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Environmental Assessment for Decontamination and Decommissioning of the Zero Power Reactors (Building 315) at Argonne National Laboratory, Argonne, Illinois

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U.S. Department of Energy
Argonne Site Office
Argonne, Illinois

DOE/EA-1519

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Acronyms and Abbreviations

ANL	Argonne National Laboratory
ASA	Auditable Safety Analysis
CFR	Code of Federal Regulations
CH	contact-handled
cm	centimeter
DOE	U.S. Department of Energy
EA	environmental assessment
ESH	Environment, Safety and Health
HEPA	high-efficiency particulate air
LLW	low-level radioactive waste
µg	microgram
MACE	Melt Attack and Coolability Experiments
MCCI	Melt Coolability and Concrete Interaction
mrem	millirem ($1/1000^{th}$ of a rem)
NEPA	National Environmental Policy Act
NTS	Nevada Test Site
OSHA	Occupational Safety and Health Act
PCBs	polychlorinated biphenyls
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act
ZPR	zero power reactor

Environmental Assessment for Decontamination and Decommissioning of the Zero Power Reactors (Building 315) at Argonne National Laboratory, Argonne, Illinois

1.0 Background

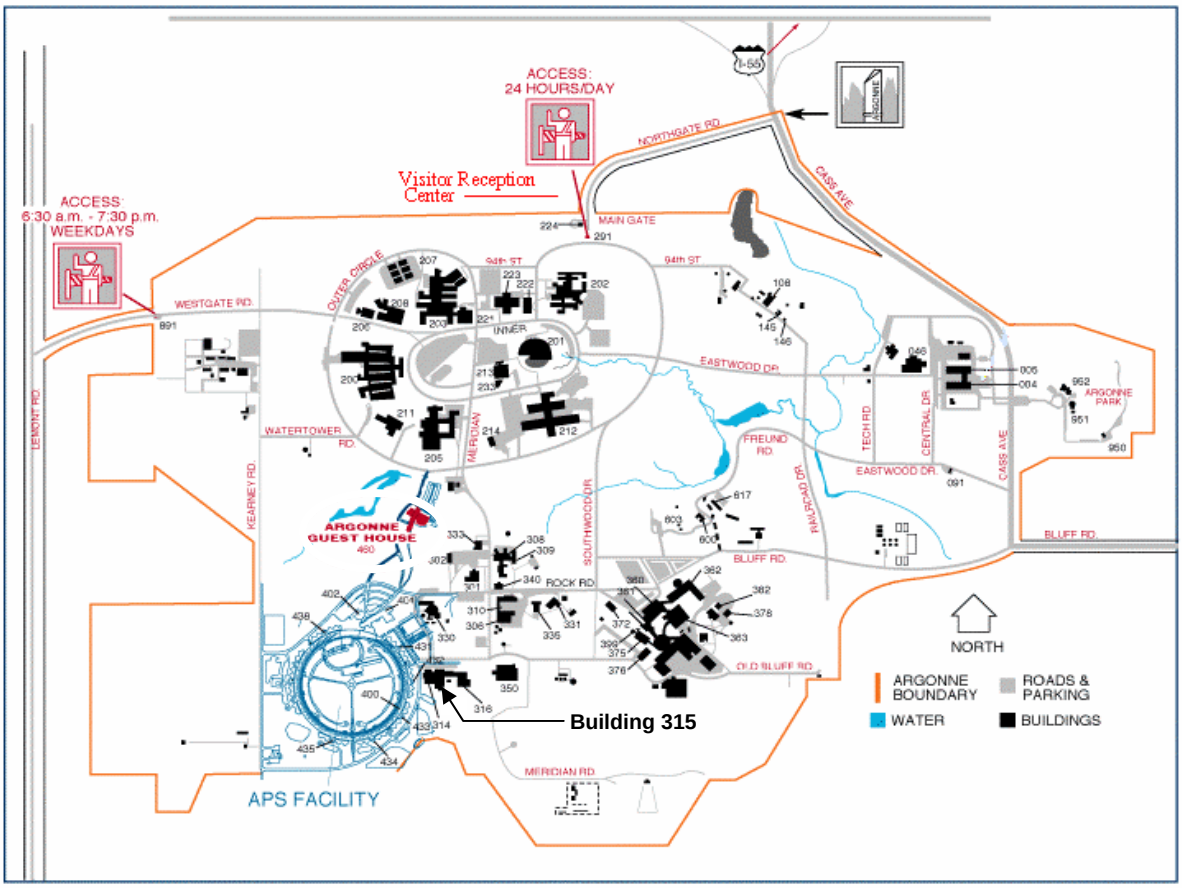
The U.S. Department of Energy (DOE) is proposing to decontaminate and decommission the Zero Power Reactor (ZPR) facilities located in Building 315 at Argonne National Laboratory (ANL) in Argonne, Illinois (Figure 1-1).[1] The proposed action would occur in two phases: ZPR-6 would be the focus of Phase I and ZPR-9 would be the focus of Phase II. DOE has prepared this environmental assessment (EA) in accordance with the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321 *et seq*., and applicable regulations (Title 40, Code of Federal Regulations [CFR] Parts 1500 – 1508 and 10 CFR Part 1021).

This section describes the reactors and their current status. The primary source for the information in this section is the *Characterization Report for the ZPR-6 and ZPR-9 Reactors* (ANL 2002).

1.1 Facility History

Building 315 was completed in 1962 and contained two cells for holding ZPR-6 (Cell 5) and ZPR-9 (Cell 4). Figure 1-2 is a diagram of ZPR-6 and ZPR-9 in Building 315. These reactors were constructed to develop further knowledge and understanding of the physics of fast reactors. ZPR-6 (shown in Figure 1-3), also called the Fast Critical Facility, focused on fast reactor studies for civilian power production. ZPR-9 was used for nuclear rocket studies and fast reactor studies. Both reactors operated from the mid-1960s until 1982 when they were shut down. The operating power level of the ZPRs was usually restricted to well below 1,000 watts, resulting in low levels of radioactivity.

[1] Until recently, ANL was referred to as Argonne National Laboratory – East, to distinguish it from a sister laboratory located in Idaho Falls, Idaho. The Idaho laboratory has since become part of the Idaho National Laboratory. Argonne National Laboratory – East is now referred to simply as ANL.



Source: ANL 2004a.

Figure 1-1. Map of Argonne National Laboratory, Argonne, Illinois

The control panel for ZPR-6 was removed in 1997. The control panel for ZPR-9 has also been removed and the ZPR-9 reactor has been partially dismantled.

1.2 Facility Description

The ZPR-6 and ZPR-9 facilities are located in blast-resistant, highly reinforced concrete cells. Each cell measures 12 meters (40 feet) by 9 meters (30 feet) and has a height of 9 meters (30 feet). Between each cell and its control room are 1.5 meters (5 feet) of reinforced concrete. The other three sides of the cells, the floors, and the ceilings have 1.2 meters (4 feet) of reinforced concrete as shielding. Access to each cell is from the respective control rooms

