5 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND THE NO-ACTION ALTERNATIVE

This section describes the environmental consequences of the Proposed Action and the No-Action Alternative, as well as the cumulative impacts of the Proposed Action when added to other past, present, and future actions. The Proposed Action includes continuing and enhanced operations of the APS facilities, including construction and operation of new facilities. In each topical area, the impacts of continuing operation are discussed first, followed by the impacts of constructing and operating new facilities. Where appropriate, the potential impacts of BSL-3 research at the APS are also addressed.

Where the impacts of APS operations have changed from the conclusions reached in the 1990 EA for constructions and operations (DOE 1990), these changes are identified. In addition, where appropriate, the wetlands management EA (DOE 2001) is referenced, since wetlands adjacent to the APS facility were included in that document. The environmental remediation EA, prepared for ANL-E in 1997, did not address APS site areas, since no RCRA Solid Waste Management Units (SWMUs) are located in the APS area.

5.1 EFFECTS OF THE PROPOSED ACTION

5.1.1 Soils

As discussed in Section 4.2, soil activation and contamination are negligible under the current APS operations. The proposed action would not involve changes in the design and operation of the APS primary components (LINAC, LEUTL, synchrotron, and storage ring); therefore, conclusions from Section 4.2 still hold under the proposed action.

Soil erosion at the APS site during continued operations would remain low, as under current conditions (Section 4.2) because the vegetation cover would continue to be maintained. Construction of the CNM facility and parking area (Figure 3.2) would disturb soils on the western side of the APS ring. Construction of the CNM and parking area, beginning as early as 2003, would disturb between 2 and 4 acres (0.8 and 2 ha) of land. Most of this area of the APS site has been previously disturbed by construction of the APS ring and a road and parking lot. None of this area is classified as wetland or as a SWMU as defined by RCRA.

During construction of the CNM facility, ANL-E-approved construction practices, such as use of sediment fences, compaction, contouring, and sediment retention basins, would limit potential erosion and runoff. As described in Section 5.1.2, proposed mitigation for stormwater management from the CNM area includes creating a collection basin north of the new facility.

After construction of the CNM facility and parking area, landscaping and revegetation of disturbed soils would retard runoff and control erosion. The sediment load in stormwater runoff would be reduced by routing the runoff through a collection basin. No adverse impacts to soils would be expected as a result of implementing the proposed action.

5.1.2 Water Resources

5.1.2.1 Surface Water: Continued Operations

Potential surface water impacts at the APS site would continue to be associated only with stormwater discharges. The APS facility sanitary and laboratory wastewaters would continue to be separately collected, treated, and discharged by the ANL-E sanitary wastewater treatment plant and the ANL-E LWTP.

Continued operation of the APS facility as currently configured would continue to include control of stormwater throughout the APS site as described in Section 4.3.1. Under continued operations, attenuation of flow peaks and fluctuations in stormwater flows from the APS site, including flows to Wetland 302, would not be changed. Implementation of vegetation management and placement of flow-control grates for APS infield drainage would improve attenuation of flows into Wetland R. Concentrations of road salt and other materials in flows from roadways and parking lots following snowmelt and rain events would be reduced to a level that would protect the wetland through implementation of a sitewide wetland management plan.

As under current conditions, small amounts of cooling water containing short-lived activation products may be released to the wastewater treatment system as part of maintenance operations. Analysis of outfall effluent would be expected to continue to not detect the presence of O-15, the primary activation product. Thus, no radiation exposures are expected to result from the discharge of the cooling water.

5.1.2.2 Surface Water: Enhanced Operations

Adherence to the Stormwater Pollution Prevention Plan (SPPP), prepared prior to construction, would result in the minimization of impacts to surface water quality from construction of the CNM facility. During the construction, surface water quality impacts would be mitigated by implementation of sediment and erosion control measures (Section 3.1.3). The water quality of stormwater flows into the receiving stream to the north would be protected, and downstream impacts from sedimentation would be avoided.

During operations, stormwater flows would be routed as described in Figure 5.1. During operations of the CNM facility, flows in runoff from all existing and new roof drains would be attenuated by a new collection basin of 10,500 ft^3 (297 m^3) capacity prior to flow to the north. This control would reduce fluctuation in flows and filter and degrade some contaminants. Under the proposed action, the first 3,033 ft^3 (86 m^3) of runoff from the new APS parking lot would be collected and pumped to the south to a bioswale. Water from this location would drain to the

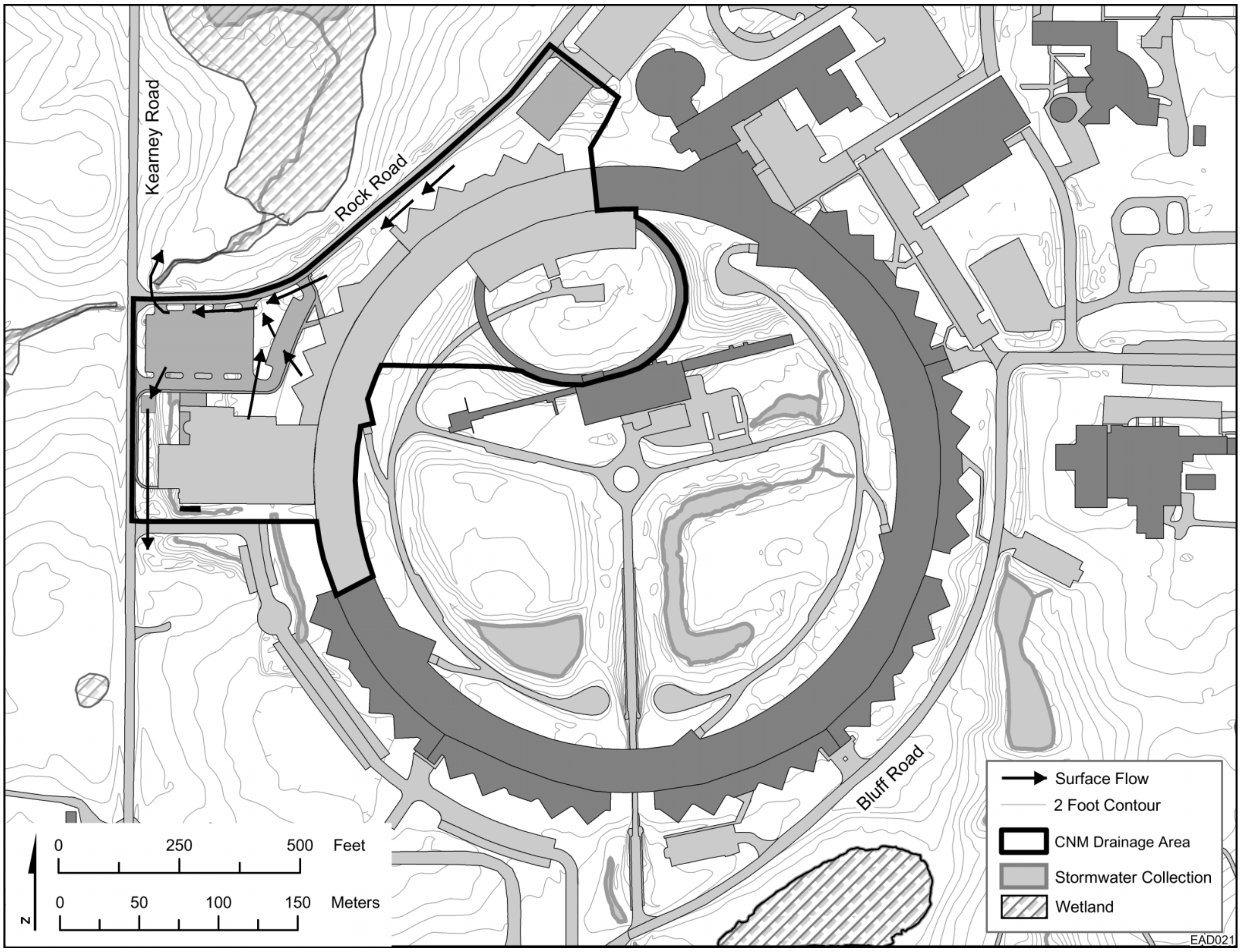

FIGURE 5.1 Direction of Stormwater Flow (arrows) in the Area of the CNM Facility

south across the ANL site boundary. The effect of alternative parking configurations on water quality are discussed below. Stormwater flows from the CNM site would meet water quality criteria that are protective of wetlands, including wetland communities and component biota. In addition, stormwater flows from the CNM drainage area would be diluted upon entering the receiving stream at the drainage system outflow point. The planting of native species in stormwater collection areas and other landscaped areas on the CNM site would promote the infiltration of precipitation.

