100 cubic meters (74,000 cubic feet) of transuranic waste being managed from ongoing activities at WNYNSC, would exceed the capacity analyzed for WVDP in the *WIPP SEIS*.

[24] *Pursuant to 10 CFR 61.7, there may be some instances where Greater-Than-Class C waste would be acceptable for near-surface disposal; these instances would be evaluated on a case-by-case basis.*

Under all alternatives, transuranic waste generated during decommissioning and/or site monitoring and maintenance or long-term stewardship would be safely stored on site until DOE has determined that all statutory and regulatory requirements regarding disposal have been met, subject to appropriate NEPA review.

Decommissioning and/or site monitoring and maintenance or long-term stewardship activities would also generate mixed Class A low-level radioactive waste (e.g., contaminated equipment, filters, sludge, soils, and sediment). Mixed low-level radioactive wastes generated during decommissioning would be sent to a commercial disposal facility such as EnergySolutions in Clive, Utah, for treatment and disposal. Mixed low-level radioactive waste would be treated to meet RCRA land disposal restriction treatment standards prior to disposal. This mixed low-level radioactive waste would be packaged and transported in a manner consistent with its chemical or radiological characteristics, as described in 49 CFR Part 173.

The existing high-level radioactive waste canisters would be stored on site until disposition decisions are made and implemented. No high-level radioactive waste would be generated by decommissioning and/or site monitoring and maintenance or long-term stewardship of WNYNSC, except where the waste incidental to reprocessing process outlined in DOE Manual 435.1-1 (DOE 1999a) is not applied in classifying remedial waste as low-level radioactive waste and transuranic waste. Therefore, two waste disposal options (waste incidental to reprocessing and high-level radioactive waste) were evaluated for the high-level radioactive waste tanks in WMA 3. The waste incidental to reprocessing option assumes the wastes associated with Tanks 8D-1, 8D-2, and 8D-4 would be managed as low-level radioactive waste and transuranic waste. However, future characterization may require some of this waste to be managed as mixed low-level radioactive waste. The quantities of waste associated with this approach are included in Table 4–47. If it is determined that the waste incidental to reprocessing process cannot be applied (i.e., the wastes associated with these tanks cannot be managed as low-level radioactive waste and transuranic waste), the high-level radioactive waste option assumes Tanks 8D-1, 8D-2, and 8D-4 would need to be managed as high-level radioactive waste.

If the high-level radioactive waste option becomes necessary, a maximum of approximately 500 cubic meters (18,000 cubic feet) of high-level radioactive waste would be added to the inventory of high-level radioactive waste already stored on site, and the amount of low-level radioactive waste and transuranic waste shown in Table 4–47 for the Sitewide Removal Alternative would be reduced by about 210 cubic meters (7,500 cubic feet) and 280 cubic meters (10,000 cubic feet), respectively.

Under the alternatives analyzed in this EIS, varying amounts of waste would be processed and shipped off site for disposal. For example, under the Sitewide Removal Alternative, all waste would be processed and shipped off site for disposal. Under the other alternatives, lesser quantities of waste would be processed and disposed of off site, meaning that more of the waste would remain on site.

There are uncertainties surrounding the options available for offsite disposal of commercial Class B and C low-level radioactive waste, transuranic waste, and Greater-Than-Class C waste generated under these alternatives. Because of these uncertainties, both offsite disposal and onsite storage of these wastes were analyzed. If onsite storage is needed, it would be accomplished using the new Container Management Facility or existing Lag Storage Area 4.

4.1.11.3 Impacts of the Alternatives

This section describes the waste management impacts specific to each EIS alternative.

Table 4–50 shows the new waste management facilities that would be constructed under each of the alternatives. Upon completion of the actions to be taken in these facilities, they would be demolished and disposed of off site. For additional information on the actions that would be taking place in these facilities, refer to Appendix C of this EIS and the appropriate technical report (WSMS 2009a, 2009b, 2009c, 2009d).

Table 4–50 New Waste Management Facilities Associated with West Valley Demonstration Project Alternatives

Waste Management Facility	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)* [a]	*No Action Alternative*
Interim Storage Facility for high-level radioactive waste canisters	X	X	X	
Waste Tank Farm Waste Processing Facility	X			
Soil Drying Facility	X			
Leachate Treatment Facility	X	X		
Container Management Facility	X			

[a] Additional actions, including the construction of additional waste management facilities, could be taken in the future under Phase 2 of this alternative.

Sources: WSMS 2009a, 2009b, 2009c, 2009d.

Sitewide Removal Alternative

As shown in Tables 4–46 through 4–48, the Sitewide Removal Alternative would generate the largest volume of waste (approximately 1.6 million cubic meters [56 million cubic feet]) from decommissioning, but zero waste from long-term stewardship. Nonhazardous waste, Class A low-level radioactive waste (including low-specific-activity waste), and Greater-Than-Class C waste would exceed the volumes being managed from ongoing activities at WNYNSC as presented in Chapter 3, Table 3–20. Nonhazardous waste is common demolition debris that is expected to have no adverse impact on the capacity of commercial disposal facilities. Much of the Class A low-level radioactive waste is low-specific-activity waste that is expected to have no adverse impact on the capacity of DOE or commercial disposal facilities. Until the issues related to disposal of commercial Class B and C low-level radioactive waste, Greater-Than-Class C waste, and non-defense transuranic waste are resolved, these wastes would be safely stored in the new Container Management Facility. An additional 3.2 cubic meters (110 cubic feet) of Class A low-level radioactive waste would be generated annually during maintenance and surveillance of this orphan waste. High-level radioactive waste would be safely stored in the new Interim Storage Facility until disposition decisions are made and implemented.

New waste management facilities that would be constructed to support decommissioning of WNYNSC would include:

- An Interim Storage Facility for high-level radioactive waste canisters (see Appendix C, Section C.4.1, of this EIS),
- A Waste Tank Farm Waste Processing Facility to support exhumation of the high-level radioactive waste tanks (see Appendix C, Section C.4.2, of this EIS),
- A Soil Drying Facility to process soils contaminated by the North Plateau Groundwater Plume (see Appendix C, Section C.4.3, of this EIS),
- A Container Management Facility to process wastes exhumed from the NDA and SDA and to store orphan waste (see Appendix C, Section C.4.4, of this EIS),
- A Leachate Treatment Facility to process contaminated water from the NDA and SDA (see Appendix C, Section C.4.5, of this EIS), and
- Environmental enclosures and confinement structures to support removal of buried wastes and contaminated soils from the NDA and SDA (see Appendix C, Section C.4.6 and related subsections of, this EIS).

Upon completion of operations in these facilities, the facilities would be demolished and disposed of off site. The waste volumes reported for this alternative reflect demolition of these facilities. Additional information on the activities that would take place in these facilities is presented in Appendix C of this EIS and the Sitewide Removal Alternative technical report (WSMS 2009a).

Sitewide Close-In-Place Alternative

As shown in Tables 4–46 through 4–48, the Sitewide Close-In-Place Alternative would generate the third largest volume of waste (approximately 26,000 cubic meters [920,000 cubic feet]) from decommissioning, and approximately 110 cubic meters (3,900 cubic feet) per year from long-term stewardship activities. All waste volumes would be less than the volumes being managed from ongoing activities at WNYNSC (see Chapter 3, Table 3–20), and therefore should have minimal impacts on the waste management infrastructure. Until the issues related to disposal of commercial Class B and C low-level radioactive waste and non-defense transuranic waste are resolved, these wastes would be safely stored in Lag Storage Area 4. Less than 3.2 cubic meters (110 cubic feet) of Class A low-level radioactive waste would be generated annually during maintenance and surveillance of this orphan waste. High-level radioactive waste would be safely stored in the Interim Storage Facility until disposition decisions are made and implemented.

Under the Sitewide Close-In-Place Alternative, the high-level radioactive waste tanks and vaults, below-grade portions of the Main Plant Process Building, NDA, SDA, Construction and Demolition Debris Landfill, and Scrap Material Landfill would be stabilized and closed in place. New waste management facilities that would be constructed to support closure and decommissioning of the site would include:

- An Interim Storage Facility for high-level radioactive waste canisters (see Appendix C, Section C.4.1, of this EIS), and
- A Leachate Treatment Facility to process contaminated water from the NDA and SDA (see Appendix C, Section C.4.5, of this EIS).

Upon completion of the actions to be taken at the Interim Storage Facility and Leachate Treatment Facility, these facilities would be demolished and disposed of off site. The waste volumes reported for this alternative reflect demolition of these facilities. Additional information on the activities that would be taking place in these facilities is presented in Appendix C of this EIS and the Sitewide Close-In-Place Alternative Technical Report (WSMS 2009b).

Phased Decisionmaking Alternative

As shown in Tables 4–46 through 4–48, Phase 1 of the Phased Decisionmaking Alternative would generate the second largest volume of waste (approximately 210,000 cubic meters [7.5 million cubic feet]) from decommissioning, and approximately 150 cubic meters (5,300 cubic feet) per year from site monitoring and maintenance activities. Nonhazardous waste and Class A low-level radioactive waste (including low-specific-activity waste) would exceed the volumes being managed from ongoing activities at WNYNSC as presented in Chapter 3, Table 3–20. The nonhazardous waste is common demolition debris that is expected to have no adverse impact on commercial disposal facility capacity. Much of the DOE Class A–equivalent low-level radioactive waste is low-specific-activity waste that is expected to have no adverse impact on DOE or commercial disposal facility capacity. Until the issues related to disposal of non-defense transuranic waste are resolved, these wastes would be safely stored in Lag Storage Area 4. Less than or equal to 3.2 cubic meters (110 cubic feet) of Class A low-level radioactive waste would be generated annually during maintenance and surveillance of this orphan waste. High-level radioactive waste would be safely stored in the new Interim Storage Facility until disposition decisions are made and implemented.

New waste management facilities constructed to support decommissioning would include an Interim Storage Facility for high-level radioactive waste canisters (see Appendix C, Section C.4.1, of this EIS). Upon completion of the actions to be taken at the Interim Storage Facility, it would be demolished and disposed of off site. The waste volumes reported for this alternative reflect demolition of this facility. Additional information on the activities that would take place in this facility is presented in Appendix C of this EIS and the Phased Decisionmaking Alternative Technical Report (WSMS 2009c).

The Phase 2 decision would be deferred until additional studies are completed. This decision may result in the removal of additional facilities and waste, or the closure of some facilities. If the Phase 2 decision is removal of all remaining waste and contamination, decommissioning waste volumes generated for the entire Phased Decisionmaking Alternative (Phases 1 and 2) would be similar to those for the Sitewide Removal Alternative (see Table 4–47). If the Phase 2 decision is in-place closure of all remaining waste and contamination, the waste volumes generated for the entire Phased Decisionmaking Alternative (Phases 1 and 2) would be the sum of the Phase 1 waste volume plus about 30 percent of the waste volume generated under the Sitewide Close-In-Place Alternative (see Table 4–47). Annual long-term stewardship waste generation rates for Phase 2 would be almost double the Phase 1 monitoring and maintenance rates if remaining facilities are closed in place (WVES 2008), and would be zero if Phase 2 results in the removal of the remaining waste and contamination.

If the Phase 2 decision is continued active management of the SDA and in-place closure of the remaining waste and contamination, the quantities of wastes from decommissioning would be slightly lower than those indicated in the previous paragraph. If the Phase 2 decision is continued active management of the SDA and removal of the remaining waste and contamination, there would be less waste from decommissioning than that for the Sitewide Removal Alternative (i.e., approximately 30 percent less Class A/low-specific-activity low-level radioactive waste and almost no mixed low-level radioactive, Class B and C low-level radioactive, and no Greater-Than-Class C waste).

Following decommissioning, if the Phase 2 decision for the SDA is continued active management and the decision for the remaining waste and contamination is in-place closure, small quantities of waste would be generated annually from ongoing monitoring and maintenance of the SDA and long-term stewardship of the remainder of the site. If the Phase 2 decision for the SDA is continued active management and the decision for the remaining waste and contamination is removal, small quantities of waste would be generated annually from ongoing monitoring and maintenance of the SDA. No additional waste would be generated from the remainder of the site.

No Action Alternative

As shown in Tables 4–46 through 4–48, the No Action Alternative would generate no waste from decommissioning, and the largest volume of waste (approximately 480 cubic meters [17,000 cubic feet] per year) from site monitoring and maintenance activities. All waste volumes would be less than the volumes being managed from ongoing activities at WNYNSC (see Chapter 3, Table 3–20), and therefore should have minimal impact on the waste management infrastructure. High-level radioactive waste canisters would continue to be safely stored in the Main Plant Process Building until disposition decisions are made and implemented.

Under the No Action Alternative, no new waste management facilities would be constructed. Additional information on the activities that would take place under this alternative is presented in Appendix C of this EIS and the No Action Alternative Technical Report (WSMS 2009d).

4.1.12 Transportation

Both radiological and nonradiological impacts would result from the shipment of radioactive waste from WNYNSC to offsite disposal sites. Radiological impacts are those associated with the effects from low levels of radiation emitted during incident-free transportation and from the accidental release of radioactive materials, and are expressed as additional LCFs. Nonradiological impacts are independent of the nature of the cargo being transported, and are expressed as fatal traffic accidents when there is no release of radioactive material. Increases in traffic density are discussed in Section 4.1.2, while increases in nonradiological pollutants from traffic emissions are discussed in Section 4.1.5.

A summary of the transportation impacts of each alternative is presented in **Table 4–51**.

Table 4–51 Summary of Transportation Impacts

Environmental Resource	*Sitewide Removal Alternative*	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative*	*No Action Alternative*
Incident-Free Radiological Impacts	Largest number of truck or rail shipments of radioactive waste and highest population dose. However, it is unlikely that radioactive waste transportation would cause an additional LCF.	Third largest number of truck or rail shipments of radioactive waste and population dose. It is unlikely that radioactive waste transportation would cause an additional LCF.	Second largest number of truck or rail shipments of radioactive waste and population dose from Phase 1. It is unlikely that radioactive waste transportation would cause an additional LCF. If the Phase 2 decision is removal of all remaining waste and contamination, total risks from both phases would be similar to those for the Sitewide Removal Alternative. Risks would be reduced by 40 percent if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, total risks from both phases would be about 5 percent greater than those from Phase 1 alone. Risks would be slightly less if the Phase 2 decision for the SDA is continued active management.	Smallest number of truck or rail shipments of radioactive waste and population dose over a 20-year period. It is unlikely that radioactive waste transportation would cause an additional LCF.
Radiological Impacts from Accidents	Maximum radiological dose-risk to population estimated to be 2.7 person-rem, or 0.0016 LCFs.	Maximum radiological dose-risk to population estimated to be 0.00093 person-rem, or 5.6 × 10-7 LCFs.	Maximum radiological dose-risk to population estimated to be 0.53 person-rem, or 0.00032 LCFs. If the Phase 2 decision is removal of all remaining waste and contamination, total dose-risks from both phases would be similar to those for the Sitewide Removal Alternative. Risks would be reduced by 40 percent if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, total dose-risks from both phases would be about 2 percent greater than those from Phase 1 alone. Risks would be slightly less if the Phase 2 decision for the SDA is continued active management.	Maximum radiological dose-risk to population estimated to be 0.00070 person-rem, or 4.3 × 10-7 LCFs.
Nonradiological Impacts–Traffic Fatalities	Up to 15 fatalities for radioactive waste shipments by rail and less than 1 fatality for nonradioactive shipments during decommissioning.	No fatalities for radioactive waste shipments and 1(1.2) fatalities for nonradioactive shipments during decommissioning.	Up to 2 (1.8) fatalities for radioactive waste shipments (rail) and no fatalities for nonradioactive shipments during Phase 1 of decommissioning. If the Phase 2 decision is removal of all remaining waste and contamination, total risks from both phases would be essentially equivalent to those for the Sitewide Removal Alternative. Risks would be reduced by about 30 percent if the Phase 2 decision for the SDA is continued active management. If the Phase 2 decision is in-place closure, total risks from both phases would be higher than those from Phase 1 alone. Risks would be less if the Phase 2 decision for the SDA is continued active management.	No fatalities for radioactive waste shipments (rail) and no fatalities for nonradioactive shipments over a 20-year period.

LCF = latent cancer fatality, SDA = State-Licensed Disposal Area.

4.1.12.1 Methodology and Assumptions

Shipping packages containing radioactive materials emit low levels of radiation; the amount of radiation depends on the kind and amount of transported materials. DOT regulations require that shipping packages containing radioactive materials have sufficient radiation shielding to limit the radiation to 10 millirem per hour at a distance of 2 meters (6.6 feet) from the transporter. For incident-free transportation, the potential human health impacts of the radiation field surrounding the transportation packages were estimated for transportation workers and the general population along the route (off-traffic, or off-link), as well as people sharing the route (in traffic or on-link), at rest areas, and at other stops along the route. The RADTRAN 5 computer program (Neuhauser and Kanipe 2003) was used to estimate the impacts on transportation workers and populations, as well as the impacts on an MEI (e.g., a person stuck in traffic, a gas station attendant, an inspector) who could be a worker or a member of the public.

> ***The NYSERDA View Indicates….***
>
> *Current Methods for Assessing Nonradiological Risk from Transportation Have Limitations and are Likely to Overestimate Fatalities. Nonradiological fatalities from waste transportation rail accidents appear to be over-estimated because the analysis in the Final EIS uses railcar-kilometers to assess the number of expected accident fatalities.*
>
> ***DOE's Response….***
>
> *The only acceptable reference for railcar accident data reports in units of railcar-kilometers. While DOE acknowledges this data may result in an overestimate of potential nonradiological fatalities due to accidents, there is no other accepted method for this analysis at this time. DOE has made other changes in the transportation analysis for this Final EIS, however, which have reduced the conservatism in the analysis: state-specific accident and fatality rate data have replaced the national mean accident and fatality rates, and the possibility of under-reporting of truck accident and fatality data has been accounted for by using published correction factors. Because a consistent methodology and set of assumptions were applied to each alternative; a meaningful comparison between the alternatives can be made. In its View for this Final EIS, NYSERDA acknowledges that calculating fatalities based on train-kilometers is not at this time defensible, and accepts that, although likely to be overestimated, the rail fatality rates presented in the Final EIS are adequate for decisionmaking.*

Transportation accidents involving radioactive materials present both nonradiological and radiological risks to workers and the public. Nonradiological impacts of transportation accidents include traffic accident fatalities. Radioactive material would be released during transportation accidents only when the package carrying the material is subjected to forces that exceed the package design standard. Only a severe fire and/or a powerful collision, both events of extremely low probability, could lead to a transportation package of the type used to transport radioactive material being damaged to the extent that there could be a release of radioactivity to the environment with significant consequences.

The impact of a specific radiological accident is expressed in terms of probabilistic risk (i.e., dose-risk), which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences (dose). The overall risk is obtained by summing the individual risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accident severities ranging from high-probability accidents of low severity (e.g., fender bender) to hypothetical high-severity accidents that have a low probability of occurrence. In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive wastes, this EIS assesses the highest consequences of a maximum reasonably foreseeable accident with a radioactive release frequency greater than 1×10^{-7} (1 chance in 10 million) per year in an urban or suburban population area along the route. The latter consequences were determined for atmospheric conditions that could prevail during accidents. This latter analysis used the RISKIND computer program to estimate doses to individuals and populations (Yuan et al. 1995).

Incident-free radiological health impacts are expressed in terms of additional LCFs. Radiological accident health impacts are also expressed as additional LCFs, and nonradiological accident risk as additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by a dose conversion factor of 0.0006 LCFs per rem or person-rem of exposure (DOE 2002a). The health impacts associated with the shipment of radioactive wastes were calculated assuming that all wastes would be transported using either truck or rail transport.

In determining transportation risks, per-shipment risk factors were calculated for incident-free and accident conditions using the RADTRAN 5 computer program (Neuhauser and Kanipe 2003) in conjunction with the Transportation Routing Analysis Geographic Information System (TRAGIS) computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with DOT regulations. The TRAGIS program provides population density estimates along the routes based on the 2000 U.S. census for determining population radiological risk factors. For incident-free operations, the affected population includes individuals living within 800 meters (0.5 miles) of each side of the road or rail line. For accident conditions, the affected population includes individuals living within 80 kilometers (50 miles) of the accident, and the MEI is assumed to be a receptor located 100 meters (330 feet) directly downwind from the accident. Additional details on the analysis approach and on modeling and parameter selections are provided in Appendix J of this EIS.

Two options for disposing of low-level radioactive waste were evaluated in this EIS:

- *DOE/Commercial Disposal Option* – DOE low-level radioactive waste would be disposed of at DOE disposal facilities. Commercial low-level radioactive waste would be disposed of at commercial disposal facilities.

- *Commercial Disposal Option* – All low-level radioactive waste would be disposed of at commercial disposal facilities.

For both options, all waste would be disposed of in accordance with current waste acceptance criteria and appropriate permits/licenses. Transportation impacts for each of these options were estimated with the following assumptions:

- Construction debris and hazardous wastes would be transported to local commercial disposal sites estimated to be located about 160 kilometers (100 miles) from the site.

- Radioactive DOE Class A and low-specific-activity low-level radioactive wastes would be transported to the Nevada Test Site (NTS) (DOE/Commercial Disposal Option) or to a commercial disposal facility such as EnergySolutions (Commercial Disposal Option).

- DOE Class B and C low-level radioactive wastes could be transported either to NTS under the DOE/Commercial Disposal Option or to a commercial disposal facility under the Commercial Disposal Option. Commercial Class B and C low-level radioactive wastes can only be transported to a commercial disposal facility. Because there are no commercial disposal facilities that currently accept Class B and C low-level radioactive waste from New York State, this transportation analysis assumes:

  - For the DOE/Commercial Disposal Option, commercial Class B and C low-level radioactive waste would be transported to a proxy commercial disposal facility located either in the western or eastern United States; DOE Class B and C low-level radioactive waste would be transported to NTS.