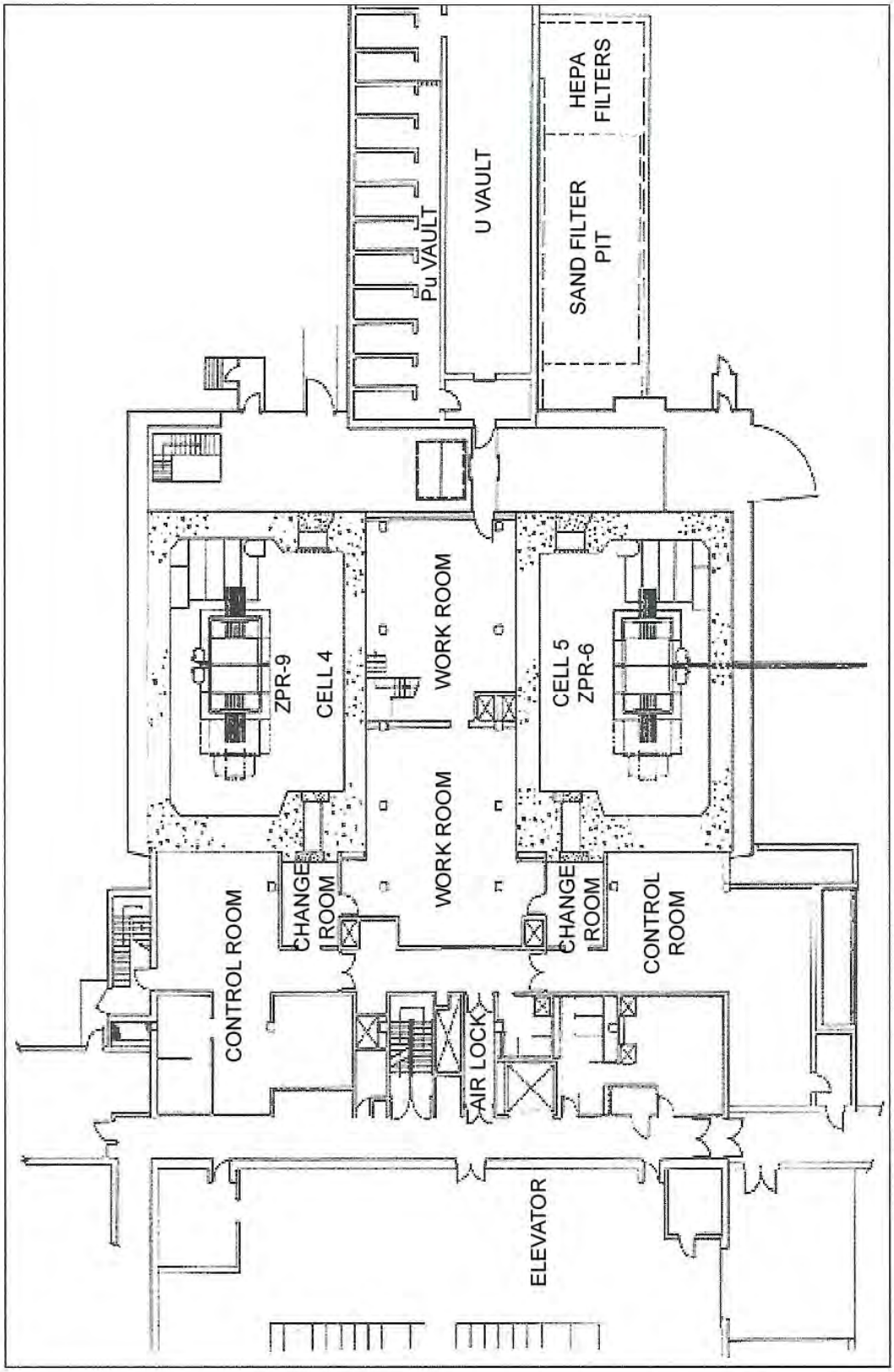


Figure 1-2. Diagram of ZPR-6 and ZPR-9 First Floor and Adjacent Rooms

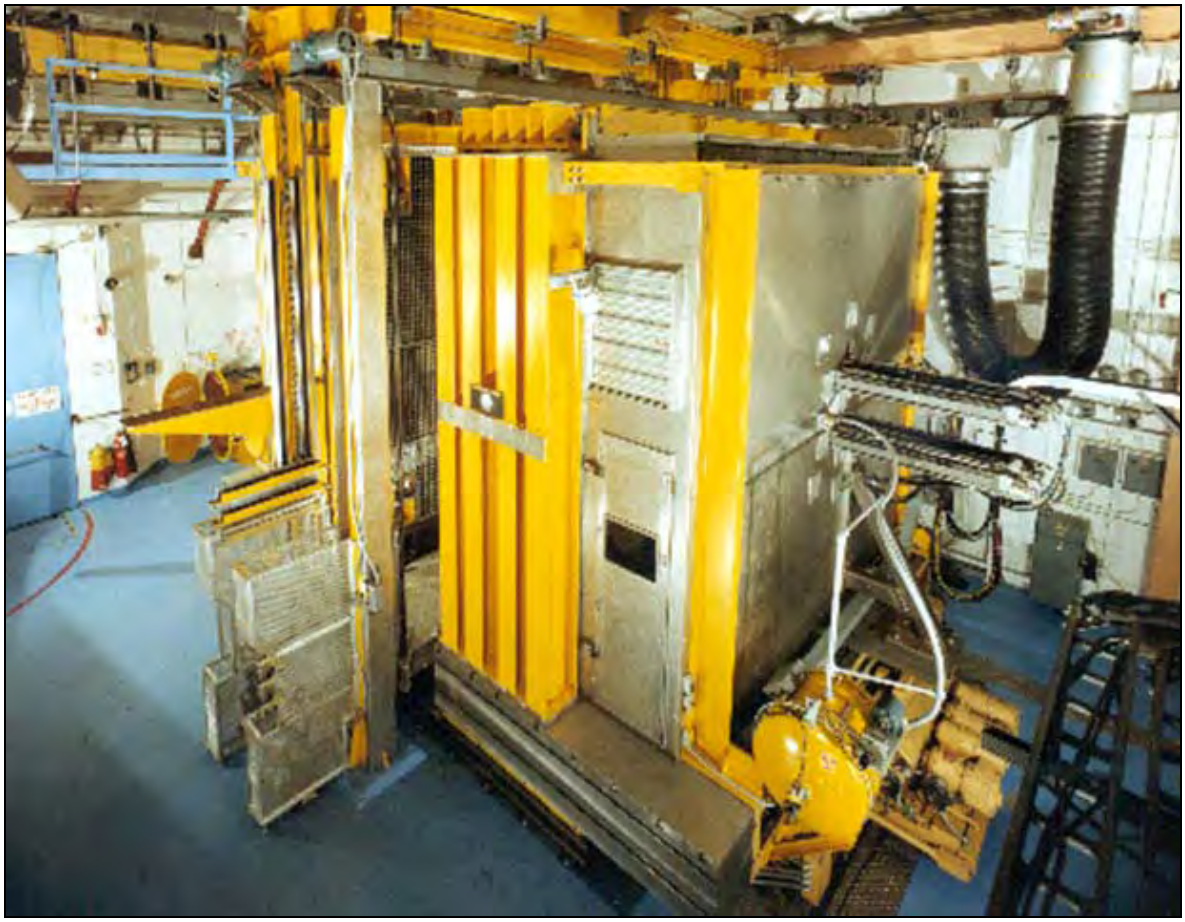


Figure 1-3. View of ZPR-6 and Associated Systems

through an airlock 2.5 meters (8 feet) long. Both ends of the airlock are fitted with a thick, steel-plated concrete blast door. An emergency escape chute is located in the south corner of each cell; each chute leads to a room on the service floor below.

In 1967, the reactors were converted for plutonium use. At that time, a vault measuring 21 meters (69 feet) by 16.8 meters (55 feet) was added to the south wall of Building 315 for uranium and plutonium storage (see Figure 1-2). This vault is not part of the proposed action, is currently being used by ANL's Special Materials Group, and will be used for the foreseeable future.

A sketch of the original ZPR-6 and ZPR-9 design is shown in Figure 1-4. The original reactors were essentially identical except that ZPR-9 originally had a smaller matrix assembly. The ZPR-6 assembly was later enlarged to accommodate plutonium loadings. ZPR-6 and ZPR-9 are

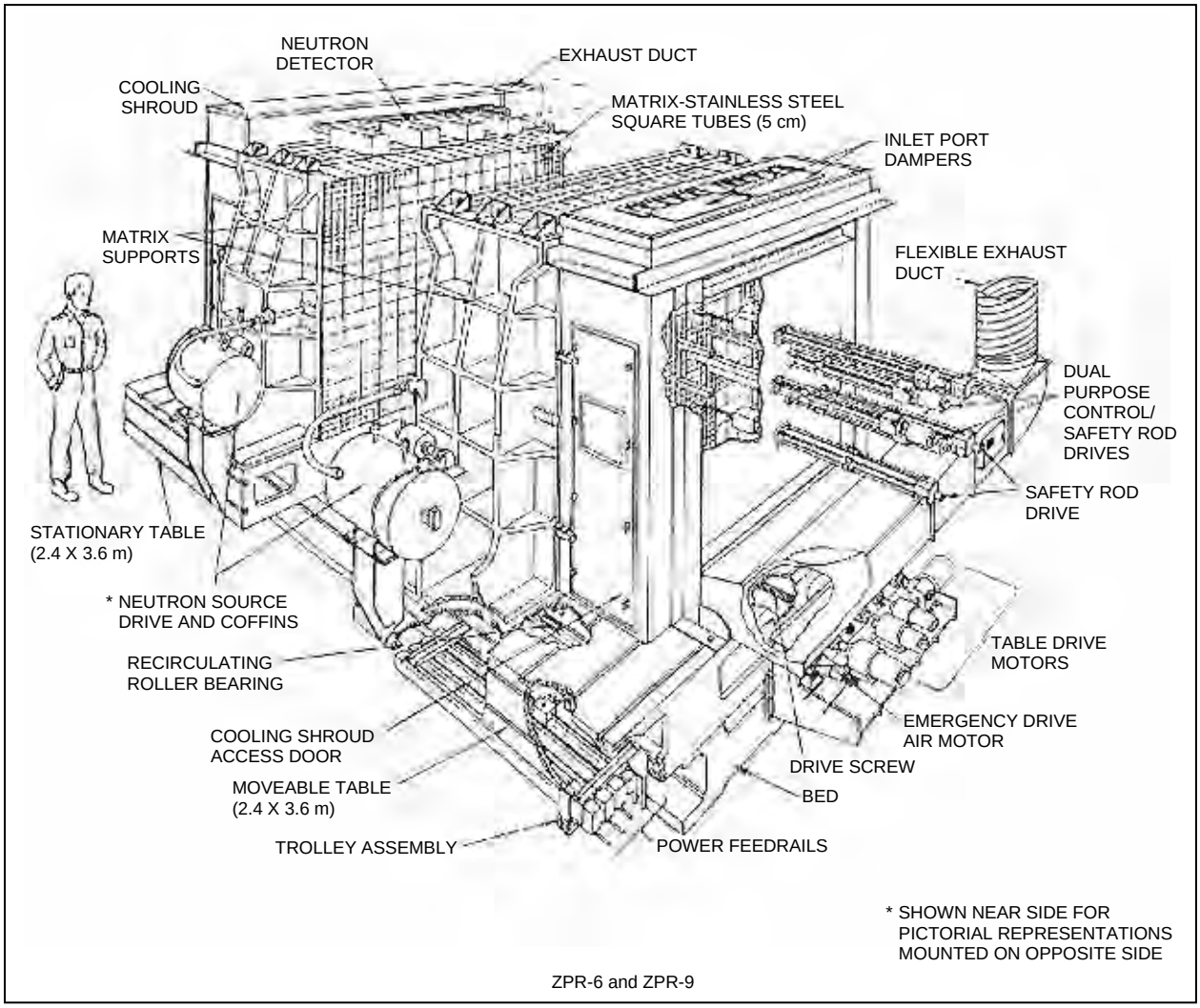


Figure 1-4. ZPR-6 and ZPR-9 Critical Assembly Schematic

both split-table type critical assemblies consisting of one stationary and one movable table. The two tables are 3.7 meters (12 feet) wide and 2.4 meters (8 feet) long and rest on a cast steel bed. Each table contains a 45-row by 45-column array of horizontally stacked 5-centimeter (cm) (2-inch) square stainless steel or aluminum tubing of 1.2 meters (4 feet), forming half of a 2.4-meter (8-foot) cube reactor. The tubes are constrained in position by massive supports on both sides. Fissile material such as enriched uranium and plutonium and materials such as

depleted uranium, stainless steel, aluminum, zirconium, sodium, graphite, and oxides of heavy metals were used to simulate various reactor compositions.