Table 5.1 lists contaminants that originate on road and parking surfaces and may be included in stormwater runoff (Nelson 2002; Sonstrom 2002). Also given are the benchmark concentrations protective of wetlands and aquatic biota. Most of the benchmarks are the National Ambient Water Quality Criteria (NAWQC) established by the EPA; however, several contaminants do not have established national criteria. The ethylene glycol benchmark is the State of Michigan Water Quality Standard (the State of Illinois does not have a water quality standard for ethylene glycol); total phosphorus and total nitrogen are the EPA nutrient criteria for

TABLE 5.1 Water Quality Criteria for Aquatic Biota for Common Parking Lot Runoff Constituents

Constituent	Benchmark Value (mg/L)	Benchmark Type[a]	Source[b]
Chloride	230	National WQC	EPA 1988
Copper	0.009[c]	National WQC	EPA 2002
Ethylene glycol	190	Michigan WQS	MDEQ 2002
Lead	0.0025[c]	National WQC	EPA 2002
Zinc	0.120[c]	National WQC	EPA 2002
Total phosphorus	0.07625	Ecoregional Nutrient Criteria	EPA 2000a
Total nitrogen	2.180	Ecoregional Nutrient Criteria	EPA 2000a
Oil/grease	15[d]	Illinois WQS	IPCB 1996

[a] WQC = water quality criteria; WQS = water quality standard.

[b] MDEQ = Michigan Department of Environmental Quality; IPCB = Illinois Pollution Control Board.

[c] Value assumes a water hardness of 100 mg/L.

[d] Illinois indigenous aquatic life standard (IPCB 1996).

Ecoregion VI, which includes northern Illinois; and the benchmark for oil/grease is the Illinois Water Quality Standard for Indigenous Aquatic Life. Salt used for deicing enters the wetland or aquatic environment as sodium and chloride ions in solution following snowmelt or rain events. However, chloride has a greater impact on biota than sodium (TRB 1991; Richburg et al. 2001) and is a more reliable measure of salt in the environment. No NAWQC for sodium has been established by the EPA.

Under the proposed action, most contaminants in stormwater runoff from the CNM parking area would be prevented from entering the receiving stream north of Rock Road. These contaminants would be included in the stormwater runoff that would be pumped to the south of the CNM site and outside the watershed of Wetland 302. The first 0.5 in. (1.3 cm) of stormwater runoff from impervious surfaces, such as parking areas, carries approximately 90% of the contaminant load of stormwater (IDEQ 2001). Pumping of runoff from the CNM parking area would include the first 0.5 in. (1.3 cm), and a minimum of approximately the first inch (2.5 cm) of rainfall, including 100-year, 24-hour storm events. Therefore, less than 10% of the contaminants from the CNM parking area would remain in the runoff remaining in the Wetland 302 watershed. These contaminant levels would be well below benchmark levels.

An analysis of impacts to surface water from winter salt application is provided in Appendix D. Under the proposed action, with present salting rates, chloride concentrations, averaged over the winter season, entering Wetland 302 from the receiving stream north of Rock Road would be between 50 mg/L and 126 mg/L, depending on the soil temperature and potential infiltration.

Under parking alternative B, bioretention swales would be incorporated into the CNM facility parking area to receive stormwater flows from this parking area and adjacent areas. By temporarily retaining stormwater flows, the bioretention swales would reduce flow fluctuations and the amplitude of peak flows and would permit a gradual release of water. Stormwater peak flows would generally be lower than those presently occurring at the outflow of the existing stormwater collection basin, which only slightly reduces flow peaks. In addition, the soil and vegetation of the bioretention swales would filter out suspended particulates and contaminants from stormwater and contribute to the degradation of organic contaminants. Highly soluble materials, such as road salt and ethylene glycol, may largely pass through bioretention swales, although a portion of the ethylene glycol may be degraded. A wide range of removal efficiencies has been observed in bioretention swales, depending on engineering parameters and success of vegetation establishment (SMRC 2002; EPA 1999, 2000b). Contaminant concentrations in stormwater runoff from roads and parking lots, removal rates, and resulting concentrations are given in Table 5.2. Contaminant concentrations calculated for the low removal rates using the high value for initial runoff concentrations would be below respective benchmark values, except for nitrogen and phosphorus. However, the contaminants remaining in the stormwater would be diluted by the addition of flows from roof runoff, prior to release into the receiving stream. Resulting concentrations of nitrogen and phosphorus would be below benchmark values. In addition, the replaceable filter that would be included in the drainage system would further lower concentrations of petroleum-based oils and grease.

Chloride concentrations in runoff from the CNM facility drainage area were estimated for parking alternative B. Chloride concentrations, averaged over the winter seasons, entering Wetland 302 from the receiving stream north of Rock Road would be between 83 and 201 mg/L. For parking alternative C and D, chloride concentrations from the 16,000 ft^3 (453 m^3) of parking north of the CNM would be between 28 and 74 mg/L in the receiving stream.

Following storm events, stormwater runoff from developed areas has the potential to increase water elevation fluctuations in wetlands within the watershed. Therefore, potential changes in surface water elevation in Wetland 302 from construction of the CNM, LOM 437, and associated parking areas were evaluated. Under the proposed action, construction of the CNM, LOM 437, and associated parking areas would result in a negligible change in the increase in surface elevation of Wetland 302 compared with current conditions, primarily because the increase in impermeable area represents a small percentage of the watershed (Kottmeyer 2003). Thus the impact on wetland hydroperiod characteristics would be negligible.

TABLE 5.2 Road and Parking Surface Runoff Concentrations, Bioretention Swale Reduction Rates, Resulting Concentrations, and Discharge Concentrations

Constituent	Runoff Concentration (mg/L)[a]	Bioswale Removal Rate (%)	Maximum Resulting Concentration (mg/L)[b]	Discharge Concentration (mg/L)	Benchmark Value (mg/L)
Copper	0.007–0.013	43–97	0.0074	0.002	0.009
Ethylene glycol	70.2	0	70.2	22.1	190
Lead	0.003–0.005	67–95	0.00165	0.0005	0.0025
Zinc	0.108–0.151	63–98	0.0559	0.018	0.120
Total phosphorus	0-0.143	29–87	0.102	0.032	0.07625
Total nitrogen	1.6–5.63	49–84	2.87	0.905	2.180
Oil/grease	2.43–4.3	75–90	1.08	0.341	15

[a] Sources: Nelson (2002); Sonstrom et al. (2002).

[b] Maximum concentrations were determined by using the high runoff concentration value and the low removal rate.

In addition, the stormwater detention area for roof drains that would be constructed under the proposed action, as well as the removal of a portion of parking area runoff by pumping, would contribute to attenuating storm flow peaks. Parking alternative B would also result in a negligible change from current conditions. Flow attenuation would be promoted by the detention capacity of the bioretention swales and the detention area for roof runoff. Because parking alternatives C and D have the same configuration within the CNM watershed, they would have similar effects on Wetland 302 surface water elevations. The detention area for roof drains, in addition to the reduced parking area north of the CNM facility, would contribute to attenuating storm flow peaks.

5.1.2.3 Groundwater

Continued operation of the APS facility would not involve the use of groundwater or the release of effluents to groundwater sources; thus, no direct impacts to groundwater are expected.

Any radioactivity in soil could be leached out by water and could result in groundwater contamination. However, as discussed in Sections 4.3.2 and 5.1.1, soil contamination is negligible under current APS operations. The proposed action would not change the design and operation of the APS components; therefore, soil contamination would continue to be negligible, so would groundwater contamination.