  - For the Commercial Disposal Option, DOE and commercial Class B and C low-level radioactive wastes would be both transported to a proxy commercial disposal facility located either in the western or eastern United States.

- The route characteristics for the western and eastern proxy commercial disposal facilities are similar to those for transporting wastes to the Hanford Site in Washington State and to the Barnwell disposal facility in South Carolina, respectively.[25]

- Mixed low-level radioactive wastes, after treatment, would be transported under either option to a commercial disposal facility such as EnergySolutions.

- The impacts of transporting WVDP transuranic waste to the Waste Isolation Pilot Plant (WIPP) were included for purposes of analysis, although DOE is not currently approved to ship WVDP transuranic waste to WIPP, and there is currently no identified disposal facility for non-defense transuranic waste.[27]

- To compare impacts among the alternatives, this transportation analysis uses the Nevada Test Site as a representative site for disposal of Greater-Than-Class C waste.[27] There is currently no disposal facility for Greater-Than-Class C waste; the *GTCC EIS*, in preparation, evaluates alternatives for developing a Greater-Than-Class C disposal facility.

Waste materials to be shipped off site for disposal were classified into three broad disposal groupings: construction and demolition debris, hazardous wastes, and radioactive wastes. Low-level radioactive wastes were classified in accordance with Federal regulations governing land disposal of radioactive waste (10 CFR Part 61), and transportation of low-specific-activity waste. The volumes of the different waste types that are expected to be generated under each alternative during WNYNSC decommissioning are given in Section 4.1.11.

4.1.12.2 Summary of Transportation Impacts

Table 4–52 provides the estimated number of waste shipments by truck under each alternative by waste type. A shipment is defined as the amount of waste transported on a single truck or a single railcar. For each waste type, each railcar would contain twice the amount of waste transported by a single truck. Multiple waste railcars (i.e., two or more railcars) could be used to reduce the number of rail shipments. However, because the rail accident and fatalities data are calculated per railcar-kilometer, the transportation analysis presented here is based on one waste railcar per rail shipment. While it may be possible to reduce the number of rail shipments by using multiple railcars, there would be a proportional increase in the transportation risks per transport in terms of the radioactive waste present, accident frequency, and nonradiological transport accident fatalities. There are other options that could be considered, including shipments of waste using a combination of rail and trucks for disposal.[28] This EIS did not calculate all potential options. The results presented using either all truck shipments or all rail shipments would provide a range of risks that would encompass all potential options.

---

[25] *The risks presented in this section are based on assumed transport of commercial Class B and C low-level radioactive waste to a western U.S. commercial disposal facility . The risks for transport of this waste to an eastern U.S. commercial disposal facility are presented in Table J-8 of Appendix J.*

[26] *DOE also analyzed the impacts associated with transporting commercial Class B and C low-level radioactive waste to the Barnwell Disposal Facility in South Carolina. See Appendix J, Table J–8.*

[27] *All Greater-Than-Class C waste generated as part of any EIS alternative would be safely stored until an appropriate offsite disposal facility is available. DOE proposes to identify a disposal facility for Greater-Than-Class C and potential non-defense transuranic waste based on the* Disposal of Greater-Than-Class C Low-Level Radioactive Waste Environmental Impact Statement *(DOE/EIS-0375). As announced in the July 23, 2007, Notice of Intent, the GTCC EIS will evaluate several DOE sites and generic locations for the disposal of Greater-Than-Class C waste and similar DOE waste (72 FR 40135).*

[28] *Shipments involving a combination of rail and truck for a specific shipment would involve workers who would transfer waste containers from railcars to trucks (or visa versa) at an intermodal station. Based on a study of total risk to workers and population from truck-only transportation and a combination of truck-rail transportation (PNNL 1999), it is estimated that the total dose to workers and public for a combination of rail and truck shipment would be less than those that could occur if the entire transportation occurred by truck.*

Table 4–52 Estimated Number of Truck Shipments Under Each Alternative

DOE/Commercial Disposal Option					
Waste Types	***Assumed Disposal Location***	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative (Phase 1)***	***No Action Alternative*** [i]
Low Specific Activity	NTS/EnergySolutions [j]	92,263	831	10,799	151
Class A [a]	NTS/EnergySolutions [j]	8,212	288	1,473	470
Class A [b]	NTS/EnergySolutions [j]	46	5	29	1
Class B and C [c]	NTS/Commercial [j]	924	0	80	0
Class C-RH [d]	NTS/Commercial [j]	124	34	20	0
Mixed LLW	Energy Solutions	40	28	3	1
GTCC [e]	NTS	2,357	0	0	0
Transuranic [f]	WIPP	477	17	335	0
Hazardous [g]	Local	2	1	1	2
Other [h]	Local	8,881	1,003	2,155	43
Commercial Disposal Option					
Waste Types	***Assumed Disposal Location***	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative (Phase 1)***	***No Action Alternative*** [i]
Low Specific Activity	EnergySolutions	92,263	830	10,799	151
Class A [a]	EnergySolutions	8,211	287	1,473	470
Class A [b]	EnergySolutions	46	5	28	1
Class B and C [c]	Commercial	1,075	0	224	0
Class C-RH [d]	Commercial	124	33	20	0
Mixed LLW	EnergySolutions	40	28	3	1
GTCC [e]	NTS	2,357	0	0	0
Transuranic [f]	WIPP	477	17	335	0
Hazardous [g]	Local	2	1	1	2
Other [h]	Local	8,881	1,003	2,155	43

GTCC = Greater-Than-Class C waste, LLW = low-level radioactive waste, NTS = Nevada Test Site, RH = remote-handled, WIPP = Waste Isolation Pilot Plant.

[a] Class A low-level radioactive waste transported in Type A B-25 boxes.

[b] Class A low-level radioactive waste transported in 208-liter (55-gallon) drums.

[c] Class B and Class C contact-handled wastes are packaged in either high-integrity containers for transport to an eastern or western U.S. site (for purposes of analysis only), or Type A B-25 boxes for transport to NTS.

[d] Class C remote-handled wastes packaged in drums or high-integrity containers and transported in Type B casks. Class B wastes packaged in drums are also transported in Type B casks.

[e] For purposes of analysis only, it was assumed that Greater-Than-Class C waste would be shipped to NTS. Several DOE sites and generic commercial locations are being evaluated in the *GTCC EIS* as potential disposal locations.

[f] For purposes of analysis only, it is assumed that transuranic waste would be shipped to WIPP.

[g] Hazardous waste would be disposed of at landfills within 160 kilometers (100 miles) of WNYNSC.

[h] This includes construction/demolition debris or other wastes that go to local landfills within about 160 kilometers (100 miles) of WNYNSC.

[i] Under the No Action Alternative, waste is generated both annually and periodically (about every 20 years). Here, for the purposes of comparisons to other alternatives, waste shipments are given for monitoring and maintenance activities over a 20-year period. The waste shipment quantities under this alternative would continue to be generated every 20 years.

[j] DOE waste would go to the Nevada Test Site or EnergySolutions, or another appropriate commercial facility. Commercial waste would only go to EnergySolutions or other appropriate commercial facility because commercial wastes cannot be disposed of at DOE facilities.

Note: The values given in this table are for truck shipments. Rail shipments are assumed to be one-half of the number of truck shipments.

Table 4–53 summarizes the transportation impacts by disposal option under each alternative. The accident impacts presented in this table are those that would result from all reasonably conceivable impacts during transport of radioactive wastes. Impacts from accidents having the highest consequences of a maximally foreseeable accident are presented in Appendix J, Table J–11.

Table 4–53 Risks of Transporting Radioactive Waste Under Each Alternative [a]

LLW Disposal Option	*Transport Mode*	*Number of Shipments*	*One-way Kilometers Traveled (million)*	*Incident-Free*				*Accident*	
				Crew		*Population*			
				Dose (person-rem)	*Risk [c]*	*Dose (person-rem)*	*Risk [c]*	*Radiological Risk [b]*	*Non-radiological Risk [c]*
Sitewide Removal Alternative									
DOE/ Commercial	Truck	104,443	356.8	2,070	1.2	370	0.22	1.2×10^{-3}	9.7
	Rail	52,224	190.5	65.4	0.039	94.3	0.057	5.4×10^{-4}	15
Commercial	Truck	104,593	342.1	2,200	1.3	352	0.21	1.6×10^{-3}	10
	Rail	52,299	180.5	64.7	0.039	94.3	0.057	6.8×10^{-4}	15
Sitewide Close-In-Place Alternative									
DOE/ Commercial	Truck	1,203	4.3	48.6	0.029	11.0	0.0066	4.2×10^{-7}	0.10
	Rail	604	2.3	1.9	0.0012	2.8	0.0017	1.5×10^{-7}	0.17
Commercial	Truck	1,200	3.9	45.1	0.027	9.9	0.0060	5.6×10^{-7}	0.12
	Rail	602	2.1	1.4	0.00085	2.6	0.0016	2.0×10^{-7}	0.17
Phased Decisionmaking Alternative (Phase 1)									
DOE/ Commercial	Truck	12,739	49.6	273	0.16	71.5	0.043	9.2×10^{-6}	1.0
	Rail	6,371	27.3	10.9	0.0065	16.3	0.0098	3.4×10^{-6}	1.8
Commercial	Truck	12,882	42.0	397	0.24	58.1	0.035	3.2×10^{-4}	1.3
	Rail	6,442	22.1	10.8	0.0065	16.1	0.0097	1.4×10^{-4}	1.8
No Action Alternative [d]									
DOE/ Commercial	Truck	623	2.4	37.8	0.023	11.8	0.0071	2.4×10^{-7}	0.050
	Rail	313	1.4	1.7	0.0010	2.6	0.0016	1.0×10^{-7}	0.090
Commercial	Truck	623	2.0	31.3	0.019	9.8	0.0059	4.3×10^{-7}	0.060
	Rail	313	1.1	1.4	0.00082	2.6	0.0016	1.3×10^{-7}	0.090

LLW = low-level radioactivity waste.

[a] For purposes of analysis only, Greater-Than-Class C and transuranic wastes are assumed to be transported to the Nevada Test Site and Waste Isolation Pilot Plant, respectively. All Greater-Than-Class C waste generated as part of any EIS alternative would be safely stored until an appropriate offsite disposal facility is available. DOE proposes to identify a disposal facility for Greater-Than-Class C and potential non-defense transuranic waste based on the *Disposal of Greater-Than-Class C Low-Level Radioactive Waste Environmental Impact Statement (GTCC EIS)* (DOE/EIS-0375). As announced in the July 23, 2007, Notice of Intent, the *GTCC EIS* will evaluate several DOE sites and generic locations for the disposal of Greater-Than-Class C waste and similar DOE waste (72 FR 40135).

[b] The transportation risks presented in this table are based on use of a western U.S. commercial disposal facility for Commercial Class B and C low-level radioactive waste. The risk results for the use of an eastern U.S. commercial disposal facility are presented in Table J–8 of Appendix J.

[c] Risk is expressed in terms of LCFs, except for nonradiological risk where it refers to the number of traffic accident fatalities.

[d] Under the No Action Alternative, for the purpose of comparison to other alternatives, transportation impacts are provided for monitoring and maintenance activities over a 20-year period. The waste quantities under this alternative would continue to be generated every 20 years.

Note: To convert kilometers to miles, multiply by 0.62137.

DOE and NYSERDA could choose to use a combination of rail and truck transport during the execution of any of the decommissioning alternatives. If that turns out to be the case, the cumulative dose to the general population is expected to be between the lowest projected dose of about 2.5 person-rem, which is associated with all train transport for the DOE/Commercial Disposal Option under the Sitewide Close-In-Place

Alternative, and the highest projected dose of about 370 person-rem associated with all truck transport for the DOE/Commercial Disposal Option under the Sitewide Removal Alternative. The additional LCFs that are expected from such exposures to the general population range from 0.0015 to 0.22 LCFs, thus, it is expected that there would be no additional LCFs in the population under any of the alternatives. Similarly, the lowest cumulative dose to the crew would be under the Sitewide Close-In-Place Alternative using all train transport (1.4 person-rem), while the highest cumulative dose would be under the Sitewide Removal Alternative using all truck transport (about 2,200 person-rem). The additional LCFs that are expected from exposures to the transportation crews would range from 0.00085 to 1.3; however, it should be noted that the maximum annual dose to a transportation worker would be 100 millirem per year, unless the individual is a trained radiation worker, for which doses would be administratively limited to an annual dose of 2 rem (DOE 1999b). Because a dose of 2 rem corresponds to an LCF risk of about 0.0012 LCFs, an individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposures during these activities. In addition, there is no scenario where a combination of train and truck transport is expected to result in a higher dose to the general population or the transportation crews than the truck-only options.

4.1.12.3 Sitewide Removal Alternative

Under this alternative, DOE and NYSERDA would transport about 1.6 million cubic meters (2.1 million cubic yards) of radioactive waste, construction debris, and hazardous waste for disposal to offsite locations over approximately 60 years. As indicated in Table 4–53, a very large number of shipments (about 104,600 truck shipments) of radioactive waste would be made under this alternative. Under the Commercial Disposal Option, all Class-C-or-lower low-level radioactive waste would be shipped to commercial disposal facilities. Under the DOE/Commercial Disposal Option, the Class-C-or-lower low-level radioactive waste for which New York State is responsible would still be transported to commercial disposal facilities. For purposes of analysis only, shipments of transuranic waste to WIPP and Greater-Than-Class C waste to the Nevada Test Site are included under both disposal options. If rail transport were used, the total number of shipments (about 52,300 shipments) would be about one-half of those made under truck transport. The total projected one-way distance traveled on public roads or rail lines transporting radioactive waste to the various disposal locations under this alternative would range from 342 to 357 million kilometers (213 to 222 million miles) for trucks, and from 181 to 191 million kilometers (112 to 118 million miles) for trains.

Following the assumed 60-year decommissioning period, there would be no offsite shipments of waste except for shipments of low-level radioactive waste that may be generated as part of onsite management of orphan waste (see Table 4–46).

Impacts of Incident-Free Transportation

Under this alternative, the highest level of health impacts on transportation workers (e.g., truck crew) would occur under the Commercial Disposal Option using all truck shipments, and the highest impacts on the general population would occur under the DOE/Commercial Disposal Option using all truck shipments (see Table 4–53). Truck shipments result in higher crew doses. The impacts are proportional to the distance traveled and the assumed western commercial site (Hanford Site characteristics) is the farthest distance from WNYNSC and would be the major contributor to crew doses. In addition, for the general population, the shipments to NTS expose a larger number of public along the transportation routes.

Crew—The cumulative dose to crew members during the transportation of waste by truck would range from 2,070 to 2,200 person-rem, resulting in 1 (1.2 to 1.3) additional LCF. However, it should be noted that the maximum annual dose to a transportation worker would be 100 millirem per year, unless the individual is a trained radiation worker, who would be subject to administrative procedures that would limit the annual dose to 2 rem (DOE 1999b). The potential for a trained radiation worker to develop a fatal latent cancer from the maximum annual exposure is 0.0012 LCFs. Therefore, an individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposure during these activities. If train transport were used, the cumulative dose to crew members during the transportation of waste under this alternative would be about 65 person-rem, resulting in less than 1 (0.039) additional LCF. Rail transport would expose the crew to much lower doses, due to the greater shielding and distance between the crew and the waste being transported, and the smaller number of shipments required.

Public—The cumulative dose to the general population during the transportation of waste by truck would range from 352 to 370 person-rem, resulting in less than 1 (0.21 to 0.22) additional LCF. If train transport were used, the cumulative dose to the general population would be about 94 person-rem, resulting in less than 1 (0.057) additional LCF. Rail transport would lead to lower doses to the general population, due to the smaller number of shipments and lower exposure to people in the vicinity of stations where the reclassification and inspections would take place. Almost half of the doses to the general population from truck transport would be from doses at rest areas, gas stations, and stops along the route.

If a combination of rail and truck transport were used during the execution of this alternative, the cumulative dose to the general population is expected to be between the lowest projected dose of 94 person-rem associated with train transport, and the highest projected dose of 370 person-rem, associated with all truck transport. There is no scenario where a combination of train and truck transport is expected to result in a higher dose to the general population than the truck-only option.

Impacts of Accidents During Transportation

As described previously, two sets of analyses were performed for the evaluation of radiological transportation accident impacts: impacts of maximum reasonably foreseeable accidents (accidents with radioactive release probabilities greater than 1×10^{-7} [1 chance in 10 million] per year), and impacts of all conceivable accidents (total transportation accidents).

For waste shipped under the Sitewide Removal Alternative, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequence would involve contact-handled Class B/C waste in an HIC with no shielded cask (see Appendix J, Table J–11). These waste shipments are expected to occur over about 44 years (the number of years when Class B/C wastes would be generated). The probabilities of a truck or rail accident involving this type of waste shipment are slightly different. Transportation accident probabilities were calculated for all route segments (i.e., rural, suburban, and urban), and maximum consequences were determined for those route segments with a likelihood of release frequency exceeding 1-in-10 million per year. The maximum reasonably foreseeable probability of a truck accident involving this waste type would be 1.3×10^{-7} per year in an urban area, while the maximum probability for a rail accident would be 4.2×10^{-7} per year in an urban area, or approximately 1 chance in a million each year for both truck and rail transport. The consequences of the truck and rail transport accident in terms of population dose would be about 590 and 1,190 person-rem, respectively. Such exposures could respectively result in up to 1 (0.36 to 0.71) additional LCF among the exposed population. The difference in the general population doses between truck and rail accidents is due to the possibility of the rail accident occurring in an urban area with twice the waste inventory of the truck. Trains travel longer distances in urban areas than trucks. (Truck shipments would tend to bypass such areas to the maximum extent possible.) The maximum dose from a rail accident to an MEI, located at a distance of 100 meters (330 feet) and exposed to the accident plume for 2 hours, would be about 0.30 rem, with a risk of 0.00018 LCFs.

Estimates of the total transportation accident risks for all projected accidents involving waste shipments, regardless of waste type, under this alternative are as follows: a maximum radiological dose risk to the general population of 2.7 person-rem over the life of expected shipments, resulting in less than 1 (0.0016) LCF for all truck transport under the Commercial Disposal Option, and a maximum nonradiological accident risk of 15 fatalities for all rail transport under the DOE/Commercial Disposal Option (see Table 4–53).

Impacts of Construction and Operational Material and Hazardous Waste Transport

The impacts of transporting construction/demolition debris, construction and erosion control materials (i.e., concrete, gravel/sand/soil, asphalt, steel, piping, fabric), and hazardous wastes were also evaluated. The estimated transportation impacts under this alternative would be 57.8 million kilometers (35.9 million miles) traveled, 20 (19.9) traffic accidents, and less than 1 (0.7) traffic accident fatality over the entire duration of implementation of the Sitewide Removal Alternative.

4.1.12.4 Sitewide Close-In-Place Alternative

Under this alternative, over 60 years DOE and NYSERDA would transport about 0.032 million cubic meters (0.042 million cubic yards) of radioactive waste, construction debris, and hazardous waste for disposal at offsite locations. About 59 percent of waste would be generated during the 7 years of the decommissioning activities.

As indicated in Table 4–53, about 1,200 truck shipments of radioactive materials would be made under this alternative. Similar to the Sitewide Removal Alternative, under the DOE/Commercial Disposal Option, the Class-C-or-lower low-level radioactive waste for which New York State is responsible would be transported to commercial disposal facilities; and, under the Commercial Disposal Option, all Class-C-or-lower low-level radioactive waste would be shipped to commercial disposal facilities. Transuranic waste shipments to WIPP are included under both options for purposes of analysis. No shipments of Greater-Than-Class C waste would be needed under this alternative. If train transport was used, the total number of shipments (up to 600 shipments) would be about one-half of those made under truck-only transport. The total projected distance traveled on public roads or rail lines transporting radioactive waste to its disposal location under this alternative would range from 3.9 to 4.3 million kilometers (2.4 to 2.7 million miles) for truck transport, and from 2.1 to 2.3 million kilometers (1.3 to 1.4 million miles) for train transport.

During the long-term stewardship period, it is projected that approximately 110 cubic meters (3,900 cubic feet) of low-level radioactive waste would be annually generated. Small quantities of low-level radioactive waste may be also generated annually as part of orphan waste management operations (see Table 4-46). Generation of this waste would result in a small number of annual offsite waste shipments.

Impacts of Incident-Free Transportation

Under this alternative, the highest level of health impacts on transportation workers would occur for all truck shipments under the Commercial Disposal Option, and the highest level of impacts on the general population would occur for all truck shipments under the DOE/Commercial Disposal Option (see Table 4–53). Under this alternative, a very limited amount of Class B/C waste would be generated. As discussed under the Sitewide Removal Alternative, truck shipments would result in higher crew doses. The impacts are proportional to the distance traveled, and NTS is the farthest distance from WNYNSC of the disposal facilities. In addition, the transports to NTS would expose a larger general population along the transportation routes.

Crew—Under this alternative, the cumulative dose to crew members during the transportation of waste by truck would range from about 45 to 49 person-rem, resulting in less than 1 (0.027 to 0.029) additional LCF. If train transport was used, the cumulative dose to crew members during the transportation of radioactive waste under this alternative would range from about 1.4 to 1.9 person-rem, resulting in less than 1 (0.00085 to 0.0012) additional LCF.

Public—Under this alternative, the cumulative dose to the general population during transport of radioactive waste by truck would be about 11 person-rem, resulting in less than 1 (0.0066) additional LCF. If train transport was used, the cumulative dose to the general public during the transportation of waste under this alternative would be about 2.8 person-rem, resulting in less than 1 (0.0017) additional LCF.

As discussed under the Sitewide Removal Alternative, if DOE and NYSERDA choose to use a combination of rail and truck transport during the execution of this alternative, the cumulative dose to the general population is expected to be between the lowest projected dose of 2.6 person-rem, associated with train transport, and the highest projected dose of about 11 person-rem, associated with all-truck transport. There is no scenario where a combination of train and truck transport is expected to result in a higher dose to the general population than the all-truck option.