1.3 Current Status

Both ZPR-6 and ZPR-9 are no longer in use and have been in safe dry storage since 1982. The Melt Attack and Coolability Experiments (MACE) and Melt Coolability and Concrete Interaction (MCCI) Experiment are currently being conducted in Cell 4 where ZPR-9 is located. In 1999 and 2001, DOE characterized ZPR-6 and ZPR-9 to evaluate the presence of radiological contamination and the presence of any non-nuclear hazardous or toxic material (ANL 1999, ANL 2002).

Beta-gamma contamination is the predominant radiological hazard identified throughout Cells 4 and 5. The isotopes of major concern are uranium-238, thorium-234, and cesium-137. The total isotopic inventory in ZPR-6 and ZPR-9 is estimated to be less than 2 curies.

In addition, most of the wall surfaces were painted with a lead-based paint. Asbestos-containing material has also been identified in the floor tile and floor tile mastic. Oil containing polychlorinated biphenyls (PCB) and PCB-contaminated paint may also be present.

1.4 Public Involvement

On February 11, 2005, DOE sent the Draft EA to the Illinois Office of the Governor for review, and, in March 2005, received comments from the Illinois Emergency Management Agency and Illinois Environmental Protection Agency. Those letters are included in Appendix B. In response to a comment by the Illinois Environmental Protection Agency, DOE has added a reference to 40 CFR Part 61, Subpart M in Section 5.1.5 (Compliance with Regulations) in the Final EA.

2.0 Purpose and Need for Agency Action

The purpose and need for the proposed action is to protect human health and the environment from long-term risks posed by inactive and surplus contaminated DOE facilities. In addition, remediation would allow for the future beneficial use of the facilities. The proposed action is needed to ensure the protection of the long-term health and safety of the public, DOE and contractor employees, and the environment, consistent with DOE Order 5400.5, *Radiation Protection of the Public and the Environment*.

3.0 Description of the Proposed Action and No Action Alternative

This section describes the elements of both phases of the proposed action, including anticipated air emissions and waste volumes. It also describes the no action alternative as required by NEPA-implementing regulations (10 CFR § 1021.321(c)). The primary sources for information in this section are the *Environmental Restoration Program (EM-40) Baseline for Argonne National Laboratory – East, 1999 Revision* (ANL 1999); *Characterization Report for the ZPR-6 and ZPR-9 Reactors* (ANL 2002); *Argonne National Laboratory Technical Scope of Work for Building 315 Zero Power Reactor-6 & 9 (ZPR-6 & 9) Facility D&D Project* (ANL 2003a); and *Environmental Evaluation Notification Form for Building 315 Zero Power Reactor-6 & 9 (ZPR-6 & 9) Facility D&D Project: Project Description, Scope of Work, and Waste Volume Estimates* (ANL 2004b).

3.1 Proposed Action

The proposed action is to decontaminate and decommission the ZPR facility in two phases as funding and other programmatic work allows. In Phase I, DOE would decontaminate and decommission ZPR-6 and Cell 5. In Phase II, DOE would decontaminate and decommission ZPR-9, Cell 4, and the remaining portions of the ZPR facility. Phase II would begin once the existing MACE and MCCI experiments no longer required the space.

The proposed action includes activities such as decontamination, disassembly, size reduction, waste packaging, and transportation of waste to offsite disposal sites. Table 3-1 lists the elements of the proposed action by area and by phase.

In both Phase I and Phase II, all work would be performed inside Building 315 or immediately outside of the building in previously disturbed areas. Each phase is expected to take 12 months and 12,000 worker-hours (approximately six temporary workers) to complete.

Table 3-1. Elements of the Proposed Action

Building 315 Facilities	Proposed Action Activity	Phase I Activity	Phase II Activity
All Project Areas	• Remove and package for disposal all asbestos-containing materials	X	X
	• Electrically isolate, lockout-tagout, and remove the associated electrical supply panel, all electrical components for the reactor and analysis systems	X	X
	• Positively isolate, lockout-tagout, and remove all unneeded, nonelectrical utilities, including, but not limited to, high-pressure and low-pressure air supplies, gas piping, and laboratory water supply piping	X	X
	• Survey and package lead for disposal as mixed waste	X	X
	• Package all miscellaneous materials and equipment as low-level radioactive waste (LLW) or mixed LLW	X	X
	• Remove and dispose of peeling paint and paint coverings and contaminated or suspect contaminated areas of the floor, walls, and ceiling	X	X
	• Remove contaminated concrete flooring, not to exceed structural integrity of the facility	X	X
	• Dispose of all regulated waste in accordance with applicable regulations	X	X
	• Decontaminate all surfaces to below release criteria	X	X
	• Perform 100% wipe-down and Final Status Release Survey of all project and affected areas	X	X
ZPR-6 Critical Assembly	• Remove movable shields, hangers, trolleys, and rails; package as LLW	X	
	• Remove matrix drawer elevator, drive mechanism, safety screen, and power supply; package as LLW	X	
	• Remove loading platform and package as LLW	X	
	• Remove reactor cooling air duct system and package as LLW	X	
	• Remove steel control rod mounting plates and package as LLW	X	
	• Remove tie-beam structure and package as LLW	X	
	• Package all matrix tube bundles as LLW	X	
	• Remove table casting, lead screw, power feed rails, and trolley assembly; package as LLW	X	
	• Remove argon feed piping and steel bed casting; package as LLW	X	
Cell 5	• Remove vacuum high-efficiency particulate air (HEPA) ductwork and package as LLW	X	
	• Remove TV camera rail and package as LLW	X	
	• Remove wire-way trench covers, cables, trench wire and bed leveling jacks; package as LLW	X	
	• Remove emergency argon gas reactor supply piping; package as LLW	X	
	• Remove vacuum system and package as LLW	X	
	• Remove paint from floor of Cell 5	X	
	• Wipe down 100% of floors, walls, and ceilings	X	
	• Perform Final Status Survey of Cell 5	X	
ZPR-9 Critical Assembly	• Remove movable shields, hangers, trolleys and rails and package as radioactive waste		X
	• Remove reactor cooling shroud and plenum sections/panels and package as radioactive waste		X
	• Remove control rod mounting plates and package as radioactive waste		X
	• Remove matrix support knees and package as radioactive waste		X
	• Remove motor assemblies and transmission and package as radioactive waste		X
	• Remove table casting, lead screw, power feed rails and trolley and package as radioactive waste		X
	• Remove steel bed casting and package as radioactive waste		X

Table 3-1. Elements of the Proposed Action (cont)

Building 315 Facilities	Proposed Action Activity	Phase I Activity	Phase II Activity
ZPR-9 Critical Assembly (cont)	• Remove steel column and beams and package as radioactive waste		X
	• Remove source pots/partial drives and package as radioactive waste		X
	• Remove wireway trench covers, cable wire, bed leveling sacks and jacks and package as radioactive waste		X
	• Wipe down 100% of floors, walls, and ceiling		X
	• Perform Final Status Survey of area		X
Cell 4	• Perform beryllium decontamination of Cell 4 horizontal services to below 0.2 micrograms (µg) per 100 square centimeters (cm^2)		X
	• Perform beryllium surface contamination surveys		X
	• Remove reactor shielding and package as LLW		X
	• Remove emergency argon gas supply piping and package as radioactive waste		X
	• Remove vacuum pump/piping system and package as radioactive waste		X
	• Remove compressor system and package as radioactive waste		X
	• Remove reactor cooling ductwork and package as LLW		X
	• Remove shroud at south end of reactor bed and package as LLW		X
	• Replace Cell 4 HEPA filters		X
	• Wipe down 100% of floors, walls, and ceiling		X
	• Perform Final Status Survey of area		X
ZPR-6 & -9 Work Rooms	• Remove emergency venting system piping and package as radioactive waste		X
	• Decontaminate roof section		X
	• Remove sand filter tanks and package as radioactive waste		X
	• Remove sand filter vessels and piping and package as radioactive waste		X
	• Remove and survey roof cover over pit, decontaminate as necessary and determine replacement		X
	• Remove argon purge system piping, valves, and actuators and package as radioactive waste		X
	• Decontaminate and/or remove ventilation system as required – restore to functional capacity		X
	• Remove glovebox from Room 118 and package as radioactive waste		X
	• Decontamination area and perform 100% wipe down of all surfaces		X
	• Perform Final Status Survey of area		X
Adjacent Areas	• Remove matrix tubes and associated equipment in basement; package as LLW	X	
	• Remove miscellaneous equipment in Cell 4 south dock and package as LLW	X	
	• Remove miscellaneous equipment in Cell 5 south dock and package as LLW	X	X
	• Remove asbestos floor tiles and floor mastic from ZPR-6 entry hallway and Control Room. Dispose of material as asbestos waste. Retile to match ZPR-9 décor	X	
	• Remove electrical wiring, conduit, and panels supporting reactor system from ZPR-6 Control Room. Dispose of as clean waste	X	
	• Remove elevated flooring, railings, and supports from ZPR-6 Control Room. Dispose of as clean waste	X	
	• Perform 100% wipe down of Cell 5 south dock, Cell 4 south dock, ZPR-6 entry hallway, and ZPR-6 Control Room	X	
	• Perform 100% wipedown of affected areas	X	X
	• Perform Final Status Release Survey of Cell 5 south dock, Cell 4 south dock, ZPR-6 entry hallway, and ZPR-6 Control Room	X	

Sources: ANL 1999, ANL 2003a, and ANL 2004b.

A final status release survey would be conducted at the completion of each phase to confirm that radiological release criteria for the building were met in accordance with DOE Order 5400.5. Completion of Phase I and Phase II would allow Cells 4 and 5 in Building 315 and associated facilities to be released for unrestricted use.