No groundwater would be used for CNM facility construction, nor would construction activities routinely discharge any effluents to groundwater. Construction of the CNM facility would not be expected to alter the direction or quantity of groundwater flow. The bottom of the CNM building footings would be 4 ft (1.2 m) below the proposed finished floor elevation of 744 ft (267 m). The glacial drift at the APS site is dominated by low-permeability glacial till. A thin, fairly continuous permeable sand layer is located below the APS facility at an elevation of about 720 ft (219 m) (Killey and Trask 1994). Minor, isolated sand units may be present at elevations above 720 ft (219 m); however, the presence of shallow sands is unlikely because none were encountered in the drilling program of Killey and Trask (1994). Therefore, construction of a foundation at an elevation of 740 ft (256 m) would not be expected to change groundwater flow within the glacial drift. Small accidental spills of materials or chemicals used during construction would be promptly cleaned up so that soils or groundwater would not be contaminated.

The infiltration of precipitation would be prevented on impervious surfaces in the CNM drainage area. However, because of the relatively impermeable disturbed soils currently present in the area of proposed construction and the predominance of non-native grasses in the vegetation cover, current infiltration rates are likely low. The increase in impervious surface would be expected to have a minor effect on infiltration to groundwater in the CNM drainage area. The planting of native species in stormwater collection areas and other landscaped areas on the CNM site would promote the infiltration of precipitation.

No adverse impacts to groundwater are expected as a result of implementing the proposed action.

5.1.3 Air Quality and Noise

Continued operations of the APS would result in very low emissions of criteria air pollutants. As shown in Table 4.1, the emissions from the APS facility and the associated emergency generators constitute at most about 6% of total ANL-E emissions, and emissions from ANL-E are less than 0.1% of the total emissions in the three closest counties.

A construction permit would be required before beginning construction of the CNM facility. The Urban Emissions Model (URBEMIS 2001, Version 6.2.1) (Jones & Stokes 2000) was used to estimate emissions during construction of the CNM facility. Emissions from site grading, worker trips, stationary equipment, mobile equipment, and architectural coatings were estimated. Emissions of PM_{10}, volatile organic compounds (VOCs), NO_x, CO, and SO_2 would all be less the 3 tons/yr (2,700 kg/yr). Under the EPA's general conformity program, projects with emissions less than 100 tons/yr (91,000 kg/yr) are exempted from review because their emissions have been deemed to have negligible air quality impacts. Emissions associated with CNM facility construction would be of short duration and have negligible air quality impacts.

Construction equipment would emit noise; the effects of this noise, however, would be temporary and local. Elevated noise levels may be noticed by hikers, bikers, horseback riders, and other users of the adjacent Waterfall Glen Forest Preserve. However, the forest preserve would provide a buffer zone between the construction activities and the nearest residents, schools, and religious institutions, which are more than 1 mi (1.6 km) away. Noise impacts on these sensitive receptors would be negligible.

The CNM would use existing emergency generators; thus no increase in emissions would be expected. A new 1-MW (3.5-MMBtu/h) natural-gas-fired boiler for humidification would be associated with the CNM complex.[1] This boiler would not be operated during the summer and would normally operate at less than peak capacity. Even if operated at capacity for a full year, emissions of all criteria pollutants would be less than 1.5 tons/yr (1,400 kg/yr). These emissions would all be less than the 100 tons/yr (91,000 kg/yr) de minimis cutoff used in the EPA's general conformity program and would have only negligible off-site air quality impacts.

Another emission from the CNM would be standard space ventilation from occupied areas. In addition, research processes in cleanrooms would produce emissions that may involve small amounts of materials. Those emissions would exit the facility through scrubbers or high-efficiency particulate air (HEPA) filters, which would reduce emissions by more than 99%. Thus, emissions from the CNM would be expected to have negligible off-site air quality impacts. Chemicals expected to be used in the CNM are listed in Appendix B.

The BioCARS facility is already fully operational. Given a finite number of experimental stations, when BioCARS begins experiments with BSL-3 agents under the Proposed Action, an equal number of ongoing experiments (involving noninfectious organisms) will cease. Air pollution control devices will continue to function at current performance levels. Air quality impacts from current BioCARS activities are negligible. There will be no net change in air quality impacts as a result of the Proposed Action regarding BioCARS activities.

Noise sources associated with the CNM would include ventilation fans, transformers, chillers, and fans associated with space conditioning equipment. Similar sources already exist at the APS. The addition of a small number of new sources would cause only an imperceptible increase in noise levels off-site.

No adverse air quality or noise impacts are expected as a result of implementing the proposed action.

5.1.4 Land Use, Recreation, and Aesthetics

The continued operation of the APS is consistent with the dedication of ANL-E to research and development and would not interfere with recreational use of the Waterfall Glen

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[1] The boiler will be incorporated into the sitewide Title V Air Operating Permit, if required, depending on final design specifications.

Forest Preserve. The APS facilities would remain visible from adjacent areas during continued operation.

Initiation of BSL-3 research and construction of the CNM facility are also consistent with the use of ANL-E for energy research and development and consistent with the mission of the APS as a major national user facility. Construction activities and associated noise related to the CNM may be noticed by users of the areas of the Waterfall Glen Forest Preserve that are immediately adjacent to the APS site. These effects, however, would be minor and temporary.

The CNM facility would be located adjacent to existing APS facilities and would have a negligible effect on the visual characteristics of the site. Viewers of the APS facilities from the Waterfall Glen Forest Preserve adjacent to the APS facilities are unlikely to notice the new facilities, which would be designed to achieve aesthetic harmony with the APS.

5.1.5 Ecological Resources

5.1.5.1 Terrestrial Biota

Continued operation of the APS facility would have negligible effects on terrestrial habitats and wildlife. Habitat disturbance on the APS site, including landscape maintenance activities, would not be expected to change from past disturbance levels. Wildlife would continue to avoid areas of human activity and would continue to be disturbed by vehicle use (user transportation or shipping) and noise sources (such as backup generators or cooling systems, traffic). The predominance of non-native species in vegetated areas of the APS site would be maintained by the continuation of past management practices.

Construction of the CNM facility and support areas, including parking areas, would require the disturbance of 2 to 4 acres (0.8 to 2 ha) of land. Existing vegetation and wildlife on the proposed construction sites would be eliminated. Habitat that would be lost on the proposed location is primarily managed grassland maintained by periodic mowing. Similar habitat is common on the ANL-E site. During construction of the parking area and proposed bioswales, several mature trees also would likely be removed. Construction of the CNM would result in only minor impacts to terrestrial biota because of the low species diversity and poor quality of managed grassland habitat for many species of wildlife. The use of native vegetation species for landscape plantings on the CNM facility site would increase species diversity on the APS site and avoid the introduction of invasive non-native species.

During operation of the CNM, there would be no direct discharge of wastewater effluent to the environment. Wastewater would be treated at the ANL-E wastewater treatment plant. Effects on air quality from operation of the CNM would be negligible. Therefore, operation of the CNM would be expected to have negligible impacts on biota beyond those of continued APS operations.

5.1.5.2 Wetlands and Aquatic Biota

Executive Order 11990, *Protection of Wetlands*, requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial uses of wetlands. DOE regulations for implementing Executive Order 11990, as well as 11988, *Floodplain Management*, are set forth in 10 CFR 1022.

Continued operation of the APS facility would not be expected to result in changes to existing conditions of wetlands and aquatic biota. The water quality and flow characteristics of surface water and groundwater inflows to Wetland 302 northwest of the APS facility and Wetland R to the southeast would be improved through implementation of the management plans for those two wetlands.

Construction of new LOMs would not result in direct impacts to wetlands. Indirect impacts to Wetland 302 from sedimentation would be negligible with the implementation of approved ANL-E erosion and sediment control practices.

No wetlands would be filled by construction of the CNM facility. Construction of the facility and support areas, including parking areas and LOMs, could potentially result in increased sedimentation in Wetland 302, northwest of the APS. However, implementation of approved ANL-E practices for stormwater and erosion control during construction would be expected to result in negligible water quality impacts (Section 5.1.2.2). As a result, CNM construction activities would be expected to result in only negligible impacts to wetlands and aquatic biota.

Wetland 302 is managed as mitigation for potential future wetland impacts at the ANL-E site. Issues that affect the acceptability of this wetland as mitigation include (1) quantity of water supplied to the wetland, (2) variability of flows, (3) water quality, and (4) establishment of desirable wetland species. The watershed of Wetland 302 includes a portion of the APS site, the CNM drainage area (Figure 5.1). The development and maintenance of the desired characteristics of Wetland 302 are a high priority for ANL-E. A Wetland Management Plan being developed for Wetland 302 addresses environmental factors that may potentially impact the wetland and provides management actions to mitigate potential impacts and maintain required wetland characteristics.