Impacts of Accidents During Transportation

For waste shipped under this alternative, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequence would involve Class A waste transported in Type A boxes (see Appendix J, Table J–11). These waste transports are expected to occur over a period of 7 years. The maximum reasonably foreseeable probability of a truck accident involving this waste type would be 8.7×10^{-7} per year in a suburban area, while the maximum probability for a rail accident would be 6.5×10^{-8} per year in a suburban area, or approximately 1 chance in a million each year for truck transport and 1 chance in 15 million each year for rail transport. The consequences for the truck and rail transport accident in terms of population dose would be 0.020 and 0.054 person-rem, respectively. Such an exposure could result in less than 1 (0.000012 to 0.000032) excess LCF among the exposed population. The large difference in the general population doses between truck and rail accidents is due to the possibility of the rail accident occurring with twice the waste inventory of the truck. The maximum dose from a rail accident to an MEI, located at a distance of 100 meters (330 feet) and exposed to the accident plume for 2 hours, would be 0.000072 rem, with a risk of 4.3×10^{-8} LCFs.

Estimates of the total transportation accident risks for all projected accidents involving waste shipments, regardless of waste type, under this alternative are as follows: a maximum radiological dose-risk to the general population of 0.00093 person-rem over the life of expected transportation shipments, resulting in less than 1 (5.6×10^{-7}) LCF for truck transport under the Commercial Disposal Option, and a maximum nonradiological accident risk of less than 1 (0.17) fatality for rail transport under the DOE/Commercial Disposal Option (see Table 4–53).

Impacts of Construction and Operational Material and Hazardous Waste Transportation

The impacts of transporting construction/demolition debris, construction and erosion control materials (i.e., concrete, gravel/sand/soil, asphalt, steel, piping, fabric, etc.), and hazardous wastes were also evaluated. The estimated transportation impacts under this alternative would be 95.2 million kilometers (59.2 million miles) traveled, 33 (32.8) accidents, and 1 (1.2) fatality over the duration.

4.1.12.5 Phased Decisionmaking Alternative

Assuming a 30-year Phase 1 period for purposes of analysis, DOE and NYSERDA would transport about 0.21 million cubic meters (0.28 million cubic yards) of radioactive waste, construction debris, and hazardous waste for disposal at offsite locations under Phase 1 of this alternative. Almost all of these wastes would be generated and transported over a period of 8 years.

As indicated in Table 4–53, about 12,880 truck shipments of radioactive materials would be made under Phase 1 of this alternative. No Greater-Than-Class C wastes would be generated. Similar to the Sitewide

Removal Alternative, the Class-C-or-lower low-level radioactive waste for which New York State is responsible would be transported to commercial disposal facilities; and, under the Commercial Disposal Option, all DOE Class-C-or-lower low-level radioactive waste would also be transported to commercial disposal facilities. If train transport was used, the total number of shipments (about 6,440 shipments) would be about one-half of those made under truck-only transport. The total projected distance traveled on public roads or rail transporting waste to its disposal location under this alternative would range from about 42 to 50 million kilometers (26 to 31 million miles) for truck transport, and from about 22 to 27 million kilometers (13.7 to 16.8 million miles) for train transport.

Transportation impacts for the entire Phased Decisionmaking Alternative would depend on the Phase 2 decision. If the Phase 2 decision is removal of all remaining waste and contamination, total radiological transportation risks under incident-free and accident conditions for both phases of this alternative would be essentially equal to those for the Sitewide Removal Alternative. If the Phase 2 decision is continued active management of the SDA and removal of the waste and contamination for the remainder of the site, total radiological transportation risks (for both phases) would be about 40 percent less than those for the Sitewide Removal Alternative. This is because continued active management of the SDA would reduce waste shipments by approximately 30 percent for Class A low-level radioactive waste (including low-specific-activity waste), 13 percent for mixed low-level radioactive waste, about 50 percent for Class B and C low-level radioactive waste, and about 50 percent for Greater-Than-Class C waste. If the Phase 2 decision is in-place closure of all remaining waste and contamination, total incident-free transportation risks for both phases would be about 5 percent greater than those for Phase 1 alone. The total accident dose risks would be about 2 percent greater than those for Phase 1 alone. This is because there would be only a small amount of radioactive waste generated from removal of the current geomembrane cover and construction of an engineered SDA cap. If the Phase 2 decision is continued active management of the SDA and in-place closure of the remainder of the site, total transportation risks would be essentially equivalent to those for Phase 1 alone, because no radioactive waste would be generated from removal of the existing geomembrane cover and construction of an engineered SDA cap.

Nonradiological health (traffic fatality) risks for the entire Phased Decisionmaking Alternative would follow a similar pattern. If the Phase 2 decision is removal of all remaining waste and contamination, total traffic fatality risks from both phases would be essentially equivalent to those for the Sitewide Removal Alternative. If the Phase 2 decision is continued active management of the SDA and removal of the waste and contamination in the remainder of the site, total traffic fatality risks would be about 30 percent less than those for the Sitewide Removal Alternative. This is principally because waste would not be removed from the SDA nor transported to offsite disposal facilities. If the Phase 2 decision is in-place closure of all remaining waste and contamination, total traffic fatality risks from both phases would be higher than those for Phase 1 alone. This is principally because of deliveries of construction and erosion control materials. If the Phase 2 decision is continued active management of the SDA and in-place closure of the remainder of the site, total traffic fatality risks would be less because there would be no deliveries of the construction and erosion control materials required to build the engineered SDA cap.

Following completion of Phase 2 activities, there could be offsite shipments of waste from WNYNSC depending on the Phase 2 decision. If the Phase 2 decision is removal of all remaining waste and contamination, there would be only a small number of offsite shipments of waste during the long-term stewardship period. These would be shipments of low-level radioactive waste that may be generated as part of onsite management of orphan waste (see Table 4–46). If the Phase 2 decision is continued active management of the SDA and removal of waste and contamination in the remainder of the site, there would be a larger annual number of shipments of waste offsite. These annual shipments would be bounded by those for the No Action Alternative. If the Phase 2 decision is in-place closure of all remaining waste and contamination, there would be a small number of annual shipments of low-level radioactive waste offsite associated with long-term stewardship activities (see Section 4.1.12.4). If the Phase 2 decision is continued active management of the SDA and in-place closure of the remainder of the site, there would be annual offsite shipments of waste from management of the SDA and from stewardship of the remainder of the site. Impacts of Incident-Free Transportation

Under Phase 1 of this alternative, the highest level of health impacts on transportation workers and the general population would be from activities similar to those explained under the Sitewide Removal Alternative.

Crew—Under this alternative, the cumulative dose to crew members during the transport of waste by truck would range from about 273 to 397 person-rem, resulting in less than 1 (0.16 to 0.24) additional LCF. If train transport was used, the cumulative dose to crew members during the transport of radioactive waste under this alternative would be about 11 person-rem, resulting in less than 1 (about 0.0065) additional LCF.

Public—Under this alternative, the cumulative dose to the general population during the transport of waste by truck would range from about 58 to 72 person-rem, resulting in less than 1 (0.035 to 0.043) additional LCF. If train transport was used, the cumulative dose to the general public during the transportation of waste under this alternative would be about 16 person-rem, resulting in less than 1 (about 0.0098) additional LCF.

As discussed for the Sitewide Removal Alternative, DOE and NYSERDA could choose to use a combination of rail and truck transport during the execution of this alternative. In that case, the cumulative dose to the general population is expected to be between the lowest projected dose of about 16 person-rem associated with all-train transport and the highest projected dose of about 72 person-rem associated with all-truck transport. There is no scenario where a combination of train and truck transport is expected to result in a higher dose to the general population than the truck-only option.

Impacts of Accidents During Transportation

For waste shipped under Phase 1 of this alternative, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequence would involve Class B/C waste in a Type A B-25 box for the DOE/Commercial Disposal Option, and Class B/C waste in an HIC for the Commercial Disposal Option (see Appendix J, Table J–11).

For the DOE/Commercial Disposal Option, the probability of this accident would be a maximum of about 1.3×10^{-7} and 1.4×10^{-8} per year for truck and rail transport in a suburban area, respectively. In such an accident, the dose to the general population would be 6.1 and 16 person-rem, respectively, leading to less than 1 (0.0037 and 0.0098, respectively) additional LCF for truck and rail transport. Note that the difference between these two doses is proportional to the amount of waste transported by rail and truck. The maximum dose to an MEI from this accident would be 0.022 rem, with a risk of developing a latent fatal cancer of 0.000013.

For the Commercial Disposal Option, the probability of this accident would be about 1.4×10^{-7} and 4.6×10^{-7} per year for truck and rail transport in an urban area, respectively. Given such an accident, the consequences for the general population would be about 590 to 1,190 person-rem, respectively, leading to up to 1 additional LCF for truck and rail transport (0.36 and 0.71, respectively). The difference between these two doses is proportional to the amount of waste transported by rail and truck. The maximum dose to an MEI from a rail accident would be about 0.30 rem with a corresponding risk of developing a latent fatal cancer of 0.00018 LCFs.

The differences in consequences between the accidents involving an HIC and those involving Type A B-25 boxes are driven by the container structural materials (i.e., a poly-hydrocarbon polymer in an HIC versus structural steel for the Type A box). Accidents involving an HIC would lead to a higher airborne release and greater consequences.

Estimates of the total transportation accident risks for all projected accidents involving waste shipments, regardless of waste type, under this alternative are as follows: a maximum radiological dose-risk to the general population of 0.53 person-rem over the life of the projected transportation shipments, resulting in less than 1 (0.00032) LCF for truck transport under the Commercial Disposal Option, and a maximum nonradiological accident risk of about 2 (1.8) fatalities for rail transport under the DOE/Commercial Disposal Option (see Table 4–53).

Impacts of Construction and Operational Material and Hazardous Waste Transportation

The impacts of transporting construction/demolition debris, construction and erosion control materials (i.e., concrete, gravel/sand/soil, asphalt, steel, piping, fabric), and hazardous wastes were also evaluated for Phase 1. The transportation impacts under this alternative would be 8.2 million kilometers (5.1 million miles) traveled, 3 (2.8) accidents, and less than 1 (0.10) fatality over the duration.

4.1.12.6 No Action Alternative

Under the No Action Alternative, a minimal amount of waste would be generated annually compared to the other alternatives. Additional wastes would also be generated through periodic maintenance of facility roofs and NDA/SDA geomembrane replacement activities every 20 to 25 years. Thus, for the purposes of analysis and comparisons of waste volumes and transport needs, the impact was evaluated for a 20-year operational period. During each 20-year period, DOE and NYSERDA would transport about 9,700 cubic meters (12,700 cubic yards) of radioactive waste, construction debris, and hazardous waste for disposal at offsite locations.

Under this alternative, no Class B/C, transuranic, or Greater-Than-Class C wastes would be generated. As indicated in Table 4–53, an average of about 620 truck shipments of radioactive materials would be made under this alternative over a 20-year period. If train transport was used, the total number of shipments would be about one-half of those made under truck-only transport. The total projected distance traveled on public roads or rail transporting radioactive waste would range from 2.0 to 2.4 million kilometers (1.25 to 1.5 million miles) for truck transport, and from 1.1 to 1.4 million kilometers (0.68 to 0.87 million miles) for train transport.

Impacts of Incident-free Transportation

The highest level of health impacts on transportation workers and the general population from all transportation activities would occur under the DOE/Commercial Disposal Option (see Table 4–53). As stated under the Sitewide Removal Alternative, this is because the impacts are proportional to distance traveled, and NTS is the farthest distance from WNYNSC of the analyzed transport options.

Crew—Under this alternative, the cumulative dose to crew members during the transportation of waste by truck would range from about 31 to 38 person-rem, resulting in less than 1 (0.019 to 0.023) additional LCF. If train transport was used, the cumulative dose to crew members during the transport of radioactive waste under this alternative would range from 1.4 to 1.7 person-rem, resulting in less than 1 (0.00082 to 0.0010) additional LCF.

Public—Under this alternative, the expected cumulative dose to the general population during the transport of waste by truck would range from about 10 to 12 person-rem, resulting in less than 1 (0.006 to 0.007) additional LCF. If train transport was used, the cumulative dose to the general public during the transport of waste under this alternative would be about 2.6 person-rem, resulting in less than 1 (up to 0.0016) additional LCF.

As discussed for the Sitewide Removal Alternative, if DOE and NYSERDA choose to use a combination of rail and truck transport during the execution of this alternative, the cumulative dose to the general population is expected to be between the lowest projected dose of about 2.6 person-rem, associated with all-train transport, and the highest projected dose of 12 person-rem, associated with all-truck transport. There is no scenario where a combination of train and truck transport is expected to result in a higher dose to the general population than the truck-only option.

Impacts of Accidents During Transportation

For the wastes transported under this alternative, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequence would involve Class A waste in a B-25 box for both disposal options (see Appendix J, Table J–11). The probabilities of a truck or rail accident involving this type of waste shipment are slightly different. The probability of a truck accident with maximum consequence involving this waste type would be 5.8×10^{-7} per year, while the probability for a rail accident would be 4.3×10^{-8} per year. The consequences of the maximum foreseeable accidents under this alternative would be similar to those presented under the Sitewide Close-In-Place Alternative (see Section 4.1.12.4).

Estimates of the total transportation accident risks for all projected accidents involving waste shipments, regardless of waste type, under this alternative are as follows: a maximum radiological dose-risk to the general population of about 0.00072 person-rem over 20 years, resulting in 4.3×10^{-7} LCFs for truck transport in the Commercial Disposal Option, and a maximum nonradiological accident risk of less than 1 (0.09) fatality for rail transport in the DOE/Commercial Disposal Option (see Table 4–53).

Impacts of Construction and Operational Material and Hazardous Waste Transportation

This alternative would require minimal transport of materials for monitoring and maintenance operations. The impacts of transporting clean debris and hazardous wastes to local landfills were evaluated. The estimated transportation impacts under this alternative would be 0.014 million kilometers (0.009 million miles) traveled, less than 1 (0.005) accident, and less than 1 (0.0002) fatality over 20 years.

4.1.13 Environmental Justice

Environmental justice addresses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from implementation of the alternatives in this EIS. In assessing the impacts, the following definitions were used:

- *Minority individuals*: Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, two or more races, or some other race.
- *Minority populations:* Minority populations are identified where either: (1) the minority population of the affected area exceeds 50 percent of the area's general population, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
- *Low-income population:* Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the U.S. Census Bureau's Current Population Reports, Series P60, on *Poverty in the United States* (Census 2000). Canadian low-income populations were identified from low-income measures from Statistics Canada (Giles 2004).

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as those minority and low-income populations that reside within an 80-kilometer (50-mile) radius centered on WNYNSC. Low-income populations and minority populations residing within this radius are identified in Chapter 3, Section 3.12, of this EIS.

Adverse health effects are measured in terms of risks and rates of exposure that could result in LCFs, as well as other fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects would occur if the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. The minority and low-income populations are subsets of the general public residing around the site, and all are exposed to the same hazards generated by various operations at the site. Therefore, estimates for environmental justice impacts were determined using either the human health risks results or similar methods provided in this chapter.

4.1.13.1 Decommissioning Period Impacts

No disproportionately high and adverse environmental impacts on minority and low-income populations would occur during the decommissioning period under any of the alternatives for this EIS. This conclusion is a result of investigations in this EIS that determined there would be no significant impacts on human health or ecological, cultural, paleontological, socioeconomic, or other resource areas described in this chapter.

As discussed in Section 4.1.9.1, radiological and hazardous chemical risks to the public resulting from decommissioning actions would be small. These actions at WNYNSC are not expected to cause fatalities among the general population, including minority and low-income populations living within the potentially affected area. An analysis was performed of a high fish-consumption lifestyle for individuals on the lower reaches of Cattaraugus Creek. Such an individual could be a member of the Seneca Nation of Indians. This analysis showed that the projected doses from normal operations under any of the decommissioning alternatives would not be expected to adversely impact this individual during the decommissioning actions.

Even lower doses are projected for the post-decommissioning time period for the decommissioning alternatives, as indicated in Section 4.1.9.1.

Annual radiological risks to the offsite population that could result from facility accidents discussed in Section 4.1.9.2 were estimated to be less than 1 LCF under all decommissioning alternatives over the decommissioning action time periods. These risks are not expected to disproportionately impact minority or low-income populations. The general population surrounding the site is not made up of a disproportionate number of minority or low-income individuals, as discussed in Chapter 3, Section 3.12, of this EIS.

4.1.13.2 Long-term Impacts

Section 4-4 of Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs that Federal agencies, "whenever practical and appropriate, shall collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence" and "shall communicate to the public the risks of those consumption patterns."

In the analysis of long-term impacts, which is discussed in Section 4.1.10 and in Appendix H, one of the scenarios is a Seneca Nation of Indians receptor who is postulated to annually consume 62 kilograms (137 pounds) of fish that was raised in the lower reaches of Cattaraugus Creek or in Lake Erie near the point where Cattaraugus Creek discharges into the lake. This scenario is conservative due to the large amount of fish in the diet, the assumption that the fish was raised in the area, and the assumption that Cattaraugus Creek water is used for drinking and irrigation. Nevertheless, based on a review of reasonably foreseeable scenarios, the peak annual total effective dose to a Seneca Nation of Indians receptor was estimated to be approximately

0.7 millirem under the Sitewide Close-In-Place Alternative and range up to about 3 millirem for the No Action Alternative. The projected doses to the Seneca Nation of Indians receptor would not be expected to adversely impact this individual, and there would be no disproportionately high and adverse impacts. If unmitigated erosion was assumed to occur, however, the annual dose to the Seneca Nation of Indians receptor could rise to 34 millirem for the No Action Alternative, although this dose would still be smaller than DOE's limit for protection of the public of 100 millirem in a year (DOE 1990). This dose would bound the option where the SDA would remain under continued active management and the remainder of the affected areas of the site were removed or closed in place. Under such a scenario there would still be little cause for environmental justice concerns.

4.2 Cost-Benefit Considerations

The various decommissioning actions involve the investment of money and worker and public exposure in the interest of reducing future worker and public exposures. This section presents the costs for the various alternatives in present value terms to facilitate direct comparison of different expenditures patterns for the alternatives. The section also presents information on the worker and public doses that are estimated to occur during decommissioning actions and during a 1,000-year period of follow-up monitoring and maintenance or long-term stewardship for each decommissioning alternative (see Section 4.2.2). Using the No Action Alternative as a baseline, this information was used to estimate the incremental cost-effectiveness of each decommissioning alternative, expressed in terms of present value cost per avoided person-rem. A summary of the cost-benefit comparative assessment is provided in **Table 4–54**.

Cost-benefit analysis is not typically included in a DOE EIS but is included in an NRC EIS. The cost-benefit analysis presented in this EIS is intended to increase the utility of the document to NRC. The analysis was performed for all alternatives assuming real discount rates ranging from 1 to 5 percent. The analysis considers a range of unit disposal costs for Greater-Than-Class C waste—i.e., $2,300 per cubic foot to $21,000 per cubic foot (WSMS 2009e). The values presented in Table 4–54 are based on long-term performance assessment results that reflect the assumption of continued institutional controls.

All decommissioning alternatives have an incremental cost for avoided population dose (expressed in person-rem) that is much greater than the $2,000 per person-rem which is both the NRC general and decommissioning-specific standard. All decommissioning alternatives appear to meet NRC's decommissioning ALARA requirement.

Table 4–54 Cost-Benefit Comparative Assessment [a]

Sitewide Removal Alternative	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative [b]*	*No Action Alternative*
The Sitewide Removal Alternative would transfer essentially the entire site radionuclide inventory to other disposal sites. The incremental cost-effectiveness is estimated to range from about $430,000 to $1,300,000 per avoided person-rem.	The Sitewide Close-In-Place Alternative would keep most of the site radionuclide inventory out of the site's accessible environment. The incremental cost-effectiveness is estimated to range from about $210,000 to $950,000 per avoided person-rem.	The cost-effectiveness of this alternative would depend primarily on the Phase 2 decision. If the Phase 2 decision is timely removal of the remaining waste and contamination, the incremental cost-effectiveness is estimated to range from about $230,000 to $1,300,000 per avoided person-rem. If the Phase 2 decision is timely in-place closure for the remaining waste and contamination, the incremental cost-effectiveness is estimated to range from about $450,000 to $760,000 per avoided person-rem.	The No Action Alternative serves as a baseline for assessing the incremental cost-effectiveness of the decommissioning alternatives.

[a] The analysis was performed for all alternatives assuming real discount rates ranging from 1 to 5 percent, and unit Greater-Than-Class C waste disposal costs ranging from $2,300 to $21,000 per cubic foot (WSMS 2009e). The values in this table are based on calculations that assume continued institutional controls.

[b] The analysis for the Phased Decisionmaking Alternative assumes the Phase 2 decision is either all removal or all in-place closure for the Waste Tank Farm, NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, and State-Licensed Disposal Area.

4.2.1 Cost

The NYSERDA View Indicates….

The Final EIS Approach for Exhumation may be Overly Conservative. NYSERDA believes that the approach identified in the Final EIS for exhuming the disposal areas and the Waste Tank Farm should be reassessed to determine whether less conservative, but still protective, methods of exhumation could be identified that would significantly reduce the cost of exhumation.

DOE's Response….

The pre-conceptual engineering approach to implementing the Sitewide Removal Alternative was reviewed, and revisions were made to the design of modular environmental enclosures used for exhuming waste from the SDA and estimates of the contamination levels for some of the soil removed from the burial areas. These changes resulted in small reductions in the estimated cost of removing these facilities.

DOE recognizes that fabric structures have been used to provide containment for exhumation of buried material with chemical and alpha-contamination. In particular, DOE notes the use of multiple, moderate-sized enclosures that utilize an industrial fabric skin over a prefabricated steel structure to support waste retrieval operations. The Accelerated Retrieval Project at DOE's Idaho National Laboratory has used these structures to enclose areas of about one-half acre to support the exhumation of waste that includes plutonium contamination and volatile organic compounds. These structures are designed to minimize the spread of contamination and provide protection from the environment. The first structure supported Accelerated Retrieval Project 1, which lasted about 3 years.