Cleaning supplies, paint, decontamination solutions, and hydraulic fluid would be stored in cabinets designed for that purpose at the work site. Inventories would be kept to the minimum amount expected to be used and would be inventoried periodically.

A characterization of the ZPR-6 and ZPR-9 facilities was conducted in 1999 and again in 2001. Based on the sample analyses collected during those surveys and other information and assumptions, the following waste volume estimates are provided.

Contact-Handled (CH) LLW. Approximately 258 cubic meters (9,100 cubic feet) of CH-LLW, in the form of metal and contaminated paper, cloth, and plastic, would be generated, packaged, and shipped to a LLW disposal site in accordance with DOE policies and procedures. This waste would be shipped to potential disposal sites at either the Hanford Site in Richland, Washington; the Nevada Test Site (NTS) in Mercury, Nevada; Envirocare, a permitted and regulated commercial site in Clive, Utah; or a combination of those sites. For purposes of analysis, DOE assumed all the LLW would be shipped to Hanford, NTS, or Envirocare (note that Hanford is not currently available as a disposal site for waste generated offsite). However, the proposed action would be accomplished in two phases and, when wastes were generated, they would be shipped to a DOE-approved waste disposal site. DOE believes that the analysis in this EA would be bounding for any DOE-approved disposal site; this would be confirmed if the agency later decided to ship the waste to a site not specifically analyzed here.

Definitions

CH-LLW has an outer surface dose rate no more than 200 mrem per hour and requires no additional shielding or special handling.

Mixed LLW contains hazardous components regulated under the Resource Conservation and Recovery Act (RCRA) or Toxic Substances Control Act (TSCA) and radioactive components regulated under the Atomic Energy Act.

Mixed LLW. Mixed LLW in the form of radioactive lead shielding and bricks, lead-based paint, PCB-contaminated paint, and PCB oil would be accumulated during this project. Approximately 13 cubic meters (450 cubic feet) would be expected to require packaging and shipment, which would be conducted in accordance with applicable regulations and DOE policies and procedures. This waste would be shipped to Hanford, NTS, or Envirocare for treatment and disposal. As noted above, the proposed action would be accomplished in two phases and, when wastes were generated, they would be shipped to a DOE-approved waste disposal site. DOE believes that the analysis in this EA would be bounding for any DOE-approved disposal site; this would be confirmed if the agency later decided to ship the waste to a site not specifically analyzed here.

Hazardous Waste. Hazardous waste would include approximately 6 cubic meters (200 cubic feet) of nonradioactive lead, PCB-contaminated paint, and PCB oil. The lead would be recycled if practicable, or disposed of at a hazardous waste landfill. PCB waste would be packaged and transported in accordance with applicable regulations and DOE policies and procedures. It would be treated and disposed of at a licensed, special waste landfill within 160 kilometers (100 miles) of ANL.

Asbestos. Approximately 1.5 cubic meters (50 cubic feet) of asbestos would be removed from the floors. Testing for asbestos would be performed before beginning decommissioning procedures. Any asbestos found would be labeled and removed before starting any decommissioning work in those areas. Asbestos abatement would be conducted in accordance with established procedures. This waste would be disposed of at an industrial landfill designated by the Illinois Environmental Protection Agency, located within 160 kilometers (100 miles) of ANL.

Solid Wastes. Approximately 28 cubic meters (1,000 cubic feet) of nonradioactive and nonhazardous debris waste would be generated. This would be disposed of at a local landfill within 160 kilometers (100 miles) of ANL.

Table 3-2 lists the waste volumes estimated and the sites to which the waste would be shipped for disposal.

Table 3-2. Estimated Waste Volumes (Phases I and II)

Waste Type	Volume	Planned Destination	Notes
CH-LLW	258 m^3 (9,100 ft^3)	Hanford, NTS, or Envirocare	Includes matrix tube, electrical conduit, wiring, carbon steel, and stainless steel
Mixed LLW	13 m^3 (450 ft^3)	Hanford, NTS, or Envirocare	Radioactive lead shielding and bricks, lead-based paint, PCB-contaminated paint, and PCB oil
Hazardous waste	6 m^3 (200 ft^3)	Special/hazardous waste landfill within 100 miles of ANL	Nonradioactive lead, PCB-contaminated paint, and PCB oil
Asbestos	1.5 m^3 (50 ft^3)	Special waste landfill within 100 miles of ANL	Floor tiles and mastic from control room
Solid waste	28 m^3 (1,000 ft^3)	Local landfill within 100 miles of ANL	Nonradioactive and nonhazardous debris

Note: m^3 = cubic meter; ft^3 = cubic foot
Sources: ANL 1999 and ANL 2004b.

3.2 No Action Alternative

Under the no action alternative, ZPR-6 and ZPR-9 would not be decontaminated and the existing equipment would not be removed. The facilities would be maintained in their present safe shutdown condition. Surveillance and monitoring activities would continue to ensure adequate containment of radioactive contamination, provide physical safety and security controls, and allow for personnel access. The facility would remain unavailable for other beneficial uses.

4.0 Affected Environment

This section briefly describes the existing conditions at the ANL site. Decontamination and decommissioning activities would occur within Building 315 or immediately outside of the building in previously disturbed areas. For this reason, no direct, indirect, or cumulative impacts would be expected to current land use, biological resources (including sensitive, threatened, or endangered species or their critical habitat), visual resources, ambient noise levels, wetlands, or floodplains. The primary sources for information in this section are the *Argonne National Laboratory-East Site Environmental Report for Calendar Year 2003* (ANL 2004c) and the *Environmental Evaluation Notification Form for Building 315 Zero Power Reactor-6 & 9 (ZPR-6 & 9) Facility D&D Project: Project Description, Scope of Work, and Waste Volume Estimates* (ANL 2004b).

4.1 Site Description

ANL occupies the central 607 hectares (1,500 acres) of a 1,514-hectare (3,740-acre) tract in DuPage County, Illinois (Figure 4-1). ANL is completely surrounded by the 907-hectare (2,240-acre) Waterfall Glen Forest Preserve, which is used as a public recreational area, nature preserve, and demonstration forest. The ANL site is approximately 43 kilometers (27 miles) southwest of downtown Chicago and 39 kilometers (24 miles) west of Lake Michigan. The terrain of ANL is gently rolling, partially wooded, former prairie and farmland. The grounds contain a number of small ponds and streams.

ANL is in a region that is subject to tornadoes. Tornadoes have been observed in the area almost every month of the year but are more active during April to June.

Land use in the area surrounding ANL includes residential, commercial, and industrial properties. No resident population lives within 1.6 kilometers (1 mile) of the center of the project site. Approximately 4,000 people work at ANL.

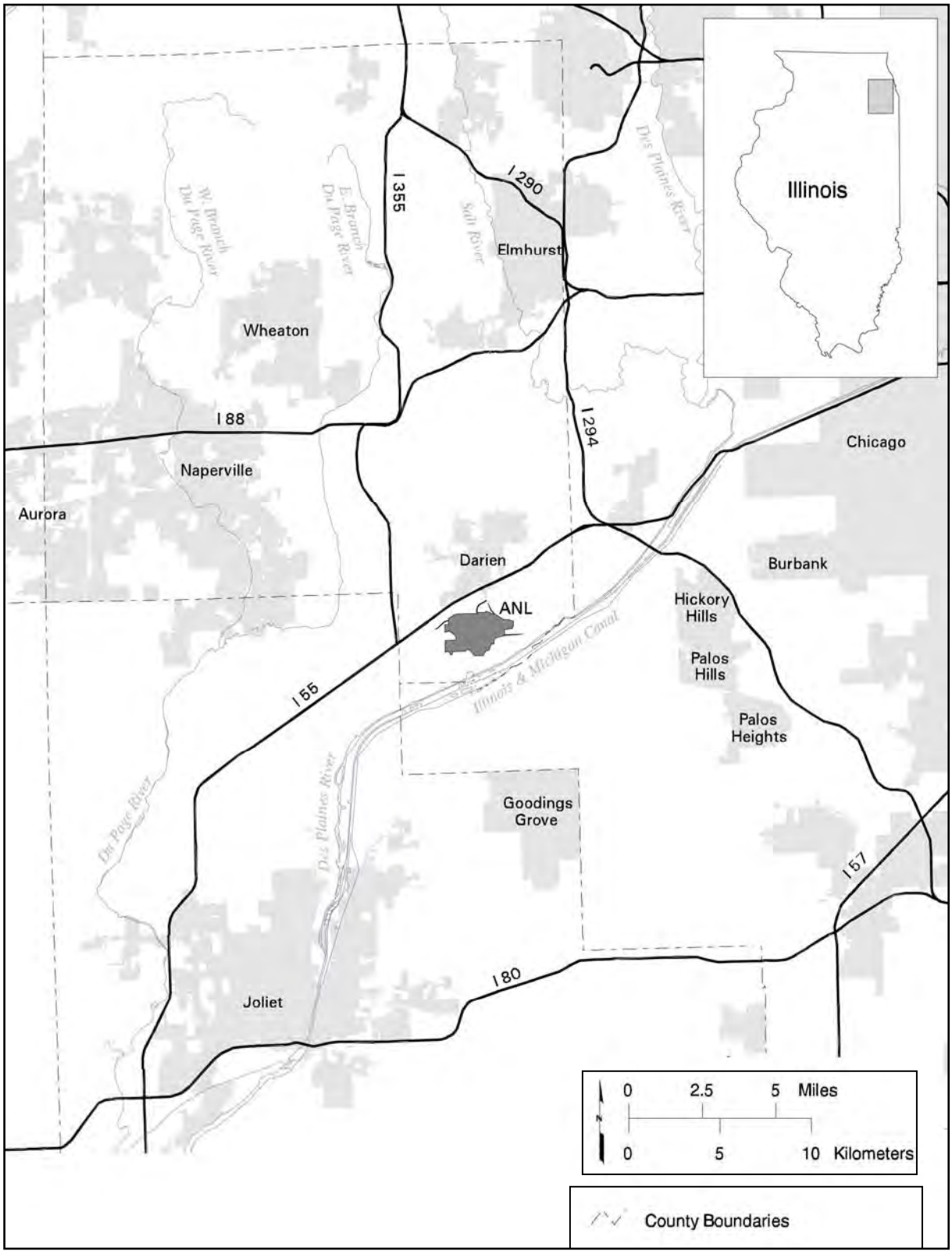


Figure 4-1. Location of Argonne National Laboratory

4.2 Air Quality

Routine continuous monitoring of the permitted emission sources at ANL has indicated that the amount of radioactive material released to the atmosphere from these sources is extremely small, resulting in a very small incremental radiation dosage to the neighboring population. The calculated potential maximum individual offsite dose to a member of the general public from ANL operations for 2003 was 0.080 millirem (mrem) (air, water, and direct radiation pathways), well below the DOE radiation protection standard of 100 mrem per year for all pathways set forth in DOE Order 5400.5. For comparison, the average American living in the United States is typically exposed to 360 mrem annually from natural and other sources of radiation.