Under the Proposed Action, most of the surface water originating within the CNM drainage area of the Wetland 302 watershed would continue to be directed into Wetland 302. A portion of the stormwater runoff from the CNM parking area would be pumped to the south and removed from Wetland 302 watershed. However, the amount of water removed would represent a small portion of the total hydrologic input to Wetland 302. The CNM parking area would constitute about 0.7% of the watershed of Wetland 302. The effect on infiltration to groundwater would be expected to be minor, and no changes are expected in groundwater flow as a result of the proposed action (Section 5.1.2.3). In addition, the planting of native species in stormwater collection areas and other landscaped areas on the CNM site would promote the infiltration of precipitation. The proposed action would not be expected to change the function or biotic communities of Wetland 302.

As a result of the Proposed Action, the total amount of impervious surfaces within the watershed of Wetland 302 would increase from 13.1% to 14.8% of the watershed. Stormwater runoff from developed areas following storm events has the potential to increase water elevation fluctuations in wetlands within the watershed. As discussed in Section 5.1.2.2, construction of the CNM, LOM 437, and associated parking areas would result in a negligible change in the rise in surface elevation of Wetland 302 following storm events, compared with current conditions. The stormwater detention area for roof drains that would be constructed under the proposed action, as well as the removal of a portion of parking area runoff by pumping, would contribute to attenuating storm flow peaks.

Under the proposed action, most contaminants in stormwater runoff from the CNM parking area would be prevented from entering the receiving stream north of Rock Road (see Section 5.1.2.2). Most of these contaminants would be included in the stormwater runoff that would be pumped south of the CNM site and outside the watershed of Wetland 302. Less than 10% of the contaminants from the CNM parking area would remain in the runoff that enters Wetland 302. These contaminant levels would be well below benchmark levels and would not be expected to result in adverse impacts to Wetland 302.

Under the Proposed Action, the total amount of roads, parking areas, and walkways receiving deicing salt within the watershed of Wetland 302 would increase approximately 3% and would change from 8.3 to 8.5% of the watershed. The total surface area within the watershed of Wetland 302 presently receiving salt is 8.3% of the watershed. The management of Wetland 302, including minimization of salt usage on-site, will be discussed in the sitewide wetland management plan.

Although deicing salt applied to roads, parking lots, and walkways enters the wetland or aquatic environment as sodium and chloride ions, chloride has a greater impact on biota than does sodium (TRB 1991; Richburg et al. 2001) and is a more reliable measure of salt in the environment. Although the NAWQC for chloride, 230 mg/L, is considered protective of wetlands (EPA 1990), some wetland species can be affected by chloride concentrations of 168 mg/L (Wilcox 1986), potentially affecting wetland vegetation communities. Salt-tolerant species may increase in abundance while intolerant species decrease.

The concentration of chloride in runoff from the CNM drainage area currently entering the receiving stream was calculated to be between 197 mg/L and 356 mg/L, depending on soil temperature (see Section 5.1.2.2). Implementation of the Wetland 302 Management Plan would result in reduced chloride levels in the wetland, including the input from the CNM drainage area. In addition, chloride concentrations in Wetland 302 would likely be lower during the growing season. Because the sodium chloride (NaCl) brought into the CNM building may interfere with the scientific mission, it is also the intent of the program to develop alternative methods of controlling hazardous conditions caused by snow and ice. These methods would likely further reduce chloride concentrations in runoff from the CNM area. Stormwater runoff from the CNM drainage area combines with the runoff from the southwest portion of the Wetland 302 watershed. That runoff forms the receiving stream into which the CNM runoff discharges. These combined flows then enter Wetland 302. The concentration of chloride in runoff from the combined flows currently entering Wetland 302 was calculated to be between 70 mg/L and

184 mg/L, depending on soil temperature. Thus, current chloride concentrations may exceed benchmark levels and result in adverse impacts to Wetland 302.

Under the proposed action, the concentration of chloride in runoff from the CNM drainage area entering the receiving stream was calculated to be between 148 mg/L and 224 mg/L, depending on soil temperature. The concentration of chloride in runoff from the combined flows entering Wetland 302 was calculated to be between 50 mg/L and 126 mg/L, depending on soil temperature. Of the four parking alternatives evaluated, the proposed action results in the lowest chloride concentrations. Operation of the CNM under the proposed action, including parking areas, would not be expected to result in the degradation of Wetland 302 biotic communities.

Under parking alternative B, the construction of a series of bioretention swales in association with CNM facility construction would be expected to mitigate the effects of the increase in impervious surface by reducing amplitudes of stormwater flows (see Section 5.1.2.2). Bioretention swales are stormwater management features constructed to treat stormwater flows discharged to sensitive areas such as streams and other wetlands. Surface water from the CNM drainage area enters a small stream that flows into Wetland 302. The proposed bioretention swales would permit infiltration and reduce velocities of stormwater flows, as well as provide temporary retention to allow more gradual outflow of stormwater to the stream entering Wetland 302. Parking alternative B would result in a negligible change in the increase in surface elevation of Wetland 302 from current conditions. Flow attenuation would be promoted by the detention capacity of the bioretention swales and the detention area for roof runoff.

During CNM operation, most of the contaminants in stormwater runoff from the CNM drainage area, including parking areas, roadways, and roof drains, would be expected to be filtered out by the bioretention swales. Water quality characteristics of stormwater runoff entering the receiving stream from the CNM drainage area are discussed in Section 5.1.2.2. Concentrations of contaminants from the drainage area, prior to mixing in the stream, would be below water quality criteria that are protective of wetlands, including wetland communities and component biota. In addition, these concentrations would be further reduced by dilution in the receiving stream. Impacts to wetland biota due to exposure to contaminant concentrations below these benchmark values would be expected to be negligible.

Under parking alternative B, the concentration of chloride in runoff from the CNM drainage area entering the receiving stream was calculated to be between 260 mg/L and 374 mg/L, depending on soil temperature. The concentration of chloride in runoff from the combined flows entering Wetland 302 was calculated to be between 83 mg/L and 201 mg/L, depending on soil temperature. As a result, operation of the CNM under parking alternative B may exceed benchmark levels for chloride and result in adverse impacts to Wetland 302. However, as noted above, impacts to Wetland 302 from deicing salts would be addressed in the Wetland Management Plan.

Because parking alternatives C and D have the same configuration within the CNM watershed, they would have similar effects on Wetland 302 surface water elevations. The detention area for roof drains, in addition to the reduced parking area north of the CNM facility, would contribute to attenuating storm flow peaks.

Under parking alternatives C and D, the concentration of chloride in runoff from the CNM drainage area entering the receiving stream was calculated to be between 173 mg/L and 263 mg/L, depending on soil temperature. The concentration of chloride in runoff from the combined flows entering Wetland 302 was calculated to be between 59 mg/L and 146 mg/L, depending on soil temperature. The upper level, resulting from thawed soil, represents 87% of the benchmark value for chloride (168 mg/L). Operation of the CNM under parking alternatives C and D would not likely result in the degradation of Wetland 302 biotic communities; however, under thawed soil conditions, chloride concentrations would approach the benchmark level.

Comparison with Past Predictions. Stormwater from the existing main parking lot to the north of the APS discharges through a channel into the lower portion of Wetland 302 near the upstream end of Wetland 303. Before APS construction began, DOE estimated that stormwater impacts to these wetlands would be minor as a result of a planned stormwater management system that would attenuate stormwater surges and remove hydrocarbons from the parking lot runoff (*Environmental Assessment Proposed 7-GeV Advanced Photon Source*, DOE/EA-0389) (DOE 1990). A recent assessment indicated that the stormwater management system was not installed as planned and that the quality of the two wetlands was somewhat degraded near the stormwater discharge point. DOE will more thoroughly evaluate stormwater impacts to Wetlands 302 and 303 and identify in the sitewide wetland management plan actions to address the impacts.

5.1.5.3 Threatened and Endangered Species

Continued operation of the APS facility would have negligible effects on federal- and state-listed species. Listed species are not likely to use habitats present on the APS site. Habitat disturbance on the APS site, including landscape maintenance activities, would not be expected to change from past disturbance levels. Wildlife would continue to avoid areas of human activity and would continue to be disturbed by vehicle use and noise sources.