DOE is not aware of any successful use of fabric-covered structures for the exhumation of NDA- and SDA-type waste in which there are major gamma radiation sources that require increased worker protection from this penetrating radiation. DOE also notes that its design standards call for the facilities that handle higher activity material to be able to withstand natural phenomena including snow loads, high winds, and wind-driven missiles.

DOE has used fabric structures at WNYNSC to protect materials, including packaged waste, from the environment. The fabric cover of LSA 3 was torn and removed by a wind storm in 1996 and a framed structure with a fabric cover used for equipment storage collapsed from a snow load in 2003.

While DOE recognizes the potential for the use of fabric-covered structures to reduce the initial cost of exhumation projects, there are other issues that must be considered in the design of structures used to support the exhumation of waste with the potential for high dose rates. At the present time, DOE considers it prudent to develop preliminary exhumation designs and costs estimates based on the use of solid-walled structures. DOE will continue to monitor the development of remote exhumation technologies applicable to nuclear waste. If decommissioning actions involves removal actions, the detailed design effort will review the existing technology and select a design approach that is protective of worker and public safety and involves the efficient use of public funds.

A summary of the costs needed to complete the decommissioning actions, as well as the annual post-decommissioning monitoring and maintenance or long-term stewardship cost for each alternative, is presented in **Table 4–55** (WSMS 2009a, 2009b, 2009c, 2009d). This information is presented in the first two rows of Table 4–55 in 2008 dollars. The table shows the high initial cost and absence of post-decommissioning cost for the Sitewide Removal Alternative, and the annual monitoring and maintenance cost and absence of initial cost for the No Action Alternative. Two estimates are presented for the decommissioning cost for the Sitewide Removal Alternative to reflect uncertainty in Greater-Than-Class C waste disposal cost. The higher estimate is associated with a higher unit Greater-Than-Class C waste disposal cost and the lower estimate is associated with a lower unit Greater-Than-Class C waste disposal cost. The table also shows the costs for the Sitewide Close-In-Place Alternative, which would incur initial decommissioning costs for 7 years followed by annual long-term stewardship costs.

Two cost estimates are presented in the first row of Table 4–55 for the Phased Decisionmaking Alternative. The first cost estimate is based on the assumption that Phase 2 involves removing the remaining waste and contamination (Waste Tank Farm, NDA, and SDA) while the second cost estimate is based on the assumption that the remaining waste and contamination is closed in place. The range for the Phase 2 removal option reflects uncertainty in Greater-Than-Class C waste disposal cost.

As noted, the cost estimates presented in the first two rows of the table are based on engineering studies intended to identify the actions necessary to complete decommissioning and to conduct post-decommissioning monitoring and maintenance or long-term stewardship. It does not include an estimate of funds for responding to potential catastrophic events. There are limited bases for developing cost estimates for responding to catastrophic events. Furthermore, if such estimates were developed, weighted according to probability of occurring and discounted (see following text), it is estimated that the additional cost would represent a small addition to the existing estimates. In addition, all alternatives would include this future cost risk and it would be difficult to establish a meaningful, discriminating difference in this cost for the alternatives.

Table 4–55 Costs for Environmental Impact Statement Alternatives

Cost Element	***Sitewide Removal Alternative***	***Sitewide Close-In-Place Alternative***	***Phased Decisionmaking Alternative***	***No Action Alternative***
Cost to complete decommissioning actions (billions of 2008 dollars)	9.3 – 6.5 [a]	1.0	9.4 – 6.6 (Removal) [a, b] 1.7 (Close-In-Place) [b]	0
Effective annual costs for monitoring and maintenance or long-term stewardship (millions of 2008 dollars per year)	0	4.7	0 (Removal) [c] 4.7 (Close-In-Place) [c]	12.6
Present value (billions of 2008 dollars) assuming 1, 3, and 5 percent real discount rates and 1,000 years of monitoring and maintenance or long-term stewardship for the Sitewide Close-In-Place, Phased Decisionmaking, and No Action Alternatives	7.0 – 4.9 (1%) [a] 4.4 – 3.1 (3%) [a] 3.1 – 2.1 (5%) [a]	1.4 (1%) 1.1 (3%) 0.9 (5%)	6.9 – 4.2 (1%, Removal) 1.8 (1%, Close-In-Place) 4.2 – 2.1 (3%, Removal) 1.2 –1.3 (3%, Close-In-Place) 2.8 – 1.3 (5%, Removal) 0.9 – 1.41 (5%, Close-In-Place)	1.3 (1%) 0.4 (3%) 0.3 (5%)

[a] The higher cost estimate includes $3.1 billion for disposal of Greater-Than-Class C waste (unit disposal cost of $21,000 per cubic foot) while the lower cost estimate includes $0.34 billion for disposal of Greater-Than-Class C waste (unit disposal cost of $2,300 per cubic foot) (WSMS 2009e).
[b] The listed costs include a cost of $1.2 billion for Phase 1 of the Phased Decisionmaking Alternative.
[c] These are annual costs after completion of Phase 2 decommissioning actions.

The dollar expenditure patterns vary among the alternatives, based on the timing and duration of the decommissioning actions. For example, the Sitewide Removal Alternative decommissioning actions extend for 60 years, after which there would be no need for long-term stewardship (although there may be a need for temporary orphan waste storage). This is reflected in the pattern of costs, with high costs for 60 years, followed by no additional costs. In contrast, under the No Action Alternative, the site would be maintained indefinitely at the starting point of this EIS. Thus, for the No Action Alternative there would be no initial decommissioning expenditures, but there would be annual monitoring and maintenance costs that would continue indefinitely. One way of comparing these costs is to express them in terms of present value which reflects a statement about how much money in today's dollars would be necessary to make all future payments. Making this conversion requires one to make estimates of how the cost would escalate over time as well as the interest that could be accrued on funds prior to their expenditure. The difference between these rates (nominal interest rate – expected inflation rate) is termed the *real discount rate*.[29] NRC guidance suggests that a lower range of discount rates can be considered when there are intergenerational

[29] *OMB Circular A-94 Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (http://www.whitehouse.gov/omb/circulars/index.html)*

consequences.[30] To investigate the sensitivity of the results to real discount rate, three real discount rates (1, 3 and 5 percent) were used in a simplified present value analysis that considers costs through 1,000 years. The results of this analysis are presented in the last row of Table 4–55. The No Action Alternative has the least expensive present value range, the Sitewide Removal Alternative has the most expensive present value range, and the Sitewide Close-In-Place Alternative has an intermediate present value range. The Phased Decisionmaking Alternative present value range is approximately equal to that for the Sitewide Removal Alternative if the Phase 2 decision is removal and it is slightly higher than the Sitewide Close-In-Place Alternative if the Phase 2 decision is in-place closure. The range of discounted costs for the Phased Decisionmaking Alternative includes analysis of the effect of the Phase 2 decision made both 10 years and 30 years after issuance of the Phase 1 Record of Decision.

4.2.2 Population Dose

To compare the cost-effectiveness of the decommissioning alternatives for reducing population exposure, it is necessary to compare the time-integrated population dose for each of the alternatives, including the No Action Alternative, which serves as the baseline for the cost-effectiveness analysis.

There are two major components to the worker and public population doses for each alternative. The first is the population dose that would be incurred in carrying out the decommissioning actions (removing or isolating site waste and contamination, and shipping waste off site). The second is the time-integrated long-term population dose resulting from the postulated long-term environmental release of any waste and contamination that remains on site. The integration period is 1,000 years, a timeframe that was selected to be consistent with the analytical timeframe used in NRC's license termination assessments. The estimate of the first component is the dose to workers and populations presented in Section 4.1.9 and Section 4.1.12. The transportation dose estimates are those for rail transportation. This mode of transport results in smaller doses than those for truck transport, thus resulting in a higher estimate of avoided person-rem for the Sitewide Removal Alternative. The estimate of the second component of worker and public population doses is based on the estimated worker dose from monitoring and maintenance activities as presented in Section 4.1.9 and the time-integrated population dose to Lake Erie/Niagara River water user receptors presented in Section 4.1.10. This analysis uses two values for the time-integrated Lake Erie/Niagara River water user receptor population dose. The first value assumes continuance of institutional controls (Table 4–30) while the second value is for assumed loss of institutional controls after 100 years (Table 4–39). This analysis does not consider the time-integrated population dose for the unmitigated erosion scenario because this scenario is considered to be very unlikely.

The population dose components and the total population dose for each of the alternatives are presented in **Table 4–56** and drawn from information provided in Sections 4.1.9, 4.1.10, and 4.1.12. The doses for the Sitewide Removal and Sitewide Close-In-Place Alternatives are given in the first two columns. The 1,000-year population dose due to assumed long-term release of contamination from the site is conservative because it does not take credit for the performance of the permeable treatment wall intended to treat the leading edge of the North Plateau Groundwater Plume. Doses for the Phased Decisionmaking Alternative are given in the third column. For this alternative, two values are given. The first value assumes the Phase 2 decision is removal of the remaining waste and contamination. The second value assumes the Phase 2 decision is in-place closure of the remaining waste and contamination (again, no credit is taken for the performance of the permeable treatment wall). The last column of the table is the information for the No Action Alternative. The total population dose for the No Action Alternative has a range. The lower value is based on the assumption that institutional controls remain in place. The higher value is based on the assumption that institutional controls fail after 100 years. The No Action Alternative serves as the baseline for the cost-effectiveness analysis presented in Section 4.2.3.

---

[30] *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission, NUREG/BR-0058, Revision 4, September 2004.*

Table 4–56 Population Dose for Each Alternative

Population Dose Element	Alternative			
	Sitewide Removal	*Sitewide Close-In-Place*	*Phased Decisionmaking*	*No Action*
Dose to site and transportation workers during decommissioning actions (person-rem)	1,100	120	1,000 (Removal) 240 (Close-In-Place)	0
Dose to the offsite population and to the population along transportation routes incurred during decommissioning actions (person-rem)	220	40	200 (Removal) 100 (Close-In-Place)	0
1,000 years of worker dose from monitoring and maintenance activities (person-rem)	0	800	0 (Removal) 800 (Close-In-Place)	2,000
1,000 years of dose to the offsite population from contaminant migration from the site (person-rem), assuming continuance of institutional controls	0 [a]	4,000	0 (Removal) 3,400 (Close-In-Place)	3,600
1,000 years of dose to the offsite population from contaminant migration from the site (person-rem), assuming loss of institutional controls after 100 years	0 [a]	4,000	0 (Removal) 3,400 (Close-In-Place)	40,000 [b]
1,000 years of dose to the offsite population from site monitoring and maintenance activities (person-rem)	0	2	0 (Removal) 2 (Close-In-Place)	80
Total population dose through 1,000 years (person-rem) [c]	1,300	5,000	1,300 (Removal) 4,500 (Close-In-Place)	5,700 – 42,000

[a] The population dose would be a small number; however, for this analysis, the dose is conservatively assumed to be zero.
[b] This population dose assumes failure of the Waste Tank Farm after 100 years. This assumption conservatively increases the estimated dose reduction for the decommissioning alternatives.
[c] The total population dose includes the dose incurred during the decommissioning actions and also during 1,000 years of follow-up monitoring and maintenance.
Note: Individual values as well as totals are rounded. Totals may not add exactly due to this rounding.

4.2.3 Cost-Effectiveness

The information given in the previous sections was used to estimate the total incremental population dose reduction to both workers and the public as a result of implementing each decommissioning alternative, the incremental cost to achieve this population dose reduction, and the incremental cost-effectiveness of the population dose reduction for each decommissioning alternative.

With the following simplifying and conservative assumptions, the analysis applies the principles identified in NRC guidance for conducting as low as is reasonably achievable (ALARA) analyses as presented in Appendix N of NUREG-1757, Volume 2, Revision 1 (NRC 2006):

- The cost estimate does not include a cost equivalence for worker and public fatalities during decommissioning activities and waste and material transportation. NRC guidance identifies a cost equivalence of $3 million per fatality (NRC 2006). If such a cost-equivalence for fatalities was considered, it would increase the effective cost for all alternatives, particularly the Sitewide Removal Alternative, and thereby increase the cost per avoided person-rem for all alternatives.

- Future radiation doses are not discounted. Discounting future radiation doses would decrease the magnitude of the future dose. This would reduce the estimate of the benefit (the avoided population dose), and would thereby increase the cost per avoided person-rem. The increase would be greatest for the Sitewide Removal Alternative which achieves a long-term avoided population dose at the price of a short-term population dose associated with decommissioning.

- The analysis does not consider the population dose that would occur over the short and long term at the disposal facilities to which waste from WNYNSC could be sent. If those population dose consequences were included in the analysis, they would add to the population dose associated with alternatives involving offsite waste disposal, thereby reducing the benefit (the avoided population dose) for these alternatives. The effect would be to increase the incremental cost per avoided person-rem for alternatives that involve offsite disposal of waste.

The analysis uses two estimates of avoided population dose: one based on the assumption that institutional controls remain in place and one based on the assumption that institutional controls are lost after 100 years. Use of the population dose that assumes continuance of institutional controls is considered to be consistent with the spirit of NEPA and SEQR which call for analysis of reasonably foreseeable consequences as well as consistent with the spirit of the NRC guidance which calls for as little bias as possible in ALARA analysis.

The results are given in **Table 4–57**. The first row in the table shows the estimated population dose reduction due to decommissioning. There is a range presented for each alternative. For the Sitewide Removal and Sitewide Close-In-Place Alternatives, the lower value is based on the assumption that institutional controls remain in place (data from Table 4–30), while the higher value is based on the assumption that institutional controls are lost after 100 years (data from Table 4–39). For the Phased Decisionmaking Alternative, two ranges are presented. The first range assumes the Phase 2 decision is removal for the Waste Tank Farm, NDA, and SDA, while the second range assumed the Phase 2 decision is in-place closure. The lower value in each range is based on the assumption that institutional controls remain in place, and the higher value is based on the assumption that institutional controls are lost after 100 years. The population dose reduction for the Sitewide Close-In-Place Alternative and the case where the Phase 2 decision for the Phased Decisionmaking Alternative is in-place closure do not take credit for the performance of the permeable treatment wall as discussed earlier.

The next three rows present the incremental cost necessary to implement an alternative using the differences between the present value for implementing the alternative and the present value for the No Action Alternative. Each of the rows presents the incremental cost based on a different discount rate as noted in Table 4–55. A range of costs is presented for the Sitewide Removal Alternative and for the Phase Decisionmaking Alternative where it is assumed that the Phase 2 decision is removal. The range is the result of different assumptions about the unit Greater-Than-Class C waste disposal cost as discussed for Table 4–55.

The last two rows of Table 4–57 present ranges of incremental cost-effectiveness for population dose reduction. The second-to-last row assumes perpetual continuance of institutional controls, while the last row assumes institutional controls are lost after 100 years. The range reflects the effect of the cost range presented in the three previous rows and the effect of the assumption about the presence or absence of institutional controls. For the Sitewide Removal Alternative, the lower cost-effectiveness value is associated with the higher real discount rate (5 percent) and the lower unit Greater-Than-Class C waste disposal cost. For the Sitewide Close-In-Place Alternative, the lower cost-effectiveness value is associated with the lower real discount rate. For the Phased Decisionmaking Alternative assuming Phase 2 is removal, the lower cost-effectiveness value is associated with the higher real discount rate, the lower unit Greater-Than-Class C disposal cost, and the assumption that Phase 2 actions are initiated 30 years after the Record of Decision documenting selection of the Phased Decisionmaking Alternative. Assuming Phase 2 is close-in-place, the lower cost-effectiveness value is associated with the lower real discount rate and the assumption that Phase 2 actions are initiated 30 years after issuance of the Phase 1 Record of Decision.

Table 4–57 Population Dose Reduction, Incremental Cost, and Cost-effectiveness for Each Action Alternative

Population Dose Element	*Alternative*			
	Sitewide Removal	*Sitewide Close-In-Place*	*Phased Decisionmaking* [b]	*No Action*
Total population dose reduction due to decommissioning actions (person-rem) [a]	4,400 – 41,000	700 – 37,000	4,400 – 41,000 1,100 – 38,000	The No Action Alternative is the baseline
Incremental cost to achieve the dose reduction (billions of present value dollars at 1 percent real discount rate)	3.6 – 5.7 [c]	0.2	2.9 – 5.6 [c] 0.5 – 0.6	The No Action Alternative is the baseline
Incremental cost to achieve the dose reduction (billions of present value dollars at 3 percent real discount rate)	2.6 – 4.0 [c]	0.6	1.6 – 3.8 [c] 0.7 – 0.9	The No Action Alternative is the baseline
Incremental cost to achieve the dose reduction (billions of present value dollars at 5 percent real discount rate)	1.9 – 2.8 [c]	0.7	1.0 – 2.6 [c] 0.7 – 0.9	The No Action Alternative is the baseline
Incremental cost-effectiveness, $ (present value) per avoided person-rem considering dose savings assuming continuance of institutional controls	430,000 – 1,300,000	210,000 – 950,000	230,000 – 1,300,000 450,000 – 760,000	The No Action Alternative is the baseline
Incremental cost-effectiveness $ (present value) per avoided person-rem considering dose savings assuming loss of institutional controls after 100 years	46,000 – 140,000	4,000 – 18,000	25,000 – 110,000 14,000 – 20,000	The No Action Alternative is the baseline

[a] The dose reduction for each alternative is the difference between the total alternative dose that is incurred during both the period of decommissioning actions and, if applicable, a 1,000-year period of subsequent monitoring and maintenance (refer to the last row of Table 4–56) and the total No Action Alternative dose.

[b] The first range assumes that Phase 2 would be removal of remaining waste and contamination; the second range number assumes in-place closure of remaining waste and contamination.

[c] The minimum value reflects a unit Greater-Than-Class C waste disposal cost of $2,300 per cubic foot; the maximum value reflects a unit Greater-Than-Class C waste disposal cost of $21,000 per cubic foot (WSMS 2009e).

Assuming institutional controls continue indefinitely, the Sitewide Close-In-Place Alternative has the lowest range of incremental cost-effectiveness, although portions of the ranges of incremental cost-effectiveness overlap for all action alternatives. Assuming institutional controls fail after 100 years, the Sitewide Close-In-Place Alternative has the lowest incremental cost-effectiveness range among the action alternatives.

The last two rows show that all of the decommissioning alternatives would cost much more than $2,000 per avoided person-rem and therefore appear to meet NRC's decommissioning ALARA requirement. In addition, ALARA considerations would not be expected to be a significant factor for discriminating among the decommissioning alternatives.

4.3 Incomplete and Unavailable Information

The NYSERDA View Indicates….

The Uncertainties in the Final EIS Long-Term Performance Analyses are not Adequately Presented or Discussed. The EIS does not address uncertainty in a manner that provides decisionmakers with information on the critical contributors to uncertainty or the importance of uncertainty in site cleanup decisions. In particular, NYSERDA concludes that a more comprehensive and transparent analysis and presentation of uncertainty is needed to support long-term decisionmaking for WNYNSC cleanup.

DOE's Response….

DOE fully recognizes the inherent and unavoidable uncertainty in long-term performance assessment. In Section 4.3.5, uncertainty in the estimates of environmental consequences for the various alternatives is acknowledged and incomplete or unavailable information that contributes to the uncertainty in the environmental consequence estimates is identified consistent with CEQ NEPA Regulations (Sec. 1502.22, Incomplete or unavailable information).

Recognizing the uncertainty, DOE has taken several actions to more fully inform decisionmakers. Where informative and useful upper and lower bounds can be established, DOE has developed and presented bounding analyses. The primary example of this is the bounding analysis for the reliability of institutional controls that maintain engineered barriers and limit access to the site. The long-term performance assessment addresses this uncertainty by analyzing scenarios in which institutional controls remain in effect (Section 4.1.10.3.1), institutional controls are lost (Section 4.1.10.3.2), and the special case in which the loss of institutional controls continues for hundreds of years and leads to unmitigated erosion (Section 4.1.10.3.3).

In instances where such bounding analysis is not possible or practical, moderately conservative values were used for parameters in the deterministic long-term performance assessment. The use of moderately conservative values for many of the individual parameters (e.g., lower distribution coefficients (K_d) and higher hydraulic conductivities) and the use of conservative conceptual models (e.g., no radionuclide removal in stream channels or from water treatment) produces overall consequence estimates that are considered to be conservative but still useful when trying to understand the consequences from specific source areas and for specific alternatives. Also, the models of physical processes such as hydrologic transport and erosion are based on theoretical approaches that are generally accepted by the scientific community as required by NEPA. The discussion of the conservatism in the various elements of the long-term performance assessment in Section H.2.2.1 has been expanded to more clearly articulate the conservatism in the overall dose estimates presented in this Final EIS.

DOE recognizes that several parts of the NYSERDA View call for comprehensive uncertainty analysis for the long-term performance assessment and acknowledges the value of such information it if were available. However, the development of probabilistic uncertainty analysis for the long-term dose estimates is not practical for this EIS. In particular, it is not possible at this time to provide defensible quantification of the uncertainty in parameters related to the nature and timing of future human actions that are important parameters in the quantification of future human health impacts.

Incomplete and unavailable information can introduce uncertainty into the consequence analyses presented in this chapter. This section discusses the nature of incomplete and unavailable information for those resource areas having the greatest impact, as identified at the beginning of this chapter. The resource areas and the sections of Chapter 4 where they are discussed are:

- Worker exposure (Section 4.1.9)
- Transportation (Section 4.1.12)
- Waste management (Section 4.1.11)

- Public health and safety during decommissioning actions (Section 4.1.9)
- Human health impacts resulting from long-term release and transport (Section 4.1.10)

The nature of the incomplete or unavailable information for each of these areas and the manner in which the environmental analysis dealt with this data limitation is discussed in the balance of this section. Consistent with the requirements of 40 CFR 1502.22, "Incomplete or Unavailable Information," the discussion includes: (1) information that is incomplete or unavailable, (2) relevance of the information to adverse impacts, (3) summary of existing credible scientific evidence to support evaluation, and (4) evaluation of impacts.