Particulates in the air are also monitored at ANL perimeter and offsite sampling stations for total alpha activity, total beta activity, strontium-90, isotopic thorium, isotopic uranium, and plutonium-239. No statistically significant difference was identified between samples collected at the ANL perimeter and samples collected offsite.

4.3 Biological Resources

The area surrounding Building 315 is previously disturbed and provides little or no wildlife habitat. No state- or Federal-listed threatened or endangered species are known to reside at the Building 315 site.

4.4 Cultural Resources

ZPR-6 is eligible for listing on the National Register of Historic Places for its engineering value and as a contributing component to the eligible Building 314/315/316 Complex.

4.5 Environmental Justice

Executive Order No. 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, directs Federal agencies to identify any disproportionately high and adverse human health or environmental effects of their actions on minority or low-income populations. To identify such impacts, it is first necessary to identify the minority or low-income populations that could be affected by the proposed action or no action alternative.

Approximately 8.9 million people live within an 80 kilometer (50 mile) radius of ANL, and approximately 149,000 people live within 8 kilometers (5 miles) of ANL (DOE 2004). On the basis of 2000 census data, 51 percent of the population within 80 kilometers (50 miles) and 24.5 percent of the population within 8 kilometers (5 miles) of the site consists of minorities, as compared with the state averages of 32.2 percent for Illinois, 14.2 percent for Indiana, and a national average of 30.9 percent (U.S. Census Bureau 2004a). With respect to low-income populations, based on 2000 census tract data, 10.6 percent of the population within 80 kilometers (50 miles) and 3.4 percent of the population within 8 kilometers (5 miles) of the site are comprised of low-income populations, as compared with the state averages of 12.7 percent for Illinois, 9.5 percent for Indiana, and a national average of 12.3 percent (U.S. Census Bureau 2004b).

5.0 Environmental Consequences

This section describes the potential environmental impacts of implementing Phases I and II of the proposed action and the no action alternative.

5.1 Proposed Action

Under the proposed action, impacts could occur from (1) decontamination and decommissioning activities, (2) natural hazards and accidents, and (3) transportation of wastes. Sections 5.1.1 through 5.1.3 discuss the potential impacts that could occur. Section 5.1.4 discusses the potential for other direct, indirect, cumulative, or long-term impacts to occur if the proposed action were implemented. Sections 5.1.5 and 5.1.6 discuss regulatory compliance and pollution prevention efforts under the proposed action.

5.1.1 Decontamination and Decommissioning

This section describes potential impacts to air quality, cultural resources, human health, noise, and waste disposal capacity from decontamination and decommissioning activities. Potential socioeconomic impacts and environmental justice considerations are also addressed. Because all decontamination and decommissioning activities would take place within Building 315 or previously disturbed areas, no impacts would be expected to current land use, biological resources (including sensitive, threatened, or endangered species or their critical habitat), visual resources, wetlands, or floodplains.

5.1.1.1 Air Quality

Criteria Air Pollutants. The proposed action would result in minor releases of dust and combustion gases from power equipment.

Hazardous Emissions. Due to the small quantities of hazardous asbestos waste that would be generated, the potential for hazardous emissions to the atmosphere would be extremely small. Any such emissions would be limited to minor amounts of dust containing asbestos. These emissions would be controlled through high-efficiency particulate air (HEPA) filters.

Radioactive Emissions. The potential for radioactive emissions to the atmosphere would be extremely small. Any such emissions would be limited to minor amounts of dust containing radionuclides from activities that would result in the generation of radioactive wastes. These emissions would contain primarily uranium-238, thorium-234, and cesium-137 and would be controlled through HEPA filters.

5.1.1.2 Cultural Resources

As noted above, ZPR-6 is eligible for listing on the National Register of Historic Places for its engineering value and as a contributing component to the eligible Building 314/315/316 Complex. However, it would not be possible to remove the radioactive and hazardous contamination without destroying the reactor components. On September 20, 2004, DOE submitted a proposed plan to prepare Illinois Historic American Engineering Record documentation to mitigate the decontamination and demolition of ZPR-6. The Illinois Historic Preservation Agency has indicated that it will accept the documentation as appropriate mitigation. Appendix A contains the correspondence between DOE and the Illinois Historic Preservation Agency.

5.1.1.3 Human Health (Worker and Public)

Decontamination and decommissioning activities would result in the exposure of workers to radiation, which could result in an increased risk of a latent cancer fatality. In addition, workers could suffer fatalities or nonfatal injuries or illnesses as a result of industrial accidents. The proposed action is not expected to result to any exposure of the public to radioactive materials. The following discussion describes the potential for these human health impacts.

Radiological Impacts to Workers. The only radiological effect on non-project workers on the ANL site would be from radiological emissions (see Section 5.1.1.1). For project workers, personnel exposures are expected to average 125 mrem (0.125 rem) per project worker over the duration of the proposed action. The collective radiation dose for the six workers involved in the proposed action would be 0.75 person-rem for each phase of the proposed action (1.5 person-rem collective radiation dose for both phases of the proposed action, combined).

Worker exposures to radiation under normal conditions would be controlled under established procedures that require doses to be kept as low as reasonably achievable (including the use of protective clothing, personnel monitoring devices, and area radiation monitors with alarm capability) and that limit any individual's dose to less than 2 rem per year (DOE 1999). Based on an occupational risk factor of 6×10^{-4} fatal cancers per person-rem (DOE 2002a), workers engaged on either Phase I or Phase II of this proposed project would incur a 4.5×10^{-4} risk of a latent cancer fatality, or 1 chance in 2,000 that any one of the six workers would die from cancer caused by exposure to radiation as a result of this decontamination and decommissioning effort. For both phases of the proposed action combined, and assuming the same six workers worked on both phases, workers engaged on the project would incur a 9.0×10^{-4} risk of a latent cancer fatality, or 1 chance in 1,000 that any one of the six workers would die from cancer caused by exposure to radiation.

Nonradiological Impacts to Workers. Based on Bureau of Labor Statistics (BLS 1996a; BLS 1996b) and the required work effort estimated to complete decontamination and decommissioning (24,000 worker hours), no workplace fatalities (risk of 1.7×10^{-3}, or 1 chance in 600) and about 1 nonfatal injury or illness would be expected.

Radiological Impacts to the Public. The proposed action would be carried out in a HEPA-filtered, ventilated cell. No radiation exposure is expected to the population visiting the Waterfall Glen Forest Preserve or living in the surrounding communities.

5.1.1.4 Noise

Under the proposed action, the operation of machinery and equipment such as portable generators, hydraulic breakers, portable HEPA filters, and forklift trucks would generate noise. Receptors of such noise would be persons who work in or near Building 315. Noise would not affect persons beyond the ANL site and its buffer zone (Waterfall Glen Nature Preserve) because of the distances involved. Workers in areas posted for hearing protection would be required to wear plug-type personal protective equipment.

5.1.1.5 Waste Disposal Capacity

CH-LLW. Approximately 258 cubic meters (9,100 cubic feet) of CH-LLW would be generated under Phase I and Phase II of the proposed action. The major isotopes are uranium-238, thorium-234, and cesium-137. The waste would be packaged and is currently planned to be shipped to Hanford or NTS (both DOE sites) or to Envirocare (a commercial LLW disposal site) in accordance with DOE orders and procedures. These disposal sites have adequate capacity to receive this waste. If these disposal sites were not available during project execution, then an appropriate DOE-approved disposal site would be used, after DOE confirmed that the analysis in this EA bounded the potential impacts of using a different disposal site.

Mixed LLW. The proposed action would generate approximately 13 cubic meters (450 cubic feet) of mixed waste. This waste would be shipped to Hanford, NTS, or Envirocare, where it would be treated and disposed of. These disposal sites have adequate capacity to receive this waste. As noted for LLW, if these disposal sites were not available during project execution, then an appropriate DOE-approved disposal site would be used, after DOE confirmed that the analysis in this EA bounded the potential impacts of using a different disposal site.

Hazardous Waste. Approximately 6 cubic meters (200 cubic feet) of hazardous waste would be generated. Waste regulated pursuant to the Toxic Substances Control Act (TSCA) would be shipped to a special waste landfill within 160 kilometers (100 miles) of the ANL site that is licensed and has the capacity to receive this type of waste for disposal. Waste regulated pursuant to the Resource Conservation and Recovery Act (RCRA) would be shipped to a hazardous waste landfill within 160 kilometers (100 miles) of the ANL site that is licensed and has the capacity to receive this type of waste for disposal.