Continued operation of the APS would not adversely affect either the quantity or the quality of water in the aquifer that feeds the Hine's emerald dragonfly (*Somatochlora hineana*) habitat. The dragonfly habitat is fed by the regional Silurian dolomite aquifer that is 150 to 200 ft (46 to 61 m) thick in southeast DuPage County (Zeizel et al. 1962). The dolomite is a regional aquifer, extending in Illinois from Lake County in the north to Kankakee and Iroquois Counties in the south (Willman 1967). At the APS, the dolomite is overlain by more than 100 ft (30 m) of glacial drift material (Killey and Trask 1994). Much of this drift is fine-grained, low-permeability glacial till, with thin interbeds of discontinuous sands and gravels. Flow within the drift is predominantly lateral within the more permeable interbeds, with little or no connection to the dolomite aquifer (Quinn et al. 2001).

The ANL-E water supply is from Lake Michigan. Continued operation of the APS would not involve pumping water from the dolomite aquifer. Wastewater from the APS would continue to be treated at the ANL-E wastewater treatment plants and discharged to Sawmill Creek; stormwater would be managed to avoid impacts to surface waters.

Because of the configuration of the APS, soil or groundwater activation from operations is not expected (Section 4.2). In addition, because there is very little connection between the glacial till aquifer that underlies the APS and the dolomite aquifer that feeds the Hine's emerald dragonfly habitat, there would be no impacts on the dolomite aquifer from continued operation of the APS.

Construction and operation of the CNM facility would not affect Federal-listed species. Neither construction nor operation would adversely affect either the quantity or the quality of water in the aquifer that feeds the Hine's emerald dragonfly habitat. Neither construction nor operation of the CNM facility would involve pumping water from the dolomite aquifer. Wastewater from the CNM would be treated at the ANL-E wastewater treatment plants and discharged to Sawmill Creek. During construction and operation, stormwater would be managed to avoid impacts to surface waters. Because there is very little connection between the glacial till aquifer and the dolomite aquifer that feeds the dragonfly habitat, there would be no impacts on the dolomite aquifer from construction or operation of the CNM facility.

Although Kirtland's snake, state listed as threatened, may occur on the ANL-E site, its occurrence at the proposed CNM location would be unlikely because of the presence of preferred habitat nearby. Therefore, construction would be unlikely to adversely affect the Kirtland's snake. Construction of the CNM facility would have negligible affects on other state-listed species because they do not occur in the vicinity of the proposed CNM, and habitat for those species would not be impacted by construction. Operation of the CNM would not adversely affect Federal- or state-listed species.

5.1.6 Cultural Resources

No impacts to cultural resources are anticipated as a result of continued operations or new construction. The APS site has been surveyed, and archaeological sites were mitigated during APS construction. No historic structures would be impacted during construction of the CNM or operation of the CNM or BSL-3 facilities. The surrounding landscape of the nearby structures that were determined eligible for listing on the NRHP was not a factor in their eligibility status; therefore, CNM facility construction also would not have an adverse effect on these structures visually. Any APS activities or expansions beyond those proposed would require additional cultural resource analysis.

5.1.7 Socioeconomics

APS operations constitute an important part of ANL-E operations, which employ about 3,500 people and result in direct expenditures of about $500 million. However, these numbers represent only a small portion of employment and economic activity in the Chicago region. In DuPage County alone, personal nonfarm income in 2000 was approximately $42 billion dollars, while personal nonfarm income in the Chicago metropolitan area in 2000 was about $290 billion dollars (BEA 2002). Continuing operation of the APS with up to 500 permanent staff represents a very small fraction of the economic activity in the county and region.

Construction of the CNM facility would employ about 50 construction workers. This employment would have negligible economic impact on the region. Income for persons employed in the general construction industry was $2.2 billion for DuPage County and $12.7 billion for the Chicago metropolitan area in 2000 (BEA 2002).

5.1.8 Human Health

5.1.8.1 Continued Operations

Radiological Effects

Radiological effects on human health associated with continuing operations would be well below the regulatory dose limits for APS operations. Continuing operations would not involve modifications to the designs of the APS primary components and would not affect their operations. Therefore, potential radiation doses to the APS workers, beamline users, on-site workers, and off-site public would stay at the same levels as discussed in Section 4.9.1. In summary, under normal conditions, the estimated maximum radiation doses to the APS workers, beamline users, on-site workers, and off-site public would be less than 100, 5.8, 1.6, and 3.0 mrem/yr, respectively. The actual exposure levels would be much smaller than the estimated values. Under off-normal conditions, the impacts would be limited to the APS workers and the beamline users. Potential radiation doses associated with the MCI, which involves a beam loss within the LEUTL, would be about 218 mrem for an incidence duration of one minute. Potential doses to on-site workers and off-site public would be less than 0.066 mrem. In reality, a beam loss is unlikely, and even if it occurs, would last much shorter than one minute. Therefore, potential impacts would be much less than 218 mrem and 0.066 mrem. See Section 4.9.1 and Table 4.3 for conversion of doses presented throughout this section to human health risks.

Comparison with Past Predictions. Before APS operations began, potential radiation exposures to various receptors under normal and off-normal conditions were estimated and presented in a NEPA document, *Environmental Assessment, Proposed 7-GeV Advanced Photon Source*, DOE/EA-0389 (DOE 1990). Table 5.3 compares the preconstruction predictions made for the 1990 EA with the updated estimates presented in this EA. The updated estimates are either very close to or lower than the original estimates. The small differences in exposures to direct external radiation for APS workers, beamline users, on-site workers and the off-site public are due to minor changes in assumed exposure distances. The dose to the off-site public from air emissions is much lower in this EA because APS operations have changed such that production of air activation products is greatly reduced.

TABLE 5.3 Comparison of Radiation Exposures Presented in This EA with Those Reported in the 1990 APS EA[a]

Receptor/Source or Event	This EA	DOE 1990[b]
Normal Conditions		
APS workers/external radiation	100 mrem/yr	120 mrem/yr
Beamline users/external radiation	5.8 mrem/yr[b]	6 mrem/yr[c]
On-site workers/external radiation	1.6 mrem/yr[d]	1.5 mrem/yr[d]
Off-site public/external radiation	6.25 mrem/yr[e]	6 mrem/yr[e]
Off-site public/air emission	0.007 mrem/yr[f]	0.06 mrem/yr[f]
Off-Normal Conditions		
APS workers/MCI	218 mrem[g]	183 mrem[h]
On-site workers/MCI	0.066 mrem[g]	<1.0 mrem[h]

[a] Radiation exposures listed in this table are estimated maximum exposures. The 1990 EA was prepared prior to APS construction and operation (DOE 1990).

[b] Radiation dose corresponds to a distance of 66 ft (20 m) from the storage ring and an exposure duration of 2,000 h/yr.

[c] Radiation dose corresponds to a distance of 46 ft (14 m) from the storage ring and an exposure duration of 2,000 h/yr.

[d] Radiation dose corresponds to a distance of 460 ft (140 m) from the storage ring and an exposure duration of 2,000 h/yr.

[e] Radiation dose corresponds to the nearest fence line 460 ft (140 m) from the storage ring and an exposure duration of 8,000 h/yr.

[f] Radiation dose corresponds to the nearest fence line with the maximum air concentration.

[g] The MCI assumed in this report involves the loss of an electron beam in the LEUTL.

[h] The MCI assumed in DOE (1990) involved the loss of a positron beam in the insertion device. The listed dose of 1,170 mrem for an APS worker was found to be a mistake by checking the source document (Moe 1990) that provides this information. The dose to the APS worker should have been 183 mrem instead.

In the 1990 EA, the MCI was based on a scenario in which a positron beam was lost and hit the walls of an insertion device. Later study has shown this is an impossible scenario because the beam would never be able to travel that far. With the inclusion of the LEUTL in the APS systems, the revised MCI is based upon a scenario in which the electron beam is lost within its enclosure, which is the scenario considered in this EA.

Nonradiological Effects

Normal Conditions. Under normal operational conditions, potential impacts to human health would be limited to potential physical hazards for the APS workers and beamline users conducting research activities, which would not extend beyond the laboratory areas. The potential release of hazardous materials to the environment through air emissions and wastewater discharge would be very small.