4.3.1 Worker Exposure

Of all EIS alternatives, worker exposure, would be greatest for the Sitewide Removal Alternative because workers would be involved in removing, packaging, and handling all onsite waste.

The exposure to workers carrying out decommissioning actions would depend on the extent and duration of worker exposure to radiation sources, primarily gamma sources. Information that is incomplete or unavailable at this time includes: (1) precise knowledge of the distribution of radionuclides in the waste, particularly the gamma emitters; (2) design details for the facilities that would be used for waste handling and processing; and (3) knowledge of how workers would be assigned during decommissioning actions.

Further characterization of the radionuclide distributions would only become available during the physical characterization effort prior to, or as part of, decommissioning. Further understanding of facility design or operator assignment would occur following the development of detailed designs and detailed operating plans, actions that would occur only for the selected EIS alternative.

Estimates of occupational exposure were developed using labor category-specific exposure rates and resource estimates for each of the labor categories. The category-specific exposure rates were established using historical WVDP occupational exposure information contained in DOE's Radiation Exposure Monitoring System to develop exposure rates specific to 11 labor categories. These exposure rates were used in conjunction with specific labor hour estimates to develop total occupational exposure estimates for the various decommissioning actions. The development of these exposure rates and labor estimates is discussed in a supporting technical report (WSMS 2009e).

The occupational exposure estimates are presented in Section 4.1.9, with the results summarized in Table 4–18. The table shows the total occupational exposure to complete a decommissioning alternative as well as the annual occupational exposure that would occur during any monitoring and maintenance period. A more-detailed breakdown of the estimates is contained in the technical report for each alternative (WSMS 2009a, 2009b, 2009c, 2009d).

The occupational exposure estimates are considered to be conservative because of the conservatism in the development of the labor category–specific exposure rates and the fact that no credit is taken for the decay of the gamma emitters that would be the largest contributors to worker dose (cesium-137 and cobalt-60). Active management controls would assure that occupational dose standards for individual workers are met.

4.3.2 Transportation

Of all EIS alternatives, transportation workers and public exposure during transportation would be greatest for the Sitewide Removal Alternative because all onsite waste would be removed, handled, and transported to offsite disposal locations.

The consequences of radioactive waste transportation depend on the extent and duration of worker and public exposure to radiation sources (i.e., waste) being transported during the decommissioning activities and the number and type of shipments that are related to the number of transportation accidents. Information that is incomplete or unavailable at this time for this consequence analysis includes: (1) precise knowledge of the distributions of radionuclides in the packaged waste, particularly the gamma emitters; (2) radiation dose from the waste package shipment arrays; (3) the transportation routes; and (4) the method of waste shipment (truck, rail, or a combination).

Further characterization of the radionuclide distributions would only become available during the physical characterization effort prior to, or as part of, waste packaging prior to shipment. Estimates of exposure to workers and the general public from incident-free transportation, as well as the consequences of accidents, were developed using methods, codes, and databases commonly used for transportation impact analysis. Assumptions about waste package inventory were conservative and resulted in conservative dose estimates. The radionuclide inventory assumed for each type of waste is the maximum radionuclide concentration that could be present from decontamination, demolition, or decommissioning of buried wastes in the NDA, SDA, or Waste Tank Farm. The subsequent surface dose rate for each type of waste was estimated using inventories of potential gamma emitters, with no credit taken for decay beyond September 2000.

The dose rates from arrays would be known more precisely when the packages are arranged for shipment. Also, details about shipment mode and route would be defined as part of implementing the selected alternative.

Uncertainty about disposal locations for low-level radioactive waste was addressed by considering two different waste disposal strategies (DOE-plus-commercial and commercial-only) and both eastern and western U.S. low-level radioactive waste disposal sites. Uncertainty about transportation method was addressed by considering both truck and rail shipments.

The doses and risks associated with waste transportation are presented in Section 4.1.12, with the results summarized in Table 4–53. A more-detailed breakdown of the estimates is presented in Appendix J of this EIS. The dose and risk estimates are considered to be conservative because no credit is taken for the decay of the gamma emitters (i.e., cesium-137 and cobalt-60) that are expected to control the incident-free dose estimates over the period of waste shipment for each alternative. The dose estimates are considered reasonable, however, because radiological inventory and external reduction estimates are made for each type of waste depending on its specific radiological characteristics.

4.3.3 Waste Management

Of all EIS alternatives, waste management consequences would be greatest for the Sitewide Removal Alternative because all waste would be removed, packaged, handled, and ultimately shipped offsite.

The consequences of radioactive waste management depend on the volume and characteristics of the waste that would be generated under each alternative and the actions that would be taken to manage the waste: storage or disposal. Information that is incomplete or unavailable at this time for this consequence analysis includes: (1) the volumes and characteristics of waste that would be generated under each alternative; and (2) the availability of disposal capacity for all waste, particularly commercial Class B and C low-level radioactive waste, Greater-Than-Class C waste, transuranic waste, and any high-level radioactive waste.

Estimates of waste volumes by category were developed in the technical reports for each alternative (WSMS 2009a, 2009b, 2009c, 2009d). The estimates are considered to be generally conservative from both the volume and waste category viewpoints. More-precise characterization of waste volumes and waste characteristics (e.g., categories) would become available as the waste is generated. Uncertainty about the availability of offsite waste disposal locations for Class B and C low-level radioactive waste, Greater-Than-

Class C waste, or non-defense transuranic waste was addressed by analyzing the transportation impacts of shipment of the waste to distant hypothetical disposal facilities. The EIS also analyzes the annual consequences of onsite storage of Class B and C low-level radioactive waste, Greater-Than-Class C waste, and non-defense transuranic waste for the Sitewide Removal Alternative in the event it is not possible to immediately ship this waste offsite as part of decommissioning actions.

The consequences of waste management are discussed in Section 4.1.11, with the results summarized in Tables 4–46 through 4–48.

4.3.4 Public Health and Safety During Decommissioning Actions

Of all EIS alternatives, public exposure during decommissioning is greatest for the Sitewide Removal Alternative because removing, packaging, and handling all onsite waste would result in the largest cumulative environmental release from decommissioning actions.

The dose and risk consequences for the public from decommissioning actions depend on the release of radionuclides to the local atmosphere and surface waters and the potential accidents that might occur during decommissioning operations and release radionuclides to the atmosphere or local surface waters. Information that is incomplete or unavailable at this time for this consequence analysis includes: (1) more precise information on radionuclides that would be released, and (2) the location and actions of future nearby critical receptors.

Further characterization of the radionuclides would only become available as the decommissioning actions are conducted. Information about accident details (how much is released, what form, where, meteorological or hydrologic conditions) would only become available if an accident were to occur.

Estimates of public exposure and subsequent risk for normal operations were developed using a standard code (GENII Version 2) for estimating doses from atmospheric and liquid releases. Estimates of public exposure and subsequent risk for potential accidents were also developed using a standard code for that type of analysis (MACCS2). Both codes and the methodologies are discussed in Appendix I of this EIS. Estimates of discharges to the atmosphere and surface water were developed in the technical reports for each alternative (WSMS 2009a, 2009b, 2009c, 2009d).

Public exposure and risk estimates are presented in Section 4.1.9, with the results summarized in Tables 4–12 through 4–22. The public exposure and risk estimates are considered to be conservative because of the conservatism in the development of the normal operations release estimate as well as the accident release estimate. A conservative element of the airborne release dose analysis is the neglect of radioactive decay. Many of the radioisotopes (tritium, cobalt-60, strontium-90, and cesium-137) have half-lives that are comparable to or shorter than the decommissioning action timeframe and would therefore decay to an appreciable extent. The analysis also conservatively assumes the individuals and populations breathe contaminated air all the time and that all the food consumed by the individuals and populations was exposed to contaminated air and water. The downstream population estimates are also conservative because no credit is taken for radionuclide removal as part of water treatment systems, and it was assumed that in addition to direct water consumption, the water would be used to irrigate a local garden. An additional conservative factor for downstream receptors is the assumption of contaminated fish consumption where there is immediate accumulation of radionuclides in the fish to levels that are consistent with long-term bioaccumulation factors. Public accident risk estimates include conservative assumptions regarding emergency response actions, radiological source terms, and meteorology.

4.3.5 Human Health Impacts Resulting from Long-term Release and Transport

The estimates of long-term doses and risk to individuals (see Section 4.1.10) result from a complex series of calculations that involve estimates of initial hazardous and radiological material inventory and form, estimates of rates for moving these constituents from their original location through the environment taking into account interactions between the various components of the environment (e.g., water, sediment, vegetation, and fish), and finally, estimates of human use of, or interaction with, the contaminated environment.

The major elements of incomplete or unavailable pieces of information that are used in these calculations are:

- Characterization of the amount, chemical form, and physical distribution of hazardous materials (radionuclides and toxic chemicals) in the various locations including contaminated soil and sediment, buried waste, buildings, and underground tanks. The analysis for the No Action Alternative assumes the material remains in its present form, while the analysis for the Sitewide Close-In-Place Alternative assumes modification of the waste form due to the addition of material such as grout.

- Characterization of engineered barriers and their performance over long periods of time. Engineered barriers considered in the analysis include grout that is intended to reduce the mobility of hazardous constituents, hydraulic barriers intended to reduce the flow of water to and from areas containing hazardous constituents, absorptive barriers (possibly part of hydraulic barriers) intended to reduce the hydrologic transport of hazardous constituents, and intrusion barriers intended to limit human intrusion into specific areas such as those containing high concentrations of hazardous materials.

- Knowledge of present site hydrology and how this could be modified by the engineering that would be conducted for each alternative.

- Knowledge of changes in climate, whether natural or human induced.

- Knowledge of present and long-term groundwater chemistry.

- Knowledge of the hydrologic release rates of hazardous materials from the various locations (release rates that could be influenced by water chemistry changes that could occur over time and by engineered barriers).

- Knowledge of erosion mechanisms and rates across various portions of the site, both of which can change with time and be influenced by human actions.

- Knowledge of the long-term erosion-driven release rates of hazardous materials that are a function of waste properties, waste-covering soil and rock properties, and climate.

- Knowledge of the form of hazardous constituents that are released to surface streams and how these constituents would interact with the surface water environment through processes such as adsorption or deposition.

- Knowledge of how plants and animals would come in contact with contaminated environmental media and would bioconcentrate hazardous constituents.

- Knowledge of timing and location of future human activities, including construction of wells in contaminated aquifers, the treatment and use of water from such wells, the consumption of foods (plants and animals) that have come in contact with contaminated media, and the construction and use of homes and gardens in contaminated settings.

Even though there is incomplete information, there is a substantial body of knowledge regarding these factors, which provides a basis for developing informative, comparative estimates of long-term consequences. The remainder of this section discusses how this incomplete or unavailable information is accounted for in the analyses.

Long-term dose estimates were developed using integrated site-specific release, transport, and consequence codes that build on:

- Available information on hazardous material inventory and form.
- Available site geologic and hydrologic information that was used to develop a sitewide three-dimensional hydrologic model.
- Available long-term site-specific erosion information that was used to calibrate two state-of-the-art landscape evolution models as a basis for the unmitigated erosion analysis.

The integrated models are considered to be consistent with theoretical approaches commonly accepted by the scientific community involved in environmental impact assessment. The results are presented in Section 4.1.10 with more detailed information presented in Appendix H. Additional details about the hydrologic and erosion modeling that support the long-term performance assessment are presented in Appendices E and F, respectively.

The integrated models are expected to provide conservative predictions for the receptors analyzed for several reasons. The models:

- Assume a moderate degree of degradation of hydraulic barriers (one order of magnitude for clay layers and two orders of magnitude for drainage layers), thereby increasing the rate of waste removal by hydrologic processes
- Assume conservative (low end of the spectrum) partitioning coefficients for materials for which there is no site-specific information, thereby increasing the rate of waste removal by hydrologic processes
- Take no credit for loss of hazardous material by adsorption or deposition processes after it enters surface streams, thereby increasing the concentration of hazardous materials in downstream waters
- Assume high bioaccumulation factors with no uptake rate limits, as well as different fish consumption rates for specific receptor locations, thereby increasing the concentration of hazardous materials in vegetation, animals, and fish
- Assume no water treatment that would reduce the concentration of hazardous material in drinking or irrigation water, thereby increasing the concentration of hazardous materials in water used for drinking or irrigation
- Assume no dilution of Cattaraugus Creek flow from the point of discharge into Lake Erie until it is mixed with the flow in the east channel of the Niagara River, thereby increasing the concentration of hazardous materials in the Niagara River

Appendix H, Section H.2.2.1, includes a more detailed discussion of the basis for considering the long-term dose consequence estimates to be conservative.

The uncertainty about future human actions is accommodated in the analysis by considering two bounding cases: one where institutional controls are assumed to be fully effective in maintaining engineered barriers and limiting access to the site, and one where institutional controls are assumed to be permanently lost and intruders are able to enter the site. For both cases, a range of potential future human receptors are analyzed; all of which are expected to be on the conservative end of the spectrum with respect to location and behavior. Specific details of implementation of the dose calculation that contribute to the conservative dose calculation include:

- Multiple pathways whenever it appears possible (e.g., house construction in contaminated soil, home garden in the contaminated soil, and well in the contaminated aquifer with the untreated water used for drinking and gardening)
- Use of high-end estimates for utilization rates (ingestion rates for drinking water and fish)
- Longer (conservative) exposure times for hunters and hikers

For this EIS, no credit is taken for any actions that could be taken to restore institutional controls, once assumed to be lost,[31] or mitigate the calculated impacts. This assumption is especially significant for exposure scenarios such as the unmitigated erosion scenario where the erosional processes are assumed to continue unchecked for potentially hundreds of years before offsite release of contamination through this scenario. Thereafter, the scenario is assumed to continue until the onsite contamination affected through propagation of the scenario is all released to the environment (another lengthy process). These assumptions are considered unlikely given the expected continuance of regulatory and public health institutions, Federal and state regulations such as those for monitoring public water supplies, and the ability to detect radionuclides in water and other environmental media.

The uncertainty about future climate is accommodated through sensitivity analysis and more conservative erosion predictions. Appendix H, Section H.3.1, of the EIS discusses the sensitivity of groundwater flow to changes in annual precipitation. The revised erosion prediction used in the Final EIS for the unmitigated erosion dose analysis is based on the assumption that storms occur more frequently than is currently estimated. This would include more frequent occurrence of storms like the one that occurred in the region on August 8-10, 2009. The use of this elevated precipitation associated with a higher erosion rate in the human health assessments is discussed in Appendix H, Section H.2.2.1.

4.4 Intentional Destructive Acts

The environmental impacts of intentional destructive acts (IDAs), also known as intentional malevolent acts or terrorist incidents, were analyzed at WNYNSC under each of the alternatives. The vulnerability of the site to IDAs is different under each of the decommissioning alternatives and the No Action Alternative. Two measures of IDA vulnerability are considered in this analysis: maximum potential IDA scenario consequences and overall vulnerability.

The results of the assessment are summarized in **Table 4–58**. The IDA having the maximum potential consequence, the energetic release of contamination from the high-level radioactive waste tanks in WMA 3, is the same for all the alternatives because the tanks exist for some period of time under all the alternatives. The assessment of overall vulnerability of the alternatives to IDAs considers waste handling and movements that are part of the alternative and affect the vulnerability of the material over time. (Overall vulnerability is a qualitative metric for the quantity of radioactive material at risk for a postulated IDA scenario coupled with the relative time period that this material would remain susceptible to an IDA at WNYNSC.) The results of the overall vulnerability assessment on a relative scale are shown in the last row of Table 4–58.

---

[31] *Note that institutional controls are required at all radioactive and nonradioactive disposal facilities licensed or permitted under NRC, DOE, or EPA requirements.*

Table 4–58 Impacts of Intentional Destructive Acts

	Sitewide Removal Alternative	*Sitewide Close-In-Place Alternative*	*Phased Decisionmaking Alternative (Phase 1)* [a]	*No Action Alternative*
Maximum potential consequences on site	Dispersal of high-level radioactive waste tank inventory	Dispersal of high-level radioactive waste tank inventory	Dispersal of high-level radioactive waste tank inventory	Dispersal of high-level radioactive waste tank inventory
Maximum potential consequences during transportation	Dispersal of fuel and hardware drum and Greater-Than-Class C drum inventory	Dispersal of Greater-Than-Class C drum inventory	Dispersal of Greater-Than-Class C drum inventory	Dispersal of Class A box inventory
Overall vulnerability	High	Medium	Medium	Highest

[a] This assessment is based only on the consideration of Phase 1 decommissioning actions. The overall vulnerability could be higher after Phase 2 decommissioning actions are defined.

The potential impacts of IDAs are estimated by identifying and evaluating potential scenarios. The scenarios could involve larger release quantities or greater dispersion than those estimated for accidents in Section 4.1.9. Quantitative analysis of the IDA scenarios is presented in Appendix N of this EIS. Additional information on methodology and discussion of results is also presented in Appendix N.

The likelihood of these events and consequences may be mitigated by measures to: (1) reduce the probability of occurrence; (2) provide timely response to emergency situations; and (3) facilitate long-term recovery through long-term response actions including monitoring, remediation, and support for affected communities and their environment.

4.5 Cumulative Impacts

Council on Environmental Quality regulations define cumulative impacts as effects on the environment that result from implementing the Proposed Action or any of the alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource irrespective of the proponent (EPA 1999a).

Cumulative impacts can result from individually minor but collectively significant actions taken over a period of time. Cumulative impacts can also result from spatial (geographic) and/or temporal (time) crowding of environmental disturbances (i.e., concurrent human activities and the resulting impacts on the environment are additive if there is insufficient time for the environment to recover).

The analysis of cumulative impacts for this EIS has shown that generally most other actions in the region do not add in a cumulative manner to those resulting from the decommissioning actions. The only exceptions are:

- The reasonably foreseeable activities at WNYNSC (shipment of existing waste inventories, removal of unnecessary facilities) will be largely completed before decommissioning starts, but there is the potential for some additional consequences. (See Section 4.5.2.)
- If constructed, the U.S. Route 219 freeway would reduce traffic on local U.S. Route 219 (a positive impact) but would disturb land, would change land use, could negatively impact ecological resources through habitat fragmentation, and would have local impacts on water quality as a result of construction and road surface runoff. The construction of the freeway would result in a noticeable addition to local employment. (See Section 4.5.3.)

- The construction of wind-powered electrical generation towers would disturb land, change land use, impact visual resources, and negatively impact wildlife (birds and bats). The construction and operation of these facilities would result in a noticeable addition to local employment. (See Section 4.5.3.)

The approach used to identify and estimate cumulative impacts for this *Decommissioning and/or Long-Term Stewardship EIS* was to:

- Review literature and contact individuals and organizations to identify recent and reasonably foreseeable actions at WNYNSC and in the region;
- Review available environmental documentation to understand the impacts of the actions identified at WNYNSC and in the region; and
- Describe the cumulative impacts of applicable activities.

Cumulative impacts were assessed by combining the potential effects of EIS alternative activities with the effects of other past, present, and reasonably foreseeable actions in the ROI. Some of these actions would occur at different times and locations, and may not be truly additive (cumulative). For example, the set of actions that impact air quality occur at different times and different locations across the ROI, and, therefore, it is unlikely that the impacts would be completely additive.

4.5.1 Past and Present Actions at the Western New York Nuclear Service Center

The impacts of past actions at WNYNSC have resulted in the affected environment, which is described in Chapter 3 of this EIS. The most important impact of past actions, which include spent reactor fuel storage, spent reactor fuel reprocessing, high-level radioactive waste vitrification, treatment and disposal of waste, and some decontamination and facility removal, is the presence of the facilities and residual contamination that are the scope of this EIS.

4.5.2 Reasonably Foreseeable Actions at the Western New York Nuclear Service Center

Reasonably foreseeable onsite actions at WNYNSC included in the cumulative impact analysis of this EIS are ongoing waste management, decontamination, and facility removal activities.

Waste treatment, storage, and disposal activities were evaluated in the *Final West Valley Demonstration Project Waste Management Environmental Impact Statement (WVDP Waste Management EIS)* (DOE 2003e) and the *West Valley Demonstration Project Waste Management Environmental Impact Statement, Supplement Analysis, Revised Final*, prepared in 2006 (DOE 2006b). The *WVDP Waste Management EIS* was prepared to determine how DOE should disposition the operations and decontamination wastes that are in storage or will be generated over a 10-year period. In the Record of Decision for the *WVDP Waste Management EIS* (70 FR 35073), DOE decided to partially implement Alternative A: offsite shipment of high-level radioactive waste, low-level radioactive waste, mixed low-level radioactive waste, and transuranic waste for disposal. Consistent with the *Waste Management Programmatic EIS High-Level Waste* Record of Decision (64 FR 46661), DOE will safely store canisters of vitrified high-level radioactive waste at WNYNSC until disposition decisions are made and implemented. DOE is deferring a decision on the disposal of WVDP transuranic waste, pending a decision supported by the *GTCC EIS*, currently in preparation, which will address disposal of Greater-Than-Class C and non-defense transuranic waste. DOE will ship low-level radioactive waste and mixed low-level radioactive waste off site for disposal. DOE did not evaluate hazardous and nonhazardous waste management in the *WVDP Waste Management EIS*.

The disposal of 36 surplus facilities no longer needed to support WVDP activities was evaluated in the *Final Environmental Assessment for the Decontamination, Demolition, and Removal of Certain Facilities at the*

West Valley Demonstration Project (DOE 2006c). This environmental assessment examined the environmental impacts of decontaminating, dismantling, removing, and disposing of these facilities.

Most of these actions are expected to be completed prior to the start of decommissioning actions. Only moderately small volumes of waste, some of which is orphan waste, are likely to remain on site. The impacts of managing this waste would add to the impacts of managing decommissioning waste.