Asbestos. The proposed action would generate approximately 1.5 cubic meters (50 cubic feet) of asbestos. This material would be disposed of through a contract vendor in accordance with ANL, state asbestos, and TSCA requirements. A contract vendor that has adequate capacity to dispose of this waste would be selected. The disposal facility would be a special waste landfill within 160 kilometers (100 miles) of ANL.

Solid Wastes. Approximately 28 cubic meters (1,000 cubic feet) of conventional solid wastes would be generated. These wastes would be disposed of at a local, permitted landfill with adequate capacity that is located within 160 kilometers (100 miles) of ANL.

Sanitary and Laboratory Wastewater. Each phase of the proposed action would involve approximately six outside contractor personnel for about 12 months. They would represent a very small increase in wastewater handling requirements, well within the excess handling capacity of the laboratory system. Small amounts of laboratory wastewater generated during the project would be collected and sampled to determine if it meets laboratory wastewater discharge requirements or if it would need to be sent to Waste Management Operations in Building 306 for processing. In either case, ANL has adequate waste handling capacity to manage the wastewater.

5.1.1.6 Socioeconomics

Implementation of each phase of the proposed action would require approximately six additional workers for a 12-month period. This additional, temporary workforce requirement would not impose any impacts to the local economy, housing, schools, or other social services.

Total costs to implement the proposed action would be $3.1 million for each phase of the proposed action. These expenditures would take place over 12 months and would represent less than 1 percent of ANL's annual operational expenditure of approximately $588.5 million for fiscal year 2005 (ANL 2003b). Thus, the economic impact of the proposed action would be minor in the context of ANL and extremely small in the context of the regional economy.

There would be no social impacts such as those related to relocation of residents or impacts on lifestyle and living conditions.

5.1.1.7 Environmental Justice Considerations

The impacts of the proposed action would not extend beyond the site boundaries. In addition, the population demographics surrounding the ANL site are not considered to be minority or low-

income on the basis of national and Illinois thresholds for minority and low-income populations. While the greater Chicago area (within 80 kilometers [50 miles] of ANL) is ethnically and racially diverse, with areas containing a high proportion of minority populations, these areas would not be affected by the proposed decontamination and decommissioning of ZPR-6, ZPR-9, and associated facilities.

5.1.2 Natural Hazards and Accidents

This section addresses the potential environmental impacts that could occur during the decontamination and decommissioning of the ZPRs as a result of natural hazards or accidents. Because the action has not yet been authorized, an auditable safety analysis (ASA) has not been prepared for the decontamination and decommissioning of ZPR-6 and ZPR-9. DOE did prepare an ASA for the recently completed decontamination and decommissioning of the Juggernaut Reactor Facility (Building 335 at ANL) (ITS 2004). Because of the similarities between the decontamination and decommissioning of the Juggernaut Reactor Facility and the ZPRs, DOE believes that the conclusions reached in the ASA prepared for the Juggernaut Reactor Facility are applicable to this proposed action. Table 5-1 describes the similarities between the two actions.

The conclusions of the Juggernaut ASA are summarized in this section. Once an ASA is prepared specifically for the decontamination of ZPR-6 and ZPR-9, DOE would review that ASA to confirm that the conclusions reached for the Juggernaut Reactor Facility and included in this EA were accurate and applicable.

5.1.2.1 Natural Hazards

Natural hazard phenomena include wind/tornadoes, earthquakes, and floods. Although each of those could introduce significant energy sources, the estimated time period for decontamination and decommissioning activities is very short compared to frequencies of those events (the theoretical probability of a 150-mile-per-hour tornado strike at ANL is 3.0×10^{-5} per year, a

Table 5-1. Similarities between the Decontamination and Decommissioning of the Juggernaut Reactor and ZPRs

Comparison	Juggernaut Reactor	ZPRs
Types of actions to be performed	• Disassembly • Size reduction • Waste packaging	• Disassembly • Size reduction • Waste packaging
Radionuclides	• Beta-gamma contamination is the predominant radiological hazard • Primary contaminant was found to be europium-152 • Total isotopic inventory is conservatively estimated to be 22 curies	• Beta-gamma contamination is the predominant radiological hazard • Isotopes of major concern are uranium-238, thorium-234, and cesium-137 • Total isotopic inventory is estimated to be less than 2 curies
Waste volumes generated	• LLW – debris (CH): 140 m^3 (5,000 ft^3) • LLW – debris (remote handled): 7 m^3 (250 ft^3) • LLW – soil (CH): 550 m^3 (19,500 ft^3) • Aqueous radioactive liquid waste: • 380 L (100 gal) – residual in facility piping • 1,500 L (400 gal) –sludge from groundwater contaminated during soil excavation (if needed) • Mixed LLW: 6 m^3 (200 ft^3) • Contaminated oil: 114 L (30 gal) • Asbestos: 6 m^3 (220 ft^3) • PCBs: Two 208-L (55-gal) drums • Solid waste: 46 m^3 (60 yd^3)	• CH-LLW: 258 m^3 (9,100 ft^3) • Mixed LLW: 13 m^3 (450 ft^3) • Hazardous waste: 6 m^3 (200 ft^3) • Asbestos: 1.5 m^3 (50 ft^3) • Solid waste: 28 m^3 (1,000 ft^3)

Note: m^3 = cubic meter; ft^3 = cubic foot; gal = gallon; yd^3 = cubic yard
Sources: ANL 2004b; DOE 2004.

recurrence interval of one tornado every 33,000 years). A tornado of significant force to release radioactivity is highly unlikely to occur during the decontamination and decommissioning activities but was evaluated as the bounding natural phenomena event.

The probability of a tornado touching down on the ANL site is 1×10^{-4} (ANL 2003c). The ZPRs are housed in blast-resistant, highly reinforced concrete cells that are enclosed in metal frame containment shells. For this reason, a tornado touching down on Building 315 is unlikely to result in any damage to ZPR-6 or ZPR-9 or to result in the release of radioactive material. Based on good engineering judgment, DOE estimates that the probability of a dispersion of radioactive material outside of Building 315 as a result of a tornado is no higher than 1×10^{-4} (DOE 2005).

F2 (Fujita scale) tornadoes with wind speeds of 113 to 157 miles per hour have struck the ANL site, with minor damage to power lines, roofs, and trees. During the decontamination and decommissioning activities, packaged radioactive material may be temporarily staged in the Building 315 yard area or another appropriate outside temporary waste staging area. These materials would be secured and packaged in strong tight containers (waste bins) that weigh more than 2.2 metric tons (5,000 pounds). F2 tornadoes would not be likely to affect materials stored in any temporary outside waste staging area.

No other natural hazard phenomena (e.g., thunderstorms, sleet, and snow) are considered to be capable of releasing radioactivity from the Building 315. No tectonic features within 100 kilometers (60 miles) of ANL are known to be seismically active. Historical records indicate that no damaging earthquakes have occurred in a large area surrounding the ANL site. Flooding is not considered a mechanism for radiological release at Building 315 during decontamination and decommissioning activities because the site is above the floodplain and soils are deep, well-drained, and moderately slowly to slowly permeable.

5.1.2.2 Accidents

The most credible accident scenario for the decontamination and decommissioning of ZPR-6 and ZPR-9 would be the drop of a load of radioactive material. If this occurred, the impact would be minor because of the low levels of loose radioactivity. In addition, the proposed action would take place in a HEPA-filtered, ventilated cell.

The ASA for the Juggernaut Reactor considered the potential for a load drop. The limiting load drop (due to consequences of the accident) for the decontamination and decommissioning activities was during the lifting and/or crane transfer of the Juggernaut Reactor vessel. The vessel represented one of the heaviest individual lifts to be performed as part of the decontamination and decommissioning, and it had the potential for fixed contamination. In a bounding event (drop), the vessel would fall on stored/staged radioactive waste. Given that the majority of radioactive materials were entrained in concrete and/or graphite, and given the maximum possible levels of surface contamination inside the reactor vessel, the Juggernaut

Reactor ASA concluded that the result (quantity of radioactive material released/suspended) of a bounding drop would be low (ITS 2004).

General requirements for minimizing the risk and consequences of accidents associated with the proposed decontamination and decommissioning activities are contained in ANL procedures pursuant to requirements in Federal and state regulations and in DOE Orders that protect workers in hazardous environments, as well as the public. These procedures, which are frequently updated, include measures for training personnel and for monitoring and overseeing activities with the potential for accidents.

Specific protections that would be implemented under the proposed action are as follows:

- Risk of personnel exposure to radiation or the intake of radioactive material would be controlled through the use of protective clothing, including respiratory protective equipment, and the use of trained workers. Personnel radiation and contamination exposure would be maintained at levels as low as reasonably achievable and in accordance with ANL administrative radiation control limits.
- Asbestos-containing materials would be removed in accordance with the Occupational Safety and Health Act (OSHA) asbestos standard (29 CFR § 1910.1001). Asbestos removal work would be done by outside contractor personnel who would be trained and certified in asbestos removal work. Air monitoring and health hazard control would be part of this work.
- Lead-containing material would be removed in accordance with the OSHA lead standard (29 CFR § 1910.1025).
- Waste containers of hazardous and mixed waste would be segregated in accordance with established procedures.
- Fire prevention measures would be implemented during decontamination and decommissioning work. In case of fire, fire protection services are provided by the ANL Fire Department 24 hours a day.

- Hoisting and rigging procedures and requirements would significantly reduce the probability of a load drop, thereby substantially reducing the risk of worker injury or radiological release.