Potential impacts to the APS workers and beamline users would result from chemical exposures and physical injuries. Chemical exposures would occur through the inhalation, ingestion, and dermal absorption pathways; physical injuries would result from accidents during conduct of experiments under special temperature and pressure conditions with or without the use of special equipment.

Engineering designs were incorporated into the APS facilities to reduce potential air dispersion of chemical vapors and powders, thereby substantially lowering potential chemical exposures through the inhalation pathway. Such designs include the installation of fume hoods, incorporation of an air ventilation system to allow directional air flow to the laboratory, and the installation of HEPA filters to eliminate airborne particulate matter. Ingestion of chemicals would be unlikely to occur with the adoption of good hygiene practices. Dermal absorption of chemicals would be reduced to a minimum by wearing personal protective equipment (PPE), such as a laboratory coat and gloves, while conducting experiments. Potential physical hazards would be reduced to a minimum by incorporating safety measures into the experiment designs and by following safe handling procedures during the experiments. Under these conditions, potential impacts to workers and beamline users would be very small and would not result in deleterious effects to human health.

Implementation of an experiment safety review is the first step in integrating safety into management activities and would minimize the occurrence of laboratory accidents and reduce potential chemical exposures and physical hazards. To use the APS beamlines for research activities, researchers are required to submit proposals detailing experimental purposes, procedures, materials, and equipment that would be used. The proposals are reviewed by a committee with expertise in the related field. The experiment safety review has the following functions: (1) to identify and analyze hazards associated with planned experiments; (2) to define safety envelopes by selecting, specifying, and authorizing required hazard controls; (3) to perform experiments within the defined bounds of safety envelopes; and (4) to evaluate the safety performance of completed experiments to provide continuous feedback for improving safety. Under the oversight of ANL-E, each CAT management team would assume responsibility for evaluating the submitted proposals and ensuring that the experiments conducted at its beamlines and in its LOM space by CAT personnel, their collaborators, and independent investigators do not present unacceptable risks. A proposal would not be approved until all necessary safety measures for addressing the potential hazards identified by the review committee were incorporated into the experiment design. After approval of the proposal, the researchers would be required to take safety training courses defined in the selected safety envelopes before conducting the experiments. During the experiments, specific hazard controls according to the experiment design would be installed, and material and equipment safety handling procedures to reduce potential accidents would be closely followed.

The safety envelopes (APS 2000) cover potential hazards related to the conduct of experiments at the APS under the following situations: (1) at ambient temperature and pressure; (2) at cryogenic temperatures using liquid nitrogen; (3) at high temperatures involving the use of an electric furnace; (4) using Class 3 or 4 laser powers; (5) involving high-pressure systems; (6) using chemicals that are carcinogens, flammable liquids, oxidizers, corrosives, reactives, or compressed gases; (7) using infectious microorganisms; (8) using radioactive materials; and (9) any combination of the above situations. Standard precautions for personnel protection, standard laboratory operating procedures, safety training courses, and shipping guidance for experiment samples are specified in each envelope. The SOPs provide guidance on the safe use of specific chemicals and equipment and on the safe conduction of specific experimental procedures, such as etching, cleaving, and polishing. Additional SOPs related to research activities that are not covered under the current APS operation would be developed as needed in the future.

Designated safety coordinators in each LOM are responsible for monitoring experimental activities and assisting the beamline users in normal and emergency conditions. Their existence provides an additional layer of protection for human health and the environment.

Off-Normal Conditions. Typical laboratory accidents could occur; however, the primary impacts from such accidents are expected to be limited to the laboratory workers and beamline users involved in the experiments. The potential release of chemicals, if any, to the environment are expected to be very small and would be of short duration because (1) the amount of chemicals handled in the experiments would be small, (2) the engineering designs of the facilities would control and reduce the release, and (3) the accidents would be mitigated quickly by designated safety coordinators and by the ANL-E emergency response system. Therefore, potential impacts to other on-site workers and the off-site general public are expected to be negligible. The safety measures discussed under "Normal Conditions" are designed to reduce the frequency of such accidents. In fact, since the beginning of its operation, no major accident has occurred in the APS facilities.

5.1.8.2 Enhanced Operations: BSL-3 Operations

Currently, the BioCARS facility is used for BSL-2 research, although it was constructed and furnished for BSL-3 research as well. For the Proposed Action, BSL-3 research would be conducted in this facility. Research activities in the BSL-3 facility would involve indigenous or exotic agents that may cause serious or potentially lethal disease as a result of exposure by the inhalation route if released to the environment. Further descriptions of the activities and impacting factors associated with the BSL-3 facilities are provided in Appendix A.

Normal Conditions

The unique concern of potential human heath risks associated with the operation of a BSL-3 facility are the injuries and illnesses associated with handling infectious substances by the laboratory workers and the contraction of illnesses by other on-site workers and the off-site general public through contact with infected laboratory workers or through the environmental release of infectious substances. Although the BSL-3 facility at the APS would not be required to register with the CDC because there is currently no plan to use select agents in the facility, its operation would be in accordance with CDC guidelines and the safety requirements of ANL-E as established by the Institutional Biosafety Committee (IBC). The type of potential human health risks associated with the operation of the existing BSL-3 facility would be the same type as that associated with other CDC-registered laboratories, such as hospital and medical laboratories. For APS facilities, however, the potential risks of these types of adverse effects would be lower because the APS facility would not be a large-scale biological research or production facility; therefore, the quantity of each organism would be limited. Furthermore, the APS facility would be used mainly for sample preparation prior to structure examination by photon beamlines; cultivation of microorganisms would be conducted at the home institution of the beamline user and sent to the APS. The quantities of the microorganisms to be used at any time in the BSL-3 facility would be small, limited to less than 10 mL.

The incidence of acquired infections associated with operations in CDC-registered laboratories has been extremely low since the implementation of CDC-developed guidelines issued in 1974. A recent bibliographic database (Collins 2000) based on reports starting from about the beginning of the 20th century to August 2000 reveals substantial reductions in laboratory-acquired infections reported in the 1990s. There is a particularly notable lack of reported cases in the literature in the United States in the last 10 years. Therefore, the potential human health impact associated with routine operation of a BSL-3 facility would be best characterized as minor. A detailed description of the safety controls of the BSL-3 is included in Appendix A.

Potential pathways for infectious agents to escape the BSL-3 facility and cause human health impacts are direct transmission, vector-borne transmission, vehicle-borne transmission, airborne transmission, and water-borne transmission. By following the established agent-handling procedures; operating the facility in accordance with all safety requirements, including implementation of experiment safety review and safety training courses as described in Section 5.1.8.1; and conducting regular and thorough facility maintenance activities, potential human health impacts would be reduced to a minimum. The following paragraphs discuss the potential transmission pathways and the respective mechanisms for their elimination.

Direct Transmission. Direct transmission requires a worker to be exposed to an infectious agent through inhalation, ingestion, or dermal contact (e.g., through cuts in the skin). Using biosafety cabinets, following specific agent-handling requirements, and implementing facility safety procedures would minimize the likelihood of worker exposure. Although laboratory-associated infections could occur and an infected worker could become a carrier for the agents and expose other people through direct transmission, such events would be considered as abnormal because of their low frequency of occurrence. Discussions on off-normal events are provided in the “Off-Normal Conditions” section below.

Vector-Borne Transmission. With an effective pest control program, the possibility of human exposure through insects and rodents would be severely limited. Because of the location and design of the BioCARS facility, entry by pests is extremely unlikely. The ANL-E PFS administers a contract with an exterminating company. They are on-site once a week (on Tuesdays), and they cover certain areas on a routine basis. In addition, they can be called in on Tuesdays to cover any areas that need service that are not part of their regular coverage. Service for the APS area is obtained by calling the building administrator, who then makes contact with PFS for the work that is needed.

Vehicle-Borne Transmission. Vehicle-borne transmission could result from contamination of clothing, skin, hair, or any other material that leaves the BSL-3 facility. According to the SOP of BioCARS, all potentially contaminated waste materials would be captured, properly treated, packaged, and shipped to an outside vendor for final disposal. All facility personnel would be required to wear personal protective equipment (PPE), if necessary, while conducting research activities in the facility, and they would remove and leave this protective equipment behind before departing the facility. By following these guidelines, the potential for vehicle-borne transmission would be substantially reduced.