The reasonably foreseeable onsite actions at WNYNSC that are included in the cumulative impact analysis of this EIS are summarized in **Table 4–59**. Future actions that are speculative or not well defined were not analyzed, including the future use of WNYNSC.

Table 4–59 Reasonably Foreseeable Onsite Actions at the Western New York Nuclear Service Center

Activity	*Description*
Waste treatment, storage, and disposal	Low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, and high-level radioactive waste currently stored at WNYNSC would be packaged for shipment off site for treatment and disposal (DOE 2003e, 2006b) (70 FR 35073).
Dispose of 36 surplus facilities	Thirty-six facilities that are no longer needed (some lightly contaminated) are being decontaminated, dismantled, removed, and disposed of over a 4-year period (DOE 2006c).
Completion of EIS starting point actions	The major actions that are part of achieving the EIS starting point identified in Chapter 2 are: (1) installation of a geomembrane cover over the NDA, (2) installation of a permeable treatment wall on the leading edge of the North Plateau Groundwater Plume, (3) installation of the Waste Tank Farm tank and vault drying system, and (4) decontamination of the Main Plant Process Building so that it is demolition ready.

NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, WNYNSC = Western New York Nuclear Service Center.

4.5.3 Other Reasonably Foreseeable Actions in the Region

Regional actions that could contribute to cumulative effects could include future state or local development initiatives, new industrial or commercial ventures, new utility or infrastructure construction and operations, new waste treatment and disposal facilities, and new residential development. Data were collected from the Village of Springville and Town of Ellicottville; the counties of Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Livingston, Niagara, and Wyoming in New York; and the counties of McKean, Potter, and Warren in Pennsylvania regarding anticipated future activities that could contribute to cumulative impacts. The Village of Springville (Kaleta 2008); Allegany, Livingston, and Niagara Counties in New York (Ferrero 2008, Fisk 2008, Risky 2008); and McKean, Potter, and Warren Counties in Pennsylvania (Dietrich 2008, Glotz 2008, Lunden 2008) did not identify any major future actions that are expected to contribute to cumulative impacts at WNYNSC. Activities identified in the region surrounding WNYNSC include:

- Continued fast-paced development in the northern and mid-county region of Erie County, New York (Opalka 2008), approximately 28 kilometers (17 miles) north of WNYNSC.
- Redevelopment of Lake Erie waterfront areas in the cities of Buffalo and Lackawanna, New York (Opalka 2008), approximately 38 kilometers (24 miles) north of WNYNSC.
- Erie County Water Authority service extensions in southern Erie County (Opalka 2008).
- Residential development around the two ski resorts in the towns of Ellicottville and Mansfield, Cattaraugus County, New York (Isaacson 2008, Horowitz 2008), approximately 17 kilometers (11 miles) south of WNYNSC.

- Conversion of the Laidlaw Power Plant in Ellicottville, Cattaraugus County, New York, from natural gas to clean wood chips. The facility would process approximately 63,503 metric tons (70,000 tons) of clean wood waste per year and annually generate 50 million kilowatt-hours of electricity (Isaacson 2008), approximately 16 kilometers (10 miles) south of WNYNSC.

- Electrical generation project at the Chautauqua County Landfill (Moore 2008), approximately 58 kilometers (36 miles) southwest of WNYNSC.

- Proposed wind farm developments in Allegany, Chautauqua, Erie, Genesee, and Wyoming Counties (E&E 2006; Noble Allegany Windpark, LLC 2008; Noble Wethersfield Windpark, LLC 2007; Opalka 2008; Town of Alabama 2008; Town of Arkwright 2009; Town of Perry 2009), between 26 kilometers (16 miles) and 72 kilometers (45 miles) from WNYNSC.

Because of the distance from WNYNSC and the localized environmental effects of these actions, they are not expected to interact with WNYNSC activities to produce cumulative impacts.

Additional information about future activities that could contribute to cumulative impacts was collected from the U.S. Forest Service, U.S. Department of Defense, EPA, U.S. Army Corps of Engineers, NYSDEC, and New York State Department of Transportation. Portions of the Allegheny National Forest in McKean and Warren Counties, Pennsylvania, are within 80 kilometers (50 miles) of WNYNSC. A number of activities were identified that are expected to occur within the Allegheny National Forest during the period of analysis for this EIS. These include land management; vegetation management (including fuels management and overstory removal); watershed management (including management of wildlife, fish, and rare plants); road, recreation, heritage, and scenery management; minerals management (including construction and operation of oil and gas wells and pipelines); and forest products management (USFS 2008). Because these activities are farther than 48 kilometers (30 miles) from WNYNSC, are largely the continuation of ongoing activities in the Allegheny National Forest, and produce only localized environmental effects, they are not expected to interact with WNYNSC activities to produce cumulative impacts.

In May 2005, the U.S. Department of Defense announced its latest round of base realignment and closures (AFIS 2005, DoD 2005). Base realignment and closure can impact areas around military facilities by changing direct and indirect employment and through other activities that produce environmental impacts. The Navy Recruiting District Headquarters in Buffalo, New York, is the only military facility in the WNYNSC ROI that would be affected. Closure of this facility is expected to result in the loss of 53 jobs (37 direct and 16 indirect) in the region (DoD 2005). Because this facility is over 48 kilometers (30 miles) from the WNYNSC boundary, no cumulative impacts are expected.

The EPA National Priorities List (also known as Superfund sites) was reviewed to determine whether these sites could contribute to cumulative impacts at WNYNSC (EPA 2007a, 2007b). Nine active National Priorities List sites are located within 80 kilometers (50 miles) of WNYNSC. The closest National Priorities List site is the Peter Cooper site near Gowanda, New York, approximately 19 kilometers (12 miles) west of WNYNSC. The State of New York also actively pursues cleanup of contaminated sites through the State Superfund, Environmental Restoration, Brownfield Cleanup, and Voluntary Cleanup Programs (NYSDEC 2006c, 2008d). There are over 300 State of New York sites in counties within 80 kilometers (50 miles) of WNYNSC. Of these, 24 sites are located in Cattaraugus County, and 143 sites in Erie County. Most of the sites in Erie County are located in the Buffalo metropolitan area. The three State of New York sites closest to WNYNSC are:

- Machias Gravel Pit site near Machias, New York, in Cattaraugus County, approximately 10 kilometers (6 miles) southeast of WNYNSC;

- CID Landfill, Inc., site near Sardinia, New York, in Cattaraugus County, approximately 14 kilometers (8.7 miles) northeast of WNYNSC; and
- Signore, Inc. site in Ellicottville, New York, in Cattaraugus County, approximately 16 kilometers (9.9 miles) south of WNYNSC.

In addition to being at some distance from WNYNSC, most of these EPA Superfund and State of New York sites are well into the control and cleanup process, and, therefore, are not expected to contribute to cumulative impacts.

Seven sites in the ROI have been, or are being, remediated under the Formerly Utilized Sites Remedial Action Program (USACE 2008a, 2008b). This program was initiated in 1974 to identify, investigate, and clean up or control sites that were part of the nation's early atomic energy and weapons programs. Because these seven sites are not an imminent hazard to persons living near them, are located between 56 and 80 kilometers (35 and 50 miles) north-northwest of WNYNSC, and most are well into the control and cleanup process, they are not expected to contribute to cumulative impacts at WNYNSC.

NYSDEC leases oil and gas development rights on state lands. All parcels offered for lease in 2006 are outside the 80-kilometer (50-mile) radius of WNYNSC (NYSDEC 2006b), and, therefore, are not expected to add to cumulative impacts.

There are plans for six wind projects that could be constructed in the next few years within 80 kilometers (50 miles) of WNYNSC (AWEA 2007, Horizon 2008, Noble 2008). These projects are:

- Dairy Hills Wind Farm in Wyoming County (Town of Perry 2009), approximately 63 kilometers (40 miles) northeast of WNYNSC;
- Arkwright Wind Farm in Chautauqua County (Town of Arkwright 2009), approximately 46 kilometers (29 miles) west of WNYNSC;
- Alabama Ledge Wind Farm in Genesee County (Town of Alabama 2008), approximately 75 kilometers (45 miles) north of WNYNSC;
- Allegany Wind Park in Allegany County (Noble Allegany Windpark, LLC, 2008), approximately 26 kilometers (16 miles) east of WNYNSC;
- Bliss Wind Park in Wyoming County (E&E 2006), approximately 27 kilometers (17 miles) northeast of WNYNSC; and
- Wethersfield Wind Park in Wyoming County (Noble Wethersfield Windpark, LLC, 2007), approximately 54 kilometers (34 miles) northeast of WNYNSC.

These projects would involve the construction of 375 wind turbines generating a total of 634 megawatts of electricity. The projects would disturb land (708 hectares [1,749 acres] for all the projects) and result in visual impacts (375 turbines, each approximately 120 meters [400 feet] tall, and each with three 90-meter [290-foot] rotating blades). In addition, there are a number of cell phone towers in proximity to WNYNSC, most along the U.S. Route 219 corridor (MOBILEDIA 2007). Cellular phone towers are generally 15 to 61 meters (50 to 200 feet) high (FCC 2006) and are often visible from some distance. Wind turbines and cell phone towers are considered in the cumulative impact analysis.

Information on transportation projects was collected to determine if major projects could impact the region around WNYNSC. A number of transportation projects are ongoing or planned (EFLHD 2008; NYSDOT 2008a). Most of these are relatively minor maintenance, upgrade, and resurfacing projects; and some are more substantial improvement, reconstruction, and rehabilitation projects. Only the proposed U.S. Route 219 Springville to Salamanca freeway (USDOT and NYSDOT 2003b) would involve the disturbance of substantial areas of land near WNYNSC. The nearest portion of the proposed new U.S. Route 219 freeway lies approximately 1.5 kilometers (0.93 miles) from the western boundary of WNYNSC. This project is considered in the cumulative impact analysis.

On August 18, 2009, the Federal Highway Administration (FHWA) issued a notice to advise the public that a Supplemental Environmental Impact Statement (SEIS) will be prepared for the U.S. Route 219 Springville to Salamanca freeway project (74 FR 41781). The SEIS will address the segment of U.S. Route 219 between the Town of Ashford and Interstate 86 near the City of Salamanca, in Cattaraugus County, New York. The New York State Department of Transportation and FHWA concluded that an SEIS for this portion of the project was required due to a significant increase in the area of identified wetlands in the project corridor, and observed changes in traffic growth rates for some segments of existing U.S. Route 219 that may influence the safety and operational characteristics of the alternatives previously identified in the freeway project EIS (USDOT and NYSDOT 2003b). These issues will be evaluated through the development of an SEIS.

4.5.4 Results of the Cumulative Impact Analysis

The following resource areas have the potential for cumulative impacts: land use and visual resources, site infrastructure (i.e., electricity, natural gas, and water use), geology and soils, water resources, air quality and noise, ecological resources, cultural resources, socioeconomics, public health and safety, occupational health and safety, waste management, transportation, and environmental justice. The level of detail provided for each resource area is dependent on the extent of the potential cumulative impact. Many resource areas did not require a detailed analysis because of minimal or localized impacts from WNYNSC operations and an assessment that, cumulatively, there would be no appreciable impacts to these resource areas.

4.5.5 Land Use and Visual Resources

Land Use – The reasonably foreseeable actions and the decommissioning alternatives at WNYNSC would largely occur within the disturbed portion of the site. Only remediation of the Cesium Prong and implementation of erosion control measures would occur outside the disturbed area.

If constructed, the new U.S. Route 219 freeway would not disturb land on WNYNSC, but would disturb 98.2 hectares (243 acres) of agricultural land, 46.5 hectares (115 acres) of urban land, 16.4 hectares (40.5 acres) of water and wetlands, 306 hectares (755 acres) of forest, and 74.5 hectares (184 acres) of old fields, for a total of 541 hectares (1,337 acres). The freeway would also require the relocation of 63 residences (35 houses and 28 mobile homes) and 1 business, and would affect 19 major farm operations. In addition, it was estimated that future development of land around the freeway interchanges could consume another 191.8 hectares (474 acres) (USDOT and NYSDOT 2003b). As described in Section 4.5.3, the 6 wind farms could disturb 714 hectares (1,765 acres) of land in the ROI.

Continued development in the ROI is likely to convert additional forested and agricultural land to residential, commercial, industrial, and infrastructure uses. As described in county planning documents, development would be centered on the towns and cities in the ROI, particularly the Buffalo Metropolitan Area (Cattaraugus 2001, 2006e; Erie-Niagara 2006).

Therefore, the potential changes to land use under WNYNSC decommissioning alternatives would be a very small portion of the potential changes expected in the region and would not be expected to exacerbate cumulative impacts to land use.

Visual Resources – Implementation of WNYNSC decommissioning alternatives could result in an increase in construction and demolition activities as new buildings are built and old buildings demolished. This new construction would not change the current VRM Class IV rating of the disturbed portion of the site. Under some alternatives, contaminated facilities, soil, and groundwater would be removed. Most of these activities would take place within the disturbed portion of WNYNSC and would have minimal further negative visual impact. However, remediation of areas of the Cesium Prong and implementation of erosion control measures located outside the disturbed area, while temporary, would be visible from nearby public vantage points, NY Route 240, or higher elevations. Upon completion of restoration activities, these areas would be graded and reseeded to stabilize exposed soils. At this stage, these areas would no longer appear industrial and would become more consistent with a higher VRM rating (VRM Class II or III), where the natural landscape would play a more prominent role.

Cumulative visual impacts such as diminished viewsheds and increases in artificial light from residential, industrial, and commercial development on previously undeveloped land could occur. A total of 44 sensitive viewpoints for the proposed new U.S. Route 219 freeway were identified based on the potential for visual impact. Visual ratings for the proposed new freeway range between negligible and severe. Many of the sensitive viewpoints rated as strong are grouped near settlements where freeway improvements may include structures, interchanges, or major cut/fill slopes, and where high landscape quality now exists. The proposed new freeway would be visible only from a small northern portion of WNYNSC along Buttermilk Creek and therefore should not substantially contribute to cumulative impacts to visual resources at WNYNSC (USDOT and NYSDOT 2003b).

The construction of the 6 wind energy projects in the ROI could result in the operation of 375 wind turbines. These 120-meter (400-foot) tall structures with 90-meter (290-foot) rotating blades would be visible from some distance. Studies performed to assess the environmental impacts of operation of the wind farms typically analyze visual resource impacts within an 8-kilometer (5-mile) radius of the wind turbines. Beyond this distance, these studies assume that natural conditions of atmospheric and linear perspective significantly mitigate most visual impacts (Town of Arkwright 2009). None of the proposed wind farms is within 8 kilometers (5 miles) of the WNYNSC boundary.

There are a number of cellular phone towers in proximity to WNYNSC, most along the U.S. Route 219 corridor (MOBILEDIA 2007). Cellular phone tower construction is likely to continue in the ROI as cellular phone providers upgrade and fill in gaps in their service areas. Cellular phone towers are generally 15 to 61 meters (50 to 200 feet) high (FCC 2006) and are often visible from some distance. New towers could contribute to cumulative visual impacts in the region near WNYNSC.

Although the decommissioning activities evaluated in this EIS could produce short-term adverse impacts on the visual environment that could add to cumulative impacts, over the long-term, decommissioning would have beneficial effects by reducing the presence of visually intrusive manmade structures at WNYNSC. The visual impact changes associated with WNYNSC decommissioning alternatives would be a very small portion of the potential changes expected in the region from other projects.

4.5.6 Site Infrastructure

For any of the alternatives, the demand for site utilities (e.g., electricity, fuel, and water) during decommissioning would not be additive to the reasonably foreseeable actions at WNYNSC because most of the reasonably foreseeable actions would occur prior to decommissioning. Therefore, there would be no cumulative impacts on the site utility infrastructure.

The projected traffic on the main roads around WNYNSC (NY Route 240 and U.S. Route 219) would be within the capacity of these roads, even for Sitewide Close-In-Place Alternative activities, which would produce the greatest traffic increases. Most of the reasonably foreseeable actions at WNYNSC would occur prior to the decommissioning actions, and therefore would not add to the local traffic impacts.

If constructed, the U.S. Route 219 freeway project will link the existing U.S. Route 219 expressway near Springville to the Southern Tier Expressway, and will provide continuous freeway access with reduced travel time and increased safety from the Buffalo Metropolitan Area to many of the communities on the Southern Tier. The new road will divert most of the truck traffic and long-distance vehicle trips that currently use U.S. Route 219 and is estimated to reduce traffic on the existing road by 2,770 vehicle trips per day near Ashford. As part of proposed construction of the U.S. Route 219 freeway, three minor roads near Ashford will be dead-ended: Neff Road, Rock Springs Road, and Scoby Hill Road. Traffic on the proposed new freeway is estimated at 18,090 vehicle trips per day near Ashford (USDOT and NYSDOT 2003b, WIVB 2008). Therefore, traffic impacts of decommissioning activities at WNYNSC would be overshadowed by the impacts of construction and operation of the proposed new freeway, and would not contribute substantially to cumulative impacts in the region.

4.5.7 Geology and Soils

Construction of new facilities and engineered barriers for WNYNSC decommissioning would require use of geologic materials such as gravel, sand, clay, and soil. The geologic materials required for the reasonably foreseeable actions at WNYNSC (approximately 425 cubic meters [556 cubic yards]) are essentially negligible compared to the materials required for reasonably foreseeable decommissioning actions (up to 2,200,000 cubic meters [2,900,000 cubic yards] for the Sitewide Close-In-Place Alternative). Therefore, there would be no cumulative impacts from the use of geologic materials at WNYNSC.

4.5.8 Water Resources

Surface Water – Implementation of decommissioning activities would result in minor short-term impacts on water quality from permitted discharge of treated water. Most treated water discharge from reasonably foreseeable actions at WNYNSC would occur prior to decommissioning activities. Decommissioning activities at WNYNSC would not substantially contribute to adverse cumulative impacts to surface water resources, and would generally produce long-term beneficial results after decommissioning.

The Peter Cooper National Priorities List site is approximately 19 kilometers (12 miles) west of WNYNSC on Cattaraugus Creek. Landfill wastes from this former glue and industrial adhesives manufacturing facility contain elevated levels of chromium, arsenic, zinc, and some organic compounds. In some areas, contaminated leachate is seeping into Cattaraugus Creek (EPA 2006b). Current surface water discharges from WNYNSC to Cattaraugus Creek are very small, and future releases under the decommissioning alternatives are also expected to be very small. These releases would not be expected to have cumulative impacts with the Peter Cooper site. Although releases under the unmitigated erosion scenario are larger, the maximum impacts from the unmitigated erosion scenario would occur in the future after remediation at the Peter Cooper site is scheduled to be completed.

If constructed, the new U.S. Route 219 freeway will traverse 45 perennial and 83 intermittent streams. The proposed new freeway will bridge all of the major creeks, and will result in minimal disturbance to the creek bottoms. All the smaller tributaries will be culverted, which will lead to considerable disturbance to the tributary bottoms. Temporary sedimentation impacts will occur as a result of the construction of culverts, resulting in increased downstream turbidity and increased instream siltation. Erosion control structures (i.e., silt fencing and hay bales) will be used during construction to minimize instream sedimentation. Additionally, adjacent banks will be revegetated or lined with rip-rap to minimize additional sedimentation during operation of the freeway. These actions will result in temporary impacts on water resources that will subside once construction activities are complete. All bridges and culverts for the proposed new U.S. Route 219 freeway will be designed to minimize impacts on floodplains (USDOT and NYSDOT 2003b).

Pollutants from highway use and maintenance, as well as air pollutants from other sources, will accumulate on highway surfaces. These pollutants are carried from the highway surface to adjacent waters by runoff from rainfall and melting snow and ice. Based on current deicing procedures, some localized impacts on surface waters adjacent to the proposed new freeway are likely to occur due to increased chloride concentrations in runoff. The projected lead and zinc concentrations for these drainage basins are projected to be below EPA's acute criteria for the protection of aquatic life.

Stormwater management facilities will be incorporated in the design of the proposed new U.S. Route 219 freeway to mitigate impacts on surface waters resulting from peak flow, first flush, and pollutant loading. Potential impacts on surface water quality due to the introduction of pollutants such as chloride and copper will be mitigated by controlling the runoff from the highway surface and directing the flow to water bodies less susceptible to degradation. For example, redirecting the runoff into streams having higher rates of flow will result in the contaminants being more diluted and less likely to impact the overall water quality of the stream. In addition, grass-covered swales and drainage ways incorporated into the final design of the highway will be used to reduce total suspended solids. If constructed, the freeway will increase the amount of impervious surface area in the drainage basins crossed by only 0.08 percent (USDOT and NYSDOT 2003b).

Overall, surface water impacts of decommissioning activities at WNYNSC would be localized to WNYNSC and would not contribute substantially to cumulative impacts in the region.

Groundwater – The decommissioning actions would generally improve groundwater quality for the most accessible groundwater source in the disturbed area, the North Plateau Groundwater Plume. The other reasonably foreseeable actions at WNYNSC would not impact groundwater quality.

The U.S. Route 219 freeway project potentially could impact both the quantity and quality of the groundwater near the proposed new freeway. Groundwater quantity impacts evaluated include changes in discharges to wetlands and the water table due to cut-and-fill operations and the addition of impervious road surfaces. Quantity impacts are expected to have a minimal regional effect on the supply of groundwater within the project area, and therefore, are not likely to add to the cumulative effects of decommissioning activities at WNYNSC (USDOT and NYSDOT 2003b).

Groundwater quality impacts evaluated for the proposed new U.S. Route 219 freeway include those due to deicing salt, increased vehicular pollutants, and construction activities. The primary concerns for impacts on groundwater quality arise from the use of road deicing salts and vehicular pollutants such as copper, lead, and zinc. Impacts on groundwater quality, though small, may be long term. Estimates show that even with the chloride added to the environment by maintenance of the proposed new freeway, groundwater concentrations would not exceed 250 milligrams per liter, the maximum allowable chloride concentration in drinking water set by NYSDEC. Calculations also indicate that no adverse impacts on groundwater from vehicular pollutants, including copper, lead, and zinc, are expected (USDOT and NYSDOT 2003b). Therefore, cumulative groundwater impacts with decommissioning activities at WNYNSC are unlikely.