5.1.3 Transportation

To bound the impacts of transporting waste, DOE analyzed the impacts of the transportation of the maximum volume of wastes that could be generated by the proposed action. All transportation of wastes for offsite disposal would be conducted by truck. It is anticipated that approximately 15 truckloads of LLW, one truckload of mixed LLW, two truckloads of hazardous waste, and two truckloads of solid waste would leave the ANL site for shipment to disposal sites over the 24-month duration of the proposed action. This compares to the annual average of about 35 shipments of LLW (including mixed LLW) and 40 shipments of hazardous waste from ANL. Because Phase I and Phase II would occur sequentially and would each be approximately 12 months in duration, it is assumed that the decontamination and decommissioning of ZPR-6 and ZPR-9 would result in approximately 10 additional truck shipments per year, which would represent a 14-percent annual increase in LLW and hazardous waste shipments from ANL for the 2-year duration of both phases of the proposed action.

Potential LLW and mixed LLW disposal sites are the Hanford Site, NTS, and Envirocare (note that disposal of LLW and mixed LLW at Hanford is not currently available and is included only for purposes of analysis). Transportation of these waste types to the Hanford Site would result in the highest estimated impact of the three potential disposal sites because transportation impacts increase as the vehicle-miles traveled increase, and, of the three potential disposal sites analyzed, Hanford would involve the greatest travel distance from ANL.

PCB and asbestos waste would be shipped to a special waste landfill located within 160 kilometers (100 miles) of ANL. Solid waste (nonradioactive and nonhazardous) would be shipped to a local landfill located within 160 kilometers (100 miles) of ANL.

Approximately 77,000 to 110,000 round-trip vehicle-kilometers would be traveled to dispose of all of the waste types that would be generated by the proposed action, depending on the disposal site used. Based on national average rates of 0.35 accidents and 0.015 fatalities per million kilometers (DOE 2002b), the proposed waste shipments would result in an estimated 0.036 risk of an accident (1 chance in 30) and 0.0015 risk of a fatality (1 chance in 600). The risk of fatality would be due to crash impacts, not as a result of cargo hazard.

5.1.4 Other Potential Direct, Indirect, Cumulative, or Long-Term Impacts

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR § 1508.7). All of the foregoing impact analyses take into consideration ongoing ANL actions. The incremental impact of the proposed action would not be significant if added to all other past, present and reasonably foreseeable future actions. In particular, the ongoing MACE and MCCI Experiments currently being conducted in Cell 4, where ZPR-9 is located, cause no measurable radiation exposure to workers (ANL 1995) and thus would result in no cumulative radiation dose to the ZPR decontamination and decommissioning workers.

Other activities currently proposed for the ANL site include:

- Advanced Photon Source Upgrade (DOE 2003)
- Regional Biocontainment Laboratory (preparation of an EA is pending)
- Construction and operation of the Theory and Computing Science Building (categorical exclusion approved by the DOE Argonne Site Office on November 4, 2004)
- Decontamination and decommissioning of Building 301 hot cells (preparation of NEPA documentation is pending)

The environmental impacts of these activities are or would be expected to be minor, and no cumulative site-wide environmental impacts would be expected.

5.1.5 Compliance with Regulations

The proposed action would comply with applicable Federal, state, and local laws. The following environmental laws and regulations would apply:

- Construction and operating air permits for Building 315 (Clean Air Act).
- TSCA regulations (40 CFR Parts 700-766), Clean Air Act regulations (40 CFR Part 61, Subpart M), and state laws for PCB and asbestos removal.
- RCRA Part B permit for additional hazardous and mixed waste storage (the site's current RCRA permitted capacity would be sufficient for the storage of hazardous and mixed waste generated by the proposed action).
- DOE Order 435.1 governing radioactive waste management.
- DOE Order 5400.5 on radiation protection of the public and the environment.
- U.S. Department of Transportation regulations, 49 CFR Parts 390-397.

5.1.6 Pollution Prevention

To further the goals of pollution prevention and waste minimization, implementation of the proposed action would require careful waste segregation and would optimize the use of space in waste containers. Because of a current DOE moratorium on the release of potentially activated materials, recycling of metal components would not be possible.

5.2 No Action Alternative

Under the no action alternative, the ZPRs in Building 315 would not be decontaminated, and the existing equipment would not be removed. This alternative would preclude the use of this space for other activities and continue the expenditure of the Department's funds for the continued surveillance and maintenance of the facility.

No measurable exposure would be expected for personnel working inside or outside of Building 315 and around Cells 4 and 5. Minimal radiation exposure would be expected for surveillance and maintenance personnel inspecting the reactor core occasionally. This

alternative would also result in the continued risk of release of material due to accidents or natural hazards. DOE would also continue to incur costs for surveillance and monitoring activities at the facility. Annual surveillance and maintenance costs for ZPR-6 and ZPR-9 are approximately $100,000.

6.0 References

10 CFR 1021. Energy, "National Environmental Policy Act Implementing Procedures," *Code of Federal Regulations*.

29 CFR 1910. Labor, "Occupational Safety and Health Standards," *Code of Federal Regulations*, § 1001, OSHA Asbestos Standard.

29 CFR 1910. Labor, "Occupational Safety and Health Standards," *Code of Federal Regulations*, § 1025, OSHA Lead Standard.

40 CFR 61, Subpart M. Environmental Protection Agency, "Protection of Environment," *Code of Federal Regulations*. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS, National Emission Standard for Asbestos

40 CFR 700-766. Environmental Protection Agency, "Protection of Environment," *Code of Federal Regulations*.

40 CFR 1500-1508. Council on Environmental Quality, "Protection of Environment" *Code of Federal Regulations*.

49 CFR 390-397. Transportation, "Federal Motor Carrier Safety Regulations," *Code of Federal Regulations*.

ANL (Argonne National Laboratory), 1995. *Environmental Evaluation Notification Form for the Melt Attack and Coolability Experiment (Molten Actinide Core Experiment), ARG-CX-019*, Argonne National Laboratory – East, Argonne, Illinois, December 14, 1995.

ANL (Argonne National Laboratory), 1999. *Environmental Restoration Program (EM-40) Baseline for Argonne National Laboratory-East, 1999 Revision*, Argonne National Laboratory – East, Argonne, Illinois.

ANL (Argonne National Laboratory), 2002. *Characterization Report for the ZPR-6 and ZPR-9 Reactors*, Douglas J. Tinnin, Technology Development Division, Decontamination and Decommissioning Program, Argonne National Laboratory – East, Argonne, Illinois, January.

ANL (Argonne National Laboratory), 2003a. *Argonne National Laboratory Technical Scope of Work for Building 315 Zero Power Reactor-6 & 9 (ZPR-6 & 9) Facility D&D Project*, Argonne National Laboratory, July.

ANL (Argonne National Laboratory), 2003b. *Institutional Plan FY 2004-2008*, ANL/IP-2003, Argonne National Laboratory, Chicago Operations Office, online at http://www.ipd.anl.gov/instplan/, dated October 2003, accessed December 9, 2004.

ANL (Argonne National Laboratory), 2003c. *ANL-E Site Hazard Assessment*, February.

ANL (Argonne National Laboratory), 2004a. *Map of Argonne National Laboratory's Illinois Site*, online at http://www.anl.gov/Visiting/anlemap.html, accessed December 9, 2004.

ANL (Argonne National Laboratory), 2004b. *Environmental Evaluation Notification Form for Building 315 Zero Power Reactor-6 & 9 (ZPR-6 & 9) Facility D&D Project: Project Description, Scope of Work, and Waste Volume Estimates*, Nuclear Engineering Division, Argonne National Laboratory, September.

ANL (Argonne National Laboratory), 2004c. *Argonne National Laboratory – East Site Environmental Report for Calendar Year 2003*, ANL-04/2, N.W. Golchert and R.G. Kolzow, Office of Safety, Environment, and Quality Assurance, Argonne National Laboratory – East, Argonne, Illinois, September.

BLS (Bureau of Labor Statistics), 1996a. *National Census of Total Occupational Injuries*, 1995, U.S. Department of Labor, Bureau of Labor Statistics, USDL-96-315, Washington D.C.

BLS (Bureau of Labor Statistics), 1996b. *Summary of Occupational Injuries and Illnesses*, 1994, U.S. Department of Labor, Bureau of Labor Statistics, Summary 96011, Washington, D.C., April.

DOE (U.S. Department of Energy), 1999. *DOE Standard Radiological Control*, DOE-STD-1098-99. Washington, D.C., July.

DOE (U.S. Department of Energy), 2002a. *Radiation Risk Estimation from Total Effective Dose Equivalents.* Washington, DC, U.S. Department of Energy, Memorandum from A. Lawrence, Office of Environmental Policy and Guidance, August 9.

DOE (U.S. Department of Energy), 2002b. *A Resource Handbook on DOE Transportation Risk Assessment*, Report No. DOE/EM/NTP/HB-01, S.Y. Chen, F. Monette, B.M. Biwer, C. Detrick, T. Dunn, R. Pope, R. Luna, R. Yoshimura, R. Weiner, S. Maheras, and S. Bhatnagar, U.S. Department of Energy, Office of Environmental Management, National Transportation Program, July.

DOE (U.S. Department of Energy), 2003. *Environmental Assessment for Enhanced Operations of the Advanced Photon Source at Argonne National Laboratory-East, Argonne, Illinois*, DOE/EA-1455, June.

DOE (U.S. Department of Energy), 2004. *Environmental Assessment for Decontamination and Decommissioning of the Juggernaut Reactor at Argonne National Laboratory – East, Argonne, Illinois*, DOE/EA-1483, January.

DOE (U.S. Department of Energy), 2005. "Memo to File: Probability of a Tornado Causing Radiological Dispersion at the ZPR D&D Project," prepared by P. Washburn, Facility Representative, Argonne Site Office, U.S. Department of Energy, dated January 25, 2005.

ITS (Innovative Technology Solutions Inc.), 2004. *Auditable Safety Analysis for the Decontamination and Decommissioning of the Juggernaut Reactor Facility*, prepared for the U.S. Department of Energy, Argonne National Laboratory, March 31, 2004.