Air-Borne Transmission. All air leaving the BSL-3 facility would be HEPA-filtered. With the high efficiency (99.97%) of HEPA filters, the number of microorganisms in their vegetative state in the exhaust air would be nearly zero. Many environmental factors, such as ultraviolet light, dehydration, high or freezing temperatures, and free oxygen, would kill the microorganisms and further reduce their existence. A mathematical prediction of the potential survival of microorganisms in the environment is estimated to be about 0.01% (Mitscherlich and Marth 1984). With the filtration power of HEPA filters and the low survival rates of microorganisms in the ambient environment, the possibility of air-borne transmission is very low. To maintain the filtration function, the HEPA filters would be routinely checked and replaced.

Water-Borne Transmission. The wastewaters discharged from the BioCARS facility would not contain pathogenic microorganisms. Standard practices at BioCARS require that waste liquids generated from BSL-2 or BSL-3 research be accumulated, disinfected, and managed through ANL-E’s waste management program. Contaminated liquids are prohibited from being flushed down laboratory sink drains, and all discharges to the ANL-E wastewater treatment system would be in compliance with pertinent ANL-E protocols. Water from the laboratory sink drains of the BioCARS facility (e.g., glassware cleaning solutions) would be discharged to the ANL-E industrial wastewater treatment plant, where it would be treated and discharged through Outfall 001B. The flow of Outfall 001B would be combined with the flow of Outfall 001A for sanitary wastewater and discharged into Sawmill Creek approximately 3,500 ft (1,100 m) south of the wastewater treatment plant (Outfall 001).

The experience of the U.S. Department of the Army (Army) at its Biological Defense Research Program (BDRP) facilities over several decades provides further insight into the potential for laboratory-acquired infection. The final programmatic environmental impact statement (PEIS) prepared by the Army to evaluate its BDRP facilities (Army 1989) states that since 1976, there have been no occurrences of overt disease in laboratory workers handling infectious organisms; although in 1980, one focal infection with *F. tularensis* occurred at the site of a puncture wound. The BDRP PEIS also estimated laboratory-acquired infection rates for its facilities for different biocontainment levels (roughly equivalent to the CDC BSL levels) over different periods of time. For its BSL-3 equivalent laboratory operations, the estimated rate was 1 infection per 500,000 person-hours worked from 1960 to 1962. For its BSL-4 equivalent laboratory operations, the estimated rate was 1 infection per 1,000,000 person-hours worked from 1960 to 1969. These infections included subclinical infections and mild illnesses where hospitalization was not required (Army 1989). Assuming the workers worked an average of 2,000 hours per year, the above figures converted to a rate of 1 infection per 250 person-years for BSL-3 equivalent laboratory operations, and 1 infection per 500 person-years for BSL-4 equivalent laboratory operations. With much fewer working hours, as would be the case for most APS BSL-3 facility users (typically two to three days per experiment and an expected maximum of two experiments per year), the infection rate would be further reduced.

The BDRP PEIS also estimated the rate of public infection resulting from its laboratory operations to be less than 1 per billion person-years and the risk of death to a laboratory worker to be 1 per 200 million person-years for the Defensive Period (1970 to 1989). The risk of death to a laboratory worker during the Offensive or Weapons Period (1954 to 1964) was estimated to be about 5 orders of magnitude higher, 1 per 2,000 person-years. Potential risks involving the BSL-3 facilities at the APS would be much lower than the risks reported for the Army facilities. This would be because of the lower volume of infectious agents that would be handled at the APS facilities than that handled at the Army BDRP laboratories, the shorter duration of the experiments, the fewer experimental procedural steps, and the lower level of research activities that would be conducted at the APS facilities compared with the level of research activities conducted at the Army facilities during the Defensive and Offensive Weapons Periods.

Experience with biological research laboratories at ANL-E spans several decades; the Biosciences Division currently has BSL-1 and BSL-2 laboratories in operation. On the basis of information provided by the ESH Coordinator of the Biosciences Division (Essling 2002a-c), no exposure or infection associated with its laboratory operations was reported in the past 10 years. Although ANL-E does not currently operate a BSL-3 laboratory, ANL-E has the expertise to evaluate and inspect the BioCARS BSL-3 facility and to make suggestions to improve the SOP. This expertise, along with the fact that the experiments would be conducted by experienced BSL-3 workers, would ensure that the BSL-3 facilities would be operated safely and that potential impacts to human health and the environment would be controlled and minimized.

Off-Normal Conditions

The potential for laboratory-acquired infection is considered an accident because of the low frequency of exposures. According to the CDC (1999), because control of infection in laboratories has achieved such a high level of sophistication and because of common acceptance of standard laboratory practices, laboratory-acquired infections are expected to be virtually nonexistent today. The CDC statement is supported by the compilation of microbial disease reports by Collins (2000), which shows that in the last 10 years, no laboratory-acquired infection was reported in the United States. The low risk numbers estimated by the DA in the final PEIS regarding the operations of its laboratories under the BDRP (see discussions in the Normal Conditions Section) further support the CDC statement.

Although the frequency of accidents is very low, they do still occur. The primary routes of exposure are through unintentional injections by sharps, dermal contact through a cut wound in the skin, and inhalation of aerosols generated by normal laboratory equipment. The potential infection associated with such accidents could be reduced or stopped by prompt treatment with antibiotics, antiviral drugs, or other appropriate medical strategies.

Low-probability events that involve the generation of heat, fire, and wind could actually result in the microorganisms being killed. Consequently, some catastrophic events, such as earthquakes, fires, explosions, and airplane crashes, were viewed to have the potential of reducing the release of microorganisms. The low probability of such disastrous events, combined with the low probability of such an event's occurring during an activity when microorganism containment would be vulnerable, renders potential exposures through such events unlikely to occur.

An existing emergency power generator is available to provide power for the biosafety cabinets and the exhaust fans. The experimenters would be required to be present at all time when BSL-3 experiments were being conducted; thus, the risk of theft or sabotage would be very small.

5.1.8.3 Enhanced Operations: Construction and Operation of the CNM Facility

Physical injuries or even fatalities could occur during the construction of the proposed CNM facility. However, CNM construction injury rates are expected to be less than one-tenth that experienced by the general construction industry given the aggressive safety program in place at ANL-E. The current total injury rate in nonresidential building construction is 7.6 injuries per 100 workers per year. The total injury rate for contracted work at the APS during the past five years has been 0.0 (no lost-time injuries), during which more than $20 million in contracted work has been completed.

Operation of the CNM would not involve modifications to the designs of the APS components (LINAC, synchrotron, and storage ring) and would not affect their operations. The Proposed Action would involve construction of new beamlines and LOMs that would be designed in accordance with the APS shielding policy so that individual radiation exposures would be maintained at about the current levels. However, because the Proposed Action would result in hiring additional workers and attracting more beamline users (according to Glagola [2002], the number of users projected for 2007 would be twice as many as that in 2001), collective exposures of these receptors would increase proportionally. Discussions on individual radiation exposures are provided in Section 5.1.8.1 under “Radiological Effects.”

The CNM facility would support the research activities related to the study of material behavior at the nanoscale and include laboratories for fabricating and characterizing the materials. Depending on the proposed experiments by beamline users, a wide variety of chemicals and equipment would potentially be used in the study. In addition, some biological agents (BSL-1 or 2) would potentially be introduced. Appendix B provides more detailed discussions on the experimental activities associated with the CNM facility. The types of materials used in the CNM facility would potentially be diverse, and so would the types of potential hazards associated with their uses. The amount of materials used in the CNM facility would be small, thereby reducing the degree of potential hazards. The safety of human health associated with operations of the CNM facility would be ensured by (1) incorporating engineering designs into the new facilities to reduce the potential release of hazardous substances, (2) implementing the experiment safety review to identify potential hazards before conduct of the experiments and to incorporate safety measures into experiment designs, and (3) providing safety training courses to the beamline users and implementing the requirement to conform with the established safe handling procedures during the conduct of experiments to reduce the occurrence of accidents. Potential routes of human exposure to hazardous substances are inhalation, ingestion, and dermal absorption, as discussed in Section 5.1.8.1 under “Nonradiological Effects.” Therefore, the effectiveness of reducing human health risks through engineering designs, experimental safety review, and material safe handling procedures provided in that section are also applicable to the CNM facility.

On the basis of the discussions in Section 5.1.8.1, potential human health impacts associated with CNM operations would be negligible.

5.1.9 Waste Management

In accordance with standard procedures at the BioCARS facility, all liquid waste from BSL-3 level research would be decontaminated before collection, shipment, and disposition through the ANL-E waste management program (ANL 2000). All solid biohazardous wastes would also be decontaminated before management and shipment for further off-site treatment and disposition. Depending on the chemical components in the wastes and the chemical components used for disinfection, the resulting waste may be classified as hazardous due to chemical composition and would require management as such. Biological wastes generated at the CNM would be similarly managed. Operation of the BSL-3 facility and the CNM would not generate any waste required to be managed as medical waste under Illinois medical waste regulations.

Additional activities at the CNM would result in an increase in waste generation from the APS. While waste quantities and waste types are not known, the types of work carried out are similar to the types of work carried out in other areas of the APS and the ANL-E site and would be handled by ANL-E WMO. Wastes can be expected to be generated in relatively small volumes (e.g., grams, liters, or gallons per month), and existing waste management capacities at ANL-E can be expected to easily absorb increases to ANL-E waste volumes from CNM-related activities (see Table 5.4).

5.1.10 Transportation

No upgrades to transportation or transportation networks are required for continued operation of the APS facility. Materials used in BSL-3 research activities would be transported in accordance with all applicable regulations. A maximum of a 5% increase in traffic could occur if the CNM office space reaches maximum capacity of 150 people at one time (60 regular staff and up to 90 new off-site users). The majority of waste generated at APS can be combined with regular ANL-E waste shipments. However, BSL-3 wastes (estimated on the order of mg and mL quantities per year) would be transported separately (as indicated in Section 5.1.9 and Appendix A).

Parking spaces now occupying areas included in the footprint of new facilities would be replaced. Construction of the CNM facility would not interfere with the transportation requirements of other ANL-E workers or of local area residents. Construction traffic would access the APS site from existing entrances to the site. Temporary congestion at entrance gates may be experienced. All roads are adequate for transportation of both workforce and materials. Truck transport of bulk materials for construction at the APS site would not impact local area residents accessing their homes from Lemont Road, since this roadway is already used heavily for materials transport.

TABLE 5.4 Projected Hazardous Waste, Radiological Waste, and Wastewater Generated Annually by ANL-E and the APS under the Proposed Action

Waste Category	Projected ANL-E Quantity (gal)	Projected APS Quantity (gal)	Increase above Existing Levels (gal)
RCRA hazardous waste	11,248	1,711	1,200
HSWA universal hazardous waste	13,682	50	10
Low-level radioactive waste	31,933	5.25	0.25
Wastewater	321.6 million	57.2 million	0.350 million

5.1.11 Utilities and Services

No major changes in utilities services would be required for construction and operation of the CNM. The APS currently consumes approximately 25 MW of power annually. The current CNM design would draw another 3.5 MW. ANL-E, including the APS, implements energy conservation measures during times of high electricity demand.

5.1.12 Environmental Justice

For two reasons, no disproportionately high and adverse human health or environmental impacts to minority and low-income populations are anticipated under the Proposed Action during continued APS operation, construction of the proposed CNM, or operation of the CNM. First, none of the impacts of operations of the APS or proposed enhancements would have high or adverse health or environmental impacts. The impacts of the Proposed Action are limited to within site boundaries or uninhabited areas close to the ANL-E southern boundary. Second, the populations immediately surrounding the ANL-E site cannot be considered minority or low-income, on the basis of national and Illinois thresholds for minority and low-income populations (see Section 4.13). While the greater Chicago area, within 50 mi (80 km) of ANL-E is ethnically and racially diverse, with areas with a high proportion of minority peoples, these areas would not be adversely affected by APS operations.

5.2 EFFECTS OF NO ACTION

The No-Action Alternative is the continued operation of the APS without enhanced operations, such as the construction and operation of the CNM, and without BSL-3 research at BioCARS. This section summarizes the conclusions regarding the environmental impacts of continued operation contained in Section 5.1.

Soil erosion at the APS site is controlled on this relatively flat area by landscaping, lawn maintenance, and limiting transportation to paved roadways and parking lots. Continued operation of the APS facility has little impact on soils due to erosion.

The APS facility does not include sanitary or laboratory wastewater treatment facilities; these liquid wastes are collected, treated, and discharged by ANL-E (see Section 4.3, Cumulative Impacts). Surface water quality in streams and wetlands adjacent to the APS facility is maintained by detention basins that remove sediments from site runoff. Impacts from sediments on local area streams during continued APS operations would be minor. Continued operation of the APS would not impact groundwater. Activation of groundwater from APS operations is not expected, because of the configuration of the APS.

Under the No-Action Alternative, criteria air pollutant emissions from the APS would remain less than 1% of total ANL-E releases. The APS would continue to have no impacts on adjacent areas from the noise of operations.

Continued operation of the APS would be consistent with existing land use at ANL-E. Recreational and aesthetic qualities of adjacent areas of the Waterfall Glen Forest Preserve would not change from current conditions.

Impacts to ecological resources from operation of the APS facility under the No-Action Alternative would be similar to those for continued operations. Habitat disturbance and management activities on the APS site would not change from past disturbance levels. Wildlife would continue to avoid areas of human activity and would continue to be disturbed by vehicle use and noise sources. Therefore, operation of the APS facility under the No-Action Alternative would have negligible effects on terrestrial habitats, wildlife, wetlands, aquatic biota, and threatened and endangered species.

No impacts to cultural resources are anticipated as a result of continued operation of the APS.

The operations of the APS is an important part of ANL-E operations, which employ about 3,500 people and result in direct expenditures of about $500 million.

Potential human health impacts for the No-Action Alternative are expected to be the same as those for the Proposed Action. In general, radiation exposures would be well below regulatory standards set to protect human health. The possibility for acquired-infection associated with operation of the BSL-1 and BSL-2 facilities is expected to be very small so that potential biological effect is characterized as minor. Chemical risks and physical injuries are expected to be limited to the laboratory workers or beamline users. The possibility of accidents is expected to be very small because of the implementation of safety measures. Detailed discussions on the potential human health impact are provided in Section 5.1.8.

Waste management activities would continue to meet all regulatory requirements. Pollution prevention and waste minimization practices would continue to reduce the amount of waste generated.

Transportation conditions and utility usage would remain the same under the No-Action Alternative.

No disproportionately high or adverse impacts to minority or low-income populations are expected because of continued operations of the APS facility under the No-Action Alternative, because when compared with state averages, no such populations occur in the immediate vicinity of ANL-E.

5.3 CUMULATIVE EFFECTS OF THE PROPOSED ACTION

Under the proposed action, the small increase in wastewater effluents discharged to the ANL-E sanitary and laboratory wastewater treatment plants, combined with other ANL-E effluents at Outfall 001, is expected to have little cumulative effect on the water quality and biota of Sawmill Creek and the Des Plaines River. Although outfall effluents occasionally exceed

NPDES permit limits, the proposed action would not be expected to change overall surface water quality at the ANL-E site.

Criteria air pollutant releases from the APS under the proposed action would be very small. Because they represent a small portion of total ANL-E releases, cumulative impacts from air pollutant releases at the APS would be expected to be negligible. Noise generated by construction would be cumulative with noise from aircraft traffic, local road traffic, and the model airplane field in the Waterfall Glenn Forest Preserve adjacent to the APS site. Together this noise may be a temporary annoyance to other users of the forest preserve.

The Proposed Action would make a negligible contribution to cumulative effects on ecological resources at the ANL-E site. Habitat loss because of implementation of the Proposed Action would make a negligible contribution to overall habitat loss in the region from development. Planting of native species on the CNM site, combined with other landscaping with native vegetation at ANL-E, would result in greater biodiversity and habitat quality of developed areas of the site.

The APS facility is only one of many facilities at ANL-E that release airborne radioactive emissions or produce penetrating radiation as part of their operations. APS facility releases are a small fraction compared with the total emission from all ANL facilities. The maximum perimeter dose to a hypothetical off-site individual from APS emissions was estimated to be about 1.1% of the maximum perimeter dose from all ANL emissions. These doses are much lower than the 10 mrem/yr dose limit set for air emissions. The proposed action would not be expected to increase the dose to off-site individuals or exceed the dose limit when combined with other ANL-E emissions.