Overall, groundwater impacts from decommissioning activities at WNYNSC would be localized to WNYNSC and would not contribute substantially to cumulative impacts in the region.

4.5.9 Air Quality and Noise

Air Quality – Decommissioning actions would result in temporary, small, and localized impacts on air quality. Air quality standards for carbon monoxide, nitrogen oxides, and sulfur oxides would not be exceeded at the WNYNSC boundary or along public roadways. Emission of fugitive dust could result in exceedance of particulate matter standards. The impacts on air quality from reasonably foreseeable activities at WNYNSC would be less than those from decommissioning actions and would occur earlier in time; hence, they would not be additive.

Annual emissions of greenhouse gases in the form of carbon dioxide were estimated for each alternative and compared to the total U.S. emissions of carbon dioxide in 2005 (EPA 2007d). These emissions ranged from 73 metric tons (80 tons) per year under the No Action Alternative to 5,700 metric tons (6,300 tons) per year under the Sitewide Removal Alternative, representing from 0.000001 percent under the No Action Alternative to 0.00009 percent under the Sitewide Removal Alternative, of U.S. emissions in 2005. These emissions would make a small incremental contribution to cumulative impacts on global climate change.

The proposed new U.S. Route 219 freeway is included in the Transportation Improvement Program, which was found to conform to the State Implementation Plan. Therefore, the project will not interfere with the area's progress toward achieving the air quality goals of the State Implementation Plan (USDOT and NYSDOT 2003b).

As described in Section 4.5.3, the EPA National Priorities List sites (EPA 2007a, 2007b) and the State of New York cleanup sites (NYSDEC 2006c, 2008d) are distant to WNYNSC, and most of these sites are well into the control and cleanup process. Therefore, toxic pollutant emissions from these sites are not expected to substantially contribute to cumulative toxic air pollutant concentrations near WNYNSC. Cumulative impacts of radiological air pollutants are discussed in Section 4.5.13.

Overall, air quality impacts of decommissioning activities at WNYNSC would be small, and would not contribute substantially to cumulative impacts in the region, except possibly for particulate matter.

Noise – Decommissioning activities for the three decommissioning alternatives would result in some increase in noise levels from construction and demolition equipment. If multiple pieces of equipment were operating at the same time, the noise levels at the nearest residences are expected to be audible above background sound levels in the area. Truck or rail traffic traveling to and from the area as part of decommissioning activities would also contribute to noise impacts.

Noise from these and other activities near the WNYNSC boundary would occur during daytime hours and could be a source of annoyance to nearby residents. During many of the closure activities, there would be no change in day/night average sound levels and noise impacts on the public outside of WNYNSC, except for noise attributable to construction employee vehicles and trucks hauling materials and waste.

Most reasonably foreseeable activities at WNYNSC would occur before decommissioning, would have lower noise levels (DOE 2006c), and would not contribute to cumulative noise impacts.

Short-term noise increases are expected due to construction of the proposed new U.S. Route 219 freeway. However, with construction activities likely taking place only during the day, the increased noise will likely not be perceived as severe. Mitigation measures such as source control, site control, time and activity constraints, and community awareness can be incorporated to reduce construction noise impacts (USDOT and NYSDOT 2003b).

Compared to existing conditions, noise levels due to traffic on the proposed new U.S. Route 219 freeway are expected to be greater in areas adjacent to the proposed new freeway. It is estimated that 573 properties would be impacted by noise from the proposed new freeway. A reduction in noise levels is expected adjacent to the existing U.S. Route 219 due to the expected diversion of traffic to the proposed new freeway (USDOT and NYSDOT 2003b).

Overall, noise impacts from decommissioning activities at WNYNSC would be localized to WNYNSC and would not contribute substantially to cumulative impacts in the region.

4.5.10 Ecological Resources

Construction, operations, and demolition actions that are part of the decommissioning alternatives would occur primarily in previously disturbed areas and would result in localized short-term disruptions. Impacts of decommissioning actions would be minimized by controlling the timing of the actions as well as the extent of the area disturbed at any one time.

Reasonably foreseeable actions at WNYNSC would occur primarily within the disturbed area. Because these actions would be conducted in the disturbed area, they would have minimal impact on ecological resources.

If constructed, the new U.S. Route 219 freeway would contribute to habitat fragmentation, a process whereby a large continuous area of habitat is both reduced in area and divided into two or more fragments. Even though roads can occupy only a small fraction of the land area, they contribute to fragmentation by dividing previously larger habitats into two or more smaller ones. The influence of habitat fragmentation can extend far beyond the immediate road boundaries. When completed, the proposed new freeway will have disturbed 541 hectares (1,337 acres) of land along its 45-kilometer (28-mile) length. Based on the desire to avoid urban centers and significant agricultural parcels, approximately 306 hectares (756 acres) of forest communities will be disturbed by the proposed new freeway. Although some relatively mature forest stands will be impacted by the project, for the most part, the forest stands to be traversed are already disturbed and fragmented.

If the U.S. Route 219 freeway is constructed, the creation of the freeway corridor through existing ecological communities will result in increased road kill. A number of options to minimize the frequency of road kill to various wildlife species will be considered during the final design phase of the project in consultation with wildlife resource agencies. A variety of wildlife crossings, including enlarged culverts, additional culverted crossings, modified span-type bridges, and enlarged medians, will be considered to maximize opportunities for safe wildlife crossings, to allow for greater connectivity of habitat, and to potentially reduce the risks of collisions with wildlife attempting to cross roadways (USDOT and NYSDOT 2003b). Projections of changes in animal mortality from vehicle collisions were not provided in the final EIS for the proposed U.S. Route 219 freeway.

Completion of the six wind energy projects planned for the ROI would result in the loss of birds and bats from the rotating blades of the turbine. Studies have indicated an average mortality rate for the United States of 2.3 birds and 3.4 bats per turbine per year (NWCC 2004). Projection of these rates to the 375 turbines planned for the ROI would result in the loss of approximately 860 birds and 1,300 bats each year. Studies conducted at wind farms in the eastern United States have indicated that bird and bat mortality may be locally higher. Bird mortality may be 2 to 4 times higher locally, and bat mortality up to 10 times higher (Arnette et al. 2006, Fielder et al. 2007, Jain et al. 2007).

Decommissioning activities at WNYNSC would directly impact a maximum of 2.8 hectares (7.0 acres) of wetlands under the Sitewide Removal Alternative (see Section 4.1.6). Indirect impacts on other wetlands could occur due to sedimentation resulting from erosion of disturbed soils upslope from wetlands. Prior to the disturbance of any jurisdictional wetland, a Section 404 permit would be acquired from the U.S. Army Corps of Engineers. In the case of disturbance to a New York State Freshwater Wetland, a permit would be acquired from NYSDEC. Additionally, a mitigation plan would be developed with mitigation options ranging from the re-establishment of those areas impacted to the creation of new wetlands, either on or off site. Best management practices, including erosion and sediment controls, would be implemented during all remediation work to prevent indirect impacts.

If the U.S. Route 219 freeway is constructed, a total of 13.0 hectares (32.1 acres) of jurisdictional wetlands (the majority of which are small, isolated, low-quality emergent wetlands) will be lost. Twenty-eight wetlands totaling 4.4 hectares (10.8 acres) will be impacted within the Cattaraugus Creek drainage basin. Additional wetlands will be created at a 2 to 1 ratio to mitigate these impacts (USDOT and NYSDOT 2003b).

Measurable impacts on plant and animal populations on or off site are not expected as a result of the incremental increase in exposure to radionuclides or chemicals that would result from the decommissioning alternatives analyzed in this EIS. Additional deposition resulting from the alternatives analyzed in this EIS would not lead to levels of contaminants that would exceed the range of concentrations historically reported in the annual site environmental surveillance reports.

Overall, ecological impacts from decommissioning activities at WNYNSC would be localized to WNYNSC and would not contribute substantially to cumulative impacts in the region. The other activities in the region, particularly the proposed construction of the U.S. Route 219 freeway and the construction of wind turbines, would have much greater impact on the ecosystem as a result of habitat fragmentation, road kill, and bird/bat fatalities from turbine blades.

4.5.11 Cultural Resources

The majority of decommissioning activities on WNYNSC would occur within previously disturbed areas contained within or adjacent to developed areas. The likelihood that these areas contain cultural materials intact or in their original context is small. Standard measures to avoid or minimize the impacts on cultural materials discovered during site development are in place. Further, cultural resource surveys would be performed prior to construction or surface disturbance in previously undisturbed areas, and appropriate standard measures, such as avoidance or scientific documentation and Tribal consultation, would be implemented if resources are found.

If constructed, the U.S. Route 219 freeway will adversely affect a total of 12 properties eligible for listing on the National Register of Historic Places (USDOT and NYSDOT 2003b). Activities at WNYNSC are at some distance from these 12 properties and would not contribute to cumulative impacts.

Overall, cultural resources impacts from decommissioning activities at WNYNSC would be very small and localized to WNYNSC and would not contribute substantially to cumulative impacts in the region.

4.5.12 Socioeconomics

Employment – Direct employment at WNYNSC in support of decommissioning actions could reach 350 persons in the peak year of activities. Current employment would be reduced as ongoing waste management and decontamination, demolition, and removal activities are completed. Therefore, employment for existing site activities is not likely to be additive to the activities evaluated under the decommissioning alternatives for this EIS. Future employment for decommissioning activities could act to temporarily reduce the adverse effects of a reduction in baseline employment.

If constructed, the U.S. Route 219 freeway is estimated to result in 4,700 onsite temporary jobs; 11,800 indirect temporary jobs; and 8,700 induced temporary jobs in the ROI (USDOT and NYSDOT 2003b).

This would overshadow the 300 to 350 direct jobs estimated for peak years for the decommissioning alternatives considered in this EIS.

Overall, regional socioeconomic impacts from decommissioning activities at WNYNSC would be very small, of less significance than construction of the proposed U.S. Route 219 freeway, and would not contribute substantially to cumulative impacts.

4.5.13 Public Health and Safety

The peak annual dose to individual members of the public and to the general population from decommissioning actions would be relatively small, as discussed in Section 4.1.9. The activities, and therefore, the doses and health effects from reasonably foreseeable activities at WNYNSC, including waste storage and disposal (DOE 2003e, 2006b) and decontamination, demolition, and removal of lightly contaminated buildings (DOE 2006c), would be essentially complete before decommissioning activities would be initiated. Therefore, annual doses and health effects for existing site activities; waste storage and disposal; and decontamination, demolition, and removal of lightly contaminated buildings are not additive to the annual dose and health effects for the decommissioning alternatives evaluated in this EIS.

Public exposure to hazardous chemicals is not projected for any of the decommissioning alternatives or for reasonably foreseeable activities at WNYNSC.

None of the other activities identified as occurring in the ROI is likely to add to the radiological exposure or be a source of chemical exposure for individuals and populations surrounding WNYNSC. Therefore, cumulative impacts are not expected.

4.5.14 Occupational Health and Safety

As discussed in Section 4.1.9, the annual average dose to the decommissioning worker would be less than 100 millirem per year, regardless of the EIS alternative selected. Reasonably foreseeable activities at WNYNSC, including waste storage and disposal (DOE 2006b) and decontamination, demolition, and removal of lightly contaminated buildings (DOE 2006c), would have been essentially completed before decommissioning is initiated. Therefore, the annual occupational exposures from these activities are not additive to the annual occupational exposure from the decommissioning alternatives. The ongoing storage of existing orphan waste would result in an estimated 0.15 person-rem per year, which would be a small addition to the annual occupational exposure for the decommissioning actions.

None of the other activities identified as occurring in the ROI would add to the occupational exposure for WNYNSC workers. Therefore, cumulative impacts are not expected.

4.5.15 Waste Management

Waste management requirements, including waste handling, transportation, and disposal, could increase substantially for WNYNSC decommissioning. Waste management volumes would range up to a maximum of about 1.6 million cubic meters (56 million cubic feet) for the Sitewide Removal Alternative.

The disposition of waste generated by reasonably foreseeable activities at WNYNSC would be largely complete prior to the start of decommissioning activities. As noted in Chapter 3, Table 3–20, this waste is projected to include about 26,000 cubic meters (920,000 cubic feet) of nonhazardous construction/demolition debris; 2,000 cubic meters (71,000 cubic feet) of hazardous waste; 25,000 cubic meters (880,000 cubic feet) of low-level radioactive waste; 750 cubic meters (26,000 cubic feet) of mixed low-level radioactive waste; and 275 high-level radioactive waste canisters. In addition, 960 cubic meters (34,000 cubic feet) of contact-handled transuranic waste and 1,200 cubic meters (41,000 cubic feet) of remote-handled transuranic waste are projected through the end of fiscal year 2011, totaling about 2,100 cubic meters (76,000 cubic feet) of waste. This estimate is updated over the transuranic waste estimates listed in Table 3–20.

The estimated 2,100 cubic meters (75,000 cubic feet) of transuranic waste currently does not have a disposal path and is expected to be stored on site at the start of decommissioning. An insignificant quantity of additional transuranic waste would be generated if the Sitewide Close-In-Place Alternative is selected, but up to 1,000 cubic meters (35,000 cubic feet) could be generated if the Sitewide Removal Alternative or the Phased Decisionmaking Alternative is selected. The 275 high-level radioactive waste canisters currently do not have a disposition path and would have to be stored on site. Implementing the Sitewide Removal Alternative would generate 4,200 cubic meters (150,000 cubic feet) of Greater-Than-Class C waste that also does not have a current disposal path. Management of this orphan waste would produce 3.2 cubic meters (113 cubic feet) per year of additional waste (Chamberlain 2008). [32]

Other activities in the region will not add to impacts on the WNYNSC waste management infrastructure.

4.5.16 Transportation

The collective dose, cumulative health effects, and traffic fatalities from approximately 130 years of radioactive material and waste transport across the United States are estimated in **Table 4–60**. The period of time from the start of DOE nuclear materials operations in the 1940s to the end of the period of analysis for the Sitewide Removal Alternative in 2070 is approximately 130 years. The total collective worker dose from all types of shipments (general transportation, historical DOE shipments, reasonably foreseeable actions, and EIS alternatives) was estimated to be up to 380,530 person-rem, which would result in 228 LCFs among the affected transportation workers. The total collective dose to the general public was estimated to be up to 249,600 person-rem, which would result in 210 excess LCFs among the affected general population. The total estimated traffic fatalities associated with accidents involving radioactive material and waste transports would be 122 to 138. The majority of the collective doses for workers and the general population are associated with the general transportation of radioactive material. These activities include shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The majority of the traffic fatalities are due to the general transportation of radioactive materials (28 fatalities) and reasonably foreseeable actions (94 fatalities).

Table 4–60 shows that the impacts of alternatives evaluated in this EIS are small compared with the overall transportation impacts associated with radioactive materials and waste shipments across the United States. The alternatives addressed in this EIS would result in the potential for 1 worker cancer death (LCF), no public cancer deaths (LCFs), and 16 traffic fatalities, and therefore would not contribute substantially to cumulative impacts. For perspective, it may be noted that several million traffic fatalities from all causes are expected nationwide during the period from 1943 to 2047 (DOE 2004b).

Freeway facilities with controlled access have much lower accident rates than either two-lane or four-lane highways with free access. Traffic safety will be improved both for users of the new U.S. Route 219 freeway, if constructed, and for local traffic on existing U.S. Route 219, where traffic volumes will be lower. Overall public safety will be improved by providing facilities best suited for all traffic types, local roads for local

---

[32] If the waste incidental to reprocessing process is not applied to the high-level radioactive waste tanks and waste residuals in the tanks, for the Sitewide Removal Alternative approximately 500 cubic meters (18,000 cubic feet) would be added to the inventory of high-level radioactive waste already stored on site, and the amount of low-level radioactive waste and transuranic waste would be reduced by about 210 cubic meters (7,500 cubic feet) and 280 cubic meters (10,000 cubic feet), respectively. For Phase 1 of the Phased Decisionmaking Alternative, approximately 51 cubic meters (1,800 cubic feet) would be added to the inventory of high-level radioactive wastes, and the amount of low-level radioactive waste and transuranic waste would be reduced by about 21 cubic meters (1,100 cubic feet) and 19 cubic meters (670 cubic feet), respectively.

traffic, and high-speed freeways for heavy trucks and long-distance travelers, avoiding the natural conflicts when these traffic types mix (USDOT and NYSDOT 2003b). Therefore, adverse cumulative traffic fatalities with WNYNSC decommissioning activities are unlikely.

Table 4–60 Cumulative Impacts from Transportation of Radioactive Materials

Activity		*Worker*		*General Population*		*Traffic Fatalities* [a]
		Dose (person-rem)	*LCF Risk*	*Dose (person-rem)*	*LCFs*	
Past, Present, and Reasonably Foreseeable Future Actions						
General transportation, 1943 to 2073 (DOE 2008a)		350,000	210	300,000	180	28
Historical DOE shipments (from 1943) (DOE 2008a)		330	0.20	230	0.14	NR
Reasonably foreseeable actions (DOE 2008a)		28,000	16.8	49,000	29.4	94
Subtotal Other Actions		378,330	227	349,230	210	122
Decommissioning and/or Long-Term Stewardship EIS Alternatives [b]	Sitewide Removal	2,200	1.3	370	0.22	16
	Sitewide Close-In-Place	45	0.027	10	0.0061	0.019
	Phased Decisionmaking (Phase 1)	400	0.24	72	0.043	2.1
	No Action	38	0.023	12	0.0071	0.10
Total [c]		378,368 to 380,530	227 to 228	349,240 to 349,600	210	122 to 138

LCF = latent cancer fatality, NR = not reported.
[a] Traffic fatalities associated with transporting radioactive materials and waste.
[b] Maximum transportation impact indicators from this chapter. The values were rounded where applicable.
[c] Total is a range that includes the minimum and maximum values from the alternatives addressed in this EIS. Total may not equal the sum of the contributions due to rounding.
Note: LCFs were calculated using a conversion of 0.0006 LCFs per person-rem (DOE 2002a).

4.5.17 Environmental Justice

As shown in Section 4.1.13, decommissioning activities at WNYNSC would not result in disproportionately high and adverse impacts on minority and low-income populations. The reasonably foreseeable actions at WNYNSC are not expected to have impacts on minority and low-income populations. Therefore, there would be essentially no cumulative environmental justice impacts.

4.6 Resource Commitments

This section describes the unavoidable adverse environmental impacts that could result from the implementation of the EIS alternatives, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and irreversible and irretrievable commitments of resources. Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity addresses issues associated with the condition and maintenance of existing environmental resources used to support the EIS alternatives and the utility of these resources after their use. Resources that would be irreversibly and irretrievably committed are those that cannot be recovered or recycled and those that are consumed or reduced to unrecoverable forms.

4.6.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures, including those incorporated into the design elements of EIS alternatives. Implementing the alternatives considered in this EIS would result in unavoidable adverse impacts on the human environment. A summary discussion of these impacts is included in this section; however, more-detailed discussion on impacts for each resource area can be found in the appropriate subsections of Section 4.1.

Unavoidable adverse impacts would occur due to land disturbance. Some plants and small animals could be displaced during land clearing and excavation activities. Biological surveys indicate that construction of treatment and storage facilities at WNYNSC is not expected to disturb sensitive plants or animals, or alter or destroy sensitive habitat. Although noise levels would be relatively low outside the immediate construction areas, the combination of noise and associated human activity would displace small numbers of animals surrounding the construction areas. New land disturbance would be greatest under the Sitewide Removal Alternative, particularly due to the extensive excavation activities associated with remediation of the Cesium Prong.

Geologic materials (i.e., gravel, sand, soil, etc.) would be required for new facility construction and backfilling during excavation. Some onsite geologic resources could be used to satisfy this demand and would represent an unavoidable adverse impact. Grading and revegetation of native plant species would restore the areas from which materials would be acquired.

Adverse impacts on subsurface soils and groundwater, and subsequently on nearby surface water bodies, would be unavoidable over the long term due to historic releases of contaminants, and, for some alternatives, the maintenance of onsite disposal areas. The greatest impact on water resources would be experienced under the No Action Alternative, where WNYNSC facilities could be conservatively assumed to degrade over time, without repair or mitigation, leading to the eventual release of contaminants, and where construction of more-robust control features over permanent disposal facilities would not be completed. All decommissioning alternatives are designed to enhance the long-term performance of the site. The long-term performance assessment with projected impacts on various receptors is detailed in Section 4.1.10 of this chapter.

The Sitewide Removal Alternative would result in the fewest unavoidable adverse impacts due to radiological and hazardous chemical exposure from contaminant releases to groundwater or from assumed unmitigated erosion. This alternative would decontaminate the entire site to residual radiological levels that would result in a dose less than 25 millirem per year for any foreseeable onsite receptor. Because the land would be available for release for unrestricted use, except for a facility for orphan waste storage, the Sitewide Removal Alternative would not depend on institutional controls or monitoring and maintenance over the long term.

As discussed in Section 4.1.10.3.1, implementation of an alternative where waste would remain on site and institutional controls would continue would result in an estimated radiological dose to offsite receptors of less than 25 millirem per year. Exposure impacts from nonradiological hazardous chemicals would also be very low. The health risk for exposure to nonradiological chemicals would be dominated by radiological exposures.

Institutional controls are considered an important part of any alternative, and act to minimize potential impacts. For purposes of analysis, however, it is assumed that institutional control is lost in the future, and that there would be no effort to restore institutional controls or to mitigate impacts from such loss, neither situation being considered likely. These assumptions could potentially lead to unmitigated erosion and/or intruders within site boundaries and would result in radiological dose impacts on humans. The unmitigated erosion scenario could lead to doses of a few tens of millirem per year for some individual offsite receptors. The population receptor scenarios analyzed for unmitigated erosion would result in doses comparable to annual background doses. Onsite intruder scenarios would result in much larger doses to individual intruders under the No Action Alternative compared to results for the Sitewide Close-In-Place Alternative. Most of the intruder dose would be attributable to direct disturbance of the NDA and SDA. The Sitewide Close-In-Place Alternative would cover these burial grounds with multi-layered engineered barriers and, therefore, would limit direct contact and doses to intruders.

Unavoidable impacts on floodplains and wetlands would occur as the result of implementing any of the decommissioning alternatives. The Sitewide Removal Alternative would have the greatest impact on floodplains and wetlands. Floodplain impacts would occur in the short-term during Cesium Prong remediation work, removal of the North and South Reservoirs and dams, and streambed remediation along Erdman Brook and Franks Creek. These impacts on floodplains would not be permanent. Direct impacts on jurisdictional wetlands would occur as a result of Cesium Prong remediation work in the vicinity of WMAs 3, 4, and 5, and along Quarry Creek. Other wetlands that would be impacted would be in the vicinity of the SDA during exhumation and in the vicinity of WMA 12 during closure of the dams and reservoirs.

Under the Sitewide Close-In Place Alternative, construction of engineered barriers over the SDA and NDA would encroach upon and permanently alter the 100-year floodplain. Furthermore, under the Sitewide Close-In-Place Alternative, construction of erosion control features in and around the facilities would impact floodplain performance and wetlands. Phase 1 of the Phased Decisionmaking Alternative would not adversely or directly impact floodplains or wetlands, although these resources could be adversely impacted depending on the scope of Phase 2 activities.

Construction activities undertaken for any of the decommissioning alternatives could have an indirect adverse impact on wetlands due to erosion and sedimentation from earthmoving activities. Most of the indirect impacts on wetlands could be mitigated as described in Chapter 6, Section 6.5.

Even with application of best management practices, some fugitive dust and noise generation, soil erosion, and increased vehicular traffic would be unavoidable during construction of treatment facilities and removal of buried waste material and contaminated soil. These impacts would be relatively minor and temporary in nature.

Unavoidable adverse impacts on air quality would occur due to emission of various chemical and radiological constituents during treatment facility construction and operations. Under all alternatives, nonradiological emissions are not expected to exceed NAAQS. Chemical and radiological emissions would also not exceed NESHAPs.

Retrieval and treatment of waste under normal operating conditions would also result in unavoidable radiation exposure to workers and the general public. Workers would have the highest levels of exposure; however, doses would be administratively controlled. Incremental annual dose contributions to the offsite MEI, general population, and workers are discussed in Section 4.1.9. These doses are not expected to exceed regulatory standards or administrative control limits.

Generation of some waste products would be unavoidable, including transuranic waste, low-level radioactive waste, mixed low-level radioactive waste, hazardous waste, and nonhazardous waste. Wastes generated during construction and operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and state regulations, as described in the waste management sections of this chapter. Activities would be conducted and operations optimized to generate the smallest amount of waste practical. The Sitewide Removal Alternative has the highest potential for generating waste for which a final disposition pathway has not been identified, and thus may require indefinite storage on site.

4.6.2 Irreversible and Irretrievable Commitments of Resources

This section describes the major irreversible and irretrievable commitments of resources that have been identified under each alternative considered in this EIS (see Table 4–61). A commitment of resources is irreversible when primary or secondary impacts limit future options for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for future use. In general, the commitment of capital, land, energy, labor, and materials during implementation of the alternatives would be irreversible or irretrievable. Implementation of any of the alternatives considered in this EIS, including the No Action Alternative, would entail the irreversible and irretrievable commitment of land, labor, construction materials (e.g., steel, and concrete), geologic resources, energy and fossil fuels, and water. **Table 4–61** presents the major resource requirements that would be irreversibly or irretrievably consumed under each alternative. For waste containers, roll-on/roll-off and Sealand containers are not included as an irretrievable resource because these containers are reused and not buried with the waste. However, it is assumed that these containers would be refurbished approximately every 20 loads. The consumption of resources in the table has been divided into decommissioning and monitoring and maintenance categories, with the exception of Phase 1 of the Phased Decisionmaking Alternative. In the case of Phase 1, for purposes of analysis, resource commitments are assumed to include anything consumed within 30 years (the table does not distinguish between decommissioning or monitoring and maintenance activities). For all other alternatives, decommissioning activities are well defined and the consumption of resources is finite. Resources associated with decommissioning activities would generally occur in the short term and are presented as totals. Resources associated with monitoring and maintenance activities are cumulative. Because these resources would generally occur for an indefinite period of time, they are presented on an annual basis. For the Sitewide Close-In-Place Alternative, monitoring and maintenance resources would be expended as part of a long-term stewardship program.

4.6.2.1 Sitewide Removal Alternative

This alternative would consume the most labor, utilities, waste containers, and in some cases, the most material resources; however, after implementing this alternative, no additional monitoring and maintenance resources would be consumed on an annual basis because the entire site would be available for release for unrestricted use. However, commensurate with the aggressive nature of the cleanup, a large amount of waste would be generated, potentially including orphan waste. Potential orphan waste would not have an identified disposal pathway, and management of this waste on site would require the annual consumption of resources until final disposition is determined. Unrestricted release of land dedicated to the long-term storage of orphan waste would also be delayed. This would involve the continued use of the Container Management Facility occupying approximately 24.3 hectares (60 acres) of land. The estimated monitoring and maintenance resources for long-term storage of orphan waste are displayed in parentheses in Table 4–61.

4.6.2.2 Sitewide Close-In-Place Alternative

This alternative would consume the most material resources associated with the backfilling and/or grouting of void spaces and the construction of engineered surface barriers. Most of the decommissioning resources would be committed within the first 7 years; however, for purposes of analysis those associated with the operation and demolition of the Interim Storage Facility were assumed to continue for 26 more years. Monitoring and maintenance resource commitments would begin after 7 years and would continue indefinitely as part of a long-term stewardship program. Monitoring and maintenance activities would include annual maintenance of erosion control features, environmental monitoring, maintenance of the engineered surface barriers, as-needed replacement of the North Plateau Groundwater Plume permeable treatment wall about every 20 years, and as-needed replacement of the site security system about every 35 years. The land areas retained for management of disposal areas (e.g., North Plateau, SDA, and NDA) would be considered a permanent commitment of land resources.

Table 4–61 Irreversible and Irretrievable Commitment of Resources

	Sitewide Removal Alternative		***Sitewide Close-In-Place Alternative***		***Phased Decisionmaking Alternative***			***No Action Alternative***	
						Total [e]			
Resource	***Decommissioning***	***M&M (annual)*** [a]	***Decommissioning*** [b]	***M&M (annual)*** [c]	***Phase 1*** [d]	***Decommissioning***	***M&M (annual)***	***Decommissioning*** [f]	***M&M (annual)*** [f, g]
Land (hectares)	0 (24)		233		659	0 - 233		658	
Labor (FTEs)	15,000	0 (20)	2,350	23	3,010	2,350 - 15,000	0 - 23	0	74
Materials									
Concrete (cubic meters)	55,300	0	6,940	0	3,960	6,940 - 55,300	0	0	0
Concrete Block (square meters)	5,980	0	0	0	0	0 - 5,980	0	0	0
Cement (cubic meters)	520	0	150	0	250	150 - 520	0	0	0
Grout (cubic meters)	260	0	56,300	0	480	260 - 56,300	0	0	0
Soil (cubic meters)	1,107,000	0	917,000	18,300	95,300	917,000 - 1,107,000	0 - 18,300	0	0
Sand, Gravel, and Stone (cubic meters)	31,700	0	1,099,000	10,500	1,150	31,700 - 1,099,000	0 - 10,500	0	370
Clay (cubic meters)	71,200	0	149,000	1,740	68,600	71,200 - 149,000	0 - 1,740	0	0
Zeolite (cubic meters)	0	0	1,680	84	1,680	0 - 1,680	0 - 84	0	84
Bentonite (cubic meters)	950	0	26,900	0	1,470	950 - 26,900	0	0	0
Asphalt (metric tons)	2,440	0	0	0	0	0 - 2,440	0	0	2
Roofing Felt (square meters)	0	0	0	0	0	0	0	0	890
Steel (metric tons)	23,800	0	90	0	580	90 - 23,800	0	0	0
Sheet and Helical Piling (metric tons)	11,100	0	330	0	1,850	330 - 11,100	0	0	0
HDPE Sheeting (square meters)	74,600	0	0	0	0	0 - 74,600	0	0	0
Geomembrane (square meters)	0	0	367,000	0	129,000	0 - 367,000	0	0	3,410
Fabric (square meters)	3,140	0	0	0	0	0 - 3,140	0	0	0
Geotextile (square meters)	6,790	0	132,000	0	0	6,790 - 132,000	0	0	0
Slurry Materials (liters)	959,000	0	0	0	0	0 - 959,000	0	0	0

	Sitewide Removal Alternative		Sitewide Close-In-Place Alternative		Phased Decisionmaking Alternative			No Action Alternative	
						Total [e]			
Resource	Decommissioning	M&M (annual) [a]	Decommissioning [b]	M&M (annual) [c]	Phase 1 [d]	Decommissioning	M&M (annual)	Decommissioning [f]	M&M (annual) [f, g]
Utilities									
Electricity (megawatt-hours)	724,000	0 (930)	113,000	1,110	145,000	113,000 - 724,000	0 - 1,110	0	3,550
Natural Gas (cubic meters)	121,971,000	0 (148,000)	18,053,000	176,000	23,123,000	18,053,000 - 121,971,000	0 - 176,000	0	569,000
Diesel Fuel (liters)	32,204,000	0 (38,300)	25,738,000	191,000	9,545,000	25,738,000 - 32,204,000	0 - 191,000	0	33,600
Gasoline (liters)	8,954,000	0 (0)	2,755,000	27,900	793,000	2,755,000 - 8,954,000	0 - 27,900	0	9,500
Potable Water (liters)	624,921,000	0 (805,000)	97,943,000	957,000	125,449,000	97,943,000 - 624,921,000	0 - 957,000	0	3,126,000
Raw Water (liters)	3,099,832,000	0 (3,656,000)	455,316,000	4,347,000	586,176,000	455,316,000 - 3,009,832,000	0 - 4,347,000	0	14,340,000
Waste Containers [h]									
Lift Liners	185,000	0	1,660	14	21,600	1,660 - 185,000	0 - 14	0	1
55-gallon drums	29,600	0 (15)	830	0	5,750	830 - 29,600	0	0	140
B-25 Boxes	41,700	0	1,570	2	7,770	1,570 - 41,700	0 - 2	0	120
High Integrity Containers	1,080	0	0	0	220	0 - 1,080	0	0	0

FTE = full-time equivalent, HDPE = high-density polyethylene, NDA = NRC [U.S. Nuclear Regulatory Commission]-Licensed Disposal Area, SDA = State-Licensed Disposal Area, M&M = monitoring and maintenance, Raw Water = non-potable water and augmentation water.

[a] The site would be released for unrestricted use and no additional resources would be consumed. Parenthetical values represent the annual resources that would be required for storage of orphan waste.

[b] Includes the commitment of resources for operations and demolition of the Interim Storage Facility.

[c] As part of a long-term stewardship program, annual monitoring and maintenance commitments would include North Plateau Groundwater Plume permeable treatment wall replacement about every 20 years (annualized), site security system replacement about every 35 years (annualized), and maintenance of erosion control features.

[d] Includes all resource commitments for Phase 1 activities in the first 30 years.

[e] Phase 2 of the Phased Decisionmaking Alternative would involve the additional consumption of resources and potentially the unrestricted release of additional land areas. It is expected that the additional consumption of resources during Phase 2 would be generally between those for the Sitewide Removal and Sitewide Close-In-Place Alternatives, depending on the combination of activities selected for Phase 2, minus some of the resources expended to achieve decommissioning in Phase 1. If the Phase 2 decision for the SDA is continued active management, use of some resources would be bounded by those for the No Action Alternative

[f] No decommissioning activities would take place beyond the starting point of the EIS. M&M resources would be consumed on an annual basis indefinitely. Diesel fuel for the No Action Alternative includes diesel fuel and heating oil.

[g] Annual monitoring and maintenance commitments include SDA and NDA geomembrane replacements about every 25 years (annualized) as well as replacement of roofs and the permeable treatment wall about every 20 years (annualized).

[h] The highest demand for one-time use waste containers was used, depending on the disposal option (DOE/Commercial or Commercial). Roll-on/roll-off and Sealand containers are reusable and are not buried with waste as one-time use containers; therefore, these containers are not considered an irretrievable resource.

Note: To convert hectares to acres, multiply by 2.471; cubic meters to cubic yards, multiply by 1.3079; square meters to square yards, multiply by 1.196; metric tons to tons, multiply by 1.1023; liters to gallons, multiply by 0.26418. One FTE = 2,080 worker hours per year.

Sources: WSMS 2009a, 2009b, 2009c, 2009d.

The potential does exist for the generation of orphan waste similar to the Sitewide Removal Alternative. Unlike the Sitewide Removal Alternative, there would be suitable areas of the site retained under management to accommodate the long-term storage of this waste, and the quantities and risk of potential orphan waste would be much less. Therefore, no additional commitment of resources beyond those monitoring and maintenance resources already assumed is expected to be necessary for the onsite storage of orphan waste under the Sitewide Close-In-Place Alternative.

4.6.2.3 Phased Decisionmaking Alternative

This alternative addresses the decommissioning of some aspects of the site and defers other aspects until a later date. For this alternative, the commitment of resources under Phase 1 represents all activities, studies, and tests that would be implemented until Phase 2 activities are defined. For purposes of analysis, a 30-year Phase 1 period is assumed. Because many decommissioning activities would be deferred, an unknown quantity of resources would be committed in the future after Phase 2 activities have been evaluated and determined. The exact quantity of resources that would be consumed during Phase 2 is dependent on the combination of decommissioning activities that would be implemented; however, it is expected that the consumption of resources for the entire alternative would generally lie between those estimates for the Sitewide Close-In-Place and Sitewide Removal Alternatives, minus some of the resources expended to achieve a portion of the decommissioning in Phase 1 (e.g., demolition of the Main Plant Process Building). If the Phase 2 decision for the SDA is continued active management, the consumption of resources for the entire alternative would be bounded for some resources by the No Action Alternative.

4.6.2.4 No Action Alternative

This alternative entails no decommissioning activities to be implemented beyond the starting point of this EIS; therefore, there are no commitments of resources for decontamination and decommissioning activities. However, this alternative does consume the most labor and utilities on an annual basis for continuing monitoring and maintenance activities. This consumption of resources on an annual basis would continue indefinitely. The monitoring and maintenance commitment of resources includes replacement of the SDA and NDA geomembrane covers about every 25 years, replacement of the facility roofs and permeable treatment wall about every 20 years, and the maintenance of access roads on site. The annual consumption of resources would likely increase over time, because the effort to maintain the site and its buildings in a similar state would also become more difficult with the passage of time and the deterioration of structures.

4.6.3 Relationship Between Short-term Use of the Environment and Long-term Productivity

Pursuant to NEPA regulations (40 CFR 1502.16), an EIS must consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. "Short-term," for purposes of analysis in this section of the EIS, is the active project phase under each alternative during which the majority of construction, operations, and decommissioning activities would take place. "Long-term" is defined in this section of the EIS as the timeframe that extends beyond conclusion of the short term for each alternative. For purposes of human health impact analysis, "long-term" is defined differently in Section 4.1.10. Short-term and long-term uses of the environment in the broader context include elements of unavoidable adverse impacts and an irreversible and irretrievable commitment of resources in order to enhance the long-term productivity of the human environment. Unavoidable adverse environmental impacts are discussed in Section 4.6.1. The irreversible and irretrievable commitment of resources is discussed in Section 4.6.2.

The objective of any Proposed Action would be to demonstrate and implement the alternative that, on balance, would yield the greatest benefit to the public. For any EIS alternative to be considered favorable from a human health perspective, an increase in worker and public exposure under controlled circumstances (i.e., facility decommissioning) in the short term would lead to a decrease in exposure to the unprotected public and environment over the long term. The selection of an alternative would, in part, need to consider the balance of short-term impacts against long-term benefits as demonstrated and discussed throughout Section 4.1. Also, the consumption of resources in the short term could lead to the unrestricted release of certain portions of the site.

Regardless of location, air emissions associated with decommissioning actions would introduce small amounts of radiological and nonradiological constituents to the atmosphere around WNYNSC. Over time, these emissions would result in additional loading and exposure, but would not impact compliance with air quality or radiation exposure standards at WNYNSC (except possibly for $PM_{2.5}$ and PM_{10}). There would be no significant residual environmental effects on long-term environmental viability.

Under certain alternatives, and in addition to short-term use of the environment, the emplacement of engineered surface barriers over portions of the North Plateau and/or permanent waste disposal areas would be considered a long-term use of the environment, and thus, a decrease in the long-term productivity for these locations. In other parts of the site, buildings and equipment could be decontaminated and demolished and the affected areas restored to either green- or brownfield sites, ultimately returning these areas to productive use.

While emplacement of engineered barriers would lead to a decrease in long-term productivity for small portions of the site where permanent burial grounds are located, it would lead to increased protection of groundwater resources over the long term and a reduced exposure risk to individual and population receptors, especially when evaluating the onsite intruder scenarios.

Adverse impacts on wetlands and floodplains would generally increase with the aggressive nature of each alternative in remediating the site and the associated increase in disturbance of land areas.

Most disturbed wetlands could have an additional adverse impact on local ecosystems; however, over the very long term, these ecosystems are expected to recover, especially with the implementation of restoration and mitigation measures. The emplacement of engineered barriers would have a relatively small, but permanent, impact on floodplains.

Implementation of any of the alternatives would result in continued employment, expenditures, and tax revenues being generated, which, in turn, would directly benefit the local, regional, and state economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could facilitate long-term economic productivity.

The quantity of short-term resources needed to implement any of the alternatives analyzed in this EIS would not affect the long-term productivity in the region.

4.6.3.1 Sitewide Removal Alternative

The short-term duration of this alternative would take approximately 60 years to complete. This alternative would have the most significant short-term impacts. Large areas of land would be disturbed, including previously undeveloped areas for excavation and remediation of the Cesium Prong. Significant volumes of waste would be generated and would require offsite disposal. Commensurate with the exhumation and removal of contamination, this alternative would result in the highest exposure potential for onsite workers. In contrast, the enhancement of long-term productivity would be the greatest, because the entire site would be eventually released for unrestricted use. However, shipment of waste to offsite disposal facilities could reduce the long-term productivity for these locations. With the large areas of land that would be disturbed under the Sitewide Removal Alternative, the greatest impact on wetlands would occur under this alternative as compared to the other alternatives analyzed (see Section 4.1.6.1). These impacts would offset some of the enhancements to long-term productivity of the site gained by achieving unrestricted release criteria.

4.6.3.2 Sitewide Close-In-Place Alternative

The short-term period of this alternative would involve approximately 7 years of significant onsite decommissioning activities, followed by implementation of a long-term stewardship program. During the decommissioning period, vitrified high-level radioactive waste would be moved to the Interim Storage Facility pending offsite transportation. As compared to the Sitewide Removal Alternative, the eventual decay of the Cesium Prong would lead to reduction of adjacent area boundaries and the unrestricted release of additional land, without the short-term impacts on the environment that would result from excavation and or operation of wastewater treatment systems. Where engineered surface barriers would be installed, this alternative would remove portions of the site from long-term productive use. As discussed in Section 4.1.10.3, when compared to the No Action Alternative, the projected levels of radiological exposure over the long term to both onsite and offsite receptors would be significantly reduced, assuming loss of institutional controls after 100 years. The reduction in projected exposures would be achieved through construction of engineered barriers over waste burial sites and facilities that would be closed in place, and the construction of erosion control features that would protect these areas. However, the emplacement of engineered barriers and construction of erosion control features would permanently alter some floodplains. Some wetland areas would be adversely impacted, although to a lesser degree than under the Sitewide Removal Alternative.

4.6.3.3 Phased Decisionmaking Alternative

The Phased Decisionmaking Alternative pursues selected decommissioning actions, while deferring other decisions until more-effective solutions can be analyzed. Phase 1 of this alternative would involve decommissioning activities in the first 8 years, including movement of vitrified high-level radioactive waste to the Interim Storage Facility pending offsite transportation, and followed for analysis purposes by up to 22 years of ongoing monitoring and maintenance of the areas of the site that had been deferred to Phase 2 decommissioning actions. The Phase 2 decision would be based on a variety of studies and analyses that would begin during the Phase 1 decommissioning period. Phase 2 decommissioning activities would involve additional short-term impacts. The overall enhancement to the long-term productivity of the environment would remain unknown until Phase 2 activities had been determined; however, Phase 1 activities would serve to preserve the ability to maximize this enhancement by stabilizing and/or removing contaminated media from the site premises. Phase 1 activities analyzed under the Phased Decisionmaking Alternative would not adversely impact any wetlands or floodplains. The continued maintenance of some facilities, while decontaminating and decommissioning others, would result in some short-term impacts. The precise long-term impacts on human health and the environment cannot be determined for Phase 2 until the scope has been fully defined; however, long-term impacts are expected to be generally bounded by the Sitewide Close-In-Place and Sitewide Removal Alternatives. If the Phase 2 decision for the SDA is continued active management, long-term impacts for some exposure scenarios and receptors would be bounded by the No Action Alternative.

4.6.3.4 No Action Alternative

Under the No Action Alternative, environmental resources would continue to be committed to operations at WNYNSC on an annual basis. This commitment would serve to maintain existing environmental conditions with little or no enhancement of the long-term productivity of the environment. With the passage of time and the release of contaminants from onsite sources, the extent to which future remedial action would enhance the long-term productivity of the site would decrease. Under exposure scenarios involving onsite intruders, as discussed in Sections 4.1.10.3.2.1 and 4.1.10.3.2.2, significant, radiological exposures could occur to humans. Floodplains and wetlands would not be impacted, because no decommissioning actions would be taken.