U.S. Census Bureau, 2004a. *State and County Quick Facts*, data derived from population estimates, 2000 Census of Population and Housing, online at http://quickfacts.census.gov/qfd/states/00000.html

U.S. Census Bureau, 2004b. *Percentage of People in Poverty by State Using 2- and 3-Year Averages: 2001-2003*, online at http://www.census.gov/hhes/poverty/poverty03/table8.pdf

Appendix A:

Illinois State Historic Preservation Office Correspondence

Department of Energy
Argonne Site Office
9800 South Cass Avenue
Argonne, Illinois 60439

SEP 2 0 2004

Ms. Anne E. Haaker
Deputy State Historic Preservation Officer
Illinois Historic Preservation Agency
Old State Capitol
Springfield, Illinois 62701

Dear Ms. Haaker:

Reference: IHPA Log #10101598

The Department of Energy (DOE) is requesting your concurrence on our plan to prepare Illinois Historic American Engineering Record (IL HAER) documentation to mitigate the decontamination and demolition of a small nuclear reactor [the Zero-Power Reactor VI (ZPR-VI)] at Argonne National Laboratory. The ZPR VI is eligible for listing on the National Register of Historic Places for its engineering value and as a contributing component to the eligible Building 314/315/316 Complex.

This letter constitutes the Standard Mitigation Plan called for under Section III.D.2. of the Programmatic Agreement Among the Department of Energy, the Illinois State Historic Preservation Officer and the Advisory Council on Historic Preservation Concerning Management of Historical and Cultural Properties at Argonne National Laboratory-East.

There are currently two zero-power reactors (ZPRs) in Building 315: ZPR VI and ZPR IX. The ZPRs were uniquely designed to study nuclear core loadings without generating any power beyond that needed to create a nuclear reaction. ZPRs VI and IX are mechanically identical reactors that were used to complete a variety of different studies. ZPR VI retains much of its integrity; however, the ZPR VI control panel was removed in 1997. ZPR IX has been substantially altered from its original condition but its control panel is still present in the building. ZPR VI and parts of ZPR IX are scheduled to undergo decontamination and demolition in 2005. We propose to prepare Level II IL HAER documentation of ZPR VI, including any information that can be collected from the ZPR IX control panel. Because these structures are in very tight spaces, and to be consistent with previous IL HAER documentation for similar structures at Argonne, we plan to include in this documentation 35-mm format photographs instead of large-format photographs.

We also plan to submit for your review a 90 percent complete draft of the documentation. This draft will include the complete text, photocopies of the photographs, and 11" X 17" paper drawings (the photographs, negatives, and full-size mylar drawings will be included in the final package).

In addition to your concurrence on our mitigation plan, we request an IL HAER number for this project. If you have any questions, please contact Donna Green at (630) 252-2264.

Sincerely,

for/ Robert C. Wunderlich
Site Manager

A component of the Office of Science

Department of Energy
Argonne Site Office
9800 South Cass Avenue
Argonne, Illinois 60439

NOV 12 2004

Ms. Anne E. Haaker
Deputy State Historic Preservation Officer
Illinois Historic Preservation Agency
Old State Capitol
Springfield, Illinois 62701

Dear Ms. Haaker:

Reference: IHPA Log #10101598

The Department of Energy (DOE) is requesting your concurrence on our plan to decontaminate and demolish a small nuclear research reactor [the Zero-Power Reactor VI (ZPR-VI)] at Argonne National Laboratory (ANL). The ZPR-VI reactor is eligible for listing on the National Register of Historic Places for its engineering value and as a contributing component to the eligible Building 314/315/316 Complex.

The decontamination and demolition is needed because the ZPR-VI reactor is no longer in use and it is contaminated with radioactive isotopes including uranium 238, thorium 234, and cesium 137. Furthermore, most of the reactor wall surfaces have been painted with a lead-based paint and asbestos-containing material has been identified in the floor tile and floor tile mastic located in the control room. It will not be possible to remove the contamination without destroying reactor components. Leaving the contamination in place is not a desirable alternative because it would require continued monitoring and surveillance and would not allow us to reuse the space occupied by the reactor.

This letter constitutes the documentation called for under Section III.D.1. of the Programmatic Agreement Among the Department of Energy, the Illinois State Historic Preservation Officer and the Advisory Council on Historic Preservation Concerning Management of Historical and Cultural Properties at Argonne National Laboratory-East. On September 20, 2004, we submitted a proposed plan to prepare Illinois Historic American Engineering Record (IL HAER) documentation to mitigate the decontamination and demolition of the ZPR VI.

If you have any questions, please call Donna Green at (630) 252-2264.

Sincerely,

for Robert C. Wunderlich
Site Manager

A component of the Office of Science

Illinois Historic Preservation Agency

Voice (217) 782-4836
1 Old State Capitol Plaza • Springfield, Illinois 62701-1507 • Teletypewriter Only (217) 524-7128

DuPage County
Argonne
Decontamination and Demolition of ZPR-VI Reactor
Building 314/315/316 Complex

DOE
IHPA Log #033111504

November 17, 2004

Donna Green
Department of Energy
Argonne Group
9800 South Cass Avenue
Argonne, IL 60439

Dear Ms Green:

We have reviewed your request to decontaminate and demolish the above referenced property pursuant to Stipulation III.D.1 of the Programmatic Agreement (P.A.) among our agencies and the federal Advisory Council on Historic Preservation concerning the management of historical and cultural properties at Argonne National Laboratory-East.

In our opinion, the information provided adequately satisfies the requirements of the referenced P.A. and we will accept as mitigation the recordation of the historic property in accordance with the Illinois Historic American Buildings Survey/Historic American Engineering Record (ILHABS/HAER) standards. The ILHABS/HAER recordation number for this project will be DU-2005-01. We have no objection to the photo recordation being done in the 35mm format. You may submit the ILHABS/HAER documentation to this office for archiving upon its completion.

If you have any questions, you may contact Cody Wright, Cultural Resources Manager, Illinois Historic Preservation Agency, 1 Old State Capitol Plaza, Springfield, IL 62701, 217/785-3977.

Sincerely,

Anne E. Haaker
Anne E. Haaker
Deputy State Historic
Preservation Officer
AEH

Appendix B:

Comment Letters

MAR-16-2005 13:15 2175579725 2175579725 P.02

IEMA
Illinois Emergency Management Agency
Division of Nuclear Safety

Rod R. Blagojevich, Governor
William C. Burke, Director

MEMORANDUM

TO: Kristin Richards
Senior Policy Advisor

FROM: Gary N. Wright
Assistant Director

DATE: March 14, 2005

SUBJECT: Draft EA for Decontamination and Decommissioning of the Zero Power Reactors (Building 315) at Argonne National Laboratory, Argonne, Illinois (Feb 2005)

In accordance with the National Environmental Policy Act, the U.S. Department of Energy has prepared an Environmental Assessment (EA) for the Decontamination and Decommissioning of the Zero Power Reactors in Building 315 at Argonne National Laboratory. IEMA, Division of Nuclear Safety staff has reviewed a draft of this EA and offers the following comments:

- Argonne has two 1960's era experimental nuclear reactors that it would like to decommission. The objective would be to allow Building 315 to be turned over to some other group at Argonne for another use. For reference, similar projects have already been accomplished by Argonne with minimal environmental consequences. Argonne has considerable experience in this sort of work and actually teaches classes on this subject.
- Our review of the EA notes two areas worthy of discussion. First, Argonne has evaluated the possible impacts of a materials handling accident as the reactors are being disassembled. These are very large components and the work is complicated by the fact that they are contaminated. However, this work is being done in a building ideally suited to mitigate the impacts of such an accident. The building was designed to contain much more serious accidents resulting from an operating reactor and the safety systems are still intact.
- Second, this project will generate a significant amount of radioactive waste. About 9,100 cubic feet of low-level waste will be generated along with about 450 cubic feet of mixed (both radioactive and hazardous) waste. At the moment, there is ample disposal capacity within the DOE system and at Envirocare of Utah (a commercial site) to handle this waste. Nearby residents will notice more trucks than usual exiting the site, but it should be noted that this material is not spent nuclear fuel, nor is it transuranic waste. Neither reactor has run since 1982, so the waste should be "cool" enough to ship without highly specialized containers or extraordinary precautions. IEMA/DNS would not plan to inspect or escort these shipments.

In summary, IEMA/DNS would support the proposed action and agree with DOE's conclusion that the proposed action is adequately protective of public health and safety.

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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ROD R. BLAGOJEVICH, GOVERNOR RENEE CIPRIANO, DIRECTOR

March 22, 2005

Mr. Ken Chiu
Department Of Energy
Argonne Site Office
9800 South Cass Avenue
Argonne, Illinois 60439

Dear Mr. Chiu:

Thank you for the opportunity to comment on the draft Environmental Assessment for Decontamination and Decommissioning of the Zero Power Reactors at Argonne National Laboratory.

The Agency has no objections to the project. However, as the decontamination and decommissioning involves demolition and renovation, we wish to bring to your attention the asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Please keep in mind that NESHAP requires a thorough inspection for asbestos by a trained asbestos inspector prior to demolition or renovation of regulated facilities. The rules are found at 40 CFR Part 61 Subpart M. A project such as yours would make the buildings subject to these requirements.

If asbestos is found in the structures, you must have an Illinois licensed abatement firm remove all regulated asbestos prior to demolition. If more than 160 square feet or 260 linear feet of asbestos is removed, it is necessary to file a 10-working day notification to the Illinois EPA. The demolition of the structures will also require a 10-working day notice and a $150 filing fee. If the abatement and demolition can be coordinated with both contractors, you can file one notification and one $150 notification fee.

You will find more information about asbestos requirements and find downloadable forms on our website at http://www.epa.state.il.us/air/asbestos/. If you have any questions about asbestos requirements, please call Dale Halford, Manager, Asbestos Unit, at 217-557-2478.

Sincerely,

Bernard P. Killian

Bernard P. Killian
Deputy Director